Transport Canada / Transports Canada

# PUBLICATION DATA FORM

| 1. Transport Canada Publication No. | 2. Project No. | 3. Recipient's Catalogue No. |
|---|---|---|
| TP 14871E | | |

| 4. Title and Subtitle | 5. Publication Date |
|---|---|
| Research for Further Development of Ice Pellet Allowance Times: Aircraft Trials to Examine Anti-Icing Fluid Flow-Off Characteristics Winter 2007-08 | |
| | 6. Performing Organization Document No.: CM2103.001 |
| 7. Author(s): Marco Ruggi | 8. Transport Canada File No. |
| 9. Performing Organization Name and Address: APS Aviation Inc., 6700 Côte-de-Liesse, Suite 105, Montreal, Quebec, H4T 2B5, Canada | 10. PWGSC File No. |
| | 11. PWGSC or Transport Canada Contract No. |
| 12. Sponsoring Agency Name and Address: Transportation Development Centre (TDC), 800 René Lévesque Blvd. West, Suite 600, Montreal, Quebec, H3B 1X9, Canada | 13. Type of Publication and Period Covered: Draft |
| | 14. Project Officer: Barry Myers |

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 objective of this study was to examine anti-icing fluid flow-off properties of both contaminated and uncontaminated anti-icing fluids during simulated low speed and high speed take-off runs with the NRC Falcon 20 and T-33 aircraft. High speed and low speed testing was primarily conducted with the Falcon 20 aircraft. Limited tests were conducted with the T-33 to validate the low speed results obtained using the Falcon 20 aircraft.

The results indicated that the effect of extended flaps seemed to improve fluid elimination at the time of rotation. The slatted leading edge did not have a significant effect on fluid flow-off. Testing to simulate different chord lengths demonstrated better fluid flow off for shorter chord length test sections. The aerodynamic performance of the new generation triozole-free fluids meets or exceeds the performance of the older generation fluids. Fluid flow-off as a result of the aircraft rotating or not rotating at the end of the acceleration profile demonstrated a general trend pointing towards greater residual fluid following the no-rotation test runs. Low speed testing with Type III fluid demonstrated better fluid flow off when compared to Type IV fluids at low rotation speeds, however a significant amount of Type III fluid was still present at the end of the low speed test runs. Testing in mixed ice pellet and snow conditions at colder temperatures (below -5ºC) demonstrated difficulties in fluid elimination. Fluid elimination problems with Type IV fluids at lower rotation speeds appear to be a fluid issue rather than a contamination issue, however, the general trend indicated that as the speed was increased, fluid elimination was improved.

No changes were made to the Ice Pellet Allowance Time Guidelines for the winter of 2008-09. Although a significant amount of data was collected with the Falcon 20 and T-33 aircraft during the winter of 2007-08, further testing in the wind tunnel is required in order to obtain appropriate lift and drag data to confirm the results obtained with the Falcon 20 and T-33 aircraft. Wind tunnel testing should be conducted to further investigate lower rotation speeds, mixed ice pellet and snow conditions, and ice pellet testing with different fluid types, formulations, and conditions. In addition preliminary work should investigate effects of improper fluid application, differences between snow and snow pellets, reduced Type I holdover times on composite surfaces, and reduced anti-icing holdover times during frost conditions.



| 17. Key Words | 18. Distribution Statement |
|---|---|
| Ice Pellet, Allowance Time, Low Rotation Speed, Mixed Conditions, Falcon 20, T-33, Fluid Adherence, Fluid Flow-Off | Limited number of copies available from the Transportation Development Centre |

| 19. Security Classification (of this publication) | 20. Security Classification (of this page) | 21. Declassification (date) | 22. No. of Pages | 23. Price |
|---|---|---|---|---|
| Unclassified | Unclassified | — | xxx, 314 app. | — |