

# Vibration suppression Using Particle Impact Damping



When the U.S. Coast Guard installed a Forward Looking Infrared Radar (FLIR) turret under the nose of their C-130H aircraft, the structural vibrations of the Forward Nose Landing Gear Door increased significantly due to the turbulent airflow aft of the turret. Within a short operational period fatigue cracks appeared in the door rendering it unserviceable. The Coast Guard asked the Texas Center for Applied Technology (TCAT) to investigate the possibility of using Particle Impact Damping (PID) technology to attempt to reduce the vibrations of the panel to or below the levels seen in flight test data before the FLIR turret was installed. TCAT partnered with the Aerospace Engineering department at Texas A&M University.



PID is a revolutionary technology developed by researchers in Texas A&M's Aerospace Engineering Department. The technology is applied by filling an enclosure with particles and attaching it to a structure at the point of maximum vibration. When the structure vibrates the particles absorb its kinetic energy. Through particle-to-particle and particle-to-structure collisions this energy is converted into heat. Therefore this energy can never re-enter the structure in the form of kinetic energy; hence vibration damping. PID can be applied in either a vertical or horizontal mode—making it a viable solution for a wide variety of vibration issues.



We conducted extensive tests in our laboratories to determine the optimum design criteria for the damping device, then applied the devised methodology to an actual C-130 door. A reduction in vibration on the order of 40% with no more than a 10% weight penalty would be considered successful. With a weight penalty of only 5% they were able to achieve a 70% reduction in the vibration amplitude at the critical point in the structure as well as significantly reduce the levels of vibration over the entire door. The U. S. Coast Guard was pleased with the results and is currently investigating additional applications of the technology.

## TEXAS CENTER FOR APPLIED TECHNOLOGY

There are many problems that require the careful and proper integration of applied technologies to find solutions. The Texas Center for Applied Technology (TCAT) was created to focus on these specific problems and to develop effective and efficient solutions. TCAT's core competency is the innovative application of existing technologies and advanced research to solve complex real-world problems.

TCAT's primary objective is to apply and test technologies to address targeted problems and engage basic research as required. TCAT has employees in a variety of locations with the ability to perform research that cuts across multiple technologies, disciplines, and cultures. The Center's employees are knowledgeable regarding customers' requirements and are ready to respond effectively to provide the best value for the customers' needs including expertise in technology insertion, technology assessments, and test and evaluation.

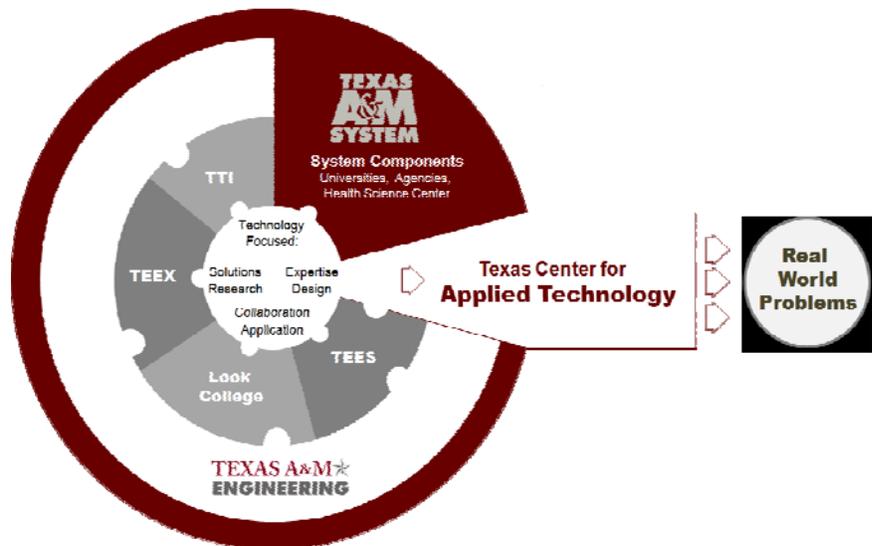
TCAT is part of the Texas A&M Engineering Experiment Station (TEES), a member of The Texas A&M University System. The A&M System is one of the largest and most comprehensive systems of higher education in the United States. Through a statewide network of eleven university campuses, seven state agencies, and a comprehensive health science center, the A&M System educates more than 120,000 students on its university campuses, conducts more than \$780 million in research, and reaches another 22 million people through service each year. TEES is an engineering research agency for the state of Texas and conducts over \$147 million in research annually. Because of the Center's position within the Texas A&M Engineering program, TCAT's expertise can easily be extended by rounding out its team with world class faculty researchers, as appropriate. TCAT is in an excellent position for collaboration not only with The Texas A&M University System components and their customers but with other universities, institutions, centers, and industry.

## TCAT'S CORE COMPETENCIES

Energy Sustainability ★ Environmental Sustainability  
Manufacturing & Systems Engineering ★ Information Technology ★ Modeling & Simulation  
Technology Insertion ★ Test & Evaluation

## TEXAS A&M ENGINEERING

Texas A&M Engineering consists of the Dwight Look College of Engineering, and three engineering agencies, including TEES: Texas A&M Transportation Institute (TTI) conducts research and professional education in all modes of transportation. The Texas A&M Engineering Extension Service (TEEX) works to develop a highly skilled and educated workforce and enhances public safety through training, continuing education, and technical assistance.



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