Training title: *Operational optimization of satellite constellation geometry*

**Field:** Research and Development, Mission Analysis, Constellation geometry design, Systems Engineering, Orbital Mechanics, Modelling and Simulation, Global optimization  
**Diploma:** Engineering degree, Master of Science

---

**Company background**

Airbus Defence & Space, Space Systems, is the European leader in the field of optical Earth Observation systems. It is the pioneer company responsible for the development of the first Earth Observation space systems in Europe, starting with the SPOT family. Since this time, it has led the major European developments in those fields, through programs for space agencies, export solutions, or Airbus’s own very-high resolution (VHR) earth observation satellites.

This evolution has allowed Airbus to develop a strong expertise in Mission Planning and Mission Analysis through the Mission Chain Department (TESUM). The department has grown significantly in recent years and now relies on about a hundred engineers.

---

**Subject**

Thanks to lower costs for both satellite manufacturing and launchers, we can now consider relying on multiple satellites constellations in order to reduce significantly delays for shooting high resolution image requests from space (typically from several days to a couple of hours) or provide worldwide Internet coverage with a limited latency.

Usually, the design of such complex systems is accurately optimized for maximizing system performances (like coverage, system capacity and reactivity) while minimizing its cost (total number of satellites and number of launches). However, once this first definition of the nominal configuration is done, the constellation design still has to be consolidated and validated from an operational point of view. The first thing to take into account is the ramp up strategy: how satellites are progressively launched, from an initial configuration ready for a minimum viable service, to the final configuration with full capacity. The second thing is the reconfiguration and spare strategies in case of satellite failure: how the constellation should be remorphed after an anomaly, how many spares do we need and where should they be located. In the context of networked constellations with inter-satellite links, such aspects can actually be major drivers and lead to a complete redesign of the constellation (modification of the number of planes and satellites per plane).

**Internship description**

Depending on the context and trainee profile, the internship will explore, analyse and assess solutions for introducing such operational constraints in constellation design:
2020 TRAINING
Mission Studies for Space Applications

- Optimization of spare strategies (cold vs hot spares, in mission plane or in a parking orbit, number of spares in orbit vs on ground...)
- Optimization of ramp up strategies (definition of intermediate viable configurations, management of topology remorphing while the system is already operational...)
- Architecture and operational use of a constellation remorphing module integrated in a satellite control centre (reactivity to a satellite failure, operational logic for introducing additional satellites...)

Tasks and accountabilities

After having familiarized with the context, the trainee shall:

- Understand drivers in constellation design and space operations
- Identify, describe and analyse the different operational options
- Design and implement relevant models for constellation operations
- Assess and benchmark the different options on reference use cases
- Provide recommendations for each use case
- Organize, plan and report the activities – work in connection with Mission experts and engineers – communicate results to the other team members.

Required skills

- Background in space systems, space operations, modelling and simulation.
- Software development Skills: python.
- Good capacity to take initiative.
- French or English: negotiation level.

And ideally:

- Background in orbital mechanics, reliability, applied mathematics, optimization.
- Initial experience in research projects and capacity to work independently.

You are a good team player and have excellent interpersonal skills.

Desired education

- Engineering school or Master

Training duration

6 months in 2020 – Ideally starting between February and May

Training Location

Airbus Defence & Space
31 rue des Cosmonautes – 31402 Toulouse Cedex 4

Contact

Thibaut WENGER Thibaut.wenger@airbus.com

UNIVERSIDAD POLITÉCNICA DE MADRID
S. DE INGENIEROS DE TELECOMUNICACIONES
HASTA 3/11/19