EUROPEAN SPACE AGENCY

Internal Research Fellow (PostDoc) on use of Digital Twin in Space Mission Operations

Job Req ID: 12463
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Internal Research Fellowship Opportunity in the Directorate of Operations.

ESA is an equal opportunity employer, committed to achieving diversity within the workforce and creating an inclusive working environment. For this purpose, we welcome applications from all qualified candidates irrespective of gender, sexual orientation, ethnicity, beliefs, age, disability or other characteristics. Applications from women are encouraged.

This post is classified F2.

Location
ESOC, Darmstadt, Germany

Our team and mission
If selected for this post you will be based in the Earth Observation Mission Data System Section, Mission Operations Data Systems Division, Ground Systems Engineering & Innovation Department.

The Mission Operations Data Systems Division is responsible for software system use during the preparation and operational phases of most ESA space missions, including:

- Mission Control Systems to monitor and operate the satellite;
- Mission Planning Systems and Mission Automation Systems;
- Spacecraft Simulators for testing, validation and training.

Supported missions include the ESA Earth Explorer, science, planetary and exploration missions, as well as most of the EU Copernicus missions.

The Division is also very active in Research and Development (R&D) on software technologies applied to space missions focused not only on the systems listed above, but also including research towards CubeSats and robotics applications. The field of R&D activities covers applications of technologies such as virtual and augmented reality, model-based system engineering, security, and artificial intelligence, big data, service-oriented architecture, web technology, advanced human-machine interfaces, cloud computing within the space domain. International standardisation in cooperation with other space agencies (e.g. NASA, JAXA, CNES and DLR) is another key interest.
A researcher role in ESA offers unique research opportunities such as access to the world-class expertise on satellite operations for many missions of heterogeneous nature, access to large amounts of data recorded from multiple missions for processing and analysis, and access to complex data systems such as high-fidelity spacecraft simulators.

Candidates are encouraged to visit the following ESA web pages:

Field(s) of activity/research for the traineeship

The main aim of this post is to expand the R&D activities related to the topic of digital twin and artificial intelligence within the ground segment. The Agency traditionally uses the following systems within the ground segment for the operations of each mission:

- A high-fidelity simulator, for testing, training and validation activities, to ensure that all operational tasks can be tested as part of a realistic scenario before being executed;
- A data archive, for storing all data received from and sent to the spacecraft for evaluation of the historical behaviour of the spacecraft;
- A mission planning facility, for planning future operations including constraint checking and prediction of utilisation of on-board resources;
- A monitoring and control system for execution of operational tasks covering commanding and monitoring of the spacecraft.

The research will focus on enhancing the above systems with digital twin and artificial intelligence technology to improve the digital representation of a spacecraft and the utilisation of such a digital representation for spacecraft operations. This includes, but is not limited to:

- advances in concepts for end-to-end digital continuity, from spacecraft design to manufacturing, and finally to operations, including the use of model-based systems engineering, simulation models and simulator data, together with "in-field" (physical) data to represent the spacecraft;
- using the combination of models and data (with the focus on AI/machine learning) to create output supporting spacecraft design, production, verification and operations as well as to improve spacecraft design;
- utilisation of advanced visualisation (for example AR/VR) and analytics tools to increase the usefulness of a digital twin for operational tasks;
- improvements in modelling technology to increase digital twin representativeness of physical spacecraft, including utilisation of AI/ML based self-learning or data-driven models;
- improvements in processing, storage and analytics capabilities for data gathered from both physical assets and digital twins;
- identification of new concepts for automation and optimisation of the spacecraft operations process to increase science return and rationalise operational tasks.

As the spacecraft digital twin and artificial intelligence topic is very broad, the expected research may focus on a selected subset of the items listed above, depending on your interests and background.

Day-to-day activities will cover a wide spectrum, such as stand-alone research, supervision of student trainees (internships, masters' theses and possibly a PhD thesis), lab activities, supervision of industrial research contracts, development of proof-of-concept software, and contributing to the Agency's R&D/investment roadmaps.

Technical competencies

Knowledge relevant to the field of research, in particular Digital Twins and/or Artificial Intelligence
Research/publication record
Ability to conduct research autonomously
Breadth of exposure coming from past and/or current research/activities
General interest in space and space research
Ability to gather and share relevant information

Behavioural competencies

Result Orientation
Operational Efficiency
Fostering Cooperation
Relationship Management
Continuous Improvement
Forward Thinking

Education
You should have recently completed, or be close to completing a PhD in a related technical or scientific discipline, such as artificial intelligence, data science, modelling and simulation, MBSE or any related field. Preference will be given to applications submitted by candidates within five years of receiving their PhD.

Additional requirements
The working languages of the Agency are English and French. A good knowledge of one of these is required. Knowledge of another Member State language would be an asset.

Other information
For behavioural competencies expected from ESA staff in general, please refer to the ESA Competency Framework.

For further information on the Internal Research Fellowship Programme please visit: Internal Research Fellowship

The Agency may require applicants to undergo selection tests.

In addition to your CV and your motivation letter, please add your proposal of no more than 5 pages outlining your proposed research in the "additional documents" field of the "application information" section.
At the Agency we value diversity and we welcome people with disabilities. Whenever possible, we seek to accommodate individuals with disabilities by providing the necessary support at the workplace. The Human Resources Department can also provide assistance during the recruitment process. If you would like to discuss this further please contact us at contact.human.resources@esa.int.

Please note that applications are only considered from nationals of one of the following States: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the United Kingdom. Nationals from Latvia, Lithuania and Slovenia, as Associate Member States, or Canada as a Cooperating State, can apply as well as those from Bulgaria, Cyprus and Slovakia as European Cooperating States (ECS).
According to the ESA Convention, the recruitment of staff must take into account an adequate distribution of posts among nationals of the ESA Member States*. When short-listing for an interview, priority will first be given to candidates from under-represented or balanced Member States*.
(https://esamultimedia.esa.int/docs/careers/NationalityTargets.pdf)

In accordance with the European Space Agency's security procedures and as part of the selection process, successful candidates will be required to undergo basic screening before appointment conducted by an external background screening service.
*Member States, Associate Members or Cooperating States.

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