Inflatable Habitat Testing Capabilities at MSFC

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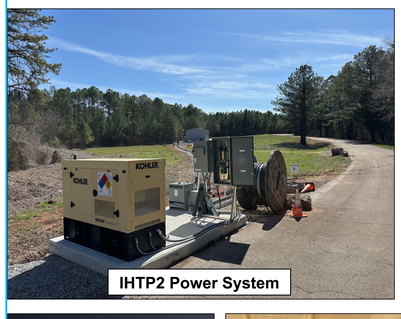
SUMMARY

Since early 2022 Marshall Space Flight Center's (MSFC) Test Lab (ET) has been the premier inflatable habitat testing organization for NASA. In the past two years the Center has strategically invested in this thriving business unit; bringing to life four distinct facilities and a dozen unique capabilities. The Center has been successful in partnering with companies developing softgoods architectures and has already executed several test campaigns for them. This poster gives an overview of the Test Lab's capabilities and the facilities used for inflatable habitat testing.

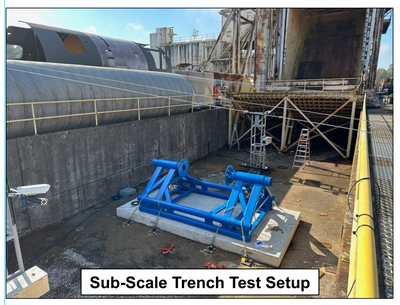
GENERAL CAPABILITIES

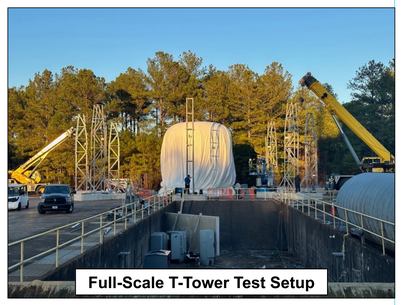
- Gas Supplies
  - High Purity Air (HPA) – 3,500 psig
  - Nitrogen (GN2) – 5,000 psig
- Instrumentation
  - Pressure Transducers, Thermocouples, Strain Gauges, Flow Meters
- High Speed Video
  - Typically run cameras at 4,000 FPS
  - Higher speeds/resolutions are available as needed
- Displacement and Strain Measurement Systems
  - VIC and ARAMIS Photogrammetry Systems
  - LEICA Laser Deflection Measurement System
- Lights
  - 40 each 200W Godox SL200 studio spotlights
- Camera Stands
  - 8 each 12' Sub-scale stands
  - 8 each 30' Full-scale stands
- Power
  - All test positions use permanent power infrastructure maintained by by the Army and HSV Utilities
- Blast Wave and Acoustic Modeling and Measurement
  - Near and far field blast wave models and measurements on sub and full-scale burst tests (ER42 and EV33)
  - Meteorological models predict acoustic noise (RTC)
- Heavy Lift Equipment
  - KAMAG transporter
  - Mobile cranes
  - Forklifts
- Facility Pan-Tilt-Zoom Cameras (PTZs)
- Load Application (Stiffness Testing)
  - Small scale (hundreds of lbf) and large scale (millions of lbf) load actuators and sensors
  - Load control systems and data collection
  - Deflection measurement devices

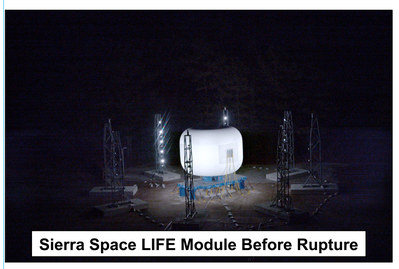


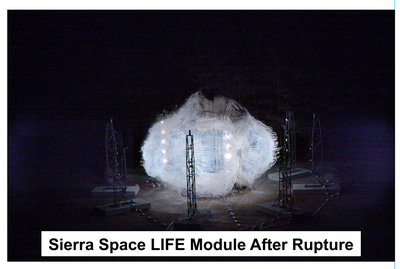
T-TOWER

- T-Tower Burst Test Facilities
  - Modular burst test facility that can be customized to fit any customer needs
  - Historic Saturn 1/1C test stand
  - Test Lab has used NE flame trench to conduct burst tests for nearly two decades
    - Mainly COPVs, but inflatable habitats more recently
  - Inside-Trench Position: Sub-Scale Tests
    - Trench Dimensions: 11' D x 30' W x 120' L
    - Modular Concrete Pad: 10' W x 20' L
    - Deployable tarp cover during test operations allows for even lighting and protection from weather
  - Outside-Trench Position: Full-Scale Tests
    - Concrete Pad: 75' W x 75' L



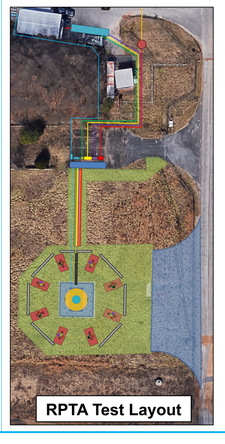






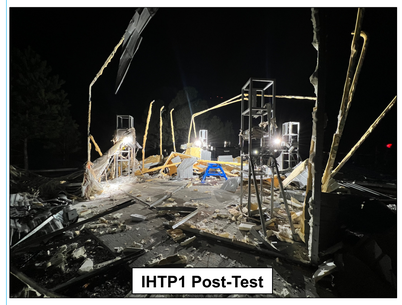
RPTA

- Rapid Pressurization Test Area (RPTA)
  - State-of-the-art burst test facility in remote location with capabilities to envelope any test requirements
    - Designed to support both sub-scale and full-scale
  - Modular camera stands on concrete bases can be configured to the customer's specifications
  - Variable-position fluid valves allow for accurate control of pressure ramps to burst
  - Cross-country gas supply allows for near limitless fluid volume and pressure
  - Permanent power, instrumentation, and controls installation support robust test operations
  - Located in the middle of a large open field with a 40' square test pad
  - Concrete Test Pad: 1' H x 40' W x 40' L



IHTP 1 & 2

- Inflatable Habitat Test Positions (IHTP1 and 2)
  - Turn-key facility for long-duration creep testing and long-duration leak campaigns
  - Quickly deployable environmental enclosures
    - Rebuilt in 4 weeks
  - Two (2) test positions both designed for rapid reuse
  - Features:
    - Environmental Enclosure:
      16' H x 30' W x 30' L
      Roll Up Door: 12' x 12'
      Modular concrete pad
      4.0 ton HVAC system
    - Back-up generators (16 hours run time at full load)
    - Remote control and monitoring of test
    - High-speed cameras run on constant buffer until burst initiated trigger
    - Designed for 2 years of robust operation



MATISS

- Multi-Axis Test of Inflatable Softgoods Structures (MATISS)
  - A large-scale, multi-axis test fixture to characterize biaxial and shear properties of large sub-component panels, enabling higher fidelity FEA verification and validation, and sub-component level testing of novel habitat architectures.
- Features:
  - Biaxial loads of 1,000,000 lbf in both X and Y-axes, with test to failure capability
  - 35-ft diameter self-reacting horizontal load frame provides attachment points for additional actuators / hardware as needed for custom tests
  - Accommodates specimens up to 16' x 16'
  - Nominal test section of 4' x 4' (20,000 lbs/in max)