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INTERLAMINAR SHEAR TEST METHOD DEVELOPMENT FOR LONG TERM DURABILITY TESTING OF COMPOSITES

by

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The high speed civil transport is a commercial aircraft that is expected to carry 300 passengers at Mach 2.4 over a range of more than 6000 nautical miles. With the existing commercial structural material technology (i.e., aluminum) the performance characteristics of the high speed civil transport would not be realized. Therefore there has been a concerted effort in the development of light weight materials capable of withstanding elevated temperatures for long duration. Thermoplastic composite materials are such candidate materials and the understanding of how these materials perform over the long term under harsh environments is essential to safe and effective design.

The matrix dominated properties of thermoplastic composites are most affected by both time and temperature. There is currently an effort to perform short term testing to predict long term behavior of in-plane mechanical properties E_{22} (transverse modulus of elasticity) and G_{12} (shear modulus). Out-of-plane properties such as E_{33}, G_{13} and G_{23} are inherently more difficult to characterize. This is especially true for the out-of-plane shear modulus G_{23} and hence there is no existing acceptable standard test method. Since G_{23} is the most matrix dominated property, it is essential that a test method be developed. This summer I have developed a shear test methodology to do just that. The test method called the double notched specimen along with the shear gage which I had previously developed was tested at room temperature. Mechanical testing confirmed the attributes of the methodology. A finite element parametric study was conducted for specimen optimization. Moire interferometry, a high sensitivity laser optical method, was used for full-field analysis of the specimen. Future work will involve extending the test methodology to elevated temperature testing. From this work, material parameters will be determined and thus enable the prediction of long term material behavior of laminates subjected to general loading states.