


Johnson Space Center Engineering Directorate

L-8: Space Environments Test Capability / James Webb Space Telescope

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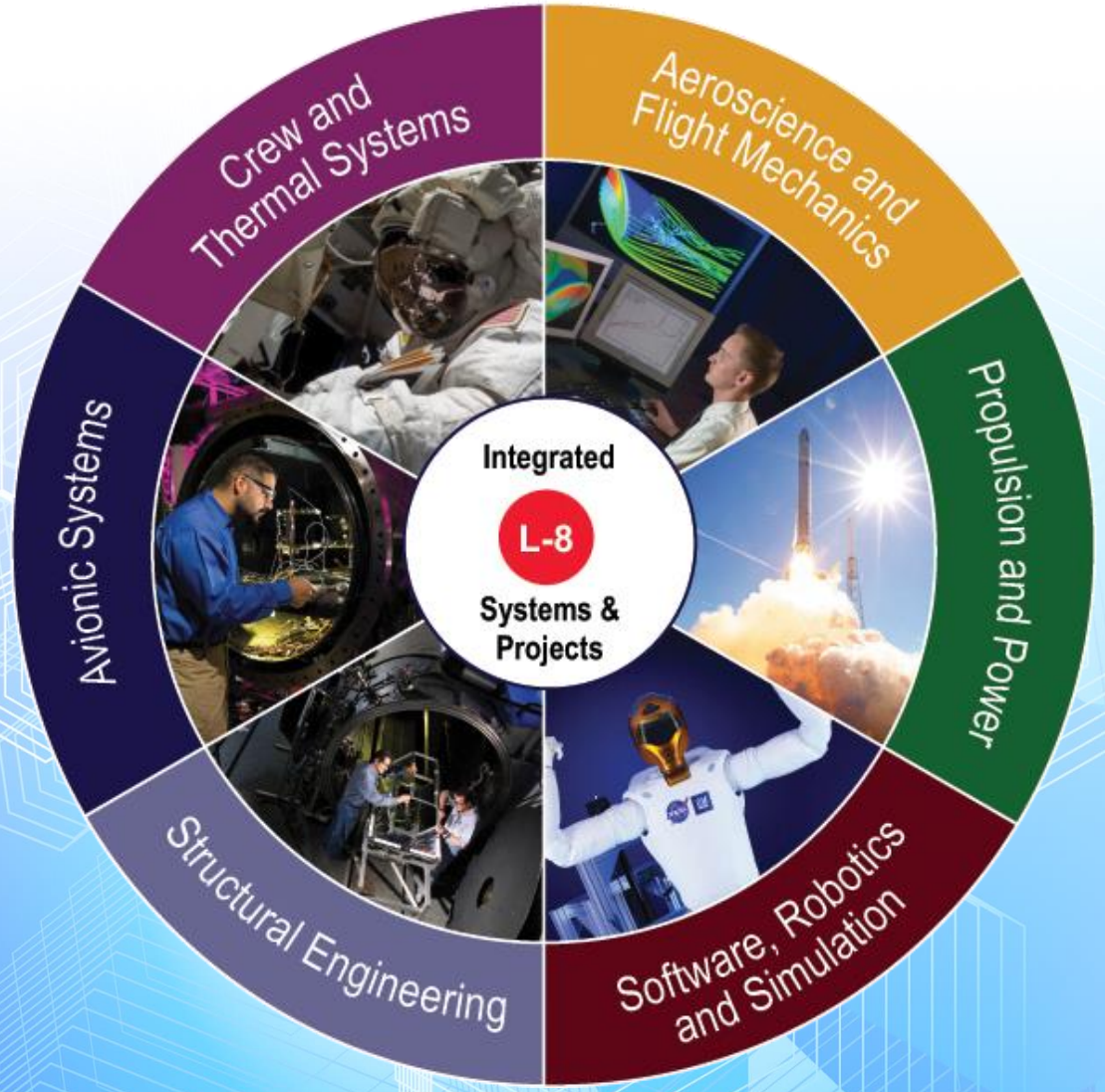
JSC Engineering: HSF Exploration Systems Development



- We are sharpening our focus on Human Space Flight (HSF) Exploration Beyond Low Earth Orbit
- We want to ensure that HSF technologies are ready to take Humans to Mars in the 2030s.
  - Various Roadmaps define the needed technologies
  - We are attempting to define our activities and dependencies
- Our Goal: Get within 8 years of launching humans to Mars (L-8) by 2025
  - Develop and Mature the technologies and systems needed
  - Develop and Mature the personnel needed
- We need collaborators to make it happen, and we think they can benefit by working with us.

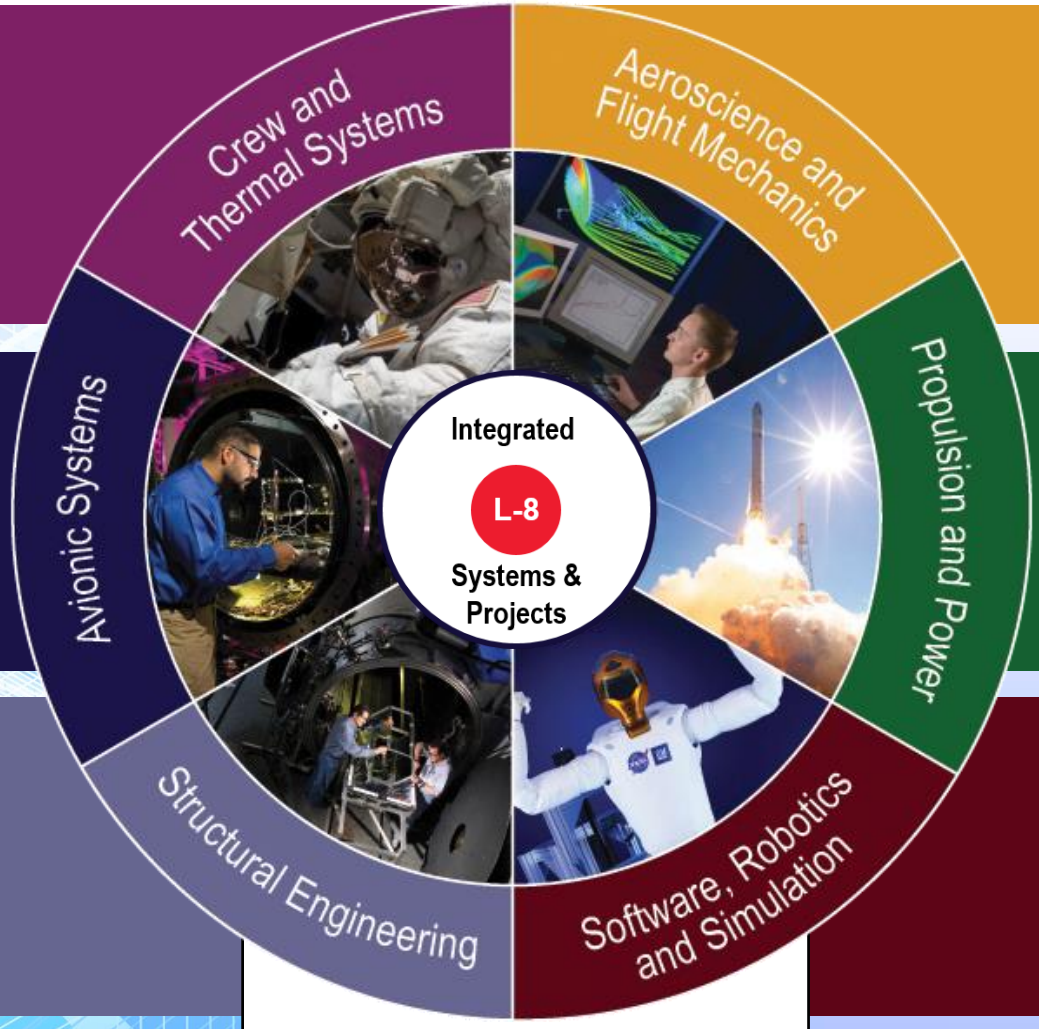
EA Domain Implementation Plan Overview

JSC Engineering: HSF Exploration Systems Development

- Life Support
- Active Thermal Control
- EVA
- Habitation Systems

- Human System Interfaces
- Wireless & Communication Systems
- Command & Data Handling
- Radiation & EEE Parts

- Lightweight Habitable Spacecraft
- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Vehicle Environments



- Entry, Descent, & Landing
- Autonomous Rendezvous & Docking
- Deep Space GN&C

- Reliable Pyrotechnics
- Integrated Propulsion, Power, & ISRU
- Energy Storage & Distribution
- Breakthrough Power & Propulsion

- Crew Exercise
- Simulation
- Autonomy
- Software
- Robotics

AA-2 | iPAS | HESTIA | Morpheus

Crew and Thermal Systems

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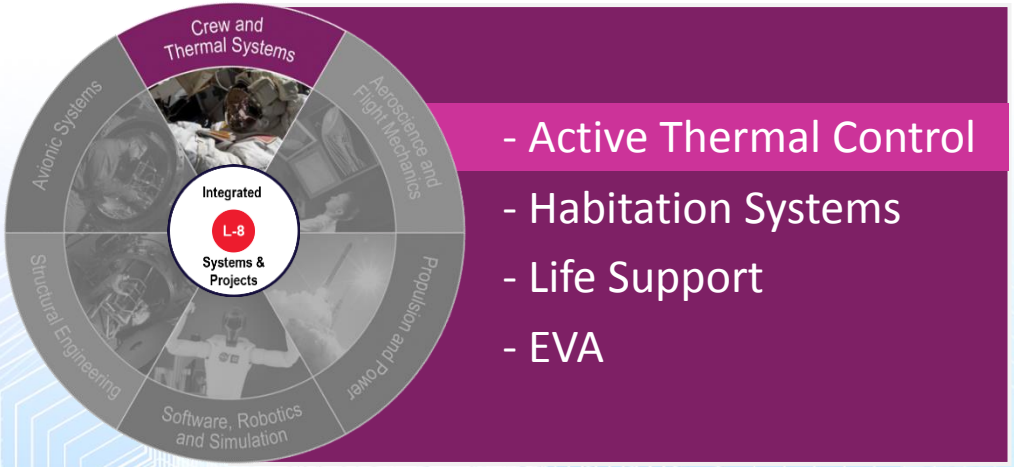


- Active Thermal Control
- Habitation Systems
- Life Support
- EVA

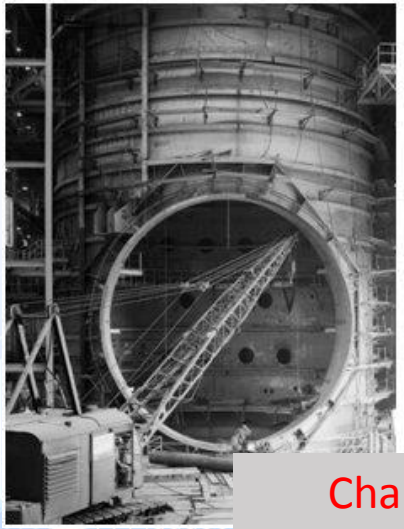
The Problem

- *Chamber A was designed for Apollo Lunar travel and Low Earth Orbit missions. (100 K environment)*
- *JWST needed a deep space environment (<20 K)*
- *NASA Science Directorate needs a facility for follow on missions (W-1st, Origins Surveyor)*
- *JSC needs a facility for testing beyond Low Earth and Mars surface environments.*

Space Environments Test Capability / James Webb Space Telescope

- *For JWST we needed a deep space environment (Very Dark and Cold: <20 Kelvin)*
- *We collaborated with the cryogenics department at the DOE's Thomas Jefferson National Accelerator Facility*
  - *This collaboration was made possible by NASA's involvement in the Cryogenic Engineering Conference*

Chamber A

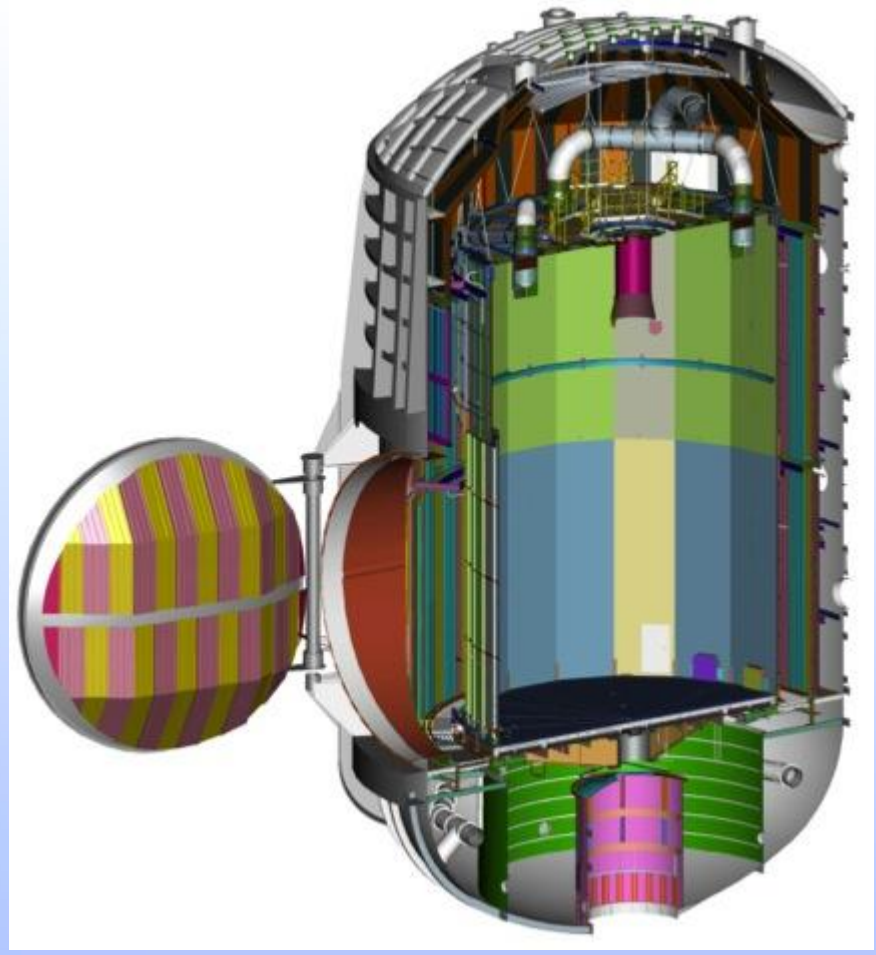


Chamber A Construction and Apollo Testing

JWST Pathfinder Testing in Chamber A

Chamber Specifications

- *Chamber A:*
  - *New Helium/Deep Space Shrouds dimensions:*
    - *13.7m diameter x 20m tall*
  - *Thermal Capabilities:*
    - *Current tested: 15 K to 335 K*
    - *Potential exists to go colder or warmer with shrouds*
  - *Refrigeration Capabilities*
    - *100 KW @ 100 K*
    - *18 KW @ 20 K*



Chamber A Future Testing

- *What the future brings*
  - *Chamber A is capable of creating Low Earth Orbit to Deep Space Environments*
    - *NASA's future missions will require these colder environments*
    - *Perhaps even lower than 10 Kelvin*
  - *Chamber A is capable of creating Martian surface environments*
    - *Surface Temperatures, Atmospheric Pressures and Gas Compositions*
    - *Size is large enough for habitat modules and large surface hardware*
    - *Was human rated for Apollo testing*

- *NASA JSC has a facility to support future missions.*

JSC Future Testing

- *Chamber A is the largest of the Thermal Vacuum Chambers at JSC, but we have a variety of test facilities:*
  - *Human Rated Chambers*
    - *Chamber B*
      - *7m dia x 5 meter high thermal environment*
      - *High vacuum, LEO (100 Kelvin)*
      - *Only LEO Man rated chamber*
    - *11 ft*
      - *Vacuum testing for space suit performance testing with human subjects*
      - *Orion ECLSS development testing*
    - *SSATA*
      - *Station Airlock Simulation*
    - *20 ft*
      - *Closed loop ECLSS Hardware Analog Testing. Cabin / Habitat module pressures (min 4 psi)*

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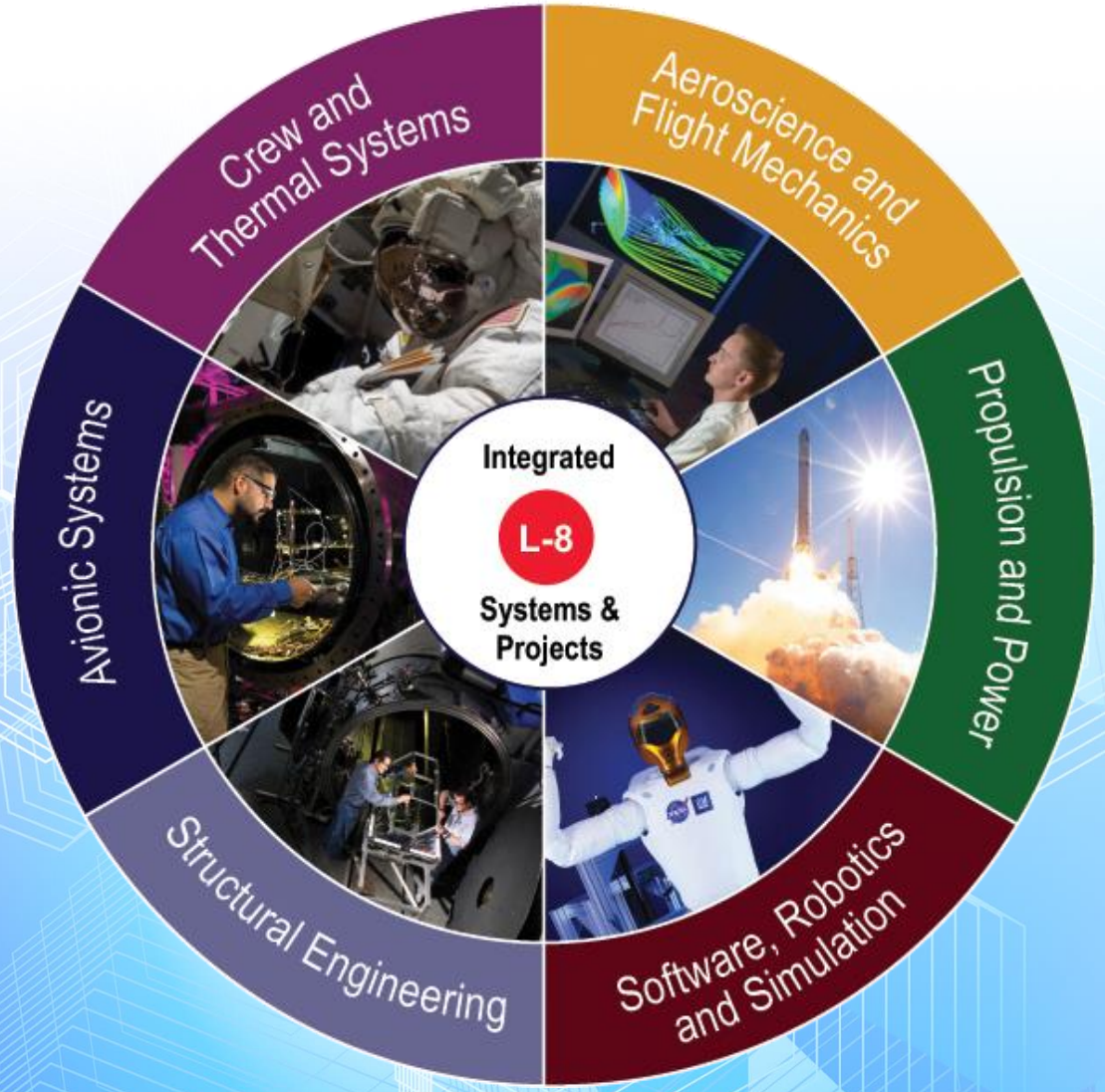

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  - Pointer to Co-Dev Announcements
  - Pointer to intake site