Forward Osmosis Bag (FOB) Flight Experiment

• In 2011 NASA **FOB flight test** on the Space Shuttle (**STS 135**).

• FOB was a water purification device for the recovery of a potable drink from wastewater in microgravity (like the LWC)

• Objective: **to verify that forward osmosis works in microgravity** and evaluate the effects of micro-scale buoyancy driven mixing.

• Flux rate and salt rejection determined at 6- and 24-hour intervals.
PERSONAL WATER RECLAMATION SYSTEM (PWRS)

Intended for personal urine recycling and water recovery during water emergencies.
South Pole Energy Challenge

“Robert Swan, the first person in history to walk to both the North and South Poles. Swan has dedicated his life to the preservation of Antarctica by the promotion of recycling, renewable energy and sustainability to combat the effects of climate change”
Let's preserve Antarctica...
**CARGO TRANSFER BAG (CTB)**

- CTB is an embedded **forward osmosis membrane** water treatment element **inside of a cargo transfer bag**.
- CTBs are cloth bags used to deliver cargo to orbit in the current international human space flight logistics system;
- CTBs are used for emergency backup water treatment and radiation shielding.
WATER WALLS (WW)
**WATER WALLS BAG INSTALLATION**

**STANDARD W.W. BAG UNIT**
Polyethylene bag with one or more specialized membranes.

Bag: 25 cm x 50 cm
Pouch: 22.5 cm x 45 cm

**INDIVIDUAL W.W. BAGS ARRANGED IN POCKETED MESH PANEL**
Mesh allows air + light to reach bags.

- In/Out ports w/tubes
- Sewn seam separating pockets
- W.W. bags secured in individual mesh pocket affixed to open mesh back panel
- Snapped closures at top and bottom of each pocket for secure access

T-beams span between inner curvature of rigidized hoop structure.
T-beam flanges abut, while standoff web is interrupted for tube and lighting raceway.

Front and back layers of arrayed bags offset to provide overlap at edges + provide continuous radiation protection.

Hard open-grid panels protect array of w.w. bags. Panel hinged at T-beam standoff web for access.
FORWARD OSMOSIS SECONDARY TREATMENT (FOST)

- FOST was designed to treat the effluent of a membrane aerated bio-Reactor (MBAR).

- The feed to MBAR was urine, humidity condensate, and grey water.

- The FOST system functions as a post treatment step to the bioreactor.

- It also provides a physical barrier to microbial and viral contamination.
FOST 2 – Different FO membranes

Urine
Osmotic agent
Product
Sustainability Base Building at NASA-ARC

- Gray water recycling system