Amine Swingbed Payload

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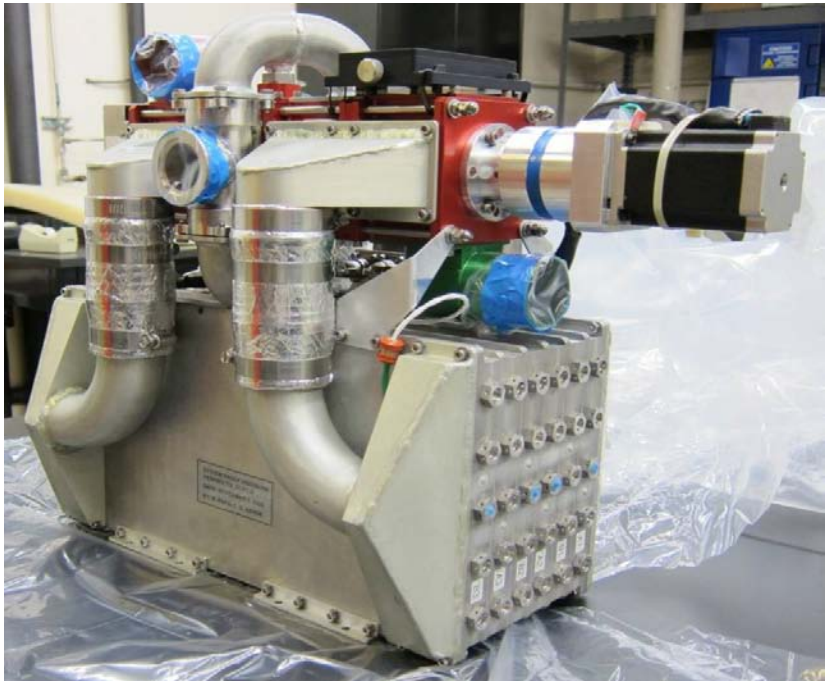
- Background
- Payload Objectives
- Hardware Overview
- System Overview
- ISS Interfaces
- Operations Concept

- What is the Amine Swingbed?
  - Hardware originally baselined as the Carbon Dioxide (CO_2) removal system for Orion
- What is the Amine Swingbed Payload?
  - System designed to incorporate the Amine Swingbed hardware into an EXPRESS rack and provide air- and water-saving functionality
  - Two-phase hardware manifest approach in order to accommodate ISS Program request due to upmass limitations
    - Phase A includes the Amine Swingbed (launched on HTV-2 January 22, 2011)
    - Phase B includes the remaining hardware assemblies (launch vehicle STS-135/ULF7)
- Why?
  - To demonstrate technology in order to benefit future exploration missions
  - To drive out technical risk through long term testing in a realistic flight environment
- Who?
  - Engineering team includes JSC EC, EV, ESCG, Hamilton Sundstrand, TDA Research, and Wyle
  - Payload Integration Manager – Scott Whitehead
  - Sponsor - ISS National Laboratory Office (OZ)

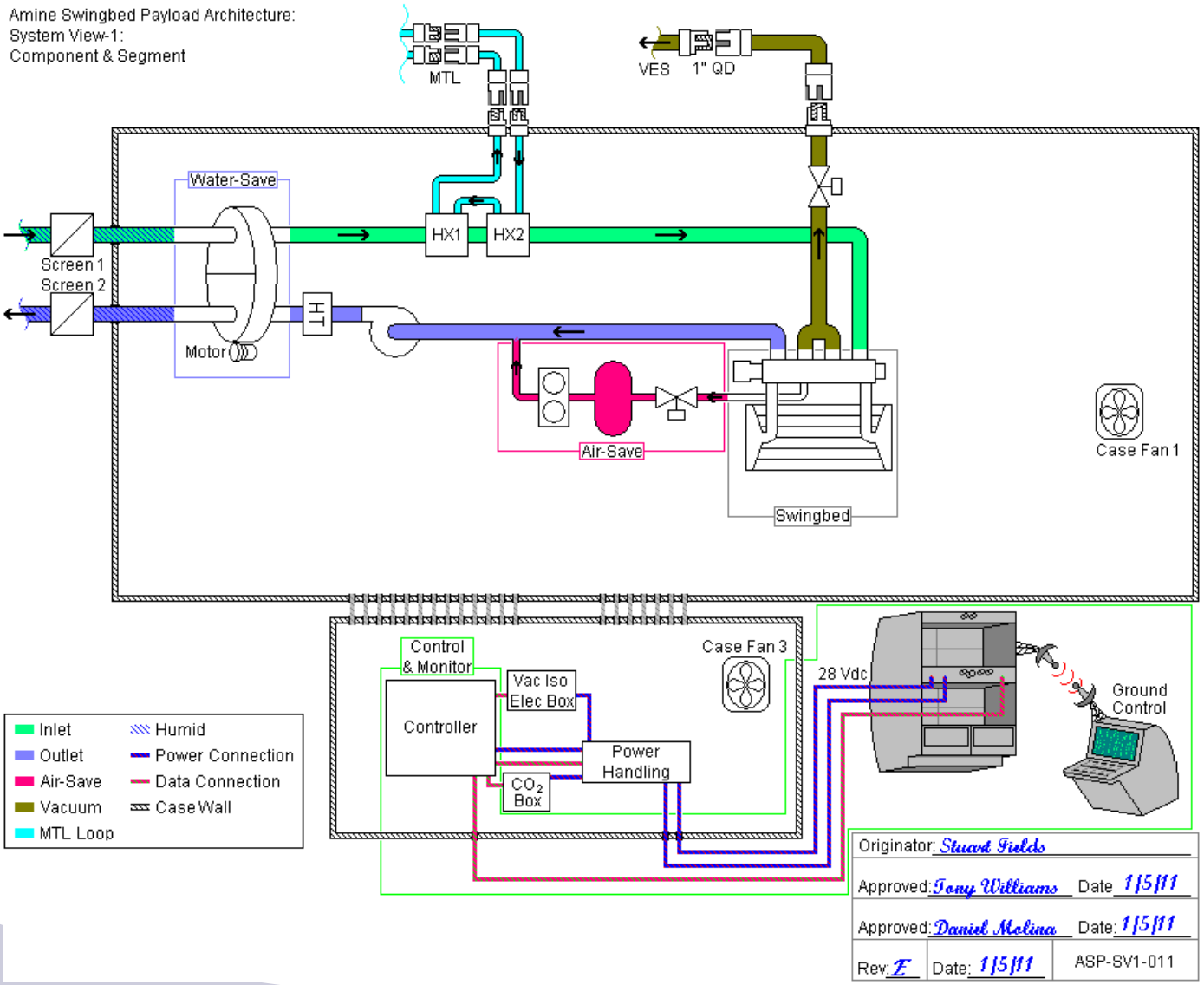
- The payload will demonstrate CO_2 removal from the ISS for a crew of 1 to 3 (depending on the operational mode) while minimizing water and air losses
- Basic CO_2 removal is performed by flowing cabin air through a bed of amine beads to collect CO_2 while exposing a second bed to vacuum to desorb previously-collected CO_2

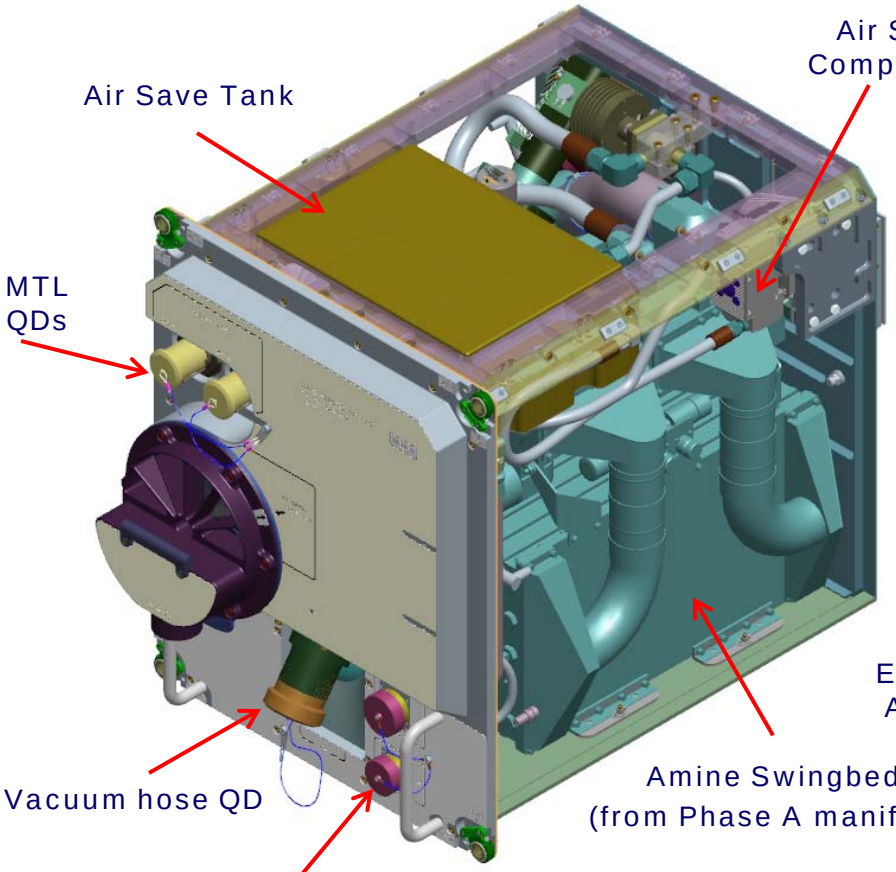


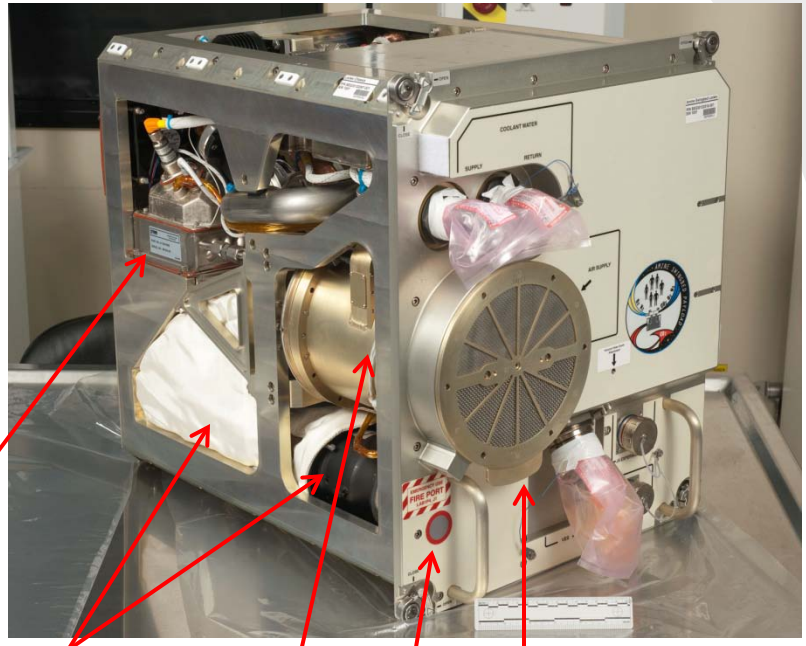
Swingbed
(~ 16”x17”x12”)

- The Amine Swingbed Payload will be housed in a Double Locker and ISIS drawer in Express Rack 8 in the U.S. Lab (Lab1_P4 location)
- Double Locker will contain the following:
  - Amine Swingbed (from Phase A hardware set)
  - Air Save Hardware
    - Compressor, air tank, air tank valve
  - Water Save Hardware
    - Desiccant wheel and motor
  - Fluid handling (air, water, vacuum)
    - Heat exchangers, heater, blower, MTL coolant lines, air ducting, vacuum isolation valve
  - Mounting Hardware, cabling, cooling fan
- ISIS Drawer will be modified to house the following electronic hardware:
  - Control & Monitor hardware
  - Power handler
  - CO2 sensor electronics
  - Vacuum isolation valve electronics
  - Cabling, cooling fan

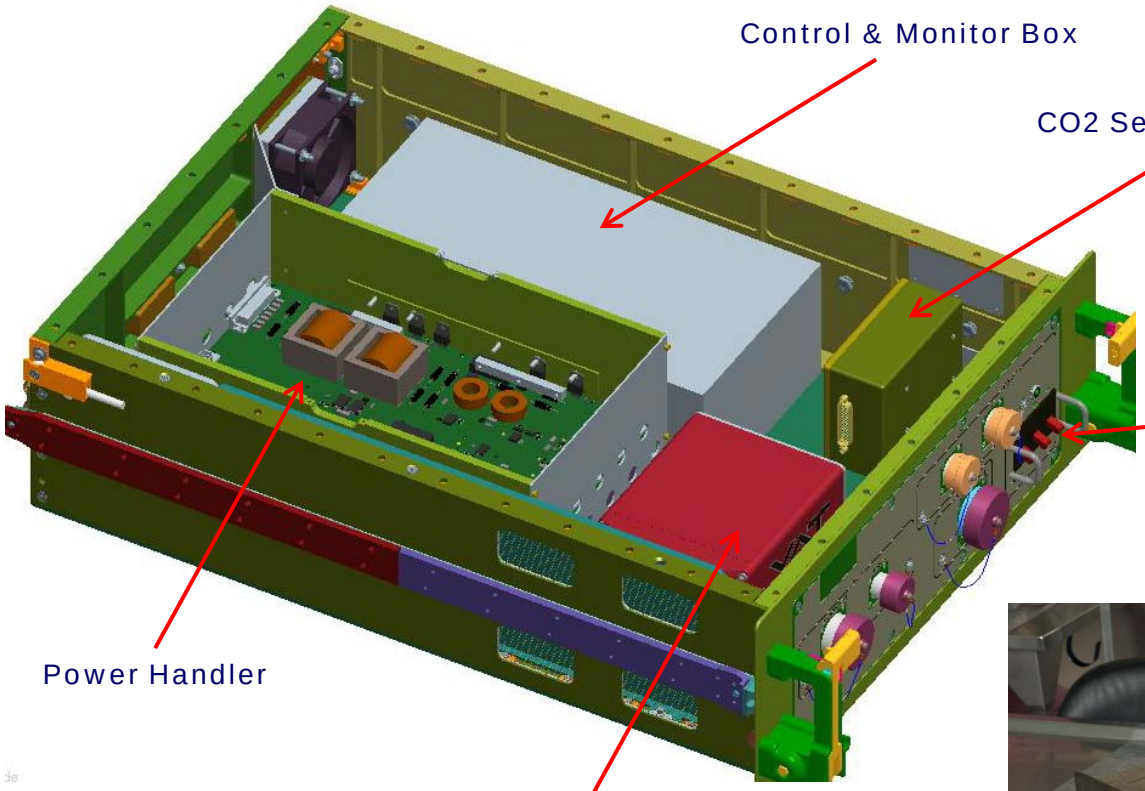
Note: Some hardware required for Payload operation will be borrowed from on orbit ISS inventory (see Backup for list)


Amine Swingbed Payload Architecture:
System View-1:
Component & Segment
MTL
VES
1" QD
Water-Save
HX1
HX2
Screen 1
Screen 2
Motor
HT
Air-Save
Swingbed
Case Fan 1
Control & Monitor
Controller
Vac Iso Elec Box
Power Handling
CO2 Box
Case Fan 3
28 Vdc
Ground Control
Inlet
Outlet
Air-Save
Vacuum
MTL Loop
Humid
Power Connection
Data Connection
Case Wall
Originator: Stuart Fields
Approved: Tony Williams Date 1/5/11
Approved: Daniel Molina Date: 1/5/11
Rev: E Date: 1/5/11
ASP-SV1-011

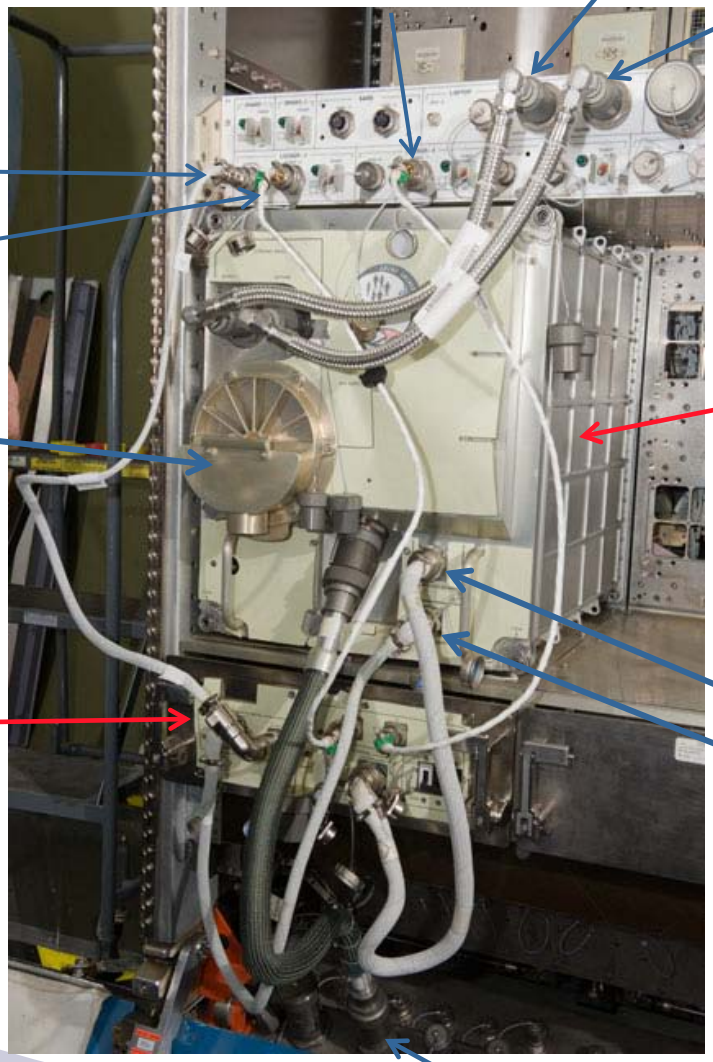


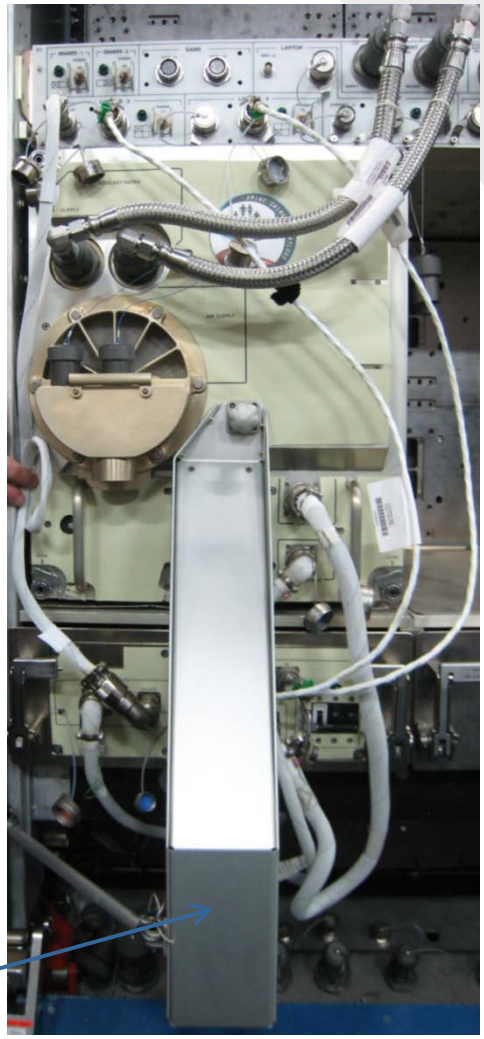


Not shown: Double locker enclosure, Outlet air duct, cable routing


Control & Monitor Box
CO2 Sensor Electronics
Circuit Breaker
Power Handler
Vacuum Isolation
Valve Electronics

- EXPRESS Rack
  - Power
    - Two 28 Vdc from ISIS drawer to rack
    - 730 Watts Total
  - Moderate Temperature Loop (MTL) used for active cooling
  - Structural Mounting
    - Double locker (Locker 3 & 4 location)
    - ISIS drawer (below Locker 4)
    - Vacuum hose enclosure attached to front panel & secured to seat track
  - Ethernet interface
    - Connection to ISIS drawer
    - Experiment command and data transfer through RIC only (no crew commanding)
- Z-Panel
  - Direct vacuum interface at VES location
- ISS Cabin
  - Cabin air
    - Fire port added to access Process Air loop





Not shown: Outlet air duct

- Installation & Assembly
  - Crew will install the Double Locker into Express Rack 8 (ER8) and remove the chassis in order to install the Swingbed
    - Launch supports will be removed and Swingbed from Phase A hardware manifest will be installed
    - Vacuum line, inlet and outlet air hose, power and data connections to the Swingbed will be made
  - Crew will return the chassis to the Double Locker and will install the Plenum/Filter Adapter to the face of the Double Locker and will complete the Vacuum jumper hose, air ducting, MTL lines, and power/data cable connections to ER8
  - Appropriate connections between the Double Locker, the ISIS drawer and ER8 will be confirmed
  - Ground support team will coordinate final installation leak check with MOD/ISS ECLSS

- Big Picture Experiment Operations
  - Two experiment modes will accommodate a low blower speed test and a high blower speed test
    - Mode A - Low blower speed test:
      - Projected conditions: 10 cfm, 20 minute half cycles (shorter if running less than 24 hours/day)
      - Chosen in order to allow operation for longer time periods while remaining under the noise, air loss and water loss constraints (~976 hrs total test time)
    - Mode B - High blower speed test:
      - Projected conditions: 26 cfm (or max), 6.5 minute half cycles
      - Must be performed in shorter time increments in order to remain under the noise, air loss and water loss constraints (~24 hrs total test time)

Experiment Nominal Test Sequence

Test	Duration (hrs)	Mode	Cumulative Experiment Time (hrs)
1	100	A	100
2	8	B	108
3	392	A	500
4	8	B	508
5	484	A	992
6	8	B	1000

- Experiment Operations (cont'd)
  - Payload will be controlled and operated from the ground at JSC in the Payload Operations Control Center (POCC) in Building 30
    - Swingbed cycle time, blower speed, heater temperature, compressor speed and test duration will be set to the appropriate test operational parameters by the payload console operator
    - Operations will be commanded to start (requires coordination with the Payload Operations Integration Center (POIC) at MSFC)
    - Data will be reviewed and parameters will be adjusted as necessary in order to optimize the payload experiment results while remaining within resource limits
    - At completion of the experiment, either an operator command or software timer will stop the experiment
  - Following initial installation and checkout tasks, crew interaction is minimal
    - Two placeholders planned to clean inlet air filter on front of double locker
- Disassembly
  - Once experiment is complete, Payload may be removed from rack and stowed on ISS or trashed depending upon ISSP direction