*NASA SBIR/STTR Technologies*

# Brine Dewatering Using Ultrasonic Nebulization

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**Phase II SBIR Contract: NNX10CA21C**

## Phase II Research

Advanced water recovery system (WRS) designed for use during future long-duration, manned space missions must improve water loop closure due to the prohibitive water resupply expense. Current technologies recover ~90% of the water in urine, hygiene water, and humidity condensate combined wastewater with the remaining water lost as brine that must be stored. Brine represents a valuable resource. The ultrasonic brine dewatering system (UBDS) prototype developed under this Phase II program provides an effective means of recovering nearly all water in brine while segregating brine solids in an easily storable form. The UBDS process creates extremely small droplets of the brine in a nebulization chamber by focusing ultrasonic waves at the brine - air interface. The droplet's high surface to volume ratio results in rapid drying at moderate temperature in the drying chamber. Brine solids and water are efficiently recovered downstream using sequential electrostatic precipitation and condensation sub-processes. The UBDS processed very high solids real brine without concern for solids, an attribute with added importance due to recent findings that state of the art, distillation processes are limited by the formation of precipitates. The UBDS prototype recovered >90% of water in brine and can readily be integrated into current NASA water recovery systems for independent performance verification.

## Phase II Research Schedule

| Tasks / Quarters | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Project Management | | | | | | | | |
| 2. Brine Production | | | | | | | | |
| 3. Brine Mist Flow Dynamics | | | | | | | | |
| 4. Nebulization Chamber Design | | | | | | | | |
| 5. Drying Chamber Design | | | | | | | | |
| 6. Determine Dried Particle Size Distribution | | | | | | | | |
| 7. Filtration Method Exploration and Selection | | | | | | | | |
| 8. Select Prototype Scale Ultrasonic Nebulizer | | | | | | | | |
| 9. Design and Fabricate Prototype Subsystems | | | | | | | | |
| 10. Assemble and Test UBDS Prototype | | | | | | | | |
| 11. Long-Term UBDS Prototype Testing | | | | | | | | |
| 12. Determine ESM | | | | | | | | |
| 13. Refurbish and Deliver the UBDS Prototype | | | | | | | | |
| 14. Prepare Final Report | | | | | | | | |

## Principal Investigator

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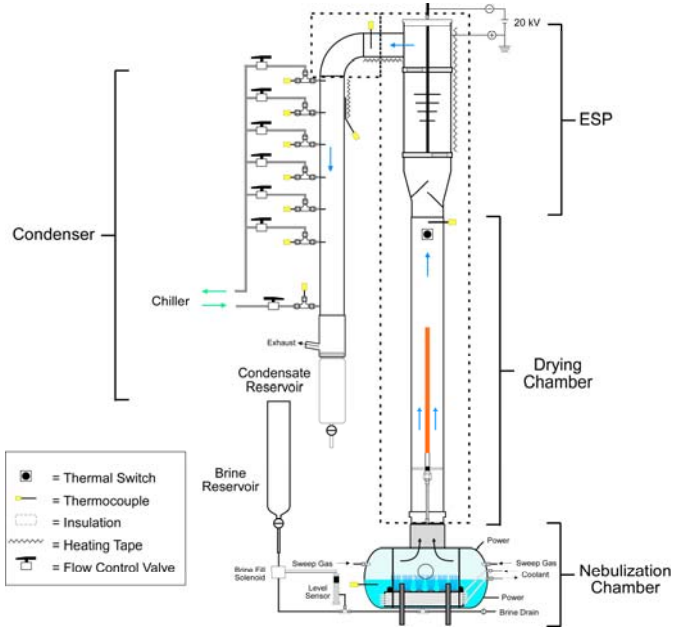
## Ultrasonic Brine Dewatering System (UBDS)




## Benefits of the Phase II Research & Development Program

An effective ultrasonic brine dewatering system (UBDS) clearly demonstrated high fractional water recovery from ersatz and urine based brine, a major untapped resource generated by the current water recovery system (WRS) processes. The UBDS enables more efficient WRS operation. The benefits of this technology include:

- ✓ Recovery of greater than 90% of water from augmented real brine;
- ✓ Capable of processing most brine compositions.
- ✓ The absence of expendable supplies;
- ✓ Insensitivity to the presence of brine solids;
- ✓ Utilizes relatively simple nebulization, drying, particle separation, and condensation processes;
- ✓ Brine solids that are recovered as an easily stored powder;
- ✓ Equivalent System Mass (ESM) for UBDS without crew time is 147.1 kg.