



# EMBEDDED SYSTEMS

ADVANCED MASTER

WITH 

## ONE YEAR FULL TIME

- 6 months of courses
- 6 months of professional thesis or internship

## TEACHING LANGUAGE

- English

## START OF CLASSES

- End of September

## LOCATION

- ISAE-SUPAERO, Toulouse, France
- ENSEEIHT, Toulouse, France

## KEY POINTS

- 40% of practice, on drones or cubesat for instance.
- Hardware and software training focused on systems.
- Numerous career opportunities in several industrial sectors.

## HEADS OF PROGRAM

- ISAE-SUPAERO: Arnaud DION  
[arnaud.dion@isae-supaero.fr](mailto:arnaud.dion@isae-supaero.fr)
- ENSEEIHT: Prof. Jean-Luc SCHARBARG  
[jean-luc.scharbarg@enseeiht.fr](mailto:jean-luc.scharbarg@enseeiht.fr)

## PRE-REQUISITES

- A Master's Degree or an equivalent degree in science
- Or a Bachelor's Degree with at least 3 years of professional experience
- International degree equivalent to the aforementioned degrees.
- These programs can also be accessed from 5 years of professional experience (VAPP)

## CONTACT

- Young graduates with less than 1 year of professional experience:  
[info-programmes@isae-supaero.fr](mailto:info-programmes@isae-supaero.fr)
- Experienced professionals:  
[info.exed@isae-supaero.fr](mailto:info.exed@isae-supaero.fr)
- People with disabilities, assistance is available at  
[laurence.ballarin@isae-supaero.fr](mailto:laurence.ballarin@isae-supaero.fr)



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• The **Advanced Master's®** Embedded Systems accredited by the Conférence des Grandes Ecoles (under number 655)

Embedded Systems are an essential part of almost every aspect of our daily lives from transportation (aeronautics, space, road, rail and sea) to energy and taking in communication systems.

As part of the AeroSpace Valley project, Toulouse has become a key centre in the design of advanced critical embedded systems. Toulouse has one of the highest concentrations of Embedded System industries in Europe with leading aerospace and equipment manufacturers working for the aeronautical, space or car industries, including the Airbus Group and its subsidiaries, CNES, Continental and Thales.

## OBJECTIVES

The Embedded Systems Advanced Master Program provides comprehensive training for engineers willing to be a part of the aerospace industry. This Embedded Systems Master Program is a one-year professional course, designed by INP-ENSEEIH and ISAE-SUPAERO partners with the support of the embedded systems industry to prepare students for challenging aerospace projects.

This program focuses on a multidisciplinary approach and prepares students by passing on in-depth and comprehensive knowledge of the technologies underpinning embedded systems with an emphasis on aerospace. The program focuses on both theoretical and concrete aspects and aims at:

- Developing Embedded-Systems engineering design skills at both system level and function level, built on a solid foundation of complementary subjects: electronics, computer science, energy conversion and management, automatic control, telecommunications and networks;
- Developing a system approach through integrated projects to master specific methods and tools as applied to the following domains: aeronautics, space and the automotive industries. The curriculum is multidisciplinary. It covers hardware (electronics, energy), software (computer science, network links, modeling, analysis and certification) and such issues as Embedded Systems control from an integrated system perspective.

## LEARNING APPROACH

**1<sup>st</sup> semester:** An academic session of teaching, provided by the tenured professors at ISAE-SUPAERO and INP-ENSEEIH and industry experts with their up to the minute knowledge and experience. Teaching activities include lectures, tutorials, lab work and a one-month multidisciplinary project aimed at integrating the academic session into an industrial case study.

**2<sup>nd</sup> semester:** Students are required to conduct a 4 to 6 months professional thesis or internship:

- in an industry or in a laboratory,
- in France or abroad,

supervised by a tutor from the host organization and from INP-ENSEEIH or from ISAE-SUPAERO.

The thesis concludes with the submission of a report and an oral dissertation in front of a jury.

## CAREER OPPORTUNITIES

Embedded Systems offer challenging career opportunities. The skills acquired in this Master's course can be applied to any industrial sector in which embedded systems are used: aeronautics, space, road, rail and sea, energy industry, communication systems...

Career opportunities in this area are numerous and on the increase in large and small companies alike.

## CAREER OUTCOMES

- R&D Engineer
- Designer
- Project Manager
- Embedded systems developer



## SYLLABUS

**Part 1: Embedded Systems - Core**

- Real-time languages architecture
- DES Design and Validation
- Feedback control
- Signal processing
- Microprocessor and DSP
- Architecture, design and Synthesis of hardware systems
- RF Front-end Architecture
- Electromagnetic compatibility

**Part 2: Energy**

- Actuator and converter control
- Electromechanical and static energy converters
- Autonomous energetic systems
- Embedded electrical networks

**Part 3: Networks**

- Embedded networks: an introduction
- Specific buses and networks
- Real time networks
- Design and validation of real-time protocols
- Architecture of fault-tolerant buses
- Scaling an avionics network.

**Part 4: Embedded Systems Design**

- Real time control of a space system
- Hybrid Systems
- Model-Based System Engineering and Architecture
- Real time control of a mechatronic system
- System Dependability
- Certification
- Embedded systems and IT Security
- Optimization

**Part 5: Embedded Systems Applications**

- Aircraft technics
- Introduction to Space Systems
- Automobile technics
- Workshops

## TESTIMONIES

**CLOTILDE PION**

Class of 2021-2022

I applied for ISAE-SUPAERO Embedded Systems Master. I chose this engineering school particularly because I knew about **the quality of the lessons and the care given to the choice of lecturers.** My objective was to enhance my knowledge in the embedded systems field. In fact, I graduated from an aerospace engineering school as an apprentice and my missions in my company were linked to embedded systems. As I knew that there was a whole embedded systems «world» behind the calculators I was working on, and because I wanted to start my career plan in this field, I applied for this master.

To me, the strong assets of this master are the variety of the lectures, and the fact that it **gives us a basis for lots of embedded systems fields of application.** I also liked the fact that the lecturers were mainly from industry or research, enabling us to benefit from their experience.

**JÉRÉMIE KAHAN**

Class of 2021-2022

Since high school, I have been passionate about robotics applied to aeronautics. I have spent my higher education pursuing a dream of entrepreneurship backed up with a services engineering robotics diploma following on 2 years of preparation for the Grandes Ecoles and an exhibition at CES2020. I found in the MS-EMS the excellence required to acquire skills at critical hardware level.

You get access to top-level classes taught by professors from two world-class Grandes Ecoles, their associated top-end research laboratories, and the best experts from industry. **This brings your skills up to high-level theory applied to very concrete industrial use cases.** You therefore develop an engineering mindset taking you beyond your former student vision. The opportunities to meet the industry through networking events are priceless.