Job Title: Internal Research Fellow (PostDoc) in Model-Based System Engineering

Requisition ID **11892** - Posted **01/12/2020**

EUROPEAN SPACE AGENCY

Research Fellowship Opportunity in the Directorate of Technical & Quality Manag.

ESA is an equal opportunity employer, committed to achieving diversity within the workforce and creating an inclusive working environment. Applications from women are encouraged.

Post
Internal Research Fellow (PostDoc) in Model-Based System Engineering
This post is classified F1.

Location
ESTEC, Noordwijk, The Netherlands

Our team and mission

The Internal Research Fellow will be based in the Systems Engineering Division, Systems Department, Directorate of Technology, Engineering & Quality.

The Division is responsible for:

•providing systems engineering and performance analysis support to all phases;
•managing and executing system studies and activities conducted by D/TEC, in particular to investigate new system concepts and architectures to answer future mission and user needs;
•research & development of end-to-end and systems engineering methods;
•managing internal pre- Phase A mission and system design studies or trade-offs executed using the Concurrent Design Facility (CDF) and with the participation of ad hoc interdisciplinary teams from ESA;
•providing cost estimates and cost engineering analysis, data bases and tools in support of programmes and projects as well as internal mission and system design studies executed in the CDF, technology development and future space systems;
•implementing the in-orbit technology demonstration strategy managed by D/TEC including in-orbit demonstration missions, cube-satellites and technology flight opportunities;
•developing cost engineering methodologies and improving overall Agency capability in cost analysis;
•developing systems engineering standards in the framework of ECSS and ESA standardisation boards.

Field(s) of activities/research/learning areas

You will conduct research in the area of Model-Based Systems Engineering (MBSE).
Model-based engineering is an approach to the development of systems characterised by the use of models, e.g. visual modelling artefacts that serve as archetypes of the system under development, but mainly data digitisation enabling tool support for transformation or verification, to improve the efficiency and productivity of the system development life cycle. MBSE is the particular use of the set of aspects of model-based engineering specifically associated with systems engineering applied in a formal way to support life cycle activities by providing the reference for engineering data.

“Model-based systems engineering (MBSE) is the formalized application of modelling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.”
INCOSE SE Vision 2020 (INCOSE-TP-2004-004-02, Sep 2007)
MBSE is the enabling set of technologies (i.e. methods, tools, languages) that allows us to author product artefacts to ensure digital continuity all along the life cycle, across disciplines and throughout the supply chain. Produced artefacts enable proper elicitation of relationships between systems entities and between system project entities.

System complexity is at the root of our needs. Initially manageable singly or by a small team of systems engineers, some of our space system complexity is starting to exceed what can be fully handled by a human team. ESA has identified the following systems engineer needs: formal representations beyond textual descriptions, controlled exchange of data supported by automated mechanisms, structured knowledge of their system, an authoritative source of truth (consistent by construction) from which appropriate viewpoints may be extracted to communicate about the system, dashboards with systems engineering information, to create consistent system baselines, to be able to initialise a system with a reusable set of consistent data, to grasp all relationships between all system entities.

The solution proposed to fulfill these needs relies on (i) semantic interoperability of tools based on the definition of a global conceptual data model (ontology) and (ii) definition of the reference architecture of a “system factory”, i.e. the software infrastructure supporting systems engineering.

Proposed Activity/ Research

Having this solution available at industry and Agency level would enable MBSE deployment in space projects. You as Research Fellow will investigate MBSE and its space applications, propose and experiment/implement solutions to the theoretical and practical issues raised by deployment. This includes:

•solving issues related to semantic interoperability, i.e. how to use the global conceptual data model (ontology) to drive data communication within the system factory (done though a “data hub” function): combining ontologies, using conceptual data models to generate logical and physical data models, and to generate tools translating physical data to/from two data models having (nearly) the same conceptual data model;
•assisting in defining ESA requirements for the space systems engineering method compliant with (i) ECSS standards and (ii) industrial practices and allowing it to implement identified MBSE use cases.
•assisting in identifying ways to deploy MBSE in ESA projects, spot project needs that could be met by MBSE techniques, define the system factory elements necessary for this, assist with deploying them for ESA projects, support project teams using them, advise on best modelling strategy for a project’s particular need;
•investigating how data available in the set of models could be used to derive knowledge of present and future systems. This notably addresses the use of artificial intelligence techniques to analyse the model data for e.g. dynamic patterns identification for reuse, requirements product lines creation from legacy requirements or/and models or software, project archiving over 30 years or more, generation and maintenance of domain ontology, derivation of design structure matrix.
•supporting innovative methods to capture system requirements and architecture in ergonomic ways (white board, semantic interpretation of manual drawings).

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 completing, a PhD in systems engineeringcomputer science or informatics, and your thesis subject should be relevant to the task description provided above (model-based approaches, etc.).

Additional requirements

The ideal candidate for the position would have:
•a theoretical (academic) background in order to retain, under the model-based approach, the mandatory rigour needed to have a strong semantic suitable for (automated) verification of models and potential automatic generation of artefacts

•a systems standpoint necessary to build up a multi-model approach based on particular system views (data and spacecraft database, real-time and interaction patterns, dependability, hardware deployment, etc.)
•a vision for the processes and tools allowing defining of the toolset architecture
•a pragmatic approach derived from knowledge of the industrial practices that will be acquired during the activity, to adapt theory to industrial real-life and the ultimate goal of improving industrial competitiveness

This position, located at the crossroads of academic approaches and industrial applications, of model-based techniques and systems engineering, is at the core of current embedded systems challenges. It is also an opportunity to transition gradually from an academic context to an industrial perspective.
Keywords include: systems, model-based, ontology, data hub, semantic interoperability, deployment, systems engineering tools requirements, functional architecture, physical architecture, Arcadia, Capella, SysML, Entreprise Architect, Cameo.
Preference will be given to candidates awarded their doctorate within the past five years
You should have good interpersonal and communication skills, to interact with the systems engineering and MBSE community, and be able to work in a multicultural environment, both independently and as part of a team. Good methodological and organisational skills are required.
You should demonstrate an interest in space as well as the ability and interest to get actively involved in prospective interdisciplinary research.
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 5 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.

If you require support with your application due to a disability, please email 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