



Water Capture Device

POIWG #45

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Water Capture Device Project Background



- The Water Capture Device (WCD) is new air/water separator technology developed by Sierra Nevada Corporation (SNC).
- The WCD passively separates free liquid from an air stream utilizing momentum transfer via proprietary vane structure.
- This water is then collected in a capillary reservoir that can be pumped to a condensate collection header.
- Current design is sized for 99%+ separation of free water up to 9.2 lb./hr. at air flowrates up to 250 CFM with 1.2 in. H₂O pressure drop.

Water Capture Device Project Background



- The WCD is a candidate for use in exploration or gateway Environmental Control and Life Support System (ECLSS) as its current design trades well versus current state of the art on mass, volume, and reliability/sparing.
- The WCD payload is a class I-E flight project to provide a test bed for two WCD test articles on ISS.
- Data collected from the flight experiment will be used to refine CFD modelling of the SNC technology with the goal of offering further trade benefits on mass, volume, and reliability.

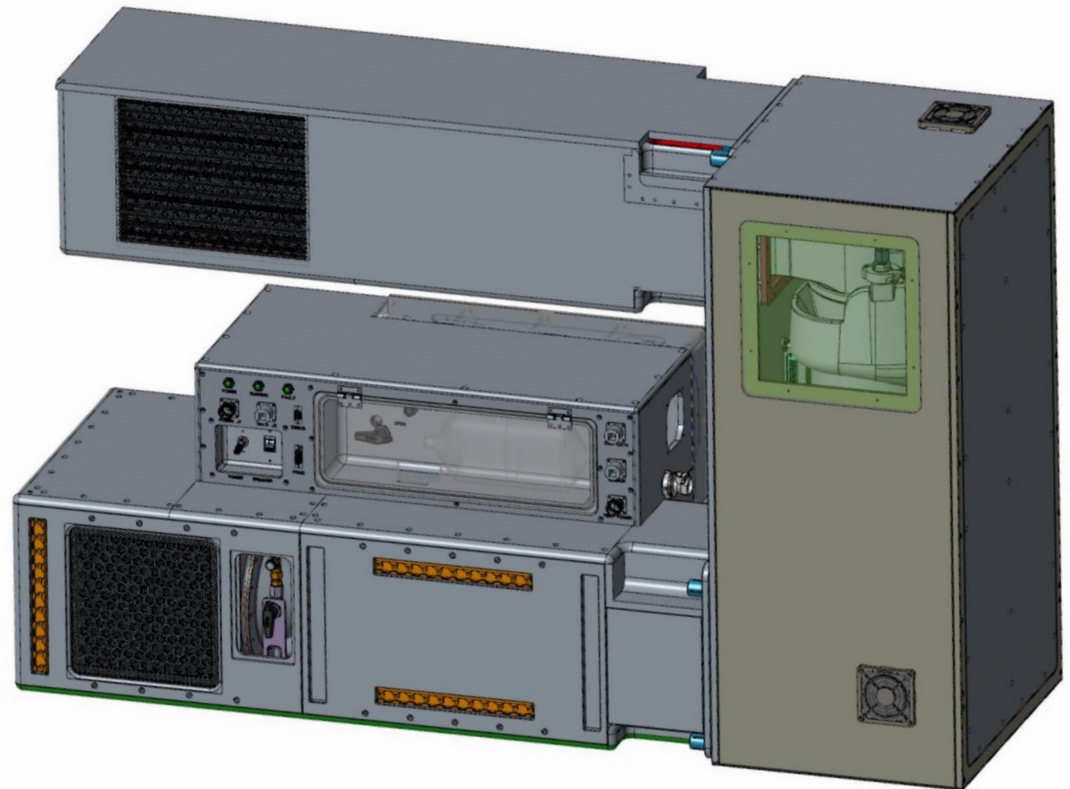


W C D P a y l o a d

- For this flight experiment the payload test bed is required to produce conditions comparable to the profile of a future vehicle's common cabin air assembly (CCAA) .
- The payload must also provide sufficient turndown to collect a range of data points that can be used to correlate CFD modelling of air/water separation in microgravity.
- The payload accomplishes this by including a variable speed blower, variable rate water injection system, and a camera system to record air/water separation and collection.

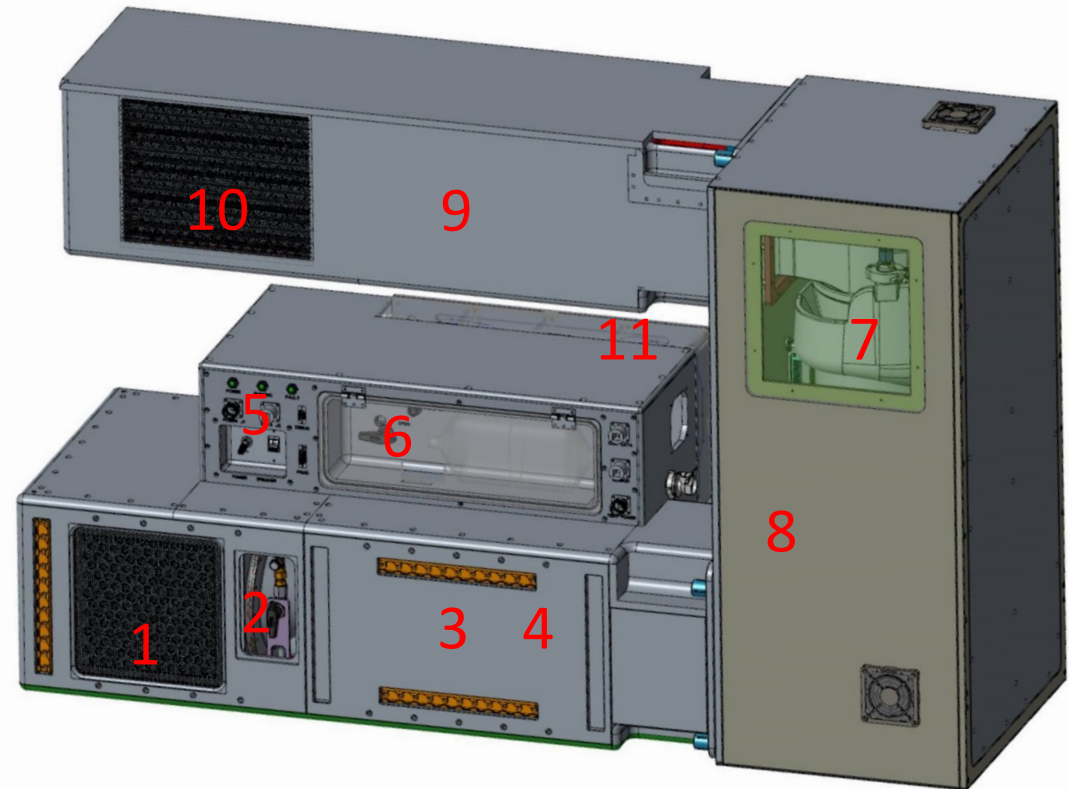
Assembly

- Overall dimensions: 47.2" x 22" x 39.9"
- Flown as 4 separate boxes
- Assembly and test article swap out on station
- Station Interfaces:
 - UOP
 - Ethernet (Payload Controller & Cameras)
 - Cabin Air Exchange – heat and humidity
 - Strap/bungee for tie down to structure
 - Water refills from PWD via ICWC
- Acts as an isle deployed CCA mock-up



Assembly – Major components

1. Air Inlet Filter
2. System Fan
3. Water Injection System
4. Mock CHX fin bundle
5. Crew Interface Panel
6. Refill Connection
7. Test Article
8. Camera System
9. Water Trap
10. Air Outlet Filter
11. Power & Controller PCBs



Operations – Station Resources/Interfaces



- Power: 762W @ 120VDC
- Data: JSL Ku-Band
- Air Interchange: up to 250 CFM
- Heat Rejection: 690W
- Water Evaporation: up to 1.5 lb./hr.; 28L over 20 test days
- Water refills from PWD: up to two ICWC refills per 20 day test campaign



Operations – Crew Activities

- The WCD payload will require crew assembly of the inlet box, test article box, outlet box, connection to station UOP and Ethernet.
- Current install location is Node 3 port end cone.
- Crew will also provide a ICWC filled with iodinated water to be connected to the payload refill port – this bag will require refill during payload operations.
- Test Article box swap out will occur once operations are complete for Test Article Box A.
- At completion of experiment the payload will be disassembled and disposed.

Operations – Ground Support

Test Day Overview



- Each test day will include the following commanded parameters:
 - System fan speed for air flow rate
 - Injection pump for water flow rate
 - Water flows through misting nozzles into the air stream to coalesce on the CHX fin bundle to produce water droplets
 - Camera commands for livestream views at flow rate transitions
 - Extraction pump on/off to pull water captured by the WCD reservoir back to the water loop accumulator

Operations – Ground Support Test Overview



- Test days will gradually increase automation of the water loop in extraction of the WCD reservoir.
- The reservoir will be fitted with redundant high and low level capacitive sensors.
- Final operational mode will allow the system to automatically pump from the reservoir when high level is detected and to stop when low level is detected.

Post-operations analysis and forward path



- Sync video data and water/air stream telemetry via timestamps
- Compare performance to CFD predications
- CFD model updates
- Improvements to test article design
- Integrated testing
- Comparison of integrated test data to current state of the art air/water separator



A c r o n y m s

WCD: Water Capture Device

ECLSS: Environmental Control and Life Support System

ISS: International Space Station

PWD: Potable Water Dispenser

ICWC: Iodine Compatible Water Container

Questions

