



technology opportunity

An Ultra-Efficient, Freeze-Resistant Hydration System

The technology is designed for rugged, cold, and high-altitude conditions



NASA's Johnson Space Center is offering an innovative freeze-resistant hydration system for licensing. The technology substantially improves on existing hydration systems that cannot prevent water from freezing in the tubing, container, and mouthpiece in the harshest conditions on earth. This technology is designed to work to -40°C and 15-mile-per-hour winds over a 12-hour summit day, and likely well beyond. Field testing was performed at Mt. Everest in May, 2009.

The device was originally conceived and designed by an astronaut-mountaineer who recognized the great risk of dehydration in high mountains and the lack of sufficient technology to meet this important need.

Benefits

- **Improved Safety:** Dehydration is a life-threatening complication for high-altitude climbers. The device will provide 2-3 liters of liquid beverage (water, tea, or nutritional supplement) over the course of a full summit day.
- **Lightweight:** The straw is insulated with aerogel or other highly efficient insulators, a feature that allows the heating system to work without extra thickness or weight.
- **Multiple approaches:** The technology uses passive transfer of body heat in one option, an intermediate variant system in another, and a battery-powered microcontroller in a third.
- **Numerous applications:** Although designed for climbers, it has applications for cold weather sports enthusiasts (skiers, snowboarders, snowmobilers, hunters), rescue crews, and military personnel.

Applications

- Mountain climbers
- Downhill skiers
- Cross-country skiers
- Winter campers
- Snowmobilers
- Hunters
- Law enforcement and rescue personnel
- Defense environments, including SEAL, underwater, and deep sea use

Learn more about field testing of this product on Mt. Everest by visiting Co-Inventor and former NASA Astronaut Scott Parazynski's climbing blog at: <http://www.onorbit.com/everest>

Technology Details

How it Works

The High Altitude Hydration System works three different ways. The first, passive thermal control, uses aerogel insulation on the outside of the conformal fluid reservoir and around the drink straw. The bottle is mounted to an inner layer of clothing and the insulated straw is pulled from underneath the suit for a sip, then tucks back into the clothing. The second uses a braided copper wire attached to the drink straw and insulating aerogels to allow body-generated heat to keep the drink straw and water conformal fluid reservoir from freezing. A third method uses a microcontroller and tape heater to keep the drink tube warm and free of ice crystals.

Why it is Better

Even when a water conformal fluid reservoir and drink straw are zipped into a down suit, water freezes under extreme conditions. This poses a health hazard, particularly to high-altitude climbers who mouth-breathe, as mouth-breathing causes substantial fluid loss (in exhaled breaths). Climbers of 8,000-meter peaks get only 1 liter or less of fluid on summit days because their drink bottles freeze so quickly.

Neoprene, an alternative, is much less effective because it performs poorly compared to aerogels and requires a thickness that would make the straw difficult to handle. Using body heat is very efficient in this configuration, and is a welcome source of warmth at the beginning of a summit climb day.

Patents

Johnson Space Center filed for patent protection for this technology in December, 2009.

Licensing and Partnering Opportunities

This technology is being made available as part of NASA's Innovative Partnerships Program (IPP), which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to consider licensing the High Altitude Hydration System technology (MSC-24490-1) for commercial applications.

For More Information

If you would like more information about this technology please contact:

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For information about other technology licensing opportunities, please visit:

Innovation Partnerships Office
NASA's Johnson Space Center
<http://technology.jsc.nasa.gov>

Fuentek is a contractor to NASA's Innovative Partnerships Program, providing support for the access and transfer of technology.