

Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

SBIR Topic Number:
AF04-291

SBIR Title:
Measurement of Angular Valve Displacement in High Vibration Environments

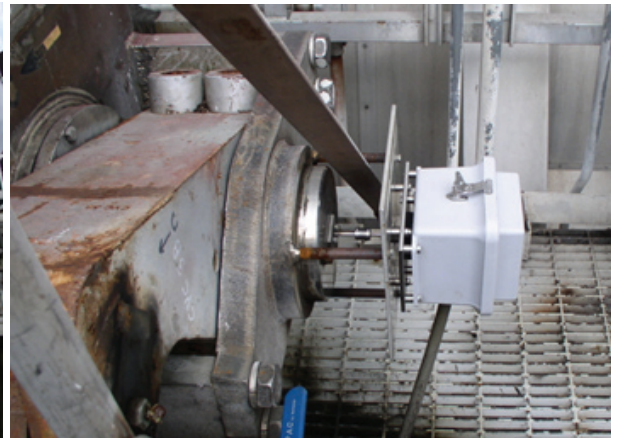
Contract Number:
FA9101-05-C-0034

SBIR Company Name:
Streamline Automation, LLC, Huntsville, AL

Technical Project Office:
Arnold Engineering Development Center (AEDC), Arnold AFB, TN



Aeropropulsion Systems Test Facility wind tunnel ducting and valves



Streamline Automation designed bushing assembly and replacement electrical enclosure

Improved Vibration Control for AEDC Wind Tunnel Testing

- Wind tunnel testing historically caused a high rate of failure of valve position indicators that led to increased maintenance costs
- SBIR project focused on designing and testing a bushing assembly suitable for permanent installation at AEDC's Aeropropulsion Systems Test Facility
- Streamline Automation's bushing device helps isolate the Angular Displacement Transducers (ADTs) from wind tunnel structural vibrations
- This has resulted in an extension of valve position indicator life by a factor of 4, and field testing has demonstrated that this technology is mature (TRL 8)
- ADT bushing assemblies are now being installed in several wind tunnel complexes at AEDC and are suitable for use on valves from 6" to more than 72" in diameter
- Cost savings are estimated by AEDC to be \$5000 per year per valve

Commercialization Pilot Program Series

AEDC 2010-110

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Air Force Requirement

Arnold Engineering Development Center (AEDC) has an extensive wind tunnel complex that provides unique propulsion and scale-model testing capabilities to both Air Force and commercial customers. This includes several high flow rate, supersonic wind tunnels that are capable of simulating operations at altitude. The angular position of large-diameter valves is used in a closed-loop feedback system that controls flow conditions during testing. The position measurement instrumentation must provide a high degree of accuracy and respond rapidly to changes in valve position, while subject to high levels of flow induced vibration. Off-the-shelf angular displacement transducers (ADTs) are used to monitor the position of 90° valves (i.e., butterfly valves) that are used to control the air flow-rate, operating pressure, and temperature. The high structural vibration levels in the wind tunnel cause an unacceptably high rate of failure during testing that leads to increased maintenance costs, and often requires test operations to be suspended while the faulty ADT is replaced, leading to significant cost and schedule impacts associated with the down-time.

SBIR Technology

The SBIR Phase II effort focused on designing, fabricating and testing a bushing assembly suitable for permanent installation at the Aeropropulsion Systems Test Facility (ASTF) at AEDC. Streamline Automation successfully developed this bushing assembly that significantly reduces the vibrational loads on the shaft of the ADTs used as valve position indicators installed in a high vibration environment on a wind tunnel at the ASTF. The bushing assembly was designed to be easily applicable to the wide range of valve sizes (6" to more than 72") that are used for flow control in ASTF.



Rotary ADT



Bushing Assembly

The problem was approached by identifying the potential vibration transmission paths to the ADT, and developing a technique for isolating the ADT from the wind tunnel structural vibrations. This was primarily accomplished

by developing an integrated bushing assembly installed between the rotating ADT shaft and the valve that prevents vibrational energy from being transmitted to the ADT shaft. The effectiveness of this solution was initially demonstrated via laboratory testing.

This was followed up with field testing at AEDC with an instrumentation package designed to monitor bushing performance over a period of several months. This testing showed that the bushing assembly significantly reduced the transmitted vibrational loads, and virtually prevented the transmission of loads due to non-repeating events (transient impact loads). This testing demonstrated that the bushing assembly is a mature technology (TRL 8) and suitable for transition.

Transition Impact

This SBIR project improved the reliability of the valve position indicators under the unique conditions experienced at AEDC. The field testing demonstrated load reductions on the ADT that will provide approximately a factor of 4 increase in operating life. This results in significantly fewer operational failures during wind tunnel operations, which will lead to reduced down time, better adherence to test schedules, and reduced costs. AEDC has estimated that the cost savings associated with the installation of the bushing assemblies is \$5000 per year per valve. Bushing assemblies have already been installed on 60 valves at AEDC in the A-plant, C-plant, and SL-plant complexes, yielding an annual cost savings of \$300,000. Additional installations are being planned. There is also interest in the bushing assembly device from Curtiss-Wright Flow Control (CWFC) for commercial valve position indication applications. Streamline Automation is currently working with CWFC to address valve equipment reliability issues at domestic and foreign nuclear power plants.

Company Impact

This project has highlighted Streamline Automation's capabilities for multi-disciplinary design and development. The bushing assembly itself is a mechanical component. The field testing, however, required the bushing assembly and test fixture to be integrated with instrumentation and data acquisition functions. This successful collaboration has led to other opportunities at AEDC and in commercial markets for further projects and product development.

Streamline Automation is a multidisciplinary engineering firm that offers services in instrumentation and control systems, custom software development, and engineering design services.



SBIR/STTR

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