Team
Vibration Testing Equipment

Systems & Solutions

Engineered vibration testing solutions for improved product quality.

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Vibration News

Winter Issue 2011

Team Aids in Future Space Travel

Written by Curt Nelson
Team Corporation

President Bush announced in 2005 the creation of the Constellation Program, consisting of a new launch vehicle program called Ares and a capsule-based manned vehicle program called Orion.

The development of any new spacecraft involves a significant investment in ground-based testing. The environmental stresses placed upon spacecraft in transportation, launch and deployment are varied, ranging from mechanical and dynamic stresses induced by acoustic affects, engine thrust and atmospheric buffeting. The size and sophistication of the Orion capsule, with its Service Module and Launch Abort System, represented a challenge to NASA and those engineers tasked with the ground test portion of the program.

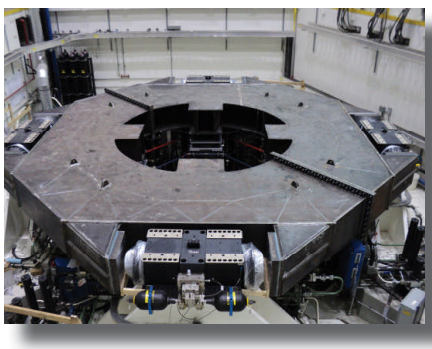
NASA engineers decided early in the program to test the assembled spacecraft, rather than testing smaller components individually. This decision fueled NASA and private industry to develop what would become the world's largest vibration test system and the world's largest and most powerful reverberant acoustic test facility. *Team* Corporation is proud to have been selected as the critical technology partner in this effort.

Team partnered with The Benham Company to design, build and validate the Mechanical Vibration Facility (MVF) slated for installation in NASA's Plum Brook center near Sandusky, OH. In addition, *Team* assisted Aiolis, a Canadian firm, and The Benham Company by supplying the very high powered acoustic modulators for the Reverberant Acoustic Test Facility (RATF), also installed at Plum Brook.

The MVF is unique and has the capability of producing a swept sine test profile to simulate the expected dynamic responses produced in the spacecraft during an actual launch event. While this capability may not seem unusual, the size and weight of the spacecraft at 75 feet tall, 18 feet in diameter and weighing 70,000 lbs, certainly adds a new perspective to the achievement. And, the MVF can excite the spacecraft vertically, longitudinally and laterally without requiring the spacecraft to be repositioned. In practice, the MVF is a full 6 Degree of Freedom test system, the largest in the world. (Continued on page 2)

Pit during construction

CIF now sits here



CIF (Construction In Fixture)

Future News

* * *

Coming Soon...

* **High Frequency CUBE ™**

* **New !**

Larger Tensor TE6-9000

Customer Comments:

"The Team system and support have exceeded my expectati . We continue to make product and process improvements and our ROI has also exceeded expectations."

Randy Birchell of Weatherford

Team Aids in Future Space Travel Cont'd

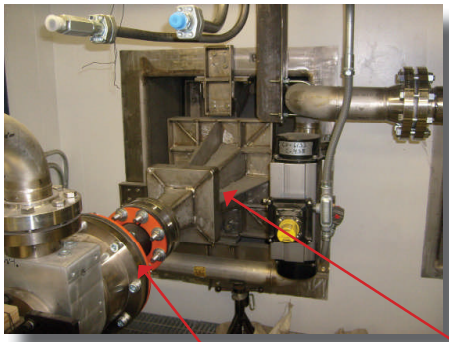
The RATF is also unique due to its enclosed volume, and the sound pressure levels that can be produced. Once in the chamber, the spacecraft will be subjected to a series of acoustic tests designed to reproduce the peak sound pressure levels anticipated during launch and transit through the atmosphere. This requirement, i.e. producing high sound pressure levels on such a dimensionally large structure, required the most powerful noise sources available; *Team* Corporation Mk VI and Mk VII acoustic modulators. *Team's* acoustic modulators are capable of generating approximately 250kW each. Even with this remarkable energy output, NASA's chamber still required 23 units to produce levels mandated by program engineers.

For more than 50 years, *Team* Corporation has been a key player in the aerospace environment test world. The commissioning of this world-class facility in Spring 2011 is just another example of our expertise.

23 Te Modulators used @ 150,000 watts each

Reverberant Chamber

*** More information available on our website : www.teamcorporation.com**

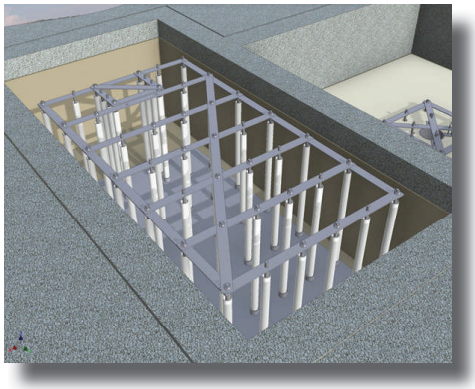


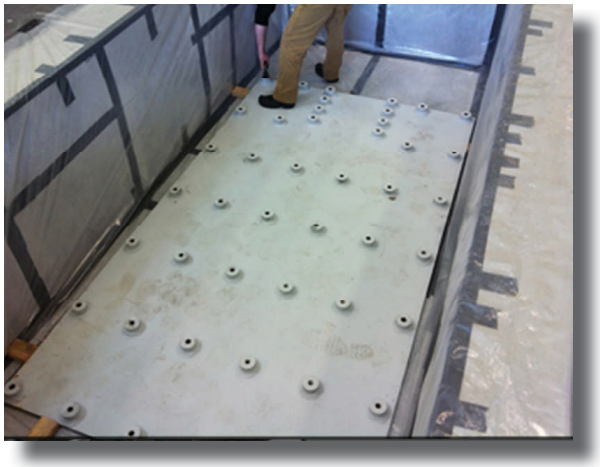
Aiolos Horn

Team Actuator

Team to Install 20th NEBS System

National Technical Systems (NTS) in Fremont, CA, a leading provider of engineering services to the aerospace, defense, telecommunications, automotive and high technology markets, is scheduled to receive the newest version of the *Team* NEBS/GR63 Earthquake and Vibration Simulation System in January 2011. *Team* and NTS have worked together to develop a system that will provide the most up to date design and most current Vibration Research software profiles for earthquake, transportation and office vibration testing. The new NTS system will complement previous *Team* NEBS/GR63 systems installed at NTS facilities in Plano, TX, and Fullerton, CA. NTS project manager Felicia Walker-Breland confirmed that their facilities improvements are near completion and the in-ground concrete and steel reaction mass (shown below) was finished in mid December. NTSC (NTS) is publicly traded on the NASDAQ stock exchange.





Novel Guided Head Expander Design Uses Close Coupled Inertial Masses and Hydrostatic Bearings to Minimize Cross-Axis Motion.

This paper is a peer-reviewed technically edited, and updated revision of a paper originally published in the 2006 Space Simulation Conference Proceedings.

Written by:
Douglas Lund, *Team* Corporation
Robert Crawford, Orbital Sciences Corporation

Abstract

When vertical vibration testing of large test articles is required, it is common to install a head expander on the armature of a shaker. Larger test articles often have a center of gravity relatively far above the mounting surface. When combined with the armature and head expander, these test articles may exhibit multiple structural resonances within the desired test band that do not exist in the intended application. These test configuration-driven characteristics are likely to create unwanted cross-axis excitation during a vibration test.

The difficulty in controlling unwanted cross-axis motion usually increases when testing large items. Excessive cross-axis motion can “over-test” the test item, creating the risk of damaging the test item, or can limit the input in the test axis, thus jeopardizing a successful test.

Orbital Sciences commissioned the design of a guided head expander system that greatly reduces the cross-axis motion at the test article mounting surface of the head expander. The design submitted by *Team* Corporation couples large inertial masses to the head expander through high-stiffness, hydrostatic, self-aligning bearings. Together, the guided head expander and inertial mass structures have a first resonance higher than the test band of interest and provide high dynamic stiffness. The head expander and inertial masses are supported by a suspension system with a low first resonance, below the test band of interest. It is noteworthy that this design approach exhibits high “dynamic” stiffness and low static stiffness.

Conventional designs for this type of equipment may have relatively high cross-axis load ratings, which might suggest that such designs would provide good cross-axis motion control, but these designs often suffer from structural resonances within the test band of interest that produce unwanted cross-axis motion.