

# IS1 - Launchers

From the Advanced Master TAS ASTRO (Space Systems Engineering)



## Highlights

- Space environment
- Space mechanics
- Launcher design
- Experts of space industry

This certificate provides knowledge of the physics of space environment and its constraints on materials, electronic devices and embedded systems.

Participants will learn the concepts of astrodynamics: terrestrial and interplanetary space trajectories. Launchers design for different missions will be presented (functions breakdown, subsystem description). A focus will be made on guidance, navigation and control.

## Prerequisites

- Master level
- Flight dynamics basics
- Automatic control basics

## Key elements

Dates: **6 Oct. 2021 - 15 Feb. 2022**

Duration: **106 hours**

For whom:

**recent graduates, jobseekers and experienced employees**

Location:

**ISAE-SUPAERO, Toulouse**

Course fees: **6 500 €**

Language: **English**

## Learning objectives

After completing this course, participants will be able to:

- Identify constraints specifically imposed by space environment (micro-gravity, radiations...);
- Perform mission analyses;
- Understand the launchers design processes;
- Analyze launcher mission customer needs;
- Design guidance navigation and control subsystem for a launcher mission

## Practical information and registration

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## Course Content

### IS413 - Space environment and effects (12 h):

- Introduction to the space environment
- Description of the physics of space environment
- Radiations - materials interactions
- Charging of materials and systems in space environment
- Effects of the space environment on electronics components

### IS415 - Mission analysis and orbital mechanics (27 h):

- Keplerian motion
- Terrestrial orbits and space systems missions
- Interplanetary trajectories
- Orbital maneuvers and station acquisition
- Perturbed movement
- Perturbations affects and station keeping
- Orbit restitution and measurements

### IS431- Launchers architecture (49 h):

- Introduction, missions
- Launch staging and performances
- Optimization and constraints of trajectories and flight mechanics
- Structural analysis and mechanical design
- Propulsion equipments and solid propulsion,
- Avionics and software
- Future projects

### IS453 - Launchers guidance and control (18 h):

- Control and Guidance algorithms: principles, operational uses, exchange parameters
- Principles and components of the inertial navigation techniques
- Specification and design of the inertial measurement units (IMU)
- System trend for future launchers

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## Teaching methods

Teaching methods	Yes
Lectures / tutorial	X
Collaborative learning	
Flipped classroom	
Blended learning (online and face to face)	
Learning by doing	X
Project-based	
Simulation	X
Case study	

## Assessment

IS413:

- Written test
- MCQ
- Marked Seminars

IS415:

- Written test
- Marked seminar

IS431:

- Written test

IS453:

- Marked seminars