

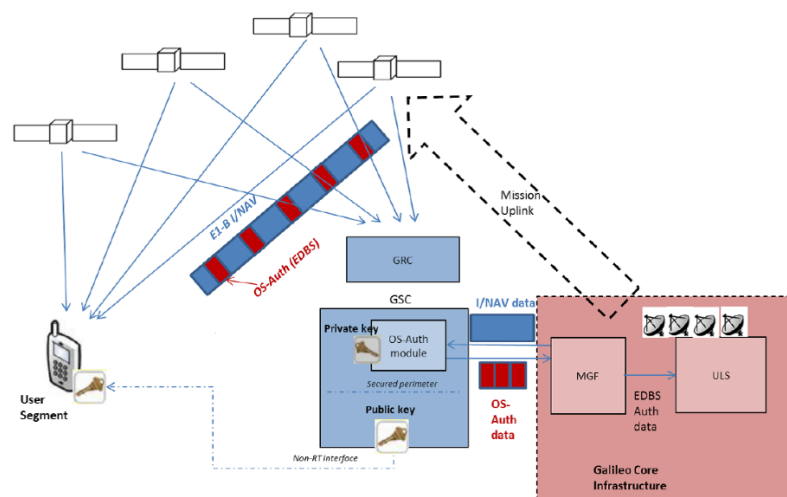
## MUNICH AEROSPACE – NEW HORIZONS IN AVIATION AND SPACE

In 2010, through Munich Aerospace and its pooling of research, graduate programmes and teaching, an alliance has been formed between the **Technical University Munich (TUM)**, the **Bundeswehr University Munich (UniBwM)**, the **German Aerospace Center (DLR)**, as well as **Bauhaus Luftfahrt (BHL)**.

To promote excellent, scientific young academics, Munich Aerospace awards a PhD scholarship on

### Galileo Open Service Navigation Message Authentication Service Test and analysis for R&D in user-specific application areas

A new service is currently being implemented for the Galileo satellite navigation system. The Open Service Navigation Message Authentication Service (OS-NMA)<sup>1</sup> will enable the verification of the calculated position in certain time intervals, which is very interesting for many safety related applications like autonomous driving/flying, various railway applications, precise farming, etc. To realize the OS NMA the OS navigation message will be used to generate a Message Authentication Code (MAC), which can be verified with a key sent by the Galileo signal with a certain delay and being authenticated itself by a PKI infrastructure. This is a distinguished feature of Galileo and not available for other GNSS like GPS, GLONASS or BeiDou.



#### Your tasks

- Continue the work on a MATLAB based OS-NMA evaluation tool and optimize it for various GNSS receivers and applications
- You will receive a full training into Global Navigation Satellite Systems (GNSS) signal processing, message decoding and OS-NMA to have kick start for your PhD work.

<sup>1</sup> [https://gssc.esa.int/navipedia/index.php/Galileo\\_Open\\_Service\\_Navigation\\_Message\\_Authentication](https://gssc.esa.int/navipedia/index.php/Galileo_Open_Service_Navigation_Message_Authentication)

- As possible research focus can be derived from the fact that incorrect demodulation of individual symbols or bits makes authentication difficult. Therefore, the receiver must have a particularly stable tracking behavior and also use advanced signal processing methods in the decoding of the symbols from multiple satellites. The method shall be implemented and tested in the MATLAB tool.
- Another research focus could be in optimizing for the relevant use cases (How often do I need a verified position? Where do I operate my receiver?, ...) including propagation conditions (channel model) of the application. For example, the use of vector tracking and inertial support of tracking loops can stabilize the OS-NMA signal reception.
- Further, the transfer of Galileo authentication to other GNSS via time transfer methods shall also be investigated and the analysis of upcoming authentication schemes like Chimera (for GPS) or Galileo watermarking on E6 shall be explored.

## Your qualifications

- Your skills should include interests in GNSS a master degree in engineering, mathematics or natural sciences. Physicists and mathematicians are particularly welcome to investigate this complex and interdisciplinary problem.
- An interest to investigate and analyze the application-specific requirements and relevant regulations (automotive, rail, UAV, etc.) is an important prerequisite.

## Your academic & industrial supervision and support

The scholarship is part of the Munich Aerospace Research Group "GNSS Receiver Algorithms for Advanced Galileo Services". It is primarily handled by professorship LRT9.2<sup>2</sup> of the Institute of Space Technology and Applications (ISTA) being part of the FZ Space<sup>3</sup>. The Institute offers an excellent research environment with tight connection to the European Space Agency (ESA) and to the European Union Agency for The Space Programme (EUSPA) both leading the development of the Galileo navigation system. Lab and software tools at ISTA to analyze OS-NMA and GNSS receiver processing are best in class. IABG is involved in various security & safety related GNSS-projects and will provide support and contacts to the relevant application domains and their stakeholders.

## The Scholarship

The Munich Aerospace scholarship amount is 1.575 € per month granted for a minimum of 12 months and limited to a maximum of 3 years. Munich Aerospace scholarship holders are entitled to attend the Munich Aerospace Graduate School, formed by the TUM Graduate School, the DLR\_Graduate\_Program and the IABG training program, and have access to special events and trainings. An additional grant of up to € 6.100 per year will be available to cover expenses that are directly related to the PhD project (e.g. textbooks, laptop, conference travels, public transport, housing subsidy). The scholarship can be combined with a part-time employment at IABG. Due to the regulatory-framework for some Galileo-projects an EU-citizenship is desirable. The scholarship

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<sup>2</sup> <https://www.unibw.de/lrt9/lrt-9.2>

<sup>3</sup> <https://www.unibw.de/space>

holder is part of a Munich Aerospace research group and receives additional technical support from the research group head. The candidates receive their PHD from UniBWM.

The scholarship can be combined with a part-time employment at IABG. Due to the regulatory-framework for some Galileo-projects an EU-citizenship is desirable.

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## Interested?

Please send us your application including relevant documents (cover letter, CV, diplomas, transcript of records) in PDF format to [antje.tucci@unibw.de](mailto:antje.tucci@unibw.de) or upload the documents to the recruitment portal of IABG (<https://www.iabg.de/karriere/stellenangebote>). The application deadline is November 30, 2021.

**We are looking forward to your application!**