Training Opportunity for Portuguese Trainees

Reference	Title	Duty Station
PT-2014-TEC-ECN(1)	GNC systems for Hybrid Propulsion Vehicles	ESTEC

Overview of the Unit missions:

The Guidance, Navigation and Control Section (TEC-ECN) is responsible for the:

- Definition and implementation of GNC systems for Planetary Exploration Orbiters and Landers, for Launchers and Re-entry Vehicles, and for specialized applications such as Formation Flying.
- Conception, initialization and supervision of corresponding enabling GNC technology R/D: Automated Rendezvous, Safe Precision Landing, Re- entry techniques, Vision-based and Hybrid Navigation Systems, Precision Formation Flying.
- Coordination of Advanced Control and Estimation Techniques Research and Development for all applications of the Control Systems Division.
- Provision of functional support to projects (Planetary Exploration, Launchers, Re-entry Vehicles and specialized applications), involving GNC requirements analysis, design and modeling, performance evaluation, GNC verification and validation, AIT (Assembly, Integration and Test) and LEOP (Launch and Early Orbit Phase) support.
- Definition, maintenance and operation of the necessary computing and laboratory facilities in support of above activities.

Overview of the field of activity proposed:

Activities

The selected Trainee will be involved in the following activities:

- T1) Assessment of optimal trajectories for small launchers based on hybrid propulsion. This task shall make use of ASTOS trajectory optimizer available and previous analysis in ESA.
- T2) Definition, design, and development of a GNC system for small launchers based on hybrid propulsion. This task shall make use of TEC-ECN MATLAB GNC development frameworks . In this task the trainee shall produce a SIL (Software in the Loop simulator with a C-code SW prototype compatible with a flight representative mother board). This task includes the modelling of hybrid propulsion systems to be accommodated in small launchers.
- T3) Verification, validation, and testing of the trajectories and GNC system previously developed. This task shall validate the GNC algorithms using the developed SIL platform as well as its extension to a PIL (Processor In the Loop) facility in the GNC Test Facility of the Control Hardware Laboratory. The GNC Test Facility allows establishing proof of concept of innovative GNC systems and algorithms through closed-loop tests with SW and HW in the loop.
- T4) Preliminary conception of a GNC system for the use of hybrid chemical/solar-electric propulsion system for the exploration of the Moon, Mars and asteroids.

Background

ESA is working on the development of small launchers based on hybrid propulsion (e.g. the North Star small launcher and sounding rocket family within the ESA's FLPP program). The design goal of these small launchers is to offer a low cost launch capability for small payloads into low Earth orbit, relying on 1) fast burning paraffin-based fuels, 2) stable and efficient combustion and 3) advanced carbon composite technology for the motor case. For task 4, ESA has a working group studying the combination of chemical and electrical propulsion for exploration, targeting a net reduction in the amount of energy used to carry payloads to a long distance.

Tools and Techniques

The Trainee will learn how to use the tools available in TEC-ECN (ASTOS, LGSST, etc). The Trainee will work in a team interacting with colleagues of the Propulsion Division, and other areas.

Required Education:

University degree or equivalent qualification in aerospace, control engineering or mathematical methods for aerospace applications. Very good command of MATLAB and knowledge of C computer programming language. A good knowledge of English is required.