The International Space Station Urine Monitoring System (UMS)

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LIMITATIONS OF CURRENT SYSTEM (UCDs)

Urine Collection Devices (UCDs), although simple, have multiple shortcomings including:

- Significant crew time requirement
- Positive crew comments
- Gender interface issues
- UCD imperfections – leakage
- Significant launch up mass for collection and trash storage supplies
- Orbit stowage and disposal of large quantities of leftover and potentially hazardous urine
- Impact on water system – Voids are "lost" to water reclamation system when UCDs are used; lithium would be introduced into reclamation system if UCD contents are reclaimed

SPECIFICATIONS

- Mass (Mechanical Module): 50 lb (23 kg)
- Dimensions (Mechanical Module): 17" x 9" x 9" (43.2cm x 22.9cm x 22.9cm)
- Vehicle Connections:
  - Electrical: 28 VDC; 10 Amps
  - Urine/air: 0.875-in internal diameter hose connections
  - Urine/air and gas outlet (flush)
  - Water: 0.250-in pipe connections
  - Requires air flow from remote fan (ACT & fans)
- Crew Interface:
  - IBM A22p: unit (Space Station Laptop)
  - Rack application-specific hardware
  - Software package provides real-time volume data, sample ID storage for each acquired sample, system status and crew intervention messages when required
  - Urine funnel is similar to Space Shuttle WCS, no gender specific interfaces

WHAT IS THE ISS UMS?

- Space flight qualified hardware that interfaces with on-board waste collection facilities to allow the measurement of the volume of each urine void and the capability to acquire samples (ambient and frozen) for storage and subsequent analysis.
- The ISS UMS is provided by EC3 as GFE to the Human Research Program (HRP) as a science payload.
- In the next enhancement, it is envisioned that analytical equipment will be developed to interface directly with the UMS in order to provide near real-time analyte measurements incorporating the volume data provided by UMS.

WHAT ARE THE SCIENCE/OPERATIONS NEEDS?

- Urine samples enable non-invasive protocols to assess human physiology during space flight (provides health/welfare information about crew):
  - Facilitates monitoring/evaluation of crew health
  - Critical for countermeasure validation
  - Reduce need for blood samples
- For interplanetary exploration missions, the only viable approach for assessing crew health and the efficacy of in-flight medical interventions is to implement in situ analytical technologies
- Mitigate renal stone risk and bone loss during long duration space flight
- Provides headstart for technologies/hardware required for use on a Mars CEV and explorational outpost
- Overarching science "need":
  - Determine individual void volume (e.g., fluid output)
  - Determine 24-hour volume (e.g., clearance data)
  - Determine and measure urine constituents (e.g., solute concentrations)
  - Real-time analyses of urine constituents (countermeasure evaluation and validation, real-time medical intervention) in enhanced version (future development)