

ICED CRM Project

The accumulation of ice on aircraft wing leading edges and other forward facing surfaces due to flight through ice clouds (icing), is a major hazard for aviation. All commercial aircraft have the design objective to fly unrestricted in icing conditions and regulations define icing conditions that must be considered and the acceptable means of compliance. This implies that the aircraft manufacturer has to calculate and evaluate the most critical ice shapes which could accrete on the airframe. Doing this with high accuracy and fidelity ensures a safe and reliable aircraft without building in too much conservatism. Conservatism would manifest as additional power for an ice protection system which would have a negative impact on aircraft drag and weight implying that the aircraft would burn more fuel for all flights, not just those in icing.

A particular problem is that of supercooled large droplets (SLD) which were thought to have been responsible for the crash of the American Eagle Flight 4184 in October 1994, which killed 68 people. Small droplet icing, which results in roughened surface effects are also a major problem, the full scale effects of which still require more research. New icing certification requirements were introduced in 2015, but new aircraft currently use a detect and exit strategy rather than being properly equipped to fly in icing conditions. This results in flight path extension, rerouting problems and associated impact on flight times and, most importantly, unnecessary fuel burn and environmental impact. This situation is unacceptable for commercial aircraft operation, and much more research needs to be undertaken to properly understand icing accretion and its affect on aircraft flight safety, as well as to develop mitigation technologies.

A key to these aims is the acquisition of high quality experimental data at real flight conditions that properly captures the effect of icing at whole aircraft level. Such data does not currently exist, and can only be acquired through cryogenic wind tunnel testing and the application of state of the art micro-scale manufacturing of representative ice shapes.

The ICED CRM project aims to bring together two of the world's leading commercial aircraft manufacturers (Airbus & Boeing), the world leading wind tunnel for testing aircraft at real flight conditions, (the European Transonic Wind Tunnel, ETW) and UK academia through the National Wind Tunnel Facility (NWTF), represented by Cranfield University as the project lead. The project will take advantage of the NASA Common Research Model (CRM) ecosystem to define and manufacture relevant ice configurations, to test and produce both numerical and experimental data based upon those configurations, to analyse, store and share the data with a wider international research community.

The project will result in a definitive database of experimental data on which to base mitigation technology development, a better understanding of the best practice for accurate numerical computation of the effects of icing on aircraft performance and an enhanced international capability to deal with aircraft icing issues.