NASA chooses UT Arlington team to develop potential Mars mission technology

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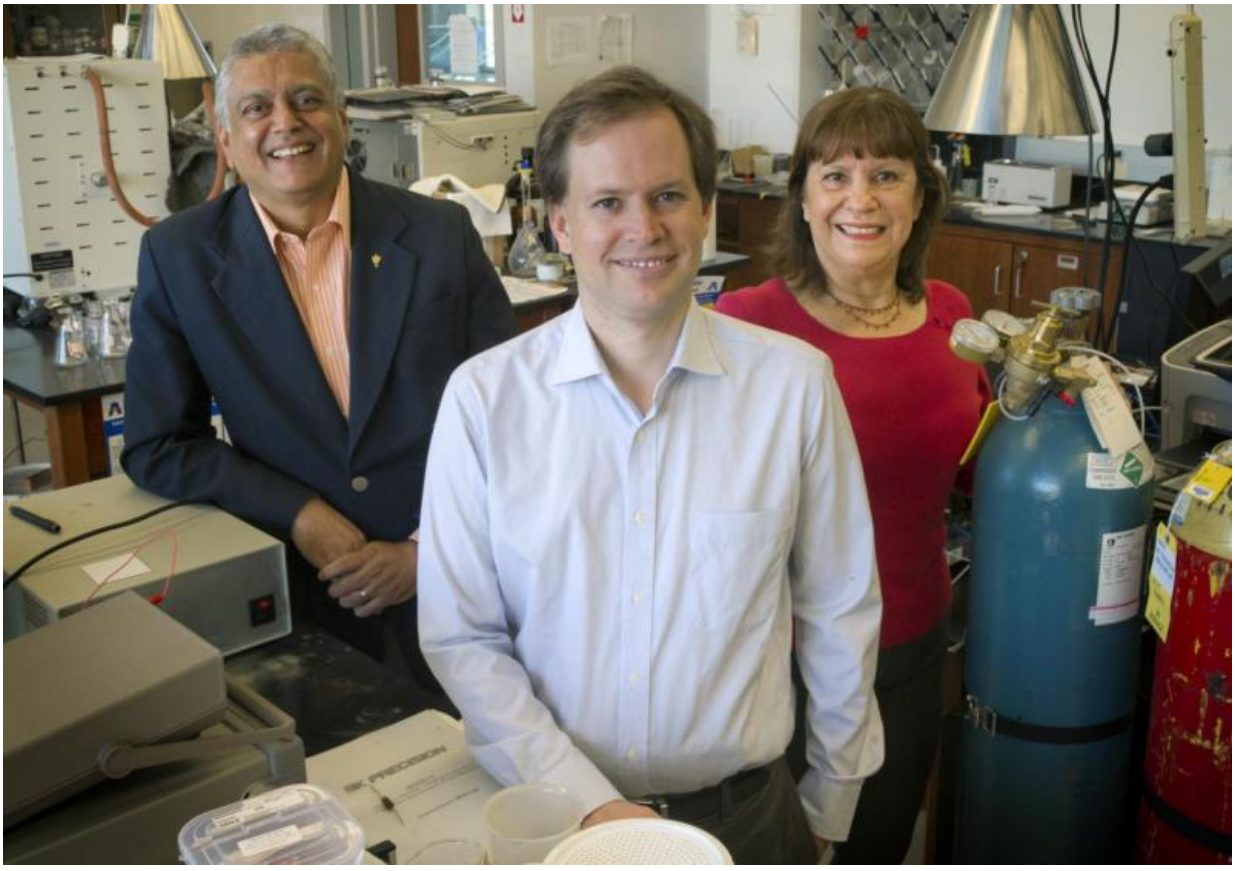

Principal investigators on the UT Arlington project are from left: Krishnan Rajeshwar, distinguished professor of chemistry and biochemistry in the College of Science; Brian Dennis, associate professor of mechanical and aerospace engineering in the College of Engineering; and Norma Tacconi, a research associate professor of chemistry and biochemistry. Credit: UT Arlington

NASA has selected UT Arlington as one of four U.S. institutions to develop improved methods for oxygen recovery and reuse aboard human spacecraft, a technology the agency says is crucial to "enable our human journey to Mars and beyond."

NASA's Game Changing Development Program awarded $513,356 recently to the UT Arlington team. UT Arlington and three other teams are charged with the goal of increasing oxygen recovery to 75 percent or more.

Principal investigators on the UT Arlington project are Brian Dennis, associate professor of mechanical and aerospace engineering in the College of Engineering; Krishnan Rajeshwar, distinguished professor of chemistry and biochemistry in the College of Science; and Norma Tacconi, a research associate professor of chemistry and biochemistry.

They will design, build and demonstrate a "microfluidic electrochemical reactor" to recover oxygen from carbon dioxide that is extracted from cabin air. The prototype will be built over the next year at the Center for Renewable Energy Science and Technology, CREST, at UT Arlington.

"At the end of this 15 month Phase I project, we will demonstrate the prototype to NASA officials. If we are selected to move to Phase II, we plan to build a full-scale unit. We hope the technology will be flight tested on the International Space Station sometime in the future," Dennis said. "That's what we're really excited about and what we'll be aiming for."

Dennis said the design uses water and carbon dioxide as reactants and produces oxygen and hydrocarbon gases, such as methane. The gases can be vented into space and the oxygen is used for breathing.

"We have developed a nanocomposite electrode that speeds oxygen

evolution at lower potential. That basically means it can produce more oxygen in a shorter time with less power and less reactor volume," said Dennis. "This is important since power on a spacecraft is limited because it comes from solar panels and spacecraft capacity also is limited. Things should be as compact and lightweight as possible."

Current methods of oxygen recovery used on the International Space Station, or ISS, achieve only about a 50 percent recovery rate. A better recovery rate means less oxygen needs to be stored and would free up precious cargo space on prolonged missions. With current technology, a trip to Mars would take about eight months, though scientists are working to shorten that time.

In a statement from NASA, Associate Administrator for Space Technology Michael Gazarak said improving oxygen recovery and designing a system with high reliability is crucial to long-duration human spaceflight.

"These ambitious projects will enable the critical life support systems needed for us to venture further into space and explore the high frontier and are another example of how technology drives exploration," Gazarak said. NASA's full announcement is available here: http://www.nasa.gov/press/2014/october/nasa-selects-advanced-oxygen-recovery-proposals-for-spacecraft-missions/#.VDV8RedDRgh.

Dennis said the proposed UT Arlington device has an advantage over the ISS method because not as much water is needed to achieve 75 percent recovery. The team estimates its system would require less water than what can be recovered in one day from a person's sweat and urine. A water recovery system that converts bodily fluids to water is already at work on the ISS.

For years, Dennis, Rajeshwar and Tacconi have developed novel

nanocomposites to be used in targeted electrochemical reactions for fuel cells and other purposes. The new project builds on that work and is another demonstration of the key role electrochemistry can play in technological advances, Tacconi and Rajeshwar said.

James Grover, interim dean of the UT Arlington College of Science, said the new NASA-funded project is a great chance for the College of Science and College of Engineering to make an impact in a field that captures human imagination and inspires innovation.

"Discoveries are cultivated through interdisciplinary collaboration and UT Arlington scientists and engineers have embraced that spirit to achieve advances," Grover said.

Khosrow Behbehani, dean of the College of Engineering, said the interdisciplinary project speaks to practical aspects of space research.

"This project has great implication for space explorations," Behbehani said. "Through collaboration of scientists and engineers at UT Arlington such innovations have become possible which can put us closer to exploring farther destinations in space."

Provided by University of Texas at Arlington

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