

# Cluster of Excellence SE<sup>2</sup>A - Sustainable and Energy Efficient Aviation

## Junior Research Group Lead (m/f/d):

### Evaporative cooling of main components in electrified aircrafts

(EG 14 TV-L, 100%, 4 years, for the next possible date)

**Motivation:** TU Braunschweig has defined one of its core research areas to create safe, efficient and sustainable mobility for the future (<https://www.tu-braunschweig.de/en/mobility-1>). In aviation research, we follow an interdisciplinary research concept, jointly with DLR and Leibniz University Hannover, within the Cluster of Excellence “SE<sup>2</sup>A - Sustainable and Energy Efficient Aviation” (EXC 2163). The Cluster defines scientific and technological foundations for a sustainable future global air transport system to meet the mobility demands. It defines solutions for transformation needs of the air transport system by introducing new aircraft technologies, new energy storage and conversion approaches, and fundamental evaluations of the overall aviation system. (<https://www.tu-braunschweig.de/en/se2a>).

**Approach:** The Cluster of Excellence is structured into the three core research areas, namely “Assessment of the Air Transport System”, focusing on Operations Research, technology assessment and life cycle analysis, “Flight Physics and Vehicle Systems” for new aircraft technologies in flight physics and aircraft structures, and “Energy Storage and Conversion”, focusing on vehicle energy storage and conversion systems and full- and hybrid-electric aircraft drive systems. The Cluster has established Junior Research Groups (JRG) as an effective means to generate effective thrusts in critical research fields. We therefore search for JRG leads with a doctoral degree and a strong research background in their respective fields for the next possible date.

The JRG “Evaporative cooling of main components in electrified aircrafts” will be part of the core research area “Energy Storage and Conversion”. Highly efficient cooling is a fundamental requirement for the functional reliability, performance and lifetime of the components of electrified aircraft such as high performant electric drives, power electronics and fuel cells. Flow boiling is a very promising cooling method for these components as it results in very high heat transfer rates while maintaining nearly isothermal conditions at the surface. Therefore, the JRG will investigate the application of flow boiling including spray cooling in the electric propulsion drive system and energy supply system of fuel cell or battery powered aircrafts, possibly taking additive manufacturing structures into account. The evaporative cooling units will be part of a modular thermal management system, which has to be numerically optimized for a specific design case. The JRG will be comprised of the lead and 2 doctoral candidates, funded for 4 years as part of the overall project. The group will work in close collaboration with related research groups in the field of thermal management, electric propulsion drive system and power supply system of electrified aircraft. Therefore, we expect a full commitment to undertaking interdisciplinary research.

**Expected research focus:** The JRG will explore, on one hand, evaporative cooling strategies for high performant electric drives. Close collaboration with the electronic propulsion groups is mandatory. Evaporative cooling of PEM FCs will be a second focus, selection of pressure adjustment strategies, selection of suitable refrigerants, spray cooling and the condensation unit with integration in the overall thermal management system will be a third focus within the team. Flow criteria to avoid dry out and hot spots due to refrigeration migration and flow instabilities for instance during take-off and landing must be considered. A comparison to effective single-phase cooling approach should be included. The JRG is expected to deliver experimentally validated design tools for evaporative cooling modules as part of an overall efficient thermal management system. As JRG leader, we seek to appoint an expert in two phase heat exchange with extensive experience in experimental validation.

**Qualifications:** The Junior Research Group lead must hold, beside a completed scientific higher education (master, university diploma), a PhD and is expected to have an excellent record of publications in good venues in their field, international exposure and have participated in competitive research projects. The lead is expected to devise, coordinate, and actively contribute to the methodological extensions and applications of simulating conceptual aircraft design as described above. Therefore, we seek a researcher with a strong background in overall aircraft design to apply for the open lead position. In-depths experience in higher-fidelity methodologies as noted above would be seen as an advantage.

**Application Process:**

Please send a complete written application in English as a single PDF file to: [se2a@tu-braunschweig.de](mailto:se2a@tu-braunschweig.de).

Applications have to consist of a cover letter (statement of purpose, including your motivation), your idea of methodical and contextual contribution to the project (length about two pages), full CV, academic certificates and transcripts (bachelor, master, and PhD), and other supporting certificates.

Please check our website [www.tu-braunschweig.de/se2a](http://www.tu-braunschweig.de/se2a) for further details and detailed description of the available positions linked to the JRG topics. Please specify in your application which JRG you are applying for. We thank all applicants, but only short-listed candidates will be contacted.

**The deadline for submitting applications is the 31<sup>st</sup> of May 2022.**

For further questions, please contact: Prof. Joerg R. Seume, [seume@tfd.uni-hannover.de](mailto:seume@tfd.uni-hannover.de), +49 511 762 2733

**Benefits:** We offer a fixed-term full-time contract with an average weekly working time of 39.8 hours for a period of up to four years. The payment will be according to task assignment and fulfillment of personal requirements up to salary group 14 TV-L. Contracts include health, retirement and unemployment benefits.

At Leibniz Universität Hannover we appreciate a team-oriented and communicative style of work. Gender Equality is an important factor for us. We aim to increase the share of women in academic positions and therefore particularly welcome applications from women. We support all our academics in their scientific and personality development and we offer a family-friendly workplace. Applications from international scientists are welcome. International applicants may have to successfully complete a visa process before hiring can take place. Severely disabled persons with equivalent qualifications will be given preference. Please attach a form of evidence of your handicap to your application. Your personal data will be saved for the application procedures. Application costs cannot be reimbursed.