

Traineeship Opportunity for “Young Graduate Trainees”

Reference	Field of specialisation	Duty Station	Closing Date
ESA/YG-ESTEC(2015)042	Advanced Concepts in Morphing Space Structures	ESTEC	15 December 2015

Overview of the Division's mission

The Future Preparation and Strategic Studies Office ensures the overall coordination, coherence and performance of programme and corporate studies in support of the preparation of the Agency's future activities, in line with its long-term strategic objectives and priorities, as well as coordinate strategy development of trans-Directorate initiatives. In particular, this includes the General Studies Programme (GSP www.esa.int/gsp), implementing studies for the preparation of new missions, and the Advanced Concepts Team (ACT, www.esa.int/act), tasked to monitor, perform and foster research on advanced space systems, innovative concepts and working methods.

Within the European Space Agency, the ACT is engaging in collaborative research relations with university institutes and research centres, focusing on advanced research topics of potential strategic interest to the space sector and in experimenting with new forms of teamwork. In order to achieve this goal a multidisciplinary research environment is provided, in which young scientific and engineering post-doctoral and post-graduate researchers carry out work on emerging technologies and innovative concepts. Candidates are strongly encouraged to visit the website of the team to obtain more information about the team in preparation of their application and interview.

Overview of the field of activity proposed

Space environments are challenging and highly dynamic: radiation and plasma fields, thermal loads, high vacuum, micrometeorites, and orbital debris. Current space technology traditionally aims toward passively protecting the spacecraft's instruments and subsystems from these conditions. Only few examples of active spacecraft protection exist. Future space structures and materials that can adapt their configuration, form or properties in response to changing environments and load cases would constitute a paradigm change. This capability could lead to morphing space structures that can be used for multiple applications during one mission. To date, very little research has been done in this area for space applications, typically limited to thermal control louvers, flexible telescope mirrors, foldable antenna systems, or Sun-tracking solar panels.

The successful candidate will investigate novel trends in the field of active materials and shape-shifting structures, including self-healing surfaces, 3D-printed metamaterials with selective buckling, 'smart' structures with embedded electroactive and shape memory polymers, or surface emissivity controllers using electro-active coatings. Other principles to enable morphology changes could be adopted from, i.e. the Japanese arts of Origami (folding) and Kirigami (folding and cutting) techniques, and exploit principles found in nature such as bone tissue reinforcement in response to mechanical loads, or pressure-actuated cellular structures in plants (e.g. Venus Flytrap). The latter could enable so-called '4D-printing' of composite materials, for example, rigid plastic combined with water-absorbent materials, which can stretch and fold over time, producing a broad range of shapes with complex geometries.

The candidate's task would typically include:

- Research on active materials and morphing structure principles suitable for space applications
- Modelling and control of functional materials and bio-mechanical systems using, for example, openSim, COMSOL, or numerical FEM analysis
- Concept feasibility studies on a systems level for potential space applications such as, for example, solar power collectors, communication antennae, sun shields and telescopes ...

The successful candidate will be a member of the Advanced Concepts Team (<http://www.esa.int/gsp/ACT/index.html>) and is therefore expected to contribute to the development and the assessment of new concepts and technologies for space applications in close interaction with ACT researchers who work on a broad range of disciplines including, informatics, artificial intelligence, climate modelling, energy systems, fundamental physics, biomimetics,

computational management science and mission analysis. Based on her/his detailed background and interests and the opportunities and needs of ESA, the successful candidate will be involved in a number of other ACT initiatives (including studies conducted via the Ariadna scheme, <http://www.esa.int/gsp/ACT/ariadna/index.html>) and participate in reporting and communicating results of the team (internally and externally).

Educational and other requirements

Applicants should have just completed, or be in their final year of a University course at Masters Level (or equivalent) specifically in Material Science, Bio-Engineering or related fields. Applicants should have an experience in numerical FEM analysis. Theoretical background in structural engineering and/or biomimetics would be an asset.

Applicants should show a genuine interest in applied academic research, together with sound analytical skills, avid curiosity and a natural aptitude to self-motivation and teamwork. Applicants should have good interpersonal and communication skills and should be able to work in a multi-cultural environment, both independently and as part of a team.

Applicants must be fluent in English and/or French, the working languages of the Agency. A good proficiency in English is required.

How can I apply?

Please fill in the [online](#) application form.

Please note that only one application may be submitted for the YGT Scheme.

The YGT Scheme is open to recently qualified young men and women
who are 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 UK, or Canada as a Cooperating State, Bulgaria, Latvia, Lithuania, Slovakia and Slovenia as European Cooperating States (ECS).