The Effects of Topcoat Color and Material Thickness on the Flammability Characteristics of Composite and Aluminum Wing Fuel Tanks

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In response to potential fuel tank safety issues highlighted by the TWA Flight 800 accident in 1996, the Federal Aviation Administration (FAA) has conducted a significant amount of research on the flammability of traditional aluminum fuel tanks. This research, along with the development and demonstration of a fuel tank inerting system, has led to regulations requiring the reduction of flammability within high-risk fuel tanks. Traditionally, fuel tanks located in the wing of an aircraft are considered to be of low flammability due to the absence of external heat sources and the rapid cooling that occurs in flight because of the high conductivity of the aluminum skin of the aircraft. There have, however, been recent advances in composite materials, and these advanced materials are increasingly being used in the construction of aircraft. Research is required on how the topcoat finish color of these materials and their aluminum counterparts may affect heat transfer into the fuel tank, and therefore the resulting flammability of the tank. In addition, as the thickness of a composite wing varies throughout the structure, information is also needed on how this variation in thickness may affect heat transfer into the fuel tank.

The Fire Safety Team performed tests at the FAA William J. Hughes Technical Center to examine the variation in flammability exposure of fuel tanks comprised of a composite material skin and a traditional aluminum skin. The variation of the total hydrocarbon concentration (THC) within the tank as a result of topcoat color of the aluminum material was analyzed, as was the variation of THC with thickness of the composite material.