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JOICE - Joint Austrian In-flight Icing Research Venture 2020+

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Vienna, 12.11.2025

Brief description of the consortium partners

- FH JOANNEUM GmbH (Coordinator)
- Aerospace & Advanced Composites GmbH
- AeroTex GmbH
- ATT Advanced Thermal Technologies GmbH
- Austrian Institute of Technology GmbH
- Eologix Sensor Technology GmbH
- FACC AG
- Graz University of Technology
- JOANNEUM RESEARCH Forschungsgesellschaft mbH

Brief description of the consortium partners

- CEST – Kompetenzzentrum für elektrochemische Oberflächentechnologie GmbH
- LKR Leichtmetallkompetenzzentrum Ranshofen GmbH
- AIIS – Österreichisches Institut für Vereisungswissenschaften in der Luftfahrt
- Rail Tec Arsenal Fahrzeugversuchsanlage GmbH
- Rembrandtin Lack GmbH Nfg KG
- University of Seoul
- Villinger GmbH

The JOICE Advisory Board

- ADSE Consulting & Engineering BV
- AIRBUS S.A.S
- Airbus Helicopters S.A.S.
- American Kestrel Co., LLC
- Austrian Research Promotion Agency (FFG)
- Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology
- Diamond Aircraft Industries GmbH
- GE Aviation Systems Limited (Dowty Propellers)
- Leonardo S.p.A. – Helicopter Division
- NLR – Royal Netherlands Aerospace Centre

Aim of the project / Background of the project

The strategic goals of JOICE were:

- Pooling of the national stakeholder's competencies in the area of in-flight icing
- Increase of the international visibility of the Austrian icing community
- Extension and deepening of the Austrian stakeholder's competencies in in-flight aircraft icing

Aim of the project / Background of the project

The technical "top level goals" of JOICE were:

- Provision of comprehensive numerical and experimental simulation methods for the development of ice protection systems in CS-25 Appendix C, O and snow icing conditions
- Demonstration of energy-efficient hybrid ice protection systems for UAV and small and medium-sized aircraft for inadvertent flight in icing conditions
- Development/extension of a comprehensive experimental 3D validation data base for numerical ice accretion simulation tools in Appendix C, O and snow icing conditions

Project results

- Breitfuß, W., Moser, R., Hassler, W., Ferschitz, H. et al., *"Comparison of Numerical Simulations with Experimental Data for an Electrothermal Ice Protection System in Appendix O Conditions,"* SAE Technical Paper 2023-01-1396, 2023, https://doi.org/10.4271/2023-01-1396.
- Puffing, R., Neubauer, T., Moser, R., Hassler, W. et al., *"Experimental Investigation of a CRM65 Wingtip Mockup under Appendix C and Appendix O Icing Conditions,"* SAE Technical Paper 2023-01-1386, 2023, https://doi.org/10.4271/2023-01-1386.
- Hassler, W., Breitfuß, W., Rapf, A., Fallast, A. et al., *"Numerical Simulation of In-flight Icing by Water Droplets with Elevated Temperature,"* SAE Technical Paper 2023-01-1477, 2023, https://doi.org/10.4271/2023-01-1477.

Project results

- Neubauer, T., Kozomara, D., Puffing, R., and Teufl, L., *"Time Resolved 3D Scanning of Ice Geometries in a Large Climatic Wind Tunnel,"* SAE Technical Paper 2023-01-1414, 2023, https://doi.org/10.4271/2023-01-1414.
- Neubauer, T., and Puffing, R., *"Introduction of an Online Ice Accretion Database,"* SAE Technical Paper 2023-01-1464, 2023, https://doi.org/10.4271/2023-01-1464.
- Kim, Y., Hong, Y., Shon, S., and Yee, K., *"Implementation of the DADI Method into the Droplet Equation for Efficient Aircraft Icing Simulation,"* SAE Technical Paper 2023-01-1465, 2023, https://doi.org/10.4271/2023-01-1465.

Utilization of the project

- By successfully achieving its strategic and technical goals, JOICE strengthened Austria's icing research community and its international connections. The project's global recognition was highlighted in a final public workshop, where experts from NASA, FAA, EASA, NRC, Boeing, and Dowty traveled to Vienna – many at their own expense – to actively contribute to the workshop.
- In addition to the technical advances achieved in JOICE, it was particularly this gain in reputation that led to a number of new collaborations and follow-up projects that would not have been possible without this flagship project.

Further steps/(potential) follow-up projects

- 3D-ICESIM
- IceDrone
- PRECISE
- NORIS
- IFIRE
- ICEBREAKER
- LABELO
- All-Weather Drone
- …