

Passive, Collapsible Contingency Urinal for Human Space Flight

Capillary-based fluid management system

Fluid transport systems for spacecraft face acute challenges because of the persistently unfamiliar and unforgiving low-gravity environment. IRPI, LLC, has developed a contingency wastewater collection and processing device that provides passive liquid collation, containment, bubble separation, and droplet coalescence functions. The lightweight, low-volume, low-cost, and potentially disposable device may be used for subsequent sampling, metering, storage, disposal, and/or reuse. The approach includes a fractal wetting design that incorporates smart capillary fluidics. This work could have a broad impact on capillary-based fluid management on spacecraft and on Earth.

Applications

NASA

- ▶ Backup waste collection device
- ▶ Urine sample metering and measuring to monitor crew health

Commercial

- ▶ Biomedical research
- ▶ Lab-on-a-chip technologies
- ▶ Fuel delivery systems
- ▶ Advanced heat pipe wick structures



IRPI, LLC photo

Phase II Objectives

- ▶ Identify, develop, and manufacture surfaces that establish micro- and mesoscale wetting for representative liquids
- ▶ Design a macrocapillary device utilizing micro/mesowetting material that encompasses a fractal wetting design that will provide passive functionality for fluids with variable wetting
- ▶ Incorporate design into an ergonomic and functional device that seamlessly merges mechanical, capillary, and standard interfacing
- ▶ Test each of the subcapillary components, including interfaces and bridges, in a high-rate drop to qualify individual components in low gravity
- ▶ Generate documentation and plans for International Space Station utilization of the developed device

Benefits

- ▶ Lightweight
- ▶ Low cost
- ▶ Low volume

Firm Contact

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