Dresden University of Technology

TUD Dresden University of Technology, as a University of Excellence, is one of the leading and most dynamic research institutions in the country. Founded in 1828, today it is a globally oriented, regionally anchored top university as it focuses on the grand challenges of the 21st century. It develops innovative solutions for the world's most pressing issues. TUD has established the Research Training Group "AirMetro - Technological & Operational Integration of Highly Automated Air Transport in Urban Areas" (RTG 2947), funded by the German Research Foundation (DFG). This interdisciplinary group, involving five faculties and the German Aerospace Centre (DLR), will conduct research on 11 research topics. The goal is to address the technical and social challenges of Innovative Air Mobility (IAM), considering ecological, economic, technological, and sociological factors. The RTG's structured PhD program aims to train young researchers in highly automated, networked mobility, featuring international collaboration with mentors from the USA, Asia, and Europe. TUD and the RTG embody a university culture that is characterized by cosmopolitanism, mutual appreciation, thriving innovation and active participation. For TUD diversity is an essential feature and a quality criterion of an excellent university. Accordingly, we welcome all applicants who would like to commit themselves, their achievements and productivity to the success of the whole institution.

The **Research Training Group RTG 2947 "AirMetro"**, funded by the DFG, offers a position, as

Research Associate / PhD Student (m/f/x)
(subject to personal qualification employees are remunerated according to salary group E 13 TV-L)

starting **May 1, 2026**. The position is limited until April 30, 2029. The period of employment is governed by the Fixed Term Research Contracts Act (Wissenschaftszeitvertragsgesetz - WissZeitVG). The position aims at obtaining further academic qualification (usually PhD).

Job ID:	**RTG2947-T8/2**
Title:	Multimodal Navigation with Adaptive Sensor Fusion and Localized Map Management
Supervisor:	Jun.-Prof. Dr. Anette Eltner, Junior Professorship in Geo Sensor Systems, Prof. Dr. Hans-Gerd Maas, Chair of Photogrammetry and co-supervised by at least one additional professor plus an international tutor of the RTG

Description of the PhD topic:
Operating UAVs in urban areas puts special requirements on the accuracy and reliability of navigation data. On the other hand, this data is impaired by effects such as signal shadowing. The project aims to combine complementary navigation methods and develop situation-dependent integration solutions.
This PhD project focuses on adaptive semantic fusion of multiple navigation sources for Innovative Air Mobility (IAM), including GNSS, high-precision MEMS-based INS, 5G/6G communication with V2X and edge computing, and vision- and LiDAR-based odometry using semantic landmarks. Accurate localization is challenged by GNSS shadowing, 5G multipath effects, and variable sensor quality, which can significantly impact the safety of flight. The thesis shall develop robust state estimation methods by combining factor graph-based sensor fusion, variance component analysis, and modern deep learning approaches such as adaptive Kalman filters and transformer architectures. Integration of object detection and landmark recognition with 3D city models may enable semantic awareness for navigation. Efficient map compression and dynamic level-of-detail switching may ensure computationally tractable on-board processing, while sensor cascades shall be optimized for varying conditions including night or convective weather. The project aims to deliver a reliable, adaptive navigation framework that supports safe and precise UAM operations in complex urban environments.

Objectives:
— develop adaptive multi-sensor fusion techniques combining GNSS, INS, 5G/6G, vision, and LiDAR to achieve robust real-time localization for UAM
— incorporate factor graph-based fusion and variance component analysis to model sensor uncertainties and improve robustness against degraded measurements
— integrate deep learning methods for object detection and semantic landmark recognition, including adaptation to textured 3D city models
— optimize cascaded sensor fusion architectures for varying operational conditions, including night operations and convective weather
— validate the framework using synthetic and real-world data sets to ensure accurate, reliable, and situation-adaptive navigation for eVTOL aircraft

Tasks:
— independent and cooperative qualification through scientific research within one of the PhD study projects on offer
— training in the technical tasks of the individual dissertation topics through study of the literature and in making the objectives more precise
— working on the individual PhD study project with experimental, numerical in collaboration with other RTG members (fellow students and supervising professors)
— implementation of the planned research program, evaluation and interpretation of the results and transferring them to a RTG internal ex-change platform, elaboration and presentation of the state-of-the-art in the respective research fields
— participation in lectures, workshops and summer schools according to the guidelines of the RTG curriculum
— supporting scientific graduation work (Bachelor/Master/Diploma) in the subject-specific research field
— regular reporting on research progress to the supervising professors
— publishing the results of the research work individually and in concert with others
— cooperative maintenance of exchange platforms (database, information pages, etc.)
— summarizing the results of the individual PhD study project in a dissertation within the due time of four years.
— Successful candidates will work together with an experienced PhD researcher at the Institute of Photogrammetry and Remote Sensing and together with other chairs being part of the RTG.

Requirements:
— good or very good university degree in geodesy, geo-information sciences or related fields, advanced programming skills
— We are looking for first-class graduates with expertise in the RTG-addressed PhD subjects, high interdisciplinary desire to learn and willingness to cooperate, very good verbal and written English communication skills as well as the absolute determination to submit the dissertation after 3 years of research.

We offer:
— **Pioneering Research Environment:** Shape the future of advanced air mobility through involvement in innovative drone-related projects that bridge technology, urban planning, material sciences, sensors and aviation. With the upcoming Smart Mobility Lab in Lusatia, Saxony, you will have access to state-of-the-art and extensive facilities for experiments. This includes a hall measuring 100x100x30 meters and outdoor space (available from 2027).
— **Cross-Disciplinary Collaboration:** Immerse yourself in a highly collaborative and interdisciplinary research environment, where you'll work alongside experts from fields such as engineering, data science, urban studies, and aerospace.
— **Skill Development:** Our extensive qualification concept goes beyond research, offering targeted training in drone technology, data analytics, regulatory aspects, project management, and leadership skills. This ensures you graduate not only as a specialist in your field but also as a well-rounded professional.
— **Global Networking:** Collaborate with our network of local and international partners, fostering connections that transcend geographical boundaries and enrich your academic and professional network. This includes a paid research stay abroad for three months.
— **Career Advancement:** Receive dedicated support for fellowship applications and tailored guidance for your career.
— **Quality of Life in Dresden:** Experience a high quality of life in Dresden, with its dynamic urban scene, relatively affordable living, rich cultural offerings, and vibrant nightlife.

Further questions regarding this call can be addressed to Jun.-Prof. Dr. Anette Eltner (anette.eltner@tu-dresden.de) or Prof. Dr. Hans-Gerd Maas (hans-gerd.maas@tu-dresden.de)

TUD strives to employ more women in academia and research. We therefore expressly encourage women to apply. The University is a certified family-friendly university. We welcome applications from candidates with disabilities. If multiple candidates prove to be equally qualified, those with disabilities or with equivalent status pursuant to the German Social Code IX (SGB IX) will receive priority for employment.

Please submit your detailed application including a cover letter detailing your research interests stating the **job-ID "RTG 2947-T8/2"** along with your curriculum vitae, academic transcripts with marks, a letter of recommendation and your publications (if applicable) by **January 30, 2026** (stamped arrival date of the university central mail service or the

time stamp on the email server of TUD applies), preferably via the TUD SecureMail Portal https://securemail.tu-dresden.de by sending it as a single pdf file to **airmetro@tu-dresden.de** or to:

TU Dresden, RTG 2947 "AirMetro", Prof. Hartmut Fricke, Helmholtzstr. 10, 01069 Dresden, Germany.

Please submit copies only, as your application will not be returned to you. Expenses incurred in attending interviews cannot be reimbursed.

TUD is a founding partner in the DRESDEN-concept alliance.