Transparency Degradation and Solutions

Birdstrike-resistant acrylic/polycarbonate laminate transparencies are the preferred spares for many existing aircraft and have been a part of the transparency system design for new aircraft. Aircraft windshields, canopies, and windows must endure a harsh environment that includes moisture, extreme temperatures, chemicals, an ultraviolet light, and as a result, are subject to the same age-related issues as other aircraft components. One particular issue that has affected many polycarbonate transparency systems is bolt-hole cracking. In some cases, particularly the F15, age-related degradation and bolt-hole cracking have caused a reduction in birdstrike capability. This is cause for concern for the Navy, because the F-15 and the F/A-18 windshields have a very similar structure. A new F/A-18 windshield is rated for an impact velocity of 475 knots for a four-pound bird, but service-aged F/A-18 windshields had not been tested.

TCAT, with the Academic Center for Aging Aircraft, conducted birdstrike testing for each windshield part type (uncoated with cast acrylic face ply, stretched acrylic face ply) to evaluate the effect of age-related degradation and bolt-hole cracking on windshield birdstrike capability. Fifteen tests were conducted with windshields mounted on a test fixture and seven tests were performed with windshields mounted on an F/A-18 fuselage section. All tests were performed with real four-pound birds, and the pass/ fail criterion was bird penetration through the windshield.

Based on bolt-hole crack inspection and birdstrike testing of F/A-18 windshields, removal criteria based solely upon bolt-hole severity would not be an effective way to remove degraded windshields from service. If the Navy were to require all F/A-18's to retain a level of protection at, or very near, the level of protection offered by new windshields (475 knots), then results from inspections and birdstrike tests suggest that five years might be the optimal life limit for F/A-18 windshields.

Additionally, bird-strike testing was conducted on uncoated monolithic stretched acrylic AV-8B windshields removed from service. The age of the windshields ranged from 3.8 to 8.4 years. The performance of the windshields during testing was typical of stretched acrylic parts. Stretched acrylic has a brittle failure mode, and each birdstrike test failure was catastrophic.

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.

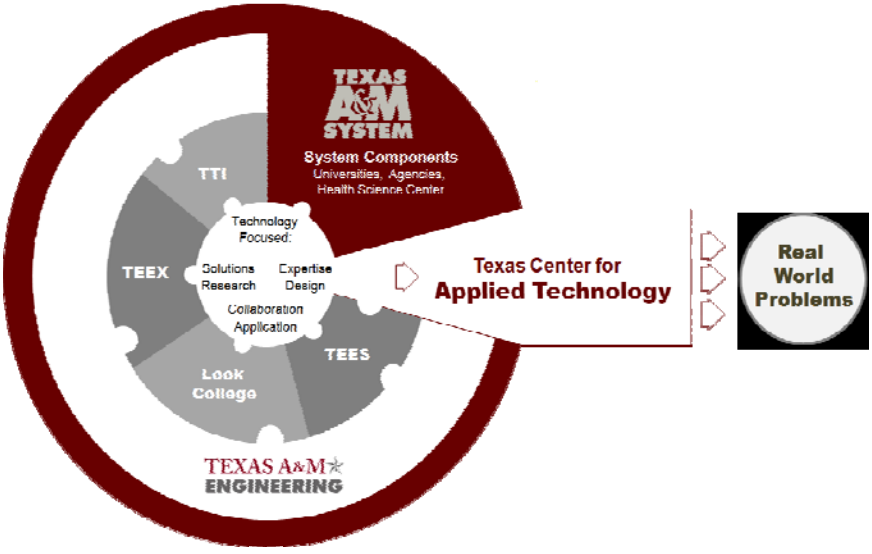
TCAT is part of the Texas A&M Engineering Experiment Station (TEES), a member of The Texas A&M University System. The A&M System is one of the largest and most comprehensive systems of higher education in the United States. Through a statewide network of eleven university campuses, seven state agencies, 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 **S**ustainability ★ **E**nvironmental **S**ustainability
Manufacturing & **S**ystems **E**ngineering ★ **I**nformation **T**echnology ★ **M**odeling & **S**imulation
Technology **I**nsertion ★ **T**est & **E**valuation

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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