

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-T9/2**

Title: Communication on Flying Devices: Cooperative SLAM and AD-hoc Mesh-Networks for Disaster Management

Supervisor: Prof. Dr. Frank Fitzek, Deutsche Telekom Chair of Communication Networks and co-supervised by at least one additional professor plus an international tutor of the RTG

Description of the PhD topic:

This PhD project focuses on developing robust and adaptive communication and computing frameworks for multi-UAV operations in Innovative Air Mobility (IAM) scenarios. The goal is to enable autonomous UAVs to perform mission-critical tasks even under adverse conditions, including GNSS unavailability, signal jamming, or degraded radio environments.

The central aim of the thesis is to extend communication concepts from single UAVs to coordinated multi-UAV systems. By deploying multiple UAVs that are centrally supervised and dispatched, swarm-like mechanisms can be exploited to efficiently handle mission-specific, spatially and temporally clustered data. This approach improves data transfer efficiency and supports innovative navigation concepts, including enhanced map quality and reduced map-building time. Both single- and multi-agent SLAM require a careful split of computation between local (onboard) and remote (edge or cloud) instances, which in turn imposes new requirements on communication. The research will therefore develop novel communication solutions in the context of emerging 6G standards and wireless mesh networks.

The project combines resilient ad-hoc networking, edge-assisted computation, and cooperative simultaneous localization and mapping (C-SLAM) to support dense, multi-agent UAV operations. Visual and map data are efficiently compressed, fused, and synchronized to sustain robust operation in dynamic urban or disaster-management scenarios. By integrating autonomous UAVs as active agents within a distributed digital twin, the project links communication resilience directly to navigation performance, safety, and mission-critical decision-making.

Objectives:

- extend communication frameworks from single UAVs to coordinated multi-UAV systems, exploiting swarm-like mechanisms to efficiently handle spatially and temporally clustered mission-specific data
- develop resilient multi-link networking solutions based on emerging 6G standards and wireless mesh architectures to ensure robust connectivity under interference, jamming, or degraded GNSS conditions
- design adaptive cooperative SLAM frameworks for multi-agent UAV operations, supporting reliable localization, mapping, and trajectory planning in complex environments

- implement efficient compression, fusion, and synchronization of visual and map data to enable real-time operation on bandwidth- and computation-constrained platforms
- optimize the distribution of computation between onboard, edge, and cloud instances to balance latency, reliability, and processing load in single- and multi-agent scenarios
- validate communication and navigation frameworks in realistic urban and disaster-management scenarios, demonstrating integration of UAVs and UGVs within a distributed digital twin for situational awareness and mission-critical decision-making

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 three 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 electrical engineering, computer science, computer engineering or comparable
- solid background in wireless communication, networked systems, or distributed computing
- knowledge of autonomous systems, multi-robot coordination, SLAM techniques and experience in software development and simulation environments (e.g., Python, C++, ROS, MATLAB)
- 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 three 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 Prof. Dr. Frank Fitzek (frank.fitzek@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-T9/2"** along with your curriculum vitae, academic transcripts with marks, a letter of recommendation and your publications (if applicable) by **February 4, 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.



AirMetro
Research Training Group
2947 at TU Dresden

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

DRESDEN
concept



Reference to data protection: Your data protection rights, the purpose for which your data will be processed, as well as further information about data protection is available to you on the website: <https://tu-dresden.de/karriere/datenschutzhinweis>.