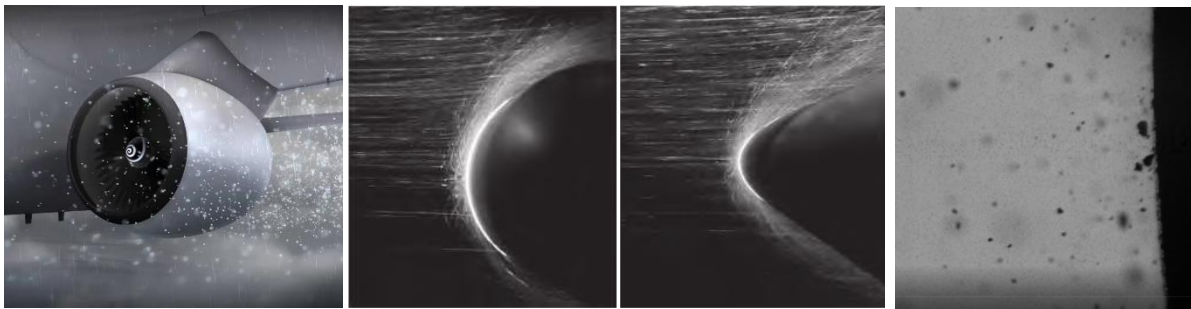




Starting from 01.08.2023, the Institute of Fluid Mechanics from Technische Universität Braunschweig is looking for a

Doctoral Candidate (m/f/d)
in the
MSCA Doctoral Network TRACES
on the topic
**“Experimental study of the initial phase of ice crystal
accretion”**
(full-time– fixed-term)

The position is to be filled on a fixed-term basis for a period of 3 years. A subsequent employment to complete the dissertation is possible.



1: Engine in ice crystal

Environment [www.nasa.gov]

2: Ice particle impact at glaciated icing conditions in

Braunschweig Icing Wind Tunnel

3: Ice crystal breakup on

impact

Background and research objective

In 2019, the European Aviation Safety Agency (EASA) identified in-flight icing as a priority 1 issue for large aeroplanes. In-flight icing can occur when an aircraft flies through clouds of supercooled droplets, namely, drops of liquid water with a temperature below the freezing point, which freezes upon impact. Aircraft icing can lead to a reduction of visibility, damage due to ice shedding, blockage of probes and static vents, reduced flight performance, engine power loss, etc. In addition to safety concerns, inservice icing events can lead to major disruption of air operation and aircraft maintenance.

Today the inception phase of ice accretion by ice crystal icing is not completely understood. Within the scope of EU Horizon Project MUSIC-haic, comparison between experimental investigations and theoretical models have revealed significant differences in the estimation of heat flux resulting from impingement of an icing cloud on a heated substrate. Existing theoretical models use superposition principle of heat transfer by individual impacts to account for impact of an icing cloud generated in wind tunnel measurements. Moreover, one of the key parameters (most empirical in nature) in numerical modeling of ice accretion is the sticking efficiency. To provide the missing data necessary for accurate modeling of sticking efficiency, experiments capturing the initiation phase of ice accretion are a necessity. Therefore, detailed (macro and microscopic) experimental investigations of the inception phase leading up to formation of an ice layer i.e. impact of ice crystals on a heated dry surface, a partly wetted surface and the enlargement of an existing ice layer are therefore not only important to improve our understanding of heat transfer and icing physics but will also enable calibration and validation of theoretical and numerical models. We are planning these new detailed investigations in our Braunschweig Icing Wind Tunnel.

About the network

TRACES (TRAIning the next generation of iCE researcherS) is a European Joint Doctorate network whose main goal is to provide high-level training in the field of in-flight icing to deliver a new generation of high achieving Doctoral Researchers (DR) in the diverse disciplines necessary for mastering the complexity of ice accretion and its mitigation in aircraft and aeroengines. TRACES will provide the transferable skills necessary for thriving careers in academia, research centres and industry. This goal will be achieved by a unique combination of hands-on research training, non-academic secondments and courses and workshops on scientific and complementary soft skills facilitated by the academic/non-academic composition of the consortium. Cutting-edge research carried in TRACES targets three major knowledge gaps in icing sciences and technologies: 1) the modelling of ice inception, ice-wall and liquid-wall interfaces, which is carried out under uncertainty to deliver robust icing models; 2) innovative multilevel ice detection systems and innovative ice protection systems suitable for current and next generation, full- or hybrid-electric aircraft; 3) Virtual certification techniques for certification by simulation of aero-subsystems or complete aircraft flying in icing conditions. The European Aviation Safety Agency and the Federal Aviation Administration (USA) will provide training on certification procedure and together with major industries in the field will assess the DRs projects during team Design & Certify exercises.

About TU Braunschweig

With around 17,800 students and 3,800 employees, [Technische Universität Braunschweig](#) is the largest Institute of Technology in northern Germany. We are known for our strategic and performance-oriented thinking and acting, top-level research, highly committed lecturers and a successful transfer of knowledge and technologies into industry and society. We are dedicated to creating a family-friendly environment and advocate for equal opportunities.

Our core research areas are Mobility, Engineering for Health, Metrology, and the City of the Future. A strong focus is placed on engineering and the natural sciences, with a close link of our core disciplines to the economics, social and educational sciences as well as the humanities.

Our campus is located in the middle of one of Europe's research hotspots, where we have established a successful working relationship—both with the more than 20 research facilities in our neighborhood and our international partner universities.

About the Host Institution

We, the [Institute of Fluid Mechanics](#), are part of the [Aeronautics Research Centre Niedersachsen \(NFL\)](#). The NFL is a leading research centre for aviation in Germany with excellent research and education. As part of the NFL, we have an internationally unique infrastructure with research aircraft, wind tunnels, simulators and test rigs with which our scientists and dedicated students conduct cutting-edge research. A major focus of current research at the NFL and TU Braunschweig is the mobility needs of society in the future and, in particular, the factors of environmental compatibility, safety and economic efficiency of air transport. In several national and international projects, our working group of Multiphase flow and Icing has experimentally and numerically investigated the fundamentals of ice accretion as well as the industrial challenges posed by icing.

About the joint Institution

[Onera](#) is one of the main French research organisms in the aerospace sector. It performs both fundamental and applied research in all fields related to civil and military aerospace activities, but also ensures an efficient knowledge and technology transfer to the aerospace industry. ONERA hosts a unique set of experimental capabilities, among which the first collection of wind tunnels in Europe. The hosting lab will be the heterogeneous multiphase flow group, located in Toulouse and within the department for energetics in multiphysics. For over a decade, the group has worked on both the modeling of icing (droplet heat and mass transfer dynamics, droplet / ice crystal wall interaction, erosion, liquid film runback and phase change phenomena, deicing, etc.) and its numerical prediction via the development of the Igloo2D / Igloo3D icing suites. These numerical tools are widely used today by leading companies in the aeronautic sector such Airbus, Dassault Aviation and Safran Aircraft Engines. The heterogeneous multiphase flow group has recently built a wind tunnel dedicated to the investigation of icing dynamics.

Benefits:

- You receive a 3-year full-time employment contract, enrolled in a PhD program
- You will carry out cutting edge research in the area of multiphase flow simulation and get innovative multidisciplinary and multisectoral training by experts and experienced supervisors from two sectors (academia and industry).
- You will publish your research findings and participate at national and international conferences.
- You will travel a lot, including stays abroad for secondments at our research partner ONERA in Toulouse and at an industrial partner.
- You will work in an international team and be part of a network of 15 PhD students.
- You will participate in a structured training program consisting of soft skill courses, targeted workshops, retreats, social events and networking.
- You can get a dual doctoral degree from two European universities.

Your Qualifications:

We welcome applications from Doctoral Researcher candidates fulfilling the following criteria:

1. Can be of any nationality but must not have resided or carried out their main activity (work, studies, etc.) in the country of the recruiting organization for more than 12 months in the 36 months immediately before their recruitment date. Time spent as part of a procedure for obtaining refugee status under the Geneva Convention (1951 Refugee Convention and the 1967 Protocol), compulsory national service, and/or short stays such as holidays are not considered. Regarding the joint institution Onera, its participation in activities related to French national security requires that candidates obtain a security clearance consisting of a routine ID check. The obtention of this clearance lasts about a month and will be started as soon as a valid application is received.
2. Must meet the entry requirements for PhD enrollment in both the Host and in Joint Institution. They must hold a 2nd Level Master Degree (120 ECTS + 180 ECTS in a bachelor degree) or a Single Cycle Degree (minimum 300 ECTS), or a comparable university degree (Second Cycle qualification) in mechanical engineering, aerospace engineering, applied physics or a related field.
3. Must not have a doctoral degree at the date of their recruitment. Researchers who have successfully defended their doctoral thesis but who have not yet formally been awarded the doctoral degree will not be considered eligible.
4. Are required to be proficient in the English language. English proficiency of short-listed applicants shall be assessed during the selection interview.
5. Must be available to enroll full-time in the PhD program at TU Braunschweig in August/September 2023.
6. Are aware of and adhere to the principles set out in the Commission Recommendation on the European Charter for Researchers.
7. Understand and accept that their application may be subject to security and background checks. TRACES is a collaborative program between different European beneficiaries and international partners. In this regard, TRACES partner countries may have restrictive measures in place following the United Nations Security Council (UNSC) sanctions regimes. Applicants who are nationals or residents of countries, against which restrictive measures are in place, may be subject to additional security checks and procedures, and eventually restrictive measures.

Furthermore, we expect a profound knowledge in aerodynamics and thermodynamics. Experience in experimental methods as well as image processing algorithms is desirable.

Selection process

The application will be done through an online application platform to be found on the TRACES website: <https://traces-project.eu/>

Applications must be in English. Each applicant may apply to a maximum of five individual research projects.

Candidates must apply through our career site in which they will be able to upload the following documents:

- a CV (including publications, if any),
- a motivation letter,

- Copies of degree and academic transcripts (with grades and rankings), for both the Bachelor's and Master's degrees. Academic records not written in English should be accompanied by a translation into English (it can be either an official translation or self-translation). If the candidate has not been awarded the qualifying degree yet, he/she should provide a document proving the expected date of award.
- Summary of Master's thesis (approx. 1 page),
- names and email addresses of three referees must be inserted on the application form,
- Scanned copy of a valid national ID, passport, or equivalent.

Optional documents:

- English Proficiency Certificate,
- Publications: maximum 3 journal papers or conference proceedings, no theses or under review manuscripts,
- reference letters.

The documents must be uploaded as indicated in the online form. This is a compulsory procedure, any other means/format for applying will not be accepted.

Eligible applications will be ranked on the basis of academic merit, research skills, motivation letter, recommendation by referees and dissemination and communication activities.

The best candidates for each position will be invited beginning of April to video interviews (taking place mid of April) where the final candidate will be selected (Communication of the final results: beginning of May). The hiring process will take place between June and September 2023 (depending on end of Master's degree) and the enrolment on our Doctoral school by October 2023.

Applicants with a positive evaluation but not selected will be included on a reserve list to cover possible future positions and might be contacted at a later stage.

What's more to know:

A monthly amount of 3,942.20 EUR will be provided by the Research Executive Agency. This sum is made up of the monthly Living Allowance in the amount of 3,342.20 EUR which already includes the country coefficient specified by the European Commission, and the Mobility Allowance of 600.00 EUR. This monthly amount corresponds to the budgetary burden for employment of the EU researcher and, after deduction of the employer's social security contributions, equals the gross salary for the activities to be remunerated.

We welcome applicants of all nationalities. At the same time, we encourage people with severe disabilities to apply. Applications from severely disabled persons will be given preference if they are equally qualified. Please attach a form of evidence of your handicap to your application. We are also working on the fulfilment of the Central Equality Plan based on the Lower Saxony Equal Rights Act (*Niedersächsisches Gleichberechtigungsgesetz—NGG*) and strive to reduce under-representation in all areas and positions as defined by the NGG. Therefore, applications from women are particularly welcome in this case.

Personal data will be stored for the purpose of carrying out the application procedure. Application costs cannot be reimbursed.

Questions and Answers:

For more information, please call Inken Knop on +49 (0) 531 391-94231 or write an email to i.knop@tu-braunschweig.de.

Closing date of first round of evaluation: 07.03.2023

Are you interested? Please hand in your application through our website: <https://traces-project.eu/>