JOSHUA W. EHRLICH

NASA Pathways Intern Employment Program

Summer 2012 – Spring 2013

Overview

- About Me
- NASA Engineering (NE) Support
  - Materials Science Division
    - Failure Analysis & Materials Evaluation (NE-L1)
    - Materials Engineering (NE-L4)
  - Mechanical Division
    - Structures & Mechanisms Design (NE-M2)
    - Flight Mechanisms/Crew Systems (NE-M3)
- Future Work
- Acknowledgments
- Q & A

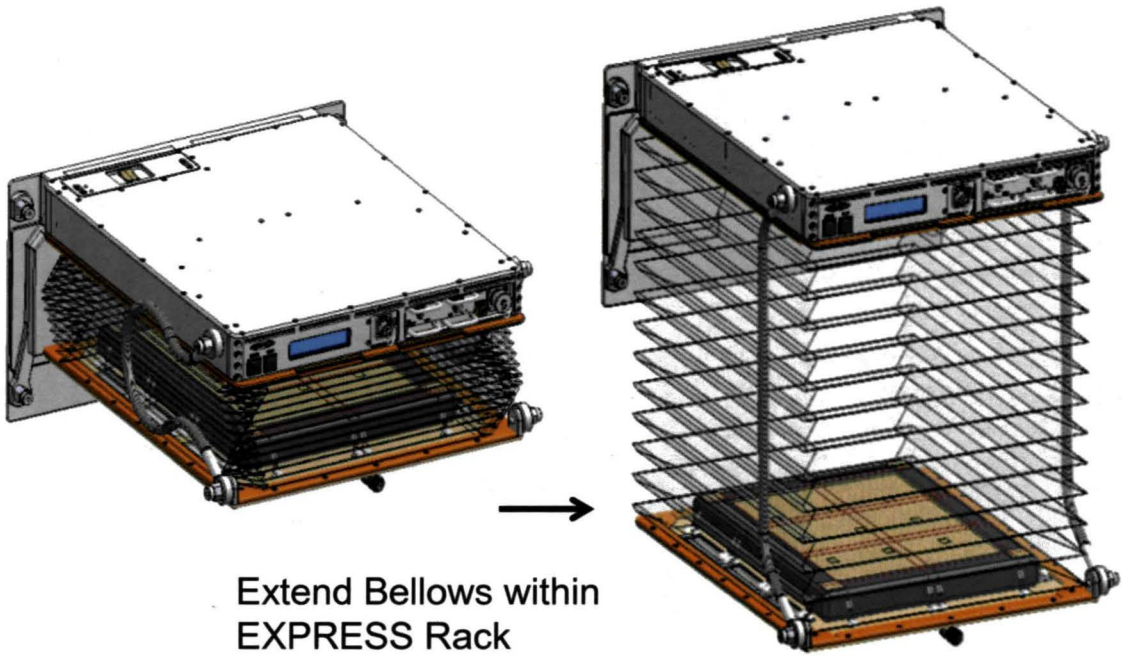
About Me

- Lived in Hollywood, FL for 20 years
- Education
  - University of Florida
    - B.S.A.E. c/o 2011
  - Embry-Riddle Aeronautical University
    - M.S.M.E. c/o 2013
    - Master's thesis: "Investigation of a Lagrange-Point Propellant Depot Rendezvous Approach Within the Restricted Earth-Moon Two-Body System for an Interplanetary Mission to Mars."

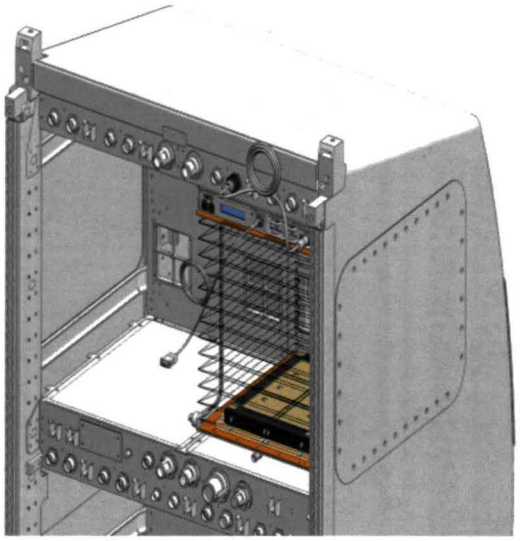
EMBRY-RIDDLE
AERONAUTICAL UNIVERSITY

Vegetable Production System

- Vegetable Production System (Veggie)
  - Small, self-sustainable plant growth EXPRESS rack payload for recreational growth of vegetables and other plants on-orbit
  - Equipped with Light Cap Assembly utilizing LEDs, cabin & avionics air circulation systems, and Root Mat Assembly
  - Target launch date in September 2013 on SpaceX CRS-3



Extend Bellows within EXPRESS Rack

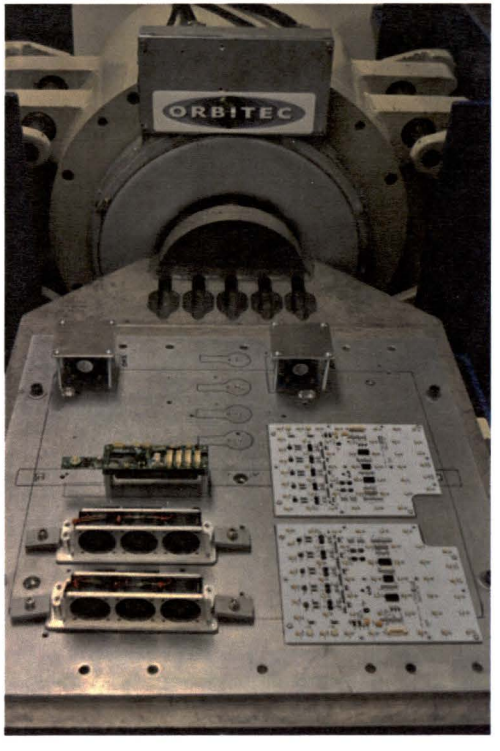


Vegetable Production System

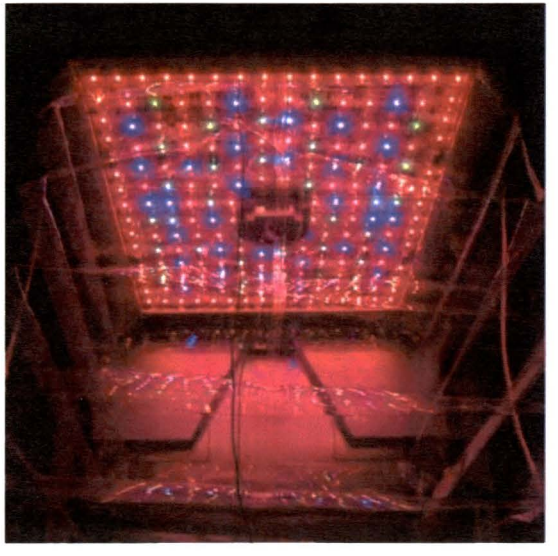
- Systems Engineering Responsibilities:
  - Interface Control Document
  - Functional Test Plan procedures and Event Work Orders:
    - Vibration testing
    - Acoustic testing
    - Payload Rack & Checkout Unit (PRCU) testing
    - Functional testing
- Flight Safety Data Package
- Design Verification Matrix / Verification & Validation (V&V)
- Acceptance Design Package (ADP)

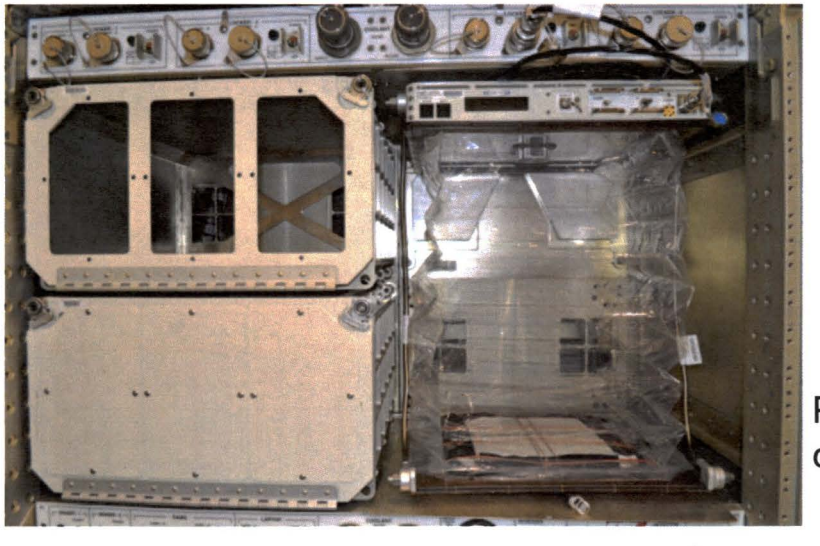
Vegetable Production System

Vibration testing at ORBITEC facility in Madison, WI

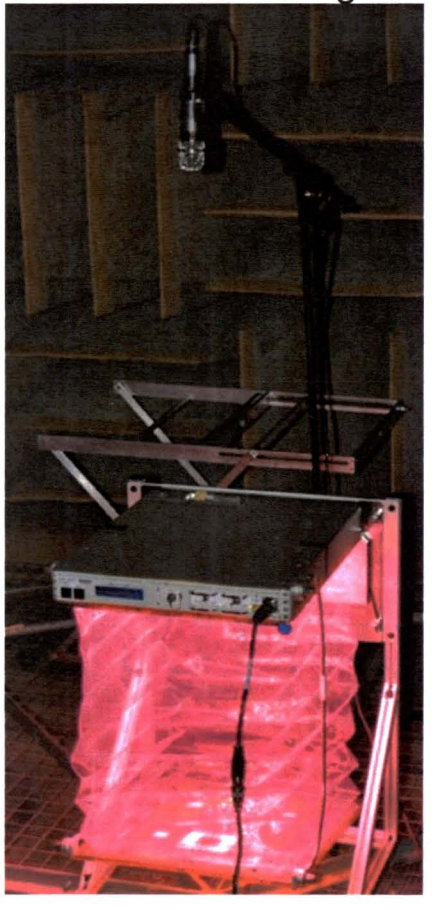


Functional testing conducted at KSC EMI Laboratory





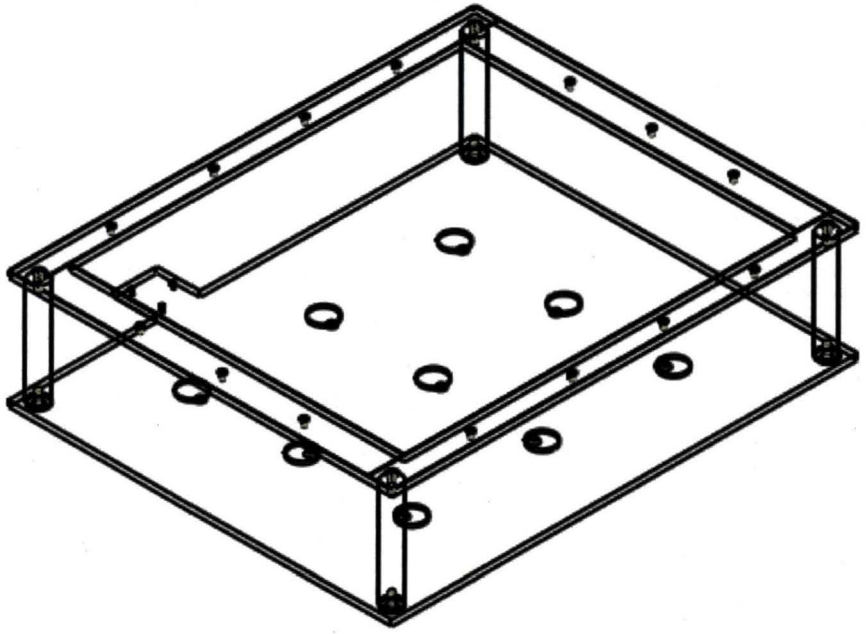
Acoustics testing

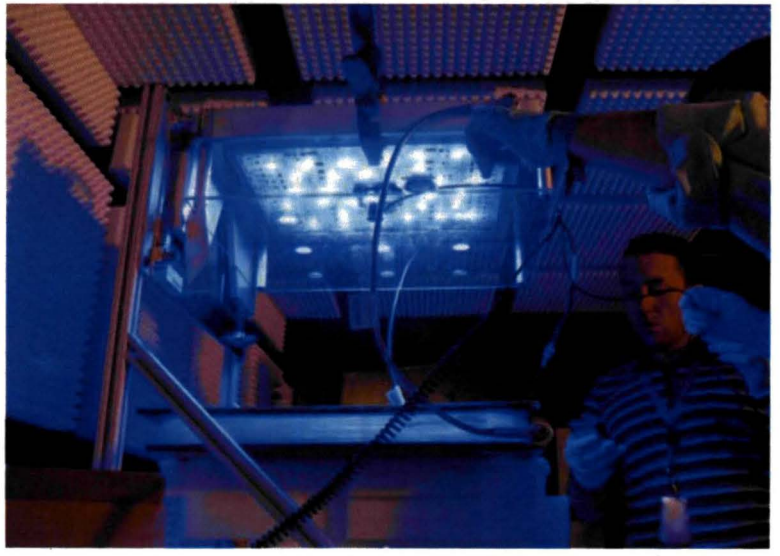


PRCU testing conducted at MSFC

Vegetable Production System

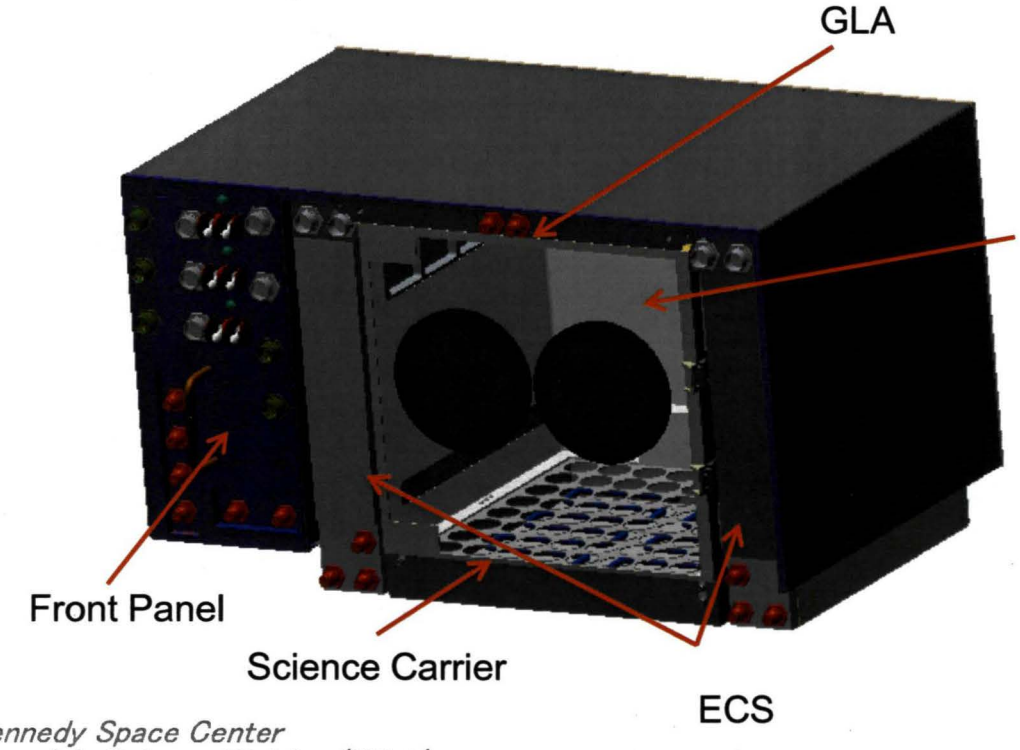
Designed and manufactured an LED ground support equipment testing fixture for V&V testing and Acceptance testing of VEGGIE payload.





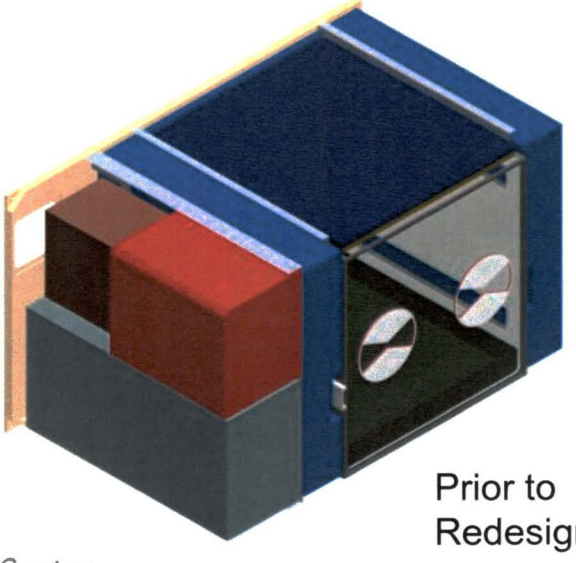
Advanced Plant Habitat

- Advanced Plant Habitat (APH)
  - Will be the largest microgravity plant growth chamber on the International Space Station (ISS)
    - Quad-locker EXPRESS Rack payload
    - Used for the study of long-term effects of microgravity on plant specimens
  - Target launch date in December 2015

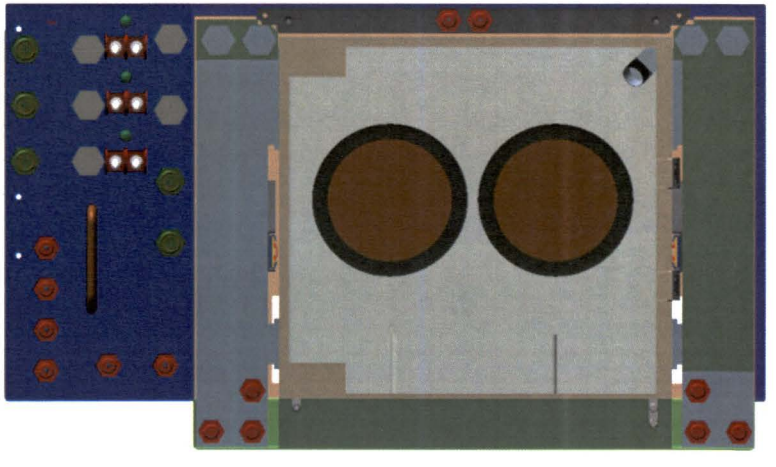


Advanced Plant Habitat

- Systems Engineering Contributions:
  - Concept of Operations (ConOps)
  - Interface Definitions Document
  - Science Requirements Envelope Document
  - Compliance Matrix
  - Preliminary Design Review (PDR) items
  - FSDP
  - Redesign effort to fit within MO3 cargo transfer bag (CTB)

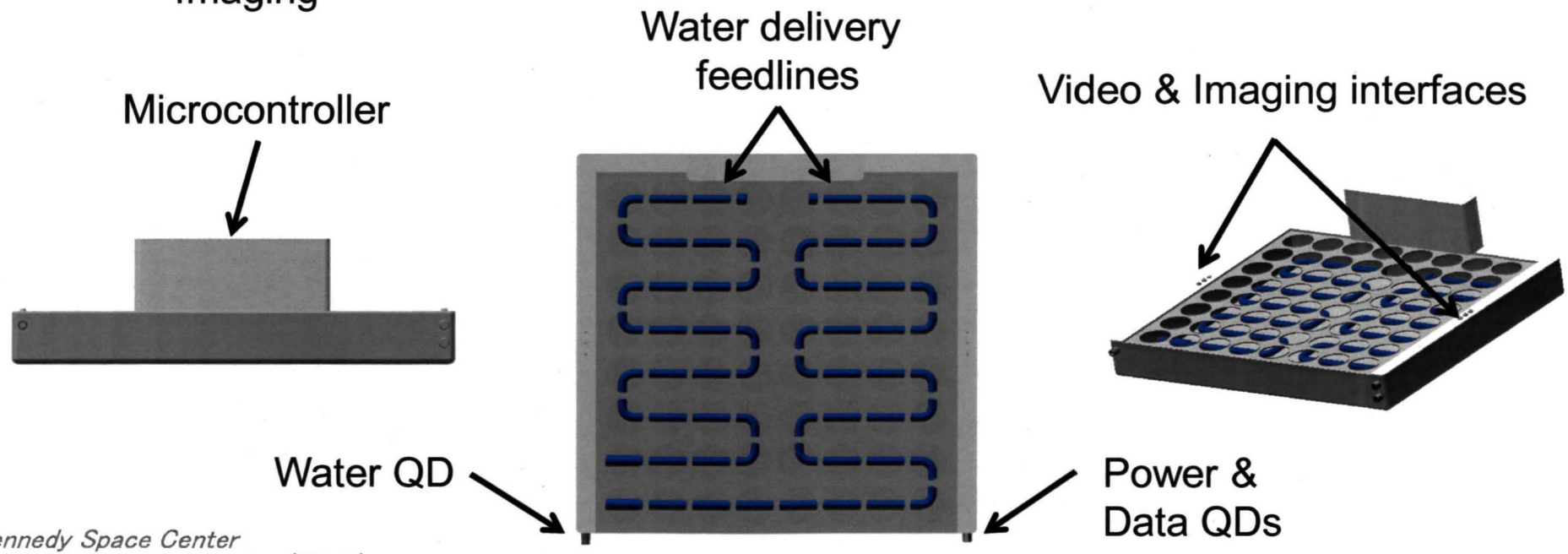


Prior to Redesign



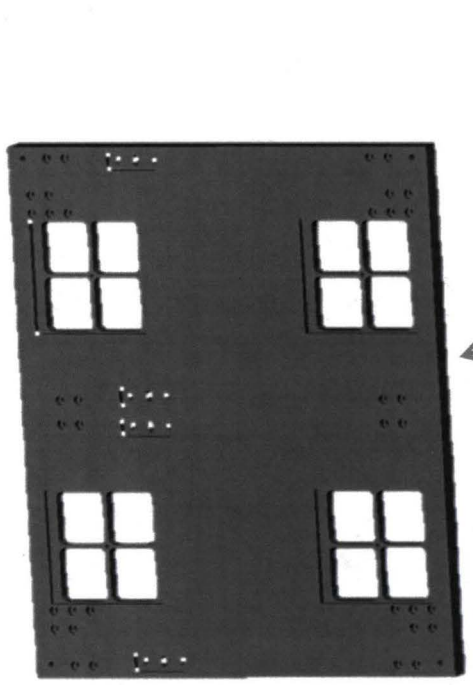
Advanced Plant Habitat

- Science Carrier
  - A removable and reconfigurable tray within APH that will provide the principal structural support and final water delivery to the root-zone for on-orbit plant growth experimentation
  - Consists of a structural element, a water delivery mechanism, and microcontroller
  - Interfaces: Water delivery input, Data QD, Power QD, Video & Imaging

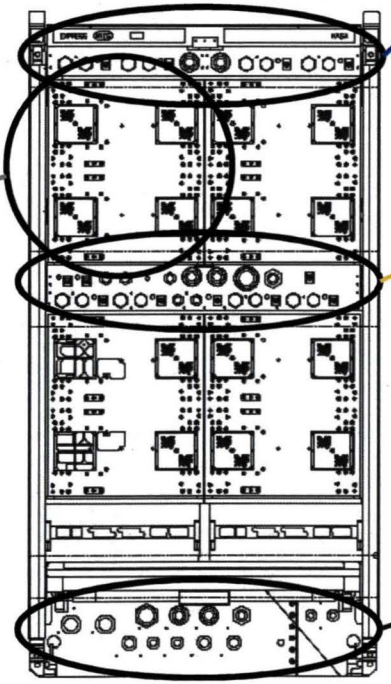


Advanced Plant Habitat

- Pro-E Modeling
  - Provided support to Mechanical teams creating simulated parts for integration development of APH.

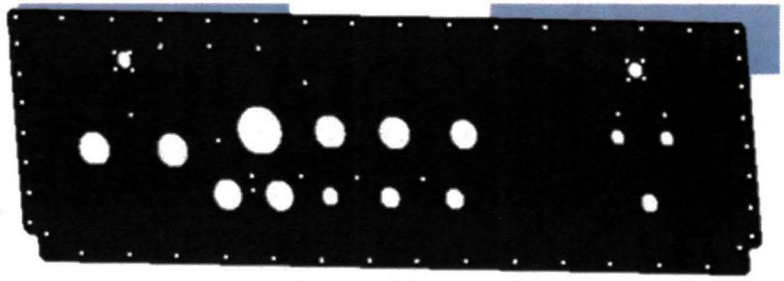


Locker Backplate



Top Panel Connector

Mid Panel Connector



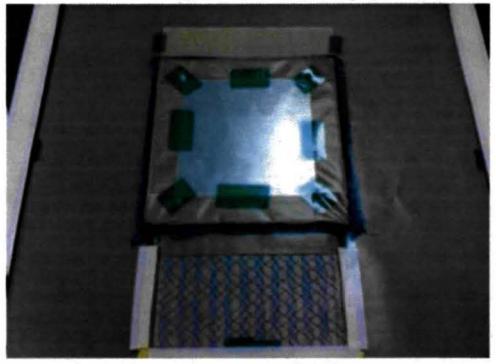
Utility Panel

Composites for Exploration

- Composites for Exploration (CoEx) Project
  - NASA-funded project to investigate dry composite structures and materials technologies with direct application to NASA's future space exploration needs.
    - Optimized Procedure for Resin-Infused Carbon Fiber Composite
    - Intermediate modulus 7 (IM7) / Bismaeleimide-2 (BMI-2) resin
    - Studies performed:
      - Metallographic optical microscopy
      - Scanning election microscope (SEM) porosity analysis
      - Differential scanning calorimetry (DSC)
      - Thermogravimetric analysis (TGA)
      - Tensile strength
      - Compression strength
  - Technical paper presentation at SAMPE Conference in Long Beach, California, planned for May 2013

Composites for Exploration

Composite Bagging

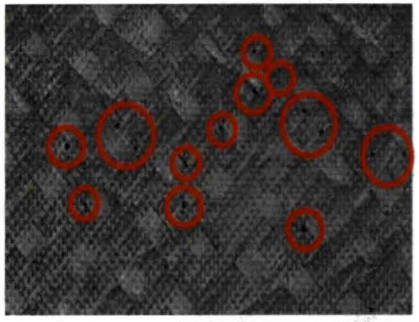


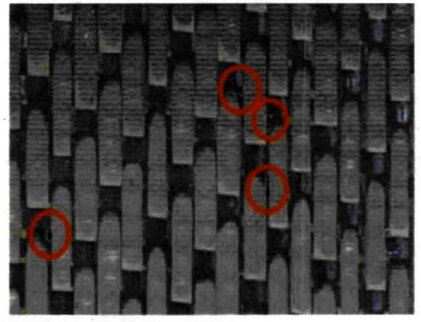
Optimized

Cure Cycle

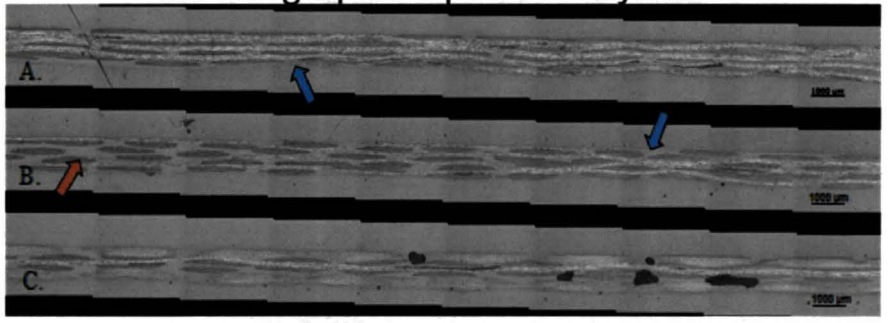
Post-Cure Inside Oven

Back-Lit Illumination Photography

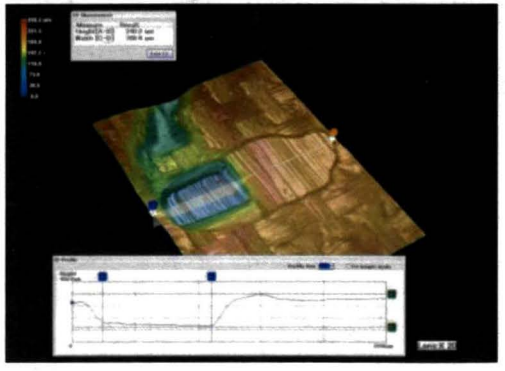


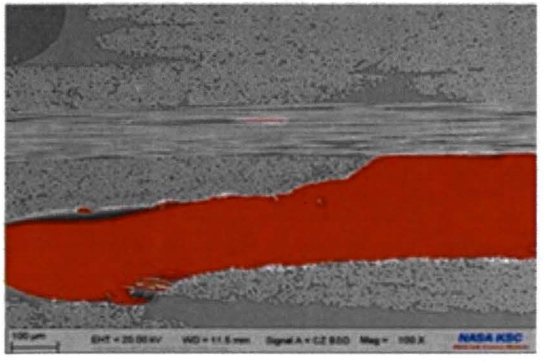


Metallographic Optical Analysis



Keyence 600 3-D Image

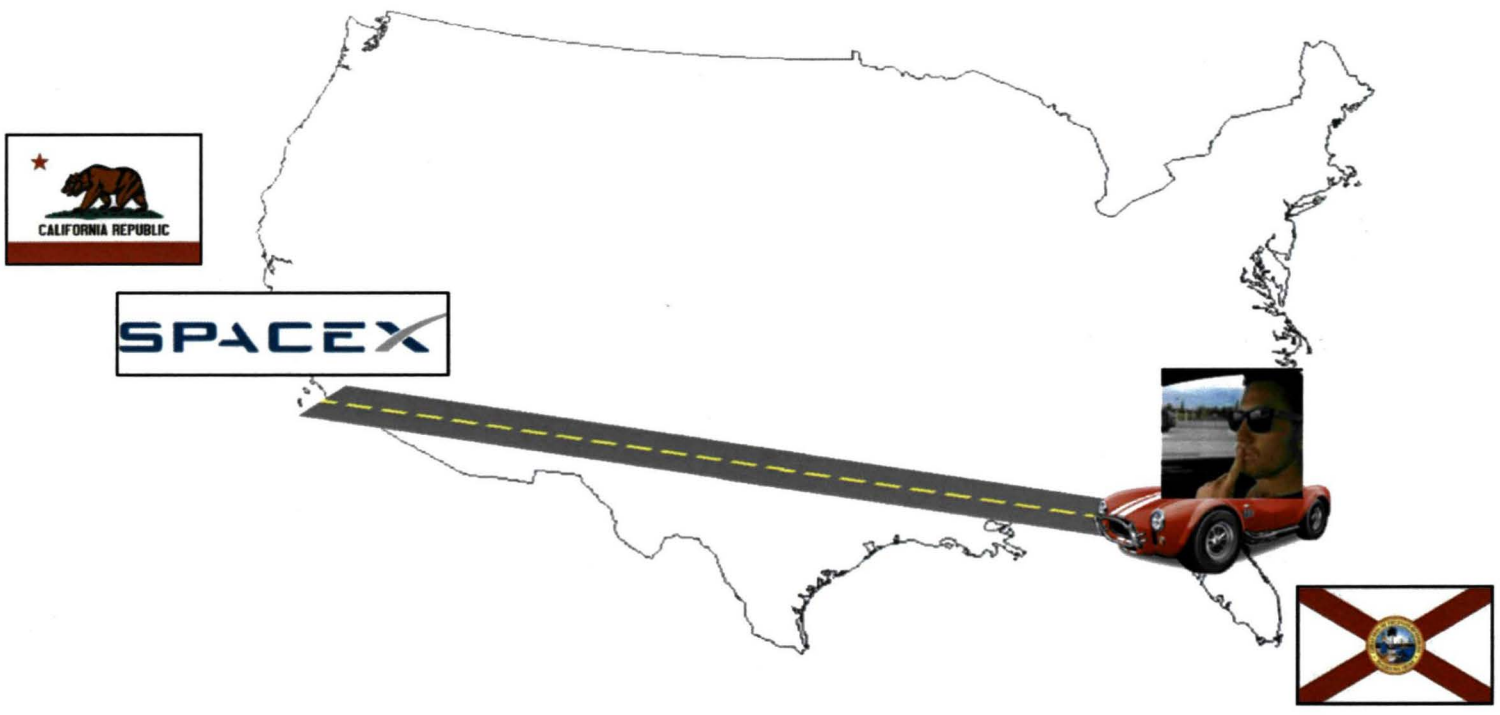




SEM Porosity Analysis

Future Work

- SpaceX, Hawthorne, CA
  - Lead Integration & Test Engineer for Falcon 9 Interstage



Acknowledgments

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  - Alexis Hongammen
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- Pathways Program Staff
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  - Dr. LaNetra Tate
- NE Staff
  - Sharon Andre
  - Sarah Cox
  - Clara Wright

The entire NASA KSC Family

KSC ENGINEERING AND TECHNOLOGY

Questions?