X3.02 Water Processing and Waste Management Systems

Lead Center: JSC

Participating Center(s): ARC, GRC, KSC, MSFC

Water processing and waste management systems supporting critical needs for lunar mission architectures are requested. Improved technologies for recovery of water and other resources as well as safe long term stabilization and storage of residuals inside and outside the habitat are needed. Water processes collect, store, recycle, and disinfect water for reuse as both drinking water and hygiene water. Waste processes collect, process, recover resources, stabilize, and store residuals. Although this solicitation is directed at technologies for lunar missions, crosscutting technologies that are also applicable to human missions to Mars are of interest. Proposals should explicitly describe the weight, power, and volume advantages of the proposed technology.

Water Reclamation

Efficient treatment of wastewater from a variety of sources is critical to long-term exploration missions. Sources of water to be recovered may include urine, wash water, humidity condensate, and/or water derived from in situ planetary resources. Treatment processes should produce potable and hygiene water supplies. Treatment methods for long duration missions should seek high levels of mass closure. Systems targeted for planetary surface applications must be designed to function in hypogravity environments but need not be microgravity compatible. Areas of emphasis include:

- Disinfection and residual disinfectant technologies that are compatible with both biological and physicochemical wastewater processing systems;
- Techniques to minimize or eliminate biofilms, microbial contamination and/or solids precipitation from potable water, wastewater and water treatment system components;
- Post-treatment methods to reduce total organic carbon from 100 mg/L to less than 1 mg/L in the presence of 50 mg/L bicarbonate ions, 25 mg/L ammonium ions and 25 ppm other inorganic ions.

Waste Management

Wastes (trash, food packaging, feces, paper, tape, filters, water brines, clothing, hygiene wipes, etc.) must be managed to protect crew health, safety, and quality of life, to avoid harmful contamination of planetary surfaces, and to recover useful resources. Areas of emphasis include:
- Solid waste stabilization including water removal and recovery of water from wet wastes (including human fecal wastes, food packaging, brines, etc.);
- Solid waste storage and odor control (e.g., catalytic and adsorptive systems);
- Energy efficient/ internal heat recycling waste pyrolysis systems for mineralization of wastes.

**Clothing Systems**

Low mass reusable or long usage clothing options that meet flammability, out gassing, and crew comfort requirements. Cleaning and drying systems for re-use of clothing that have low-water usage, non-toxic cleaning agents compatible with physicochemical or biological water reclamation systems, or that do not require water.