Aalto University
School of Engineering

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New information on airliner winter operation related aerodynamic contamination.

Title of the dissertation	New Aerodynamic Aspects of Aircraft De/Anti-icing fluids
Contents of the dissertation	This thesis considered the aerodynamic degradation caused by de/anti-icing fluids and cold soaked fuel frost. The contamination effects were studied utilizing wind tunnel tests. These two types of aerodynamic contaminations were also compared with each other. Considering anti-icing fluid behavior on a wing surface so called secondary wave was studied. Secondary wave quantitative contribution to the lift loss during take-off was studied for the first time. Also, the influence of wing section cross section geometry on the phenomenon was studied. Cold soaked fuel frost was studied using authentic frost for the first time. All the previous studies are based on sandpaper type of simulated frost. They have not been able to consider the sublimation and melting of the frost during the takeoff run. The de/anti-icing fluid flow-off phenomena in an accelerating airflow was also studied in the dissertation. The previous research has not been able to satisfactorily explain the mechanics of the fluid flow off. The feature of these fluids has not been fully recognized before this study. The concept of kinematic waves explains the flow-off phenomenon clearly better than the previous studies. Utilizing this new understanding of the fluid flow-off a new scaling law for fluid flow-off was developed. The new scaling law enables to reduce the fluid thickness reduction in time independent of scale and wind tunnel acceleration sequence.
Field of the dissertation	Energy Technology, Experimental Aerodynamics
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