National Aeronautics and Space Administration

NASA

Marshall Space Flight Center

Special Test Equipment Design

Engineering Solutions for Space Science and Exploration

Liquid Metal (Na K) Loop flexibility model

SLS Intertank Test Fixture (2.5 million lb of steel)

Shell Buckling Test Fixture

6.4 percent acoustic model at TS116

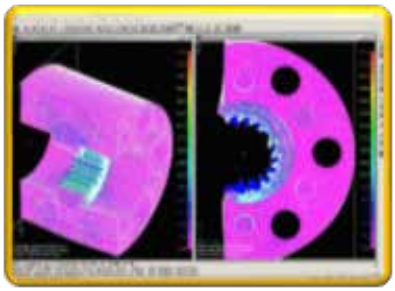
Cryogenic System Vent

Special Test Equipment (STE) Design has been Marshall Space Flight Center's (MSFC's) leading design organization for ground test hardware since the center's inception.

This hardware, called special test equipment, includes test stands, test beds, cryogenic and noncryogenic fluid delivery systems, high-pressure and/or high-temperature pressure vessels and chambers, vacuum systems, load reaction and application structures, load line components, linear and rotary motion devices, R&D prototypes, flight hardware mockups and simulators, tooling fixtures, handling and stands transportation equipment, and personnel access.

The STE Design Team also performs 3D printed modeling and continues to supply other MSFC and industry organizations with STE Designs and Analyses.

Atlas II AR (RD180 Engine) hot fire at 4670



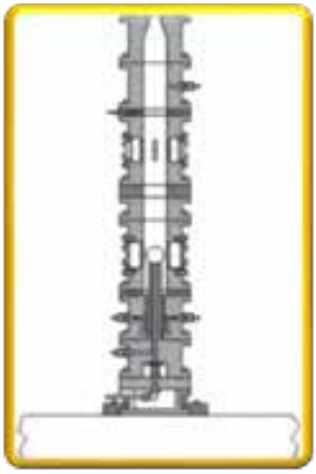
Rotary Motion Device FEM

3D Printed Model of TS 4699

The STE Design Team's diverse customer base provides this branch with a tremendous amount of experience in numerous engineering design areas.

The STE Design Branch consists of Structural Design, Piping Design, and Analysis Teams. The engineering skills mix of each of these teams reinforces the capabilities of the other team.

This relationship provides the ability to accomplish design tasks that neither team could perform alone and results in better products for our customers.



Test fixture for subscale combustion diagnostics research

Piping Design Team

Cryogenic Piping Delivery Systems Design and Analyses Include

- Low- and high-pressure cryogenic, fuel, nitrogen, and H_2Osystems.
- Test stand design and modifications.
- Piping flow, load, and growth/shrinkage analyses.
- FEA of piping systems, supports, and reaction structures.
- Pressure vessels.

Vacuum Systems Design and Analyses Include:

- Vacuum chambers, piping, and pump-down hardware.
- Test-specific support hardware.
- In-chamber load application and feed through devices.

Structural Design Team

Structural Fixtures Design and Analyses Include:

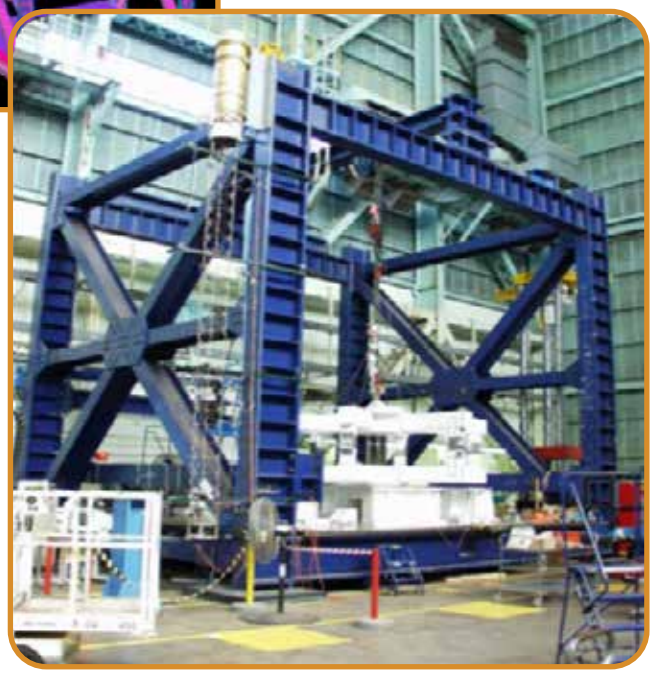
- Vibration Fixtures Design and Analysis
- Multiaxis linear motion systems design and modifications.
- Mode frequency specific mounting hardware.
- Mass simulators.

Additional Capabilities Include:

- Review of drawings for contract proposals
- Following projects from concept through completion
- Adherence to various industry or government codes andrequirements (AISC, ASME, AWS, NASA-STD-5005, etc.).
- 3D modeling for rapid prototyping and computer numericcontrolled manufacturing.
- Piping/Structural Team project collaboration.
- STE cost, manpower, and schedule estimates.
- Task initiation/contract monitoring for contractor personnel.
- Technical support for Critical Design Reviews, PreliminaryDesign Reviews, Source Evaluation Committees, and otherreviews.
- Representation of ET50 design interestings to variousfabrication, analysis, and flight hardware design organizations,both internal and external to MSFC.
- 90M Drawing System: quick turnaround for customer, largeformat scanning/printing/folding production capabilities, andconfiguration control for STE designs.

Engineering Stress Analysis to include COADE Caesar II piping analysis, ANSYS finite element modeling, FEMAP, MathCAD, Excel, hand calculations, etc.

FEA of 20-ft universal test fixture (UTF)



20-ft UTF

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