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15. Supplementary Notes (Funding programs, titles of related publications, etc.)

Several research reports for testing of de/anti-icing technologies were produced for previous winters on behalf of Transport Canada. These are available from the Transportation Development Centre (TDC). Several reports were produced as part of this winter's research program. Their subject matter is outlined in the preface. This project was co-sponsored by the Federal Aviation Administration.

16. Abstract

The increasing use of composite materials in the construction of aircraft necessitated that research be conducted to determine if published holdover times, which were developed for aluminum aircraft using aluminum test surfaces, are valid for composite aircraft surfaces. A multi-year test program was carried out by APS Aviation Inc. (APS) on behalf of Transport Canada and the Federal Aviation Administration (FAA) to collect data to make this determination. The research program started in the winter of 2004-05 and continued until the winter of 2009-10.

Exploratory research was carried out during the first five years of the program. The research looked at different composite materials and thicknesses, different fluid types, different fluid temperatures and various test surface configurations. The research concluded that Type II, III and IV fluid endurance times are similar on composite and aluminum surfaces, but Type I fluid endurance times are shorter on composite surfaces than on aluminum surfaces. The objective of the project then shifted to determining appropriate holdover times for Type I fluids on composites: validating the observed reductions, determining appropriate test protocols, and collecting sufficient data to produce composite-specific Type I holdover times. Although the Type I reductions were initially observed using non-standard test protocols, additional testing carried out using standard protocols confirmed the results.

In the winter of 2009-10, an extensive test program was carried out with five representative Type I fluids. Testing was conducted under all conditions encompassed by the Type I holdover time guidelines. All testing was conducted using standard Type I holdover time testing protocol. This testing provided the data required to develop composite-specific holdover times for Type I fluids.

Different analysis methodologies were used to determine snow (regression analysis), freezing precipitation (regression analysis, weighted average), and frost (minimum values, ratio analysis) holdover times for Type I fluids on composite surfaces. The resulting composite holdover times were generally shorter than the existing aluminum holdover times.

Transport Canada and the FAA incorporated the derived Type I composite holdover times into their Holdover Time Guidelines publications for use in the winter 2010-11 operating season. The composite holdover times were incorporated directly into the existing Type I tables.

Several recommendations came out of the six year research program. These include: conduct further testing with Type III fluids to determine the validity of Type III holdover times for heated Type III fluid applications; conduct full-scale testing to validate the Type I endurance time reductions measured on standard test surfaces; and conduct aerodynamic testing in the wind tunnel to investigate the aerodynamic effects of the reduced Type I fluid endurance times observed on composite surfaces.

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