

# Space systems engineering

OPTIONAL PATHWAY «SPACE EXPLORATION»  
(SEEDS)



## ■ Objectives

The TAS Astro - Space Systems Engineering Advanced Master program is a one-year professional course of study. The TAS Astro Advanced Master allows students to develop a high level of multidisciplinary skills in space science, space systems engineering and space project management. It enables the students to access work opportunities with numerous career opening in aerospace projects, be it with space agencies, research agencies, or industrial companies in an international environment.

The program is designed for students who wish to start immediately after the completion of their graduate degree and for employees who have enrolled through their companies continuing education programs.

The TAS Astro curriculum includes a broad spectrum of subjects with the following objectives:

- to develop specific skills applied to space sector : Space systems engineering and management of space projects
- to acquire high interdisciplinary knowledge related to technical aspects, economic and legal concerns of space projects.

## ■ Learning approach

**First semester:** academic session of 560h, provided by ISAE-SUPAERO's permanent professors and various experts from research centers (ONERA), space agencies (CNES, ESA), or European aerospace companies (Thales Alenia Space, Airbus Defense & Space, ArianeGroup).

This first semester includes:

- lectures and exercises,
- engineering and design study seminars,
- laboratory sessions,
- written reports and oral presentations,
- practical sessions, team work and industrial visits.

**Second semester :** students have to conduct a professional thesis or perform an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

## ■ Organization

### Head of program

- Prof. Stéphanie LIZY-DESTREZ  
stephanie.lizy-destrez@isae-supero.fr

### Course duration

One year full time : 6 months of courses and 6 months of professional thesis or internship.

### Course start date

September

### Location

ISAE-SUPAERO

### Teaching language

English



### SEEDS

## Space Exploration and Development Systems

The SEEDS (Space Exploration and Development Systems) international placement is an optional extra project. The student will work in multidisciplinary teams on space exploration research projects, designed in collaboration with advisors from the space industry. ISAE-SUPAERO's partners in SEEDS are the Politecnico di Torino in Italy and the University of Leicester in UK. All three institutions have strong links with the space industry, a heritage of space research and exploration, and high-level expertise in the delivery of teaching. The student will spend two months at each institution and will be required to cover basic travel and subsistence costs. The course is taught in English at all three sites.

The international SEEDS program is supported and endorsed by the Italian (ASI), French (CNES) and UK Space Agencies, as well as Thales Alenia Space, ALTEC and numerous other companies and institutions, ESA (European Space Agency).



## ■ Syllabus

### Part 1: Missions and Systems 155 h

Mission analysis and orbital mechanics – Space environment & effects – Space systems architecture: Ground segments, satellites & sub-orbital planes – Launchers architecture

Space communication systems – Satellite based localization systems – GNS ( Global Navigation Satellite System) – Human Spaceflight: History of space exploration, medical aspects & human factors

### Part 2: Space Programs 160 h

Introduction to quality processes – Space programs bid for tender – Space programs & projects – Systems engineering of space programs – Systems dependability – Integrated team project – Financial & legal aspects: debris situation, new space (nanosatellites & launchers) – Spacecraft operations

### Part 3: Sub-systems: Satellites & Launchers 190 h

Advanced control & applications - Estimation and filtering - Satellite AOC (Attitude & Orbit Control System) – Launchers guidance and control - Real time control of a space system- On board data handling sub-systems: functions and architecture-satellite electrical systems – satellite thermal control systems- satellite propulsion: chemical & electrical – Mechanical architecture: Space structures & mechanisms

## ■ Career opportunities

TAS Astro Advanced Master program leads students to technical employment either in international industries or in research centers in aerospace world.

Current positions are: Space program project managers, Space Systems engineers, Experts in industry or public research laboratories, in Consulting or services companies.

### Companies recruiting our students

Altran, Airbus Defense & Space, Aéroconseil, Astek, Atos Origin, Bertin, Eutelsat, Eurilogic, Safran, Sopra Group, Thales Alenia Space, CNES, ESA, DLR (Germany), Instituto Mexicano de Comunicaciones (Mexico). GTD International (Spain), etc...



## Testimonies

### Why did you choose ISAE-SUPAERO and apply for this master? What were your objectives?

**PAULINE DELANDE**  
Graduated in 2019  
Operations Engineer - CNES

I would like to emphasize the quality of the theoretical and practical courses provided by numerous passionate industrial experts, researchers and ISAE-SUPAERO teachers.

The Master is well organized, turned towards an industrial application: it allows students to build a first network for future internships and jobs. The topics covered are complementary and provide strong knowledge.

This knowledge is then applied through very interesting projects. To cite two examples: **we worked per groups on the design of a Human permanent outpost on Phobos for up to 12 astronauts and on the development of a space transportation solution from Low Earth Orbit to Geostationary Orbit for commercial satellites (SpaceTug).**

At last, I also took the SEEDS option where I worked for 6 months with 38 other European students on a manned mission on the Moon to produce propellant by exploiting Lunar In-Situ Resources as a System Engineer and Project Manager. In addition to keep learning, this project allowed us to travel a lot in Europe and forge amazing memories.

### What are your career plans ?

Now that my internship at CNES (French Space Agency) is over, I would love to work as a System Engineer on space projects in relation with Advanced Concepts, Space Exploration or Human

Spaceflight missions. My dream is to work for a Space Agency and/or launch my own company one day.







## ■ ADVANCED MASTERS

### Academic requirements

A master's degree, or an equivalent degree in science or engineering (or in management for advanced masters in management), or bachelor degree completed by 3 years of professional experience

Tuition fees : see our website

## LANGUAGE REQUIREMENTS FOR ALL MASTERS

<b>TOEFL (IBT)</b>	or	<b>TOEIC</b>	or	<b>IELTS</b>	or	<b>CAE/FCE</b>
						
<b>85 points</b> (Inst. code: 9820)		<b>785 points</b>		<b>6.5 points</b>		<b>170 points</b>

NOTA BENE : Volume of teaching hours and contents of the programs are provided for information only and are subject to change.

## LANGUAGE REQUIREMENTS FOR MASTERS IN FRENCH

### Language qualification requested

Score B2-Common - European Framework of Reference for Languages

## ■ SELECTION AND ADMISSION

### Selection and admission are made by an admission committee:

Possible interviews can be organized if necessary

### Deadlines for application:

Applications open in october 2020 for intake in september 2021.

Several admission committees scheduled from January to July, see schedule on our website

### Application website :

<http://admissionsmasters.isae-supero.fr>



### Funding

Information on tuitions fees and funding can be found on our website

<https://www.isae-supero.fr/en/academics/advanced-masters/financing/>

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