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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. The work described in this report was, in part, co-sponsored by the Federal Aviation Administration (FAA).

16. Abstract

As part of a larger research program examining de/anti-icing fluid flow-off during simulated aircraft takeoff, APS conducted a series of full-scale tests in the NRC 3 m x 6 m Open-Circuit Propulsion and Icing Wind Tunnel (PIWT) using a super critical wing model to determine the flow-off characteristics of anti-icing fluid with and without mixed precipitation conditions with ice pellets.

A wind tunnel testing program was developed for the winter of 2013-14 with the primary objectives of conducting aerodynamic testing with a thin high performance airfoil ensure the repeatability of the dry wing performance, expand the ice pellet allowance times for light ice pellets mixed with light or moderate snow conditions, substantiate the current ice pellet allowance times with new fluids, fluids previously tested but with limited data, and temperatures close to the lowest operational use temperature (LOUT), and support the development of a Type III ice pellet allowance time table.

The data collected in 2013-14 supported the development of a comprehensive Type III un-heated fluid allowance time table for use with high speed aircraft. Preliminary data was also collected with heated Type III fluid applications, however the tests showed risks of adhered contamination during take-off and therefore guidance could not be issued without further investigating the possible risks associated.

Testing was conducted during the winter of 2013-14 to validate and expand the existing Type IV allowance times. The data collected in 2013-14 supported the following changes to the guidance material: 10-minute allowance time for moderate ice pellets at 115 knots rotation speed should be limited to -16ºC due to the higher lift losses observed and 7-minute allowance time for Light Ice Pellets mixed with Moderate Snow below -5º to -10ºC

Possible future areas of research for the winter of 2014-15 may include allowance time testing to expand the guidance for mixed conditions including light ice pellets with light or moderate snow conditions, investigation of the higher lift losses observed at lower temperatures close to the fluid Lowest Operational Use Temperature (LOUT) to determined the aerodynamic effects of ice pellet contamination at these colder temperatures, further substantiation of the ice pellet allowance times with new fluids, or fluids previously tested but with limited data, and lift loss scaling with NASA LS-0417 and NACA 23012 wing sections.

17. Key Words	18. Distribution Statement
Ice Pellet, Allowance Time, High Speed Rotation, Low Speed Rotation, Type II, Type III, Type IV, Fluid Adherence, Fluid Flow-Off, Wind Tunnel, Propulsion Icing Wind Tunnel, Wing Aerodynamics	Limited number of copies available from the Transportation Development Centre

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