Master thesis

„Experimental investigation of a high velocity impact onto a solid surface of a single micrometer drop“

For the development of innovative lift systems for the next generation of light to medium-weight helicopters, the reliable prediction of icing masses is a central step for improved system designs. Currently, the icing mass due to droplets in the micrometre range is greatly overestimated with current simulation tools. On the one hand, this is due to the fact that the exact residual masses at impact of 10-50 µm droplets at high velocities have not yet been determined experimentally. On the other hand, bouncing effects without direct solid contact occur more frequently in small droplets due to dominant aerodynamic forces. Therefore, the technical focus of the project is the further development and validation of innovative experimental method in order to meet conditions close to the application. First, a single drop experimental test rig is set up realizing a single droplet impact. A drop generation providing single micrometer drops is already present at the SLA. The second central component of the experimental setup is a rotating impact surface, which has a rotor-typical surface texture. This is to be designed as a rotating wheel unit with minimal imbalances in order to create a purely tangentially accelerated surface.

Icing on a helicopter [1]

Within the scope of this work, the impact of a water droplet is to be filmed and analysed using a high-speed camera. First, the existing setup for droplet acceleration is to be optimised for high speeds. Subsequently, experiments will be carried out in which various parameters such as droplet diameter and velocity, as well as surface parameters (e.g. material & temperature) will be varied. The recorded high-speed videos will then be evaluated using image recognition software in MATLAB.

Requirements:

- Interest in experimental work
- Motivation & Independence

Tasks:

- Familiarization with the topic
- Develop and build the test rig
- Carrying out the single drop experiment

Start immediately

With interest:
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[1] https://www.nlr.org/news/nlr-helps-to-make-new-kai-helicopter-resistant-to-hazardous-icing/