

## Embedded Systems (ISAE-ENSEEIH)

Accredited by the Conférence des Grandes Écoles



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### Aims

Toulouse has one of the greatest concentrations of Embedded Systems industry in Europe with the major aerospace and equipment manufacturers working either for the aeronautical, space or car industry, including Airbus, CNES, Astrium, Continental, Thalès, etc. Embedded Systems have become essential in several kinds of product in daily life. Embedded Systems encompass a broad class of systems and are actively involved in all domains, from transport systems (aeronautics, space, road, rail and sea), to energy sectors (e.g. nuclear and chemical) and also to communication systems (e.g. mobile phones and PDAs).

The Embedded Systems Master Program is a one-year professional course, designed by the ENSEEIHT and ISAE partners, with the support of the embedded systems industry.

Aware of the real need for a multidisciplinary approach, the program prepares students with in-depth and comprehensive knowledge of the underlying technologies involved in embedded systems. The program focuses on both theoretical and concrete aspects. It aims at:

- developing competencies, at system level design for the development of Embedded-Systems, based on strong basics of complementary subjects, such as electronics, computer science, energy conversion and management, automatic control, telecommunications and networks,
- developing the system approach through integrated projects to Master specific methods and tools applied to the following domains: aeronautics, space, automobile or multimedia.

The training for this Master's degree is multidisciplinary. It covers all hardware, software and control issues of Embedded Systems within an integrated system based perspective.

### Organization

#### Heads of Program:

Prof. Janette CARDOSO

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Prof. Jean-luc SCHARBARG

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**Duration of studies:** one year full time

**Beginning of classes:** September

**Location:** ISAE, campus SUPAERO and ENSEEIHT

Teaching language: English

### Pedagogical approach

**First semester:** an academic session of around 360 h, provided by permanent professors of ISAE and ENSEEIHT and experts from industry bringing current knowledge and experience, including: lectures, tutorials, and labs, a multidisciplinary project of 75 h that aims at integrating the academic session into an industrial case study.

**Second semester:** students conduct a professional thesis within an industry, in France or abroad and supervised by a tutor from the host organisation and from ISAE or ENSEEIHT. Thesis is concluded by the preparation of a report and an oral dissertation in front of jury.

### Industrial Scholarships

**THALES** has selected the Specialized Master Embedded Systems for its **THALES Academia** program: a partnership between Thales group, leading French engineering and business schools and the Ministry of Foreign Affairs. Every year scholarships are offered to students from **Brazil, China, India and Russia.**

[www.thalesgroup.com/extra/academia/index\\_en.htm](http://www.thalesgroup.com/extra/academia/index_en.htm)

## Witnesses

### Interview Fabrice NANSI, Cameroun, Graduated in 2009

"I chose this master Embedded Systems because ISAE has a good teaching reputation in France. It has a great experience and strong connection with the aero-space domain. In addition, it is located in Toulouse, which is a nice town and hosts many enterprises working on Embedded Systems.

The program is particularly dense since it is given in a short amount of time. Thus the student should be prepared to work hard and regularly. I can also mention that most of the practical work is done in pair, the choice of a classmate is then important. In my case I have chosen a classmate with electronic background which ends up to be a good complementary to my computer science background.

Thanks to the master program, I improved my technical written skills. During the master we had so many technical reports to submit so that at the end you feel like an expert in writing!

The master EMS helped me for my job: especially the project done during the one month dedicated to an integration project at the end of the master program. For example, I am reusing what I have learned during the integration project for my current internship. I can also mention that the theoretical courses of the master give the modeling skills useful when working for a R&D department of a company".

## Syllabus

Embedded Systems require collaborative training approach with a broad spectrum interweaving experts from all concerned fields: electronics, energy, computer science, networks and control systems.

The academic session of the Master program consists of a 550-hour program covering the five disciplinary fields while focusing on the architectural aspect:

### Initial Part - Standardisation - 23 h

Laplace and Fourier Transformers, Transfer functions, frequency response, basic principles of stability, Analogic and digital electronic circuits, Distributed circuits and transmission wires, Physical principles of energy conversion, Computer based operations

### Part 1 - Computer science - 52 h

Real time language, Architecture description language, Real time operational systems

### Part 2 - Control systems - 56 h

Design and Validation of DES, Feedback Control, Signal Processing

### Part 3 - Electronics - 70 h

Digital representation of analog signal, Microprocessor and DSP architecture, Architecture and conception of digital integrated systems, Hardware and software co-design, Emission/Reception architecture

### Part 4 - Energy - 58 h

Actuator and converter control, Electromechanical and static energy converters, Autonomous energetic systems, Embedded electrical network

### Part 5 - Networks - 56 h

Embedded networks: an introduction, Specific buses and networks, Real time networks, Design and valida-

tion of real time protocols, Architecture of fault-tolerant buses

### Part 6 - Embedded systems engineering - Applications - 58 h

Real time control of a space system, Hybrid Systems, System Engineering, Real time control of a mechatronic system, Networked control systems

### Part 7 - Embedded systems engineering - Courses - - 100 h

System Dependability, Certification, Computer Safety, Optimization, Electromagnetic compatibility, Mechatronic integration

### Part 8 - ISAE Information system user introduction - 2,5 h

### Part 9 - Multi-disciplinary project - 75 h

## Career opportunities

Embedded Systems offer challenging career opportunities. The Master is designed either for young graduates or more experienced engineers, who require a postgraduate program to enhance their technical and management skills. This Master concerns any industrial sectors where embedded systems are used: aeronautics, space, road, rail and sea, energy industry, communication systems, etc.

Career opportunities in this area are numerous and are growing in a variety of large and small companies. This Embedded Systems Master qualifies our students for employment as designers, developers, research engineers including project managers in design and development of innovative embedded systems. Jobs in consulting companies are also accessible after graduation in this domain.

# Admission 2010

## Common ISAE's admission procedures

### Postgraduate Specialized Masters in engineering

- **SM AMS - SM ASAA - SM EMS - SM HE - SM SCS - SM SEN - SM TAS Aero - SM TAS Astro**
- **MS EAS - MS SAS - MS SPA**

**Tuition fees 2010-2011:** 12 000 €.

**French and European Students:** 6000 € (students graduated in the year of application or the year before, and with no professional experience).

#### Academic requirements

Applicants must have a Master degree, or an equivalent degree in science or engineering, or a bachelor degree with 3 years of professional experience at least.

### Selection and admission

Selection and admission are made by an admission committee; possible interviews can be organized if necessary.

**Deadlines for application:** several admission committees scheduled from April to June 2010,

Application form to be downloaded at [www.isae.fr](http://www.isae.fr)

**Application fees:** 65 € (non-refundable).

**Complete application files to be sent:** Institut Supérieur de l'Aéronautique et de l'Espace - Direction des masters et mastères spécialisés - 10, avenue Édouard-Belin - BP 54032 - 31055 Toulouse Cedex 4 – France

### Language requirements for Masters in English

Language qualification requested : TOEFL 550 (paper-based). Except if applicant's first language is English or total instruction of Bachelor or Master degree has been provided in English.

## Other admission procedures

#### MS IEVex

Specific admission process through the French Ministry of Defence, contact us for more detailed information.

#### MS MGP

Selection and admission organized by HEC:

[www.hec.edu/Specialized-Masters](http://www.hec.edu/Specialized-Masters)

Contact us for more detailed information.

#### MS IMF

Selection and admission organized by ESC Toulouse:

[www.esc-toulouse.com](http://www.esc-toulouse.com)

Contact us for more detailed information.

## Contacts

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# ISAE

The "Institut Supérieur de l'Aéronautique et de l'Espace" (ISAE) was created in 2007 from the merger of the two prestigious French graduate and postgraduate schools of engineering, SUPAERO and ENSICA. Today, ISAE, is a world-class higher institute for aerospace engineering education and research. Nowadays with a student corpus of over 1600, ISAE is one of Europe's largest Aerospace Institute offering graduates and postgraduates programs. Yearly, ISAE awards around 20% of master's degrees in Europe in aeronautics and space field. ISAE develops its worldwide reputation on the prestige of its master's programs, the fame of its teaching staff, or the excellence of its research but also on the high-value of its graduates, their skills in engineering or management, as well, their capacity to evolve within a very high-technology environment, their enterprising mind and international opening.

## Identity card

**Name:** Institut Supérieur de l'Aéronautique et de l'Espace (ISAE)

Founded in 2007 - as the result of the merging of SUPAERO (1909) and ENSICA (1945)

**Legal Status:** A large public institution of scientific, cultural and vocational missions

**Trustees:** Délégation Générale pour l'Armement (DGA) [French Defence Procurement] - Ministry of Defense

**Endorsements and awards:** CTI agreement of the two Graduate Programs, Conference des 'Grandes Écoles', for postgraduate specialized masters Ministry of Higher Education and Research for Masters of Science

**Staff:** 420 permanent staff

## Key figures

**2** Graduate Programs: SUPAERO and ENSICA

**17** Specialized Masters including 12 in English

**2** Masters of Science

**9** Research Masters

**6** PhD Programs

**1600** students

**160** international cooperation opportunities

**50** academic and research partnerships

## Contacts ISAE

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