EVALUATION OF COMPOSITE MATERIALS AGAINST THE FOAM BLOCK HIDDEN FIRE SOURCE

Robert Ochs

Technological advances in materials science have led to the increased use of composite materials for primary structures in commercial airframes. Carbon fiber composites are favorable for aerospace applications due to their increased strength, lower density, and better corrosion resistance over traditional aircraft aluminum. Nearly every major transport-category aircraft manufacturer is currently using or has plans to use carbon fiber composites for fuselage skins. Current Federal Aviation Regulations do not require flammability testing for aircraft fuselage skins or structural members as all transport airplanes up until now have been constructed from aluminum, which will not contribute to the propagation of a fire in an inaccessible area of the cabin. In order to certify an aircraft with a composite fuselage the manufacturer must demonstrate that the composite materials will provide an equivalent level of safety to an aluminum-constructed aircraft when exposed to an in-flight fire. To standardize the certification process for all composite aircraft, the FAA is developing a laboratory scale test method to assess the flame propagation potential of composite materials. The test method is designed such that it correlates to a fire that is representative of an in-flight, moderately severe fire impinging on the inboard side of the aircraft skin. An intermediate scale test rig was constructed to simulate an inaccessible area in an aircraft cabin with the ability to interchange the test panels in order to study various composite materials. A variety of materials were evaluated in this research, including aerospace and non-aerospace woven laminates, uni-directional laminates, and laminate-honeycomb sandwich panels. The standard hidden fire source was a polyurethane foam block spiked with a small amount of heptane to promote uniform, consistent burning. Heat flux and temperature gradient measurements were made on the intermediate scale test rig to characterize the fire source and its impact on a 18-inch by 48-inch test sample oriented at a 30-degree angle from the top horizontal surface of the foam block. The intermediate scale test rig was successful at evaluating the flame propagation potential of a variety of composite materials and provides a full range of data for correlating to performance in a laboratory scale test method.