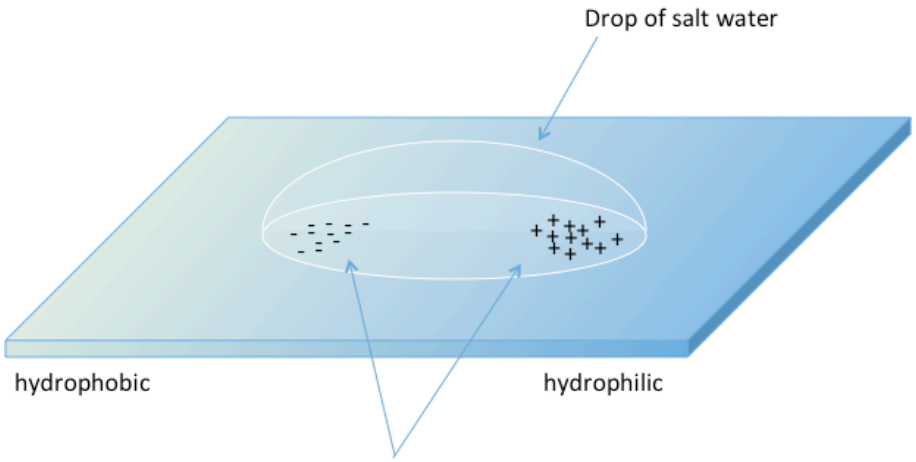
NASA SBIR/STTR Technologies

T6.03-9722 - Sustainable Water Purification

PI: Alton Reich
Streamline Automation, LLC - Huntsville, AL

Identification and Significance of Innovation

Clean, safe drinking water is as essential to supporting human life in space as any other spacecraft or habitat system. As little as 24 hours without water can impair cognitive performance and reduce effectiveness. Manned spacecraft already have water reclamation systems, but these are single purpose and require power to run. What if it were possible to use waste heat to generate purified water that would also produce the electrical power needed to run the purification system?
Recent developments in engineered nanomaterials have demonstrated that it is possible to design materials with gradients of hydrophobicity, and that these can be controlled via the application of small electrical potentials. When combined with underlying materials that generate electrical potentials due to thermal gradients it becomes possible to envision a water desalination system that operates entirely on waste heat. The system proposed herein is not simply “low power”; it is essentially “no power” – operating on waste heat that would normally be rejected.



Estimated TRL at beginning and end of contract: (Begin: 2 End: 3)

Technical Objectives and Work Plan

In Phase I, the primary goal is to demonstrate phase-engineered nanomaterials for use as a thermoelectric-desalination system powered by waste heat. The specific technical objectives of this Phase I project are:

- Develop efficient methods for creating larger amounts of the phase-engineered nanomaterials for use in thermoelectric-desalination systems that are compatible with production automation.
- Perform a heat and energy balance for typical spacecraft or habitat heat sources, including people, to estimate the amount of electrical power available for auxiliaries and amount of water desalinated.
- Develop a preliminary design for a system that would include filtration, pumping internal to the system, polishing and finishing, and water analysis.

NASA Applications

One of the primary stated purposes driving NASA's development of the SLS is to enable manned missions beyond low Earth orbit. These may include: short duration missions to the Moon, long duration missions on the Moon, asteroid recovery missions, and missions to Mars.
Most of these will require mission durations of several months to 2 years. Water recovery and reprocessing will be crucial to the success of these missions. Operation on waste heat would allow purified water to be produced without adding to the spacecraft power budget.

Non-NASA Applications

Efficient desalination that operates using existing low grade heat sources has applications over a range of scales: producing potable water for individual hikers and backpackers, as one element of a family emergency kit, part of a water recycling system to support commercial space tourism, and new technology for large-scale desalination to address persistent drought conditions.

Firm Contacts

Alton Reich
Streamline Automation, LLC
3100 Fresh Way Southwest
Huntsville, AL, 35805-6720
PHONE: (256) 713-1220