Training Opportunity for Swiss Trainees

Reference	Title	Duty Station
CH-2018-OPS-GR	**Space debris research supporting space safety**	**ESOC**

Overview of the unit's mission:

The Space Debris Office is coordinating the Agency's space debris and meteoroid research activities and is responsible for all space debris operational and analysis services in support of ESA missions, programs, 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 office provides expert support to ESA's Space Situational Awareness (SSA) programme. The objective of the SSA programme is to support Europe's independent utilisation of, and access to, space through the provision of timely and accurate information, data and services regarding the space environment, and particularly regarding hazards to infrastructure in orbit and on the ground.

Overview of the field of activity proposed:

The trainee will be involved in activities of the Space Debris Office and the Space Situational Awareness Office in the area of analyses on the status and future evolution of the space debris environment and supporting missions. Assigned to topics in the areas of analysis of mitigation and remediation techniques, evaluation of new concepts and the development and application of the necessary means to verify and qualify such concepts, the trainee will:

- support the definition of study work in that field and contribute to the technical follow-up of such studies;
- attend regular team meetings and support the coordination of activities within a group of experts;
- contribute to updating existing analysis tools.

The trainee will work in a small team, having the opportunity to actively contribute to on-going projects and research activities, develop new tools, and present results to an international community.

Three possible alternative options are presented:

1 Analysis and Implementation of Improvements to ESA's Reporting on Compliance with Space Debris Mitigation Guidelines

- Analyse the possible extension of the GEO definition that is discussed in the IADC now - especially study how the proposed change propagates into needed updates and revision of the agreed space debris mitigation guidelines. Study the matter with focus on GEO intersecting orbits in view of orbital dynamics and, finally, the compliance reporting.
- "Observed reliability" of spacecraft and related consequences for the application to space debris mitigation guidelines - bridging the gap between theory and reality - develop and test statistical methods to study reliability of space systems and support related discussion in standardisation bodies
- Link with previous work by ESA and others, and contribute to updates of the established ESA reporting and verification of compliance with space debris mitigation guidelines in public and internationally endorsed reports.

2 Support of upcoming on-orbit experiments

Support preparatory work for the upcoming experiments with

- OPSSAT for exploitation of the on-board camera, etc.
- SOLID to simulate small particle detection rates on various ESA missions, with the goal to verify the minimum detectable impulse (and diameter) by a given AOCS scenario, etc.
- LEDSAT to develop a plan of experiments, to model expected lightcurves with ESA's iOTA tool, and also to derive the minimum telescope requirements for the required ground support, etc.,

3 Improvements to ESA's collision avoidance process in view of growing orbital population, better knowledge, and automation needs

- Study approaches for handling complex object geometries in the collision risk assessment. Support the related upgrade of ESA's CORCOS tool
- Assess efficient methods for handling multiple, repetitive, close conjunctions and derive a global optimisation for the collision avoidance manoeuvre also considering operational constraints.
- Exploration of automated decision criteria for avoidance manoeuvres and strategies for low-continuous thrust missions (such as, e.g., with electrical propulsion)

Required education:

Applicants should have just completed, or be in their final year of a University course at Masters level in a technical or scientific discipline, such as Aerospace Engineering, Mathematics, Physics, or related areas.

The candidate should have a good knowledge of orbital mechanics and mathematics in general, should be familiar with UNIX/LINUX operating environments, and with scientific programming (as, e.g., programming in FORTRAN). A good experience in system and software engineering, a spirit for defining, organising and following up study work and proven documentation skills will be considered as an asset, as well as basic knowledge in project management. Candidates must be fluent in English or French, the official languages of the Agency.

Candidates 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.