

# Embedded Systems

(ISAE-SUPAERO / INP-ENSEEIH)



## Objectives

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 into account 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.

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.

## Organization

### Head of program

- Prof. Janette CARDOSO  
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- Prof. Jean-Luc SCHARBARG  
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### 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 and INP-ENSEEIH

### Teaching language

English

## Learning approach

### First semester:

An academic session of 546 hours 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.

### Second semester:

Students have to conduct a professional thesis or make an 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 is concluded by the preparation of a report and an oral dissertation in front of a jury.

## Syllabus

Embedded Systems require a collaborative training approach across a broad spectrum of knowledge involving experts from all fields concerned: electronics, energy, science, networks and control systems.

Hence, the academic part of the Master program consists of a 520 hour long program covering all five disciplinary fields that focuses on architectural aspects through a set of application-oriented lectures and seminars.

### Part 1: Embedded Systems - Core - 180 h

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

### Part 2: Energy - 63 h

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

### Part 3: Networks - 67 h

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 - 140 h

Real time control of an 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 - 50 h

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





## ■ Career opportunities

Embedded Systems offer challenging career opportunities. The course is designed for both young graduates and experienced engineers seeking a postgraduate program to enhance their technical and managerial skills. 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, etc.

Career opportunities in this area are numerous and on the increase in large and small companies alike. This Embedded Systems Master's course qualifies students for employment as designers, developers, research engineers and project managers in the design and development of innovative embedded systems.

## Companies recruiting our students

Accenture, Airbus Group, Altran, Astek, Atos Origin, CS Communications & Systèmes, NAVAL GROUP, CONTINENTAL, MBDA, Motorola, Realix, Safran, Sogeti High Tech, Sopra Group, ESA, GE HEALTHCARE TECHNOLOGIES, Philips R&D (Netherlands), Thales Alenia Space, SIGFOX, ...



### INCOSE certification in ISAE-SUPAERO

At the end of the first semester, all EMS students are encouraged to participate in a one-month complementary program in preparation for the ASEP\* level of INCOSE (International Council on System Engineering) certification. INCOSE certification consists of an exam which has internationally recognized value to validate knowledge and skills in systems engineering.

\*Associate Systems Engineering Professional



## Testimonies

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

SHIN YESL

Embedded Systems Engineer - UBLU Digital Services  
Graduated in 2019

☹☹ *Wanted to change my carrier path to aeronautics and before starting the new path I'd like to study a bit more on the subject to specialise my knowledge.*

ELIOT GENTET

Graduated in 2019

☹☹ *After graduating from a General Engineering school, I was looking for a training course that could give me more knowledge in electronics. After some research, I found that the MS EMS that offer ISAE-SUPAERO was the perfect fit for me. **It offers technical courses on embedded systems, but also courses that provide a holistic view on the embedded system sector.** My two main objective was to gain practical knowledge, and to increase my professional network.*

### According to your experience, what are the strong assets of the Advanced Master?

*You can cover the overall knowledges on the specific theme depending on the major. Most importantly **you can meet and experience many classes and people (professors) from the current business field.** So it is really practical and unique experience you can get from the MS program.*

*One of the strong assets of the MS is the system engineering module. This module provides tools for the overall conception of an embedded system, it helps understanding the big picture of the system.*

### What are your career plans?

*I recently joined to one embedded engineering company. I will keep trying to participate on aeronautics projects so I can make my dream goal comes true to become an aeronautical engineer.*

*Throw the internship I confirmed my interest in FPGAs, so my career plans are to continue working with FPGA in the space sector.*



## Admission procedures

### ■ 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> <small>(Inst. code: 9820)</small>		<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-supaero.fr>



#### Funding

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

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

### Your contacts

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