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NASA experiment lays groundwork for living on Mars

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R. Scott Baird, foreground, and Koorosh Araghi monitor the production rates of oxygen from Martian atmosphere carbon dioxides.

By Kelly Humphries

NASA ENGINEERS have succeeded in a realm often left to alchemists and magicians–creating something valuable "out of thin air." In this case, the thin air was a simulated Martian atmosphere, and the valuable commodity was oxygen.

"The concept is to use the resources on Mars to reduce the amount of material that needs to accompany a human mission," said Principal Investigator David Kaplan of the Exploration Office at JSC. "Producing oxygen using materials readily available on Mars would be an important step toward reducing the costs and risks of an eventual human mission to Mars."

Last month's demonstration was an initial test of technology that will be aboard the Mars Surveyor 2001 Lander, scheduled to launch April 10, 2001, and land on Mars on January 22, 2002. Called the Mars In-situ propellant production Precursor (MIP), the experiment tested the feasibility of using the thin Martian atmosphere to produce oxygen for breathing air and propellants. Propellants created on Mars could eventually be used to send samples and astronauts back to Earth.

"The MIP team of scientists, design engineers, and test engineers have worked very hard for nearly two years to create the prototype unit used for this test," said Project Manager Jim Ratliff. "We are all very excited about the opportunity to build the first hardware that will produce a resource on another planet. Now that these test have proven our concept works, we will finalize the design and begin development of the flight article that will operate on the Mars surface."

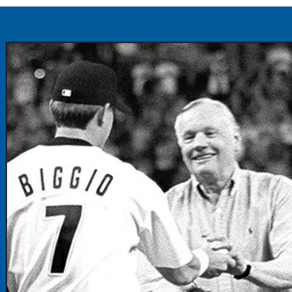
The primary test involved an experimental device inside a Mars environment chamber operated by JSC's Energy Systems Test Branch that selectively absorbed carbon dioxide from a simulated Martian atmosphere called "Mars mix" and converted it to oxygen. This technology also may be used to extract pure oxygen from Earth air for home, medical and military needs.

The atmosphere inside the experiment chamber simulated Martian temperatures and atmospheric pressures. The "Mars mix" was 95 percent carbon dioxide, thin (almost 150 times thinner than Earth's atmosphere) and cold (–125 degrees Fahrenheit, like a typical Martian night).

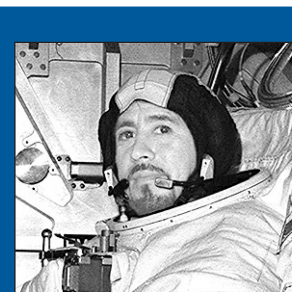
The mix provided the raw materials for the chemical reaction. A wafer-thin, solid-oxide ceramic disk made of zirconia, a little larger than the size of a quarter (1.25 inches in diameter), was sandwiched between two platinum electrodes and heated to 1,380 degrees Fahrenheit. When carbon dioxide is fed to this unit, the zirconia cell "cracks" the carbon dioxide into carbon monoxide and oxygen. Only the oxygen can penetrate through to the other side of the disk; the carbon dioxide and carbon monoxide gases are stopped in their tracks.

The MIP payload will perform five experiments on Mars. It will selectively absorb and compress carbon dioxide from the Martian atmosphere; produce propellant-grade, pure oxygen; test advanced photovoltaic solar cells for energy production; test techniques to combat the settling of airborne dust onto solar arrays; and test thermal radiators. Designers and developers of these five experiments come from JSC, the Glenn Research Center, the Jet Propulsion Laboratory and the University of Arizona. ■

For more information about the Mars Surveyor 2001 mission, visit http://mars.jpl.nasa.gov/2001/



Armstrong opens last season in the Dome. Page 3



Spacesuits used for historic test at JSC. Page 4

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