Job Title: Internal Research Fellow (PostDoc) - Space Safety and Space Debris Environment Characterisation

Requisition ID **11004** - Posted **01/12/2020**

EUROPEAN SPACE AGENCY

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.

Post
Internal Research Fellow (PostDoc) - Space Safety and Space Debris Environment Characterisation
This post is classified F2.

Location
ESOC, Darmstadt, Germany

Our team and mission
You will be based in the Space Debris Office, a self-standing entity within the Space Safety Programme Office of ESA's Directorate of Operations. The Space Debris Office is coordinating the Agency's space debris research activities and is responsible for all space debris operational and analysis services in support of ESA missions and of ESA cooperation at inter-agency level. The work of the Space Debris Office is based on a large set of operational and scientific analysis software that are developed, maintained and operated under its control.
The related activities of the Office cover:
- Characterisation of the space debris environment and its evolution
- Ground- and space-based measurements of the environment
- Impact risk analysis
- Space debris mitigation
- Collision risk prediction and operational collision avoidance manoeuvre planning
- Re-entry forecasts and re-entry risk predictions
- Maintenance of a database service on more than 40,000 objects in space

The office's experts are also responsible for leading all space debris activities in support of ESA's previous Space Situational Awareness (SSA) program and the current Space Safety Programme. The main activities comprise the advancement of sensor technology, such as e.g. in the area of laser ranging and space-based optical observation concepts, observation data and catalogue processing and correlation through establishing a community approach, the development of an Expert Centre technology, improvements of risk modelling, and developing of technologies for assessing the impact of missions on the space debris environment. Space debris experts also support ESA's Cleanspace initiative in the area of mitigation on-board technology and remediation (active removal of space debris objects).
You are encouraged to visit the ESA websites: www.esa.int, www.esa.int/spacedebris

Field(s) of activities/research
ESA's space debris environment model MASTER, one of only two operational models world-wide, is a so-called event-based model: In order to estimate how many space debris particles of a given size there are, have been, and will be, each event which takes place in orbit has to be modelled. This includes large collision and explosion events down to the delamination of paint flakes from satellites and launchers. Space surveillance data, such as observations from dedicated beam-park experiments, catalogues, and in-situ sensors, are used for the MASTER model validation. Updating event parameters based on the observed data set is currently a manual, tedious, iterative, and hence very time consuming process.
You shall investigate, design, and develop an automated process to fit event-based space object break-up models to large space surveillance datasets by casting the model validation process into an optimisation problem where each observed and virtual event in outer space is described by a limited set of parameters. This optimisation process needs to address break-up models as well as observational constraints, and respect computation constraints as all modelled fragments need to be propagated to the time of observation.
The research will include in-depth analyses and trade-offs of non-linear optimisation algorithms, including genetic, machine learning, and beyond, in order to derive a best fit during validation. A prototype of an efficient processing chain for starting either bottom-up best fits or delta fits when adding additional validation sets is to be established. A

MASTER reference population from the fit shall be compared to the current baseline and its statistical modelling of uncertainties.

The proposed field of research will inherently be multidisciplinary and will combine theoretical and application driven aspects.

In order to gain further experience, you will participate as well in other activities of the office.

Technical competencies

Knowledge relevant to the field of research
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

Innovation & Creativity
Continuous Learning
Communication
Relationship Management
Self Motivation
Problem Solving
Cross-Cultural Sensitivity

Education

You should have recently completed, or be close to completion of a PhD in a related technical or scientific discipline.
Preference will be given to applications submitted by candidates within five years of receiving their PhD.

Additional requirements

The activity requires a proven understanding of orbital mechanics, modern statistical methods for uncertainty quantification, and non-linear optimisation techniques.

A good and demonstrated understanding of the current needs in space debris research, good programming and writing skills, and demonstrated background in genetic algorithms and machine learning are considered beneficial.

You need to demonstrate familiarity with LINUX operating environments, and with scientific programming (e.g. programming in FORTRAN and Python). Previous experience with software engineering, especially in contributing to software developments, is considered an beneficial.

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.

The Agency may require applicants to undergo selection tests.

The closing date for applications is 04 January 2021.

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 and Slovenia, as Associate Member States, or Canada as a Cooperating State, can apply as well as those from Bulgaria, Cyprus, Lithuania and Slovakia as European Cooperating States (ECS).
 Priority will first be given to candidates from under-represented Member States.

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.