



TraFi

Finnish Transport Safety Agency

# Icewing III Research programme

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*Responsible traffic.  
A joint effort.*

## ***ICING/DEICING INCIDENTS IN FINLAND***

- *Cessna 208B at Helsinki in 2005.  
The aircraft was parked in Helsinki about 12 hours during snowfall and temperatures around 0°C. Normal de-icing was not performed, but the pilot attempted to clean the wings using a brush. After take-off, when retracting the flaps, the aircraft stalled.*





Wing upper surface  
contamination

- *BAe ATP at Helsinki in 2010.  
Due to anti-icing fluid in the elevator slot and the slot gap width being outside tolerances the aircraft could not make a rotation during the take-off. It turned out that the type had previously had several other incidences in which the aircraft had for example uncontrollably taken off into air.*





Picture from video at attempted rotation (underside).  
Speed approx. 100 kts

Swirls at certain positions when  
fluid runs out

Elevator in neutral position

Large amounts of fluid dripping  
from gap at attempted rotation

- *Embraer 170 at Vaasa in 2010.  
After take-off at 20 feet altitude the aircraft shook vigorously and there was a warning light for angle of incidence. After the airline's FDM analysis a defective anti-icing was suspected as a contributing factor.*



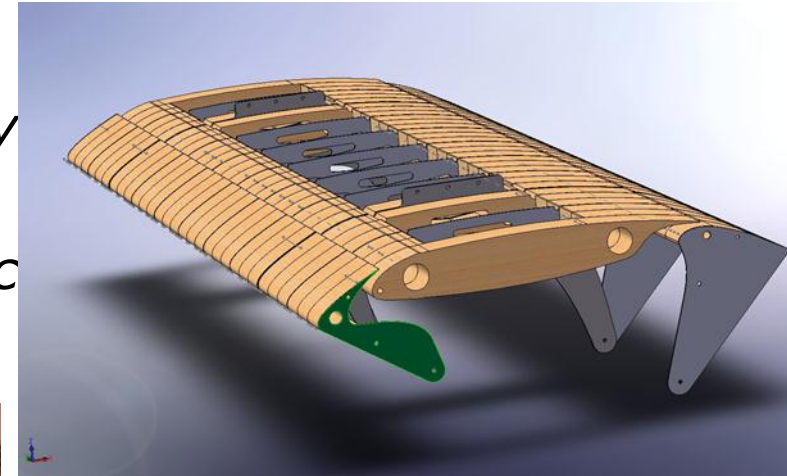
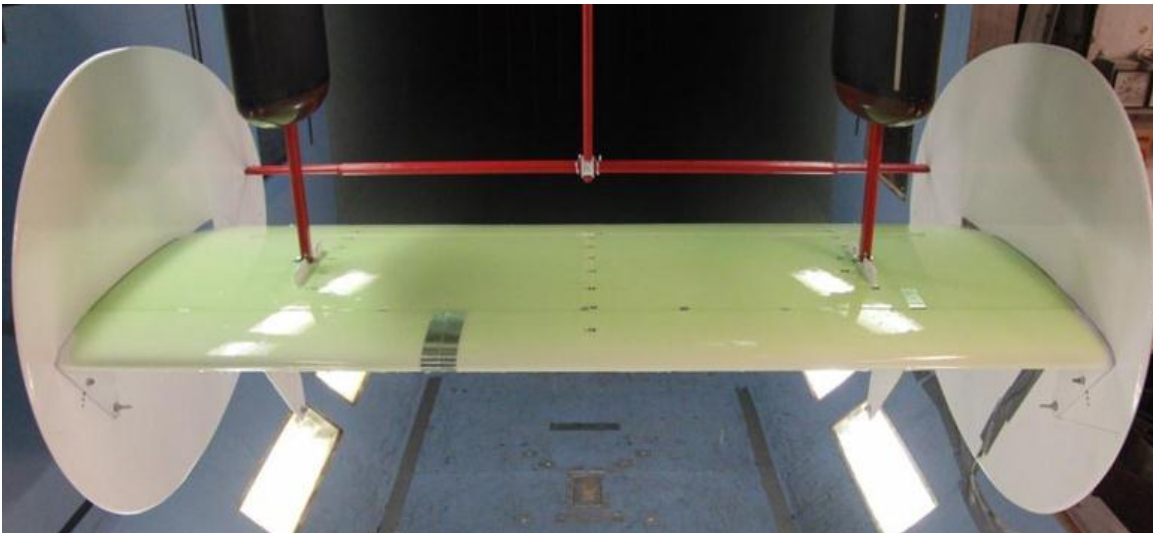
- *Boeing 737-800 at Kittilä in 2012.*

*The aircraft had been de-iced before the flight in Helsinki in temperatures of -17°C. During approach to Kittilä at an altitude of 3250 ft the aircraft – with its autothrust and autopilot engaged – began to pitch up. In spite of pilot action the pitch increased to 38.5° which activated the stick-shaker and stall warning. The preliminary investigation report resulted in a suspicion that deicing/anti-icing fluid had entered the tail cone section during application and froze at altitude, jamming the flight controls.*



## ***Icewing I-II 2011-2013***

- *Development of wind tunnel methodology*
- *Effects of anti-icing fluids investigated mainly on a rotating model with a generic Airbus type three element airfoil*





## ***Icewing III topics 2013-2015***

### ***RESEARCH PROGRAMME***

- *Targets to improve flight safety and to reduce environmental exposure*
- *2 year programme*
- *Mainly wind tunnel testing*
- *Budget 265000€ (about 200000\$)*
- ***Trafi*** *is interested in co-operation with other research organizations*

## **RESEARCH TOPICS**

### **EFFECT AND BEHAVIOUR OF REAL FROST**

- *on a flat plate boundary layer in wind tunnel*
- *on the lift reduction of a generic Airbus type three element airfoil in a wind tunnel*
- *limited trial of theoretical modelling*

### **ANTI-ICING FLUIDS**

- *flow-off and boundary layer measurements on a flat plate in wind tunnel*
- *limited trial to theoretically model the flow-off*
- *limited trial to analyze the flow-off using a two-phase CFD model*

