Masters of Science, Advanced Masters & Certificates in Aerospace Engineering & Management
The programs may be modified before the start of academic year

Welcome to ISAE-SUPAERO

A word from the Director of Masters Programs

Are you looking for high-level training towards a Master’s degree or Advanced Master’s degree, to prepare you to enter the fascinating world of aeronautics and space? The Institut Supérieur de l’Aéronautique et de l’Espace (ISAE) can help you to make this project a reality.

ISAE is now a major world actor in the training of engineers and masters students in aerospace, and the leader in Europe in the number of graduates. The Institute’s reputation is not just built on its prestigious programs, the renown of its faculty staff or the excellence of its research, but also on the quality of its graduates, their technical and managerial skills, their ability to work in an advanced high-tech sector, their entrepreneurial and international spirit.

Our programs are offered on the ISAE-SUPAERO campus or at our educational partners’ permises. Classes are taught by permanent ISAE faculty staff and a unique network of several hundred affiliate professors from research centers and European aerospace companies.

As of 2017, ISAE-SUPAERO, located in the heart of the European aerospace hub, offers a new MSc in Aerospace Engineering (MAE). The MAE program offers students a wide choice of courses combined with research opportunities, and gives them access to some of the most innovative professors, researchers and engineers from European aerospace academia and industry. The learning approach is research-driven and designed to encourage students to engage in research projects in a wide variety of subjects.

Two new majors are offered for the 1st time in 2017: Earth Observation Applications in cooperation with THALES ALENIA SPACE, and Human Factors for Aeronautics supported by the ISAE-SUPAERO research team in “Human factors and neuro-ergonomy for aviation safety”. These options are open to students enrolled in the MAE program or the aeronautical engineering and space systems engineering advanced master’s programs.

Projects are an important part of our programs, whether they are carried out in our research laboratories or within ISAE partner companies. This way, we ensure that our students’ training is constantly evolving and always adapted to the needs of companies. Our “internship and careers” office assists all students in the construction of their professional plans and integration into this professional world.

Today, over one third of ISAE graduates are not French. On the SUPAERO renovated campus, in the heart of the scientific complex of Toulouse, our 1,800 Master’s, Advanced Master’s and PhD students are immersed in an international environment that is unique in Europe: our laboratories have been fully renovated in 2015 and give access to students with exceptional facilities, among them structures and materials manufacturing and testing facilities, low and high speed wind tunnels, a turbojet test bench, embedded systems platforms, communication and navigation platforms, a research flight simulator, a micro UAV flight tests room, a SGGATA 18 20 flight laboratory, a satellite ground station, a satellite simulator, etc.

By choosing ISAE, you will open the doors to an exciting life of excellence. We hope to share this prospect with you when you join one of our programs.
Master of Science, Advanced Masters & Certificates

ISAE-SUPAERO has developed a wide range of master’s programs in aeronautics, space, embedded systems and management to provide the global aerospace industry with highly qualified engineers and managers capable of developing and delivering innovative solutions to the constantly evolving challenges facing industry and our society today.

To satisfy international demand for junior and senior engineers and managers, ISAE offers two types of degrees: Master of Science and Advanced Master. The Institute also delivers a range of professional certificates to managers looking to expand their skills in specific areas.

■ Master of Science (Master)

The Master of Science is a two-year program undertaken after undergraduate studies, including a Bachelor’s degree or an equivalent degree. It provides higher qualification for employment or for further doctoral studies. The master is accredited by the Ministry of Higher Education and Research in line with the Bologna process established in 1999 to harmonize the European higher education systems by making academic degree standards and quality assurance standards more comparable and compatible throughout Europe.

The two-year ISAE-SUPAERO Master of Science degree program is internationally renowned and highly regarded as an innovative program in science and technologies. The ISAE-SUPAERO Masters’ program is designed to prepare engineering students to find and develop solutions to today’s and tomorrow’s challenges facing the world and the aerospace industry. The program combines lectures, tutorials, research projects, and a master’s thesis to be carried out in an aerospace company or an ISAE laboratory.

Fully taught in English, the program is particularly suitable for students with a bachelor’s degree in mechanical and electrical engineering mechatronics, aeronautics or the aerospace field.

■ Advanced Master’s Program (Mastère Spécialisé®)

The «Mastère Spécialisé®» is a collective trademark and label owned by the «Conférence des Grandes Ecoles» or CGE, a network of the some of the finest French engineering schools. This label is attributed to specific training programs delivered by schools within the CGE. The highly rigorous accreditation process ensures the excellence of program content.

The Advanced Master’s program is a one-year course of professionally-oriented advanced studies, undertaken after completion of a Master’s degree. Advanced Master’s degrees delivered by ISAE-SUPAERO provide participants with unique, state-of-the-art knowledge and know-how in a specific domain for which aeronautics or space companies have a genuine need. Courses are delivered by specialists or experts from industry or state Organisations in collaboration with ISAE-SUPAERO faculty. ISAE-SUPAERO’s Advanced Master’s program combines theoretical lectures, tutorials, case studies and personal projects to grow students’ knowledge of aerospace system approaches. Attuned to aerospace global market needs, the program draws participants from all over the world with a wide range of qualifications, profiles, cultures and professional experiences. Consequently, the program offers participants an outstanding opportunity to expand their personal development skills, grow their international network, and leverage employment opportunities after graduation.

The ISAE-SUPAERO Advanced Master’s program ensures that students acquire:
- in-depth, advanced knowledge in a specific area of aerospace-related expertise,
- dual competency in management,
- professional skills in an emerging field.

■ Certificates (Certificats d’Études Spécialisées)

A number of post-graduate certificates are offered to professionals who want to grow their skills in technical areas such as UAV systems, aeronautical maintenance and support, helicopter engineering, earth observation systems and human factors.

Upon completion of these short courses (from one to three months), participants are awarded a diploma from the institute.

Participants may earn ECTS credits upon completion of courses.

6 REASONS TO CHOOSE AN ISAE-SUPAERO MASTERS PROGRAM

1) Make your passion for aerospace engineering a reality thanks to our world-class Masters programs
2) Engage with the most advanced research driving our innovative science and technology curriculum
3) Collaborate with ISAE-SUPAERO renowned experts from industry and research
4) Benefit from our ongoing partnerships with the leading aerospace companies
5) Acquire international experience in the European aerospace capital
6) Connect to the ISAE-SUPAERO alumni network of 19000 graduates around the world (67 countries)
Industrial partnerships

The Chair for Eco-Design of Aircraft

Airbus and ISAE have signed a partnership agreement to create a “Chair for Eco-Design of Aircraft”. CEDAR will permit to attract Masters students to aircraft design. These students will develop projects from real industrial cases, in the field of “Future Aircraft Design”. The Chair also funds scholarships to attract the best international students in this field. Two master degrees will benefit from CEDAR: Master of Science AMA Aerospace Mechanics and Avionics and Advanced Master in “Aeronautical Engineering”.

The GIFAS Programme of excellence

ISAE and ISAE-SUPAERO Foundation signed a sponsorship agreement with GIFAS (Groupement des Industries Françaises Aéronautiques et Spatiales) thereby setting up a scholarship programme for European and non-European students.

The MBDA Programme of Excellence

In December 2013, ISAE and the ISAE-SUPAERO Foundation signed a sponsorship agreement with MBDA, the world leader in missiles and missile systems, thereby setting up 2 Programmes of Excellence for Indian and Indonesian students.

The pedagogical approach of the ISAE-SUPAERO Master’s program is research-driven and designed to encourage students to engage in a wide variety of research opportunities throughout the program and beyond.

ISAE-SUPAERO is deeply committed to offering its students full access to its research capabilities as well as its academic and industrial partnerships, covering the entire field of aerospace engineering. From a research policy point of view, the dual objective is to foster the development of new knowledge as well as to answer the needs of the aerospace industry. The main research partners of ISAE-SUPAERO are ONERA (the French Aerospace Lab.), LAAS-CNRS and OMP (Astronomical Observatory Midi-Pyrénées), the largest French laboratories in the engineering science and space fields. ISAE has numerous long-term research and development agreements with the main European aerospace companies: Airbus Group (Airbus Defense & Space, Airbus Helicopters), SAFRAN (Sneema, Turbomeca, Microturb, Technoflat), Thales Alenia Space, Rockwell-Collins, MBDA, and Liebherr Aerospace. Reflecting its longstanding commitment to aerospace higher education and research, ISAE is a member of the management board of the Aerospace Valley cluster (550 aerospace companies and higher education and research institutions from the Aquitaine and Midi-Pyrénées Regions).

ISAE-SUPAERO scientific activities are organized into 5 training and research departments and one aerospace centre:

- The Aerodynamics, energetic and propulsion Department develops its research activities on four axes:
  - turbulence, instabilities and numerical simulation
  - turbomachinery and propulsion
  - advanced aerodynamics and flow control
  - aerodynamics and propulsion of micro-air vehicles.
- The Mechanics of structures and materials Department is part of the Clément Ader Institute that gathers in a single laboratory all the research capabilities of the Midi-Pyrénées Region (UPS, INSA, ISAE, Mines Albi). ISAE professors’ research is focused on:
  - damage to composite materials in aerospace structures
  - fatigue of metal materials and structures
  - dynamics of structures.
- The Electronics, optronics and signal Department is organized into 4 research groups:
  - microwaves and optronics for embedded systems
  - image sensor research team
  - signal, communication, antennas and navigation
  - space systems.
- The Complex systems engineering Department this department concentrates research driven in the multidisciplinary scientific fields of mathematics, computer science and control theory. It develops methods, techniques and tools that make it possible to understand, analyze, evaluate, control and design the functional and operational behavior and performances of complex systems.
- Finally, the Design and Control of Air and Space Vehicles Department (DCAS) is dedicated to the efficient and safe design and operation of vehicles. The three research groups : Av&Space Vehicles Design, Decision and Control, Neuroergonomics and Human Factors are using unique experimental platforms like instrumented aeroplanes, moving base flight simulators, satellite ground stations or brain sensors to perform their activities. The research carried out at DCAS is multidisciplinary by nature and implies close collaboration with other departments and external laboratories. All 5 departments and Aeronautics and space centre support a micro-aerial vehicle development program at an international level, on the basis of student projects, research and innovation projects, and international competitions.
Master of Science in Aerospace Engineering

Objectives
To support its steadily growing and to maintain business competitiveness, the global aerospace industry needs high qualified engineers or researchers. Design complex aerospace systems involves multinational geographically disseminated teams of project managers or various experts working in collaborative environment through integrated development platform tools. The Master of Science in Aerospace Engineering is intended to educate graduate students in subjects relevant to these demanding challenges and needs of the industry.

Giving students competences in engineering science, technology and design related to aeronautics and space, the MSc is designed to be multidisciplinary preparing future engineers to easily and efficiently work on aeronautical systems, space systems and their applications, with emphasis on the complete life cycle of the system. With a large spectrum of knowledge the MSc allows students to tackle various aspects from design to operations of products and systems either in a research organism or in an aerospace company in a multinational environment.

The MSc AE consists in a total of 4 semesters of 30 ECTS each, i.e. 120 ECTS credits for the whole program. The MSc AE starts with a first semester emphasizing aerospace mechanics and systems followed by a large choice of electives in semester 2. Six majors are offered in semester 3 covering the main domains of aeronautical and space systems design: «Advanced aerodynamics and propulsion», «Aeronautical and space structures», «aerospace systems and control», «space systems» and « systems engineering».

The MSc AE offers 2 tracks in semester 1:
- Track "Aerospace mechanics" which leads students to majors: «advanced aerodynamics and propulsion», «aeronautical and space structures», «aerospace systems and control», «space systems» and « systems engineering»
- Track "Aerospace systems" which leads students to majors: «aerospace systems and control», «embedded systems», «space systems» and « systems engineering»

Learning approach
The ISAE-SUPAERO Master’s program is designed with a combination of lectures, tutorials, study cases and projects to be performed in industrial environment or in ISAE-SUPAERO’s laboratories. They are taught in English.

The MSc AE program includes three-semester academic session, in ISAE-SUPAERO’s premises, provided by permanent professors and experts from aerospace industry bringing current knowledge and experience.

The last semester consists in a master thesis to be performed in a company or a laboratory in the aerospace sector. After the thesis, students having obtained 120 credits under examination will be awarded the Master of Science in Aerospace Engineering from ISAE-SUPAERO.

Syllabus

Semester 1: 30 credits

Common core - 241 h
Optimization – Representation and analysis of dynamical systems – Algorithm and computing – System engineering
Gas dynamics and propulsion – Aircraft structures, statics and dynamics – Aircraft systems – Architecture and environment of space systems - Foreign languages and intercultural relations

Semester 2: 30 credits

Common core (80 h)
Life cycle of aircraft: Certification and design - Production and maintenance of aircraft
Electives (120 h)
Software for computational fluid dynamics - Turbomachinery - Flight characteristics - Experimental approach in fluid mechanics - Control of dynamical systems and implementation - Real time control of an aerospace system - Aircraft control & guidance - Mechanics of materials and structures 1 - Aircraft structures 1 – Computational solid mechanics – Experimental solid mechanics - System architecture - Avionics and data transmission - Software engineering – Human factors – Instrumentation and data analysis - Aircraft design methods - Multidisciplinary optimization

4 electives (among 18) are chosen by the students with the approval of their faculty advisor, taking into account their choice of S3 major and research project. These courses realize a definable intellectual goal.

Research Project (250 h)

Semester 3: 30 credits

Common part (81 h)
Project management - Foreign languages
Students have to select one major among:
- Major 1: Advanced fluid dynamics and propulsion- 218 h
  Aerolasticity - Advanced aerodynamics of turbomachinery - Physics and modelling turbulence - Acoustics - Aeroacoustics - Numerical fluid mechanics - Parallel Numerical programming - Dynamics of aerostructured systems
- Major 2: Aerospace systems and control - 230 h
  Multi-variable systems - Control of flexible structures - Robust control and Space applications - Systems identification and estimation - Optimal control - Hybrid and non-linear control - Avionics - Model & design of actuation systems (hydraulic and electromechanical systems) – Model and design of electrical systems – Model and design of air-conditioning systems
- Major 3: Aerospace structures - 220 h
  Mechanics of materials and structures 2 - Aircraft structures 2 - Computational Solid Mechanics 2 – Space structures
- Major 4: Embedded systems - 230 h
  Real-time languages – UML, SysML/AADL - Real-time operating systems - Formal methods and certification - Avionics and data buses - Design of embedded systems - Co-simulation and models of computation(Hybrid, etc.) - System Dependability
- Major 5: Space systems - 205 h
  Financial and legal aspects - Space environment and effects - Mission analysis and orbit mechanics - Space communications systems - Space project and systems - Space projects financial aspects - Satellite engineering and design - Advanced control and applications - Satellite ACDS - Launchers guidance and control - Satellite electrical systems - On board systems and data handling - Satellite thermal control systems

Optional programs (120h):
Students may complete their major with a 1-month optional program before starting the semester 4: Helicopter engineering, UAV systems, Earth observation applications, Human factors or a preparation to PMI or INCOSE certifications.

Foreign languages:
During the two-year program, students attend «French as foreign language» classes, in order to become independent users.

This gives graduates a clear advantage when applying for high level engineering positions in the Aerospace industry as they are able to understand and express themselves clearly in three languages: English, their native language and French.

Semester 4: 30 credits

Students conduct a thesis in industry or in a laboratory, in France or abroad and supervised by a tutor from the host organisation and from ISAE. The Master thesis is concluded by the writing of a report and a public defense.

Research Project (150 h)
Organisation

Head of program Aerospace mechanics track
- Prof. Didier DELORME
  E-mail: didier.delorme@isae.fr

Head of program Aerospace systems track and major
- Prof. Janette CARDOSO
  E-mail: janette.cardoso@isae.fr

Head of program major Advanced Aerodynamics and propulsion
- Prof. Emmanuel BENARD
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Heads of program major Aerospace systems & control
- Prof. Valérie BUDINGER
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- Prof. Yves BRIERE
  E-mail: yves.briere@isae.fr

Head of program major Aerospace structures
- Prof. Patrice LUNGER
  E-mail: patrice.lunger@isae.fr

Head of program major Space systems
- Prof. Stéphanie LIZY-DESTREZ
  E-mail: stephanie.lizy-destrez@isae.fr

Prof. Patrice LONGERE
Head of program major Aerospace structures

Prof. Yves BRIERE
Heads of program major Systems engineering
- Prof. Jean-Charles CHAUDEMAR
  E-mail: jean-charles.chaudemar@isae.fr

Duration of studies: Two year full time
Beginning of classes: September
Location: ISAE-SUPAERO
Teaching language: English

Career opportunities
Toulouse is at the hub of the European aerospace industry, and hosts leading European engineering and postgraduate institutions.

MSc AE Graduates get senior positions in major aerospace industries or consulting companies (aircraft, rotorcraft, engine, aerospace systems, space launchers, satellites, …), equipment manufacturers and government agencies, as researchers, experts, designers and heads of projects or managers.

Several MSc AE graduates are recruited for PhD studies at ISAE-SUPAERO or other worldwide universities.

Companies recruiting our students
AIRBUS, AIRBUS HELICOPTERS, AIRBUS DEFENSE AND SPACE, AIRBUS India, AIRBUS China, ALENIA, ALTRAN, AKKA, AMADEUS, AVIC China, BOMBARDIER AEROSPACE Canada, BERTRANDT Germany, CNES, COMAC China, EASA Netherlands, GENERAL ELECTRIC Indonesia, GENERAL MOTORS Mexico, MTU Germany, SAFRAN, SAFRAN-SNECMA, SAFRAN India, SHELL Netherlands, SOGETI, THALES, THALES ALENIA SPACE, VALEO… and many other companies, governmental bodies, universities and research centers all over the world.

Companies recruiting our students

Common Core

Semester 1
- Sciences & Engineering
- Foreign languages

Semester 2
- Lifecycle of aircraft
- Foreign languages

Tracks

Semester 1
- Aerospace Systems
- Aerospace Mechanics

Elective courses

Semester 2
- 4 courses among 18:
  - Tarmachinery, Mechanics of materials & structures, Software engineering,
  - Human factors, Acoustics, Aircraft structures, Controls of dynamical systems and implementation,
  - Avionics and data transmission, Instrumentation & flight data analysis, Experimental approach in fluid mechanics,
  - Computational solid mechanics, Aircraft control & guidance, Systems architecture, MRO, Structures design project,
  - Flight characteristics, Real time control of an aerospace system, Aircraft design methods

Research project

SUNDAY Cecily, USA, Robotics Mechnical Engineer at NASA Jet Propulsion Laboratory - Graduated in 2014

I applied to the ISAE-SUPAERO master’s program because I was looking for a graduate school that would provide me with both a strong academic and personal challenge. In the end, I chose this program over my other options because it best satisfied these two goals. On one hand, the academic schedule, which includes a balance of lecture, research, and work components, matched my subject interests and learning objectives. On the other hand, I had the opportunity to immerse myself in a foreign language and experience first-hand a different culture. Consequently, I have found that one of the strongest assets of this program is the opportunity to work alongside a culturally diverse group of peers. The international aspect of this program creates a number of unique opportunities that would not be possible otherwise. For example, I was able to choose a research project where I collaborate simultaneously with US and French space agencies. From a personal standpoint, I now have friends from across the world that I can visit and host. Following graduation from this program, I began working as a Robotics Mechanical Engineer at the NASA Jet Propulsion Laboratory. My current tasks support future Mars and Venus missions.

Testimonies

Libin Lalu KOITHARA, India - Graduated in 2015

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

To be very frank, there is no better place to learn about the whole aircraft from scratch than the birthplace of Aircraft manufacturer “Airbus” Toulouse and the classes at ISAE-SUPAERO are taught by highly experienced professors and also some of the courses are taught by other professors from well reputed research establishments and other Aerospace companies (Airbus, DGA etc). ISAE-SUPAERO is one of the finest school in the world only for aeronautics. About the master “Aerospace Mechanics & Avionics”, the syllabus and the specializations provided fascinated me to opt for this particular Master as my higher studies. My objectives were to get the best quality education available for the aero space domain through a wide variety of theoretical courses as well as practical training. According to your experience, which are the strong assets of the Master you did?

I would say the research project studies for one year followed by six months end of study projects (Master thesis at Aerospace companies). These projects really helped me to enhance my capacity to work independently and at the same time aided me

Credit photo: © Audo Lunarchand
I focused on masters with a major in structures. At the end my in aeronautics with English as teaching language. Additionally "Aerospace Mechanics & Avionics"? What were your objectives?

Altran Benelux – Belgium - Graduated in 2015
Michael TORNACK – Germany, Junior Consultant at
Altran Benelux (Brussels) with a VIE contract. My work will combine Customer Support with structural calculations (Fatigue and Damage Tolerance).

According to your experience, which are the strong assets of the Master you did?

Definitely the 2 semesters of research (followed by 1 semester of thesis) and the strong network ISAE-SUPAERO has with the industry. Not only that I managed to publish a paper following my research work, but the large project offered me a view of assets research and placement in the industry.

Andra TONIE - Croatia, Customer Support Manager, Air France Industry - Graduated in 2014

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

I chose ISAE-SUPAERO after evaluating the best aero space schools in Europe on several criteria: program variety, international openness, professional network and reputation. In addition, the masters program "Aeronautical and Space Systems" allowed me to enter the aerospace world with a B. of Eng. in Electrical Engineering and Computer Science. My objectives were to get the best quality education available for the aerospace industry, through a rich program, offering not only courses but also practical projects, research and placement in the industry.

According to your experience, which are the strong assets of the Master you did?

I had full confidence in the school, since its reputation is well known worldwide. In addition, coming to France seemed a great opportunity to learn another language while improving English during lectures.

According to your experience, which are the strong assets of the Master you did?

UBINA Sofia - Spain, PhD student at LAAS-CNRS - Graduated in 2013

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

In Madrid, I had a very theoretical background regarding the aerospace domain. I missed both having a more practical approach to the aeronautical field and deeper knowledge in space, which has always been my passion. These two key points were decisive to choose ISAE. The MSc AES promised to give us both theoretic and practical knowledge, which was a real challenge. I had full confidence in the school, since its reputation is well known worldwide. In addition, coming to France seemed a great opportunity to learn another language while improving English during lectures.

According to your experience, which are the strong assets of the Master you did?

After graduating, I keep three main strong assets of the Master. The first one is its high technical level. The lectures take into account both theoretical and practical aspects of each course, which had to be finished with a high-quality report. The second one is related to the Research Project that has to be performed during two semesters. Thanks to it, I discovered my real vocation as researcher in the space domain. The last one regards the personal point of view. Since ISAE hosts many international students, I had the opportunity of interconnecting with other cultures, which enriches one’s life.

Which are your career plans ?

I wish to work for Airbus, if possible in flight test engineering.
# MS AHE

## Aircraft and Helicopter Engineering (with AIRBUS HELICOPTERS)

### Learning approach

**First semester:** academic session from September to February, provided by permanent professors of ISAE and experts from aeronautical industry giving their current knowledge and experience (Airbus Helicopters, Airbus Group, Safran/Turbomeca, Thales, etc.) including lectures, tutorials, and practical sessions.

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

### Syllabus

**General teaching - 150 h**

- General Aircraft Technical Overview - General Helicopter Overview – Certification - Computer-Aided Design (Catia) - Sensors and measuring systems - Automatic control engineering - Aeronautical Thermopropulsion - Aeronautical Materials - Vibrations and modal analysis - Major Avionics (Signal processing, Electrical Engineering) or Major Structures (Structure mechanics - Fatigue and aging of structures)

- *organized in Airbus Helicopters premises in Marignane*

**Aircraft engineering - 200 h**

- Flight dynamics - Aircraft and airframe architecture - Data transmission - Airframe-linked systems - Avionics systems - Helicopter propulsion and motorization - Engines Propulsion - Major Avionics (Data transmission - Avionics systems - Automatic equipment tests) or Major Structures (Composites Materials)

- Helicopter engineering - 162 h

- Aerodynamics, flight qualities & performance* - Helicopter dynamics* - Helicopter construction materials & techniques* - Systems - Prototypes* - Tests-Production quality

*organized in Airbus Helicopters premises in Marignane

**Materials - Vibrations and modal analysis - Major Avionics - Sensors and measuring systems - Automatic control engineering - Aeronautical Thermopropulsion – Aeronautical Materials**

**Flight dynamics - Aircraft and airframe architecture - Data transmission - Airframe-linked systems**

**Syllabus**

**UAV systems syllabus**

<table>
<thead>
<tr>
<th>COURSE</th>
<th>VOLUME</th>
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</thead>
<tbody>
<tr>
<td>Introduction to UAV systems design and missions</td>
<td>25 h</td>
</tr>
<tr>
<td>Payload and sensors for UAVs</td>
<td>15 h</td>
</tr>
<tr>
<td>UAS architecture and autonomy</td>
<td>20 h</td>
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</tbody>
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### Organisation

**Head of Program:** Prof. Anis HOR

**E-mail:** anis.hor@isae.fr

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

**Beginning of classes:** September

**Location:** ISAE from September to December, Airbus Helicopters premises (Marignane) from January to February

**Teaching language:** English

### Career opportunities

This programme prepares attendees to a wide range of professional opportunities from design, certification and operations of civil and military aircrafts and helicopters in France and overseas.

**Companies recruiting our students**

- Altran, Airbus Group, Airbus Helicopters, Safran-Turbomeca, Thales, Gendarmerie Nationale, SONAIR (Angola), Helibras (Brazil), AVIC (China) HAL (India), Pawan Hans Helicopters Ltd (India), Airbus Helicopters Mexico, Air Force of Algeria, Navy of Brazil, Air Force of Chile, Air Force of India, Pakistan Army, Air Force of Tunisia, Sauber F1 team... 

### Objectives

The Advanced Master «Aircraft and Helicopter Engineering» is designed for graduates or professionals having a passion for aviation. Developed by ISAE and Airbus Helicopters (global helicopter manufacturer and market leader), this 2-semester program provides high-level of engineering and technical competences for careers in aircraft and helicopter business world. Unique worldwide, the Master in Aircraft and Helicopter Engineering takes singular advantages from the marriage of both teaching approaches that allows attendees to acquire well balanced engineering knowledge, as well as techniques and technologies from a world leading company. This comprehensive program course starts with basic engineering knowledge in aeronautical design, then emphasizes on specific techniques and technologies related to the design, certification and operations of civil or military aircrafts and helicopters.

### Testimonials

**Tanguy DENANTE,** France, Aero Designer at Sauber F1 Team, Graduated in 2014

**Why did you choose ISAE and apply for our master ? What were your objectives ?**

When I was studying in engineering school, I worked during 6 months as a trainee at the Rotor design office of Airbus Helicopters. After that great experience, I was determined to work in the Helicopter industry as an engineer. That is why I decided to apply to the ISAE master, in order to have the strongest background as possible in helicopter engineering before applying to a job offer.

**According to your experience, which are the strong assets of the Master you did ?**

In my own opinion, the strongest assets of the HE master are : the quality of the courses which are taught by teachers from ISAE and high specialists from several companies, the partnership with Airbus Helicopters and the proximity with the staff, the factory and the helicopters, the fact that the master is taught in English.

**Which are your career plans ?**

As a graduate, I can confirm that following the HE Master at ISAE is definitely a huge opportunity for any engineer to improve his skills. On my side, the HE Master was a great advantage to be accepted in the company where I work nowadays. At the moment, my plan is to continue to work in Motorsport, but we never know what could happen in the future !

**Nicolas GENTY-PRISCAL,** Application Engineer at NTN-SNR, Aerospace Business Unit, Graduated in 2013

**Why did you choose ISAE and apply for our master ? What were your objectives ?**

I choose ISAE school because of the advanced master «Helicopter Engineering» which was very unique. I was and still am fond of helicopters and this was a great opportunity to obtain a specific degree in helicopter engineering field. My objectives was to be hired in a foreign helicopter company by presenting a difference compare to other engineers.

**According to your experience, which are the strong assets of the Master you did ?**

The advanced master «Helicopter Engineering» entirely in English was very well thought and organized. More than 15 different subjects from basic to some very specific ones only applicable to helicopters. The common core syllabus in cooperation with the maintenance master also was interesting in order to get strong basis in aeronautical technique and a good general culture of this world. Finally, the best asset of the master was the 5 weeks training session in Airbus Helicopters (Eurocopter at that time) called «Specific Helicopter Training».

**Which are your career plans ?**

Currently, I use everyday what I have learnt in the master for my job. My goal is to obtain more and more experience in order to improve my skills and access to a technical expert job in aeronautical office design. My greatest wish will be to become a technical expert in a Bureau of Investigation for Civilian Aircraft Safety, but that will for later !
Advanced Manufacturing

Objectives

The Aeronautical industry market is facing a rapid and continuous increase worldwide as shown by the record breaking contracts recently signed by both Airbus and Boeing. These two industry leaders forecast an increase of close to 5% in activity over the next years and estimations indicate that the annual increase of large commercial airplanes will induce a doubling of the number of aircraft by 2030. Nearly sixty percent of the turnover is subcontracted all over the world and concerns mostly production and manufacturing activities. As a consequence most aeronautical subcontracting companies will have to increase their production rates but also to keep up to date with technological changes; moving from metallic processes toward composite materials processes. Moreover the aircraft manufacturers have changed their supply chain structure in the last years, and subcontractors are now required to manage more complexes parts and to take over on their own, the qualification processes. The Advanced Master course AMPAS, is designed by Mines Albi and ISAE with the support of aeronautical industry partners. It will give a specialization to master level students allowing them to take over high level responsibilities in airframe structure manufacturing plants. It is especially well suited to students who have followed general studies in aeronautics and civil engineering.

To reach this goal, AMPAS master students will develop:
- general knowledge of flight dynamics constraints and aircraft design
- knowledge and understanding of the airframe materials and processes and their qualification constraints
- knowledge, understanding and practice of the prevalent processes for structural applications with either metallic or fiber reinforced thermoset composites materials
- ability to use state of the art simulation tools for definition and optimization of metallic sheet forming and RTM/infusion process
- knowledge of the aeronautical supply chain structure and its communication rules
- understanding of the aeronautic dedicated quality and management requirements
- knowledge and practice of lean manufacturing tools
- ability to undertake manufacturing projects in an international team environment
- ability to communicate with written reports and by oral presentation.

Organisation

Heads of Program:
- Prof. Gerard BERNHART
  E-mail: gerard.bernhart@mines-albi.fr
- Prof. Catherine MABRU
  E-mail: catherine.mabru@isae.fr

Duration of studies: One year full time

Beginning of classes: September

Location: Mines Albi, Campus Jarlard, Albi (70% of courses)
ISAE, Toulouse (30% of courses)

Teaching language: English

Learning approach

First semester: academic term of 450h and 45 credits, provided by permanent professors of Mines Albi and ISAE and expert practitioners from aerospace industry to bring current knowledge and experience. The teaching, balancing academic lessons with more applied practice, includes:
- lectures and exercises
- process simulation sessions
- laboratory sessions and tests
- practical sessions
- industrial conferences
- industrial and workshop visits
- multidisciplinary project of 120h
- written report and oral presentation

Second semester: Professional thesis in the aeronautical industry or in an academic research lab in collaboration with aeronautical industrial partners, in France or abroad. The duration is from 5 to 6 months and corresponds to 30 credits. Students are supervised by a tutor from the host Organisation and from Mines Albi or ISAE. Thesis is concluded by the preparation of a final report and an oral dissertation in front of a jury.

Syllabus

The academic course consists of modules aiming to provide a deep knowledge of the three main material families used in airframe structures (i.e. aluminium, titanium and long fiber reinforced polymer composites) and their related forming routes in aeronautical industries.

Advanced Manufacturing Processes for Aeronautical Structures

Part 1 - Aircraft, material and process basic scientific knowledge - 130 h
- Flight Dynamics AMPAS - Aircraft and airframe architecture
- AMPAS - Computer Aided Design (CATIA) - Aluminium and titanium alloys - Epoxy and thermoplastic composites - Assembly processes - Material and processes qualification - NDT for metallic and composite materials - Optical techniques for assembly aid

Part 2 - Composite structure forming and machining processes - 110 h
- Physical phenomena description and modeling related to thermoset based manufacturing - Raw material and composite quality control - LCM/RTM processes - Autoclave Vacuum Bagging (monolithic - sandwich) processes - Composite material trimming, drilling and assembly - RTM/infusion Simulation

Part 3 - Metallic structure forming and machining processes - 100 h
- Material behaviour and mechanical models - Cold and hot sheet forming processes - Surface treatments - Machining additive manufacturing - Sheet forming simulation

Part 4 - Industrial Organisation and management - 70 h
- Supply chain structure and Organisation - Materials management and Lean manufacturing - Supply chain improvement and collaborative processes - Quality requirement, management and tools

Part 5 - Integrated Team Project - 80 h
- A team project (80 hours) will demonstrate the ability to address aeronautical part processing following the theoretical and professional skills.

Career opportunities

Advanced Manufacturing Processes for Aeronautical Structures Master course offers challenging career opportunities for young engineers or more experienced engineers, who require a postgraduate program to enhance and/or focus their technical and management skills towards aeronautical industry.

Career opportunities are numerous and growing over the world, in Tier 1 and Tier 2 subcontracting companies, as well as in aeronautical companies. Graduated AMPAS students can find employments as process, industrialization, production, quality research and innovation engineer, product, project and production manager, ...

Companies recruiting our students

Airbus Group, AITEN, Safran, CDI P3-Group, EFW, FORMTECH

Processes for Aeronautical Structures

- ISAE - École des mines d’Albi -

TESTIMONY

Michael TANIS, France, Project manager A320 NEO, graduated in 2015

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

After five years of working experience in the chemical industry, I integrated the Advanced Master AMPAS in order to enter the aeronautical industry and work on projects I have always been interested in: airplane production and assembly. I chose the ISAE for its international renown, the industrial pertinence of its courses, and its top notch teachers. I also chose for it the strong links the school has with the key players in this industry. Participating in the AMPAS program is a great opportunity to gain expertise in specific aeronautical technologies and processes and to acquire knowledge about global industrial Organisation and optimization tools.

According to your experience, which are the strong assets of the Master you did ?

One strong asset of this Advanced Master’s program is to provide the possibility of acquiring industrial skills focused on specific aeronautical technologies such as the forming of composite and metal materials. Another is that the theoretical classes are associated with laboratory sessions and visits to the companies. This Organisation allows the students to have an overview of the classroom vision of the technology and its on-the-job use in an industrial environment. Not to be overlooked, the master’s program is conducted in English, providing the students with the opportunity to be prepared to work in an international environment.

Which is your career path ?

The six-month internship, which brings the Master’s program to a close, puts classroom theory into practice. I worked on the restructuration project of the A380 Final Assembly Line. Thanks to this opportunity, after graduation I was able to integrate the A320 Final Assembly Line as a project manager for the NED (New Engine Option) program. I am responsible for the coordination of the industrial ramp up activities. My other responsibilities include the coordination of projects deployed to mitigate the industrial disruptions inherent in the introduction of a new program. My next challenge would be to lead a team in a long-term industrial project, managing a group of people towards achieving the project’s goals.

Teaching language: English

Teaching, balancing academic lessons with more applied practice, includes:

- lectures and exercises
- process simulation sessions
- laboratory sessions and tests
- practical sessions
- industrial conferences
- industrial and workshop visits
- multidisciplinary project of 120h
- written report and oral presentation
Aeronautical Engineering - Aeronautical Thermopropulsion - Flight Dynamics - General Aircraft Technical Overview

Structures major - 59 h
Composites materials - Aeronautical materials - Fatigue and aging of structures

Avionics major - 24 h
Signal processing - Electrical engineering

Part 2 - Aircraft knowledge
Common part - 124 h
Aircraft and airplane architecture - Data transmission - Airframe-linked systems - Avionics systems - Engines propulsion - Helicopter propulsion and motorization

Structures major - 11 h
Non-destructive test methods

Avionics major - 45 h
Data transmission - Avionics systems - Automatic equipment tests

Part 3 - Maintenance and ILS (common programme) - 319 h
Maintenance - Influence on design - Quality - Reliability - Maintainability - Safety analysis - Maintenance methodology (military aircrafts) - Development and evolution of an aeronautical maintenance programme - ILS (military aircrafts) - Organisation of a maintenance department (Airlines)

Avionics and systems trouble shooting maint. - Help for onboard Maintenance - Avionics and propulsion systems maintenance - Avionics and systems maintenance by ground support equipment - Engines and propulsions maintenance - Ground Support Equipment - Engines and propulsion systems maintenance - Avionics and systems trouble shooting maint.

Career opportunities
It is intended to students who envisage management position in aircraft manufacturers, airlines, and MRO organisations on civil or military market.

Companies recruiting our students
Airbus, Aerosocel, Liebherr Aerospace, Safran-Snecma, Safran-Turbomeca, Sogeti-High Tech, Thales Aerospace, Thales Avionics, DGAC, Air Force, Consalfy, South Africa Airways, Denel (South Africa), SONDAR (Angola), Embraer (Brazil), Mecachrome (Canada), Lan Chieh (Chil), COMAC (China), AWC (China), Philotech GmbH (Germany), Hal (India), Royal Air Maroc, Lot (Poland), F2L Swidnik (Poland), Portugal Air Force, Singapore Air Force, China Airlines (Taiwan), Taiwan Air Force, Tunisair, SNAC: International air transport consultancy (USA).

TESTIMONIES
Bertrand LAPORTE, France, Head of MTECH services - MTechnology, Graduated in 2015
Why did you choose ISAE and apply for the advanced master «Aeronautical Maintenance and Support» ? What were your objectives ? I wanted to be trained on the aeronautical way of working, and adapt my skills on trouble shooting and maintenance team management to the aeronautical standards. My objectives were to transfer my former experience of service manager in other industry to Aeronautical Service Manager.

2/ According to your experience, which are the strong assets of the advanced Master you did ?
Regarding my internship, configuration management & MSG-3 analysis (on A320neo CFM France until Maintenance Working Group). Regarding my actual work, Support Ground Equipment (Project Leader for A320neo AIRBUS US Mobile facility), then Trouble shooting. Human factors and Organisation of a maintenance department (Service Manager).

3/ Which is your career plan ? Build up a team and manage the Service Department concerning France, Spain and Belgium within the Broetje-Automation Group.

Thibault DELUNEL, France, Technical support engineer for Rafiale engine at SNECMA maintenance workshop of Châtellerault, Graduated in 2014
Why did you choose ISAE and apply for the advanced master «Aeronautical Maintenance and Support» ? What were your objectives ? Passionate about aviation, I always wanted to work for the aviation industry. I chose to apply for an advanced master to develop my employability on the very competitive aviation jobs’ market. I chose the «AMS Master» because aircraft maintenance is a promising sector given the planned increase of global air traffic in the next 20 years.

According to your experience, which are the strong assets of the Master you did ?
The main asset for the AMS master is to enable students to get skills directly usable in business area. Knowing the global economic context, it is a strong advantage for a company to hire an engineer who will be quickly operational.

Which is your career plan ? I would like to progress in various management positions of the aviation industry more particularly in maintenance workshops.
### Objectives

Aircraft airworthiness must be considered as a coherent process running from the design of the aircraft to the monitoring of its technical condition in airline service. The Master in Aviation Safety - Aircraft Airworthiness covers both the technical aspects of certification and the legal and economic implications. This course has been designed to give future managers a broad understanding of the issues and priorities which, as far as aeronautical construction is concerned, have an international dimension.

Air transport deregulation and the development of a global economy necessarily imply an increase in vigilance on behalf of both the regulatory authorities and the industry. Progress regarding safety has been constant. During the last 30 years, the accident rate per flight hour has been reduced by a factor of 10. This is becoming insufficient due to the considerable increase in traffic. Current trends should encourage us to make even more improvements, and this necessarily involves trainings. The Master in Aviation Safety Aircraft Airworthiness will provide future operators with the key to success in times to come.

### Organisation

**Head of Program ISAE:** Joël JEZEGOU  
E-mail: joel.jezegou@isae.fr  
**Head of Program ENAC:** Pascale PUEL  
E-mail: pascale.puel@enac.fr  
**Head of Program École de l’Air:** Cne PIERRE

Duration of studies: One year full time  
**Beginning of classes:** September  
**Location:** ISAE - from September to November, ENAC from December to February and École de l’Air (Salon de Provence) March.

Teaching language: English

### Learning approach

**First semester:** academic session of 18 courses from September to March, provided by permanent professors of ISAE, ENAC & EOAA and experts from aerospace industry giving their current knowledge and experience, including lectures, tutorials, Practical sessions, visits of industries (Airbus, EAT, etc.).

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

### Syllabus

**Part 1: Aeronautical techniques and study of the aircraft**  
- At ISAE - 236 h  
  - Flight - Structures - Engine and power plant  
  - Aeronautics  
  - Aircraft systems  
  - Qualification tests

**Part 2: Air Transport safety - at ENAC - 290 h**  
- Aircraft Systems  
- System Safety analysis  
- On-board software and hardware  
- Air transport safety and human factors  
- Production Organisational approval  
- Operating procedures  
- Continuing airworthiness  
- Post TC activities

**Part 3: Airworthiness at École de l’Air (Salon de Provence) - 34 h**  
- Airworthiness of state aircrafts

### Career opportunities

This Master prepares students to various jobs either in aircraft manufacturers, or in civil aviation authorities and airlines: airworthiness inspectors, certification managers, airworthiness follow-up, etc.

MS ASAA students interested in the growing field of civilian or military Unmanned Aerial Systems can choose to attend an in-depth program on this topic. A 60-hour «UAV systems» program is proposed by ISAE. This advanced training program is validated by a common certificate awarded by the three institutions.

**Companies recruiting our students**  
Airbus Group and its subsidiaries, AKKA, Safran-Turbomeca, Safran-Snecma, Civil Aviation Authorities of Algeria, of South Africa, of China, of Colombia, of Malaysia, DGAC (Civil Aviation Authority of France), Malaysian Air Force, French Ministry of Defence, Venezuelan Ministry of Defence, Royal Air Force of Oman, Royal Jordanian Airforce, South Africa Airways, Embraer (Brazil), Hal (India), SONDIAF (Angola), AVIC (China), COMAC (China), IATA Belgium

**Saurav MOHANTY, India, Consultant Engineering at Altran France, Graduated in 2015.**

Why did you choose ISAE and apply for the advanced master «Aviation Safety Aircraft Airworthiness”? What were your objectives?

Airworthiness is the discipline to judge the complete structural validity and safety. It requires abundant knowledge and technical experience to evaluate an aerial vehicle’s fitness to work, not only according to the theorised plan, but also according to indefinite practically probable situations.

After working for 4 years in aircraft maintenance domain, I was amazed to see how much aircraft manufacturers are involved in keeping the aircraft safe in operation even after the aircraft is operated by its operator. I came to a realisation that enhancing my design and technical skills with depth of knowledge and airworthiness will provide me an edge; this is why I decided to advance my education in this field by pursuing Advanced Masters in Aviation Safety and Aircraft Airworthiness at ISAE-SUPERO & ENAC.

The fact that master is shared by ISAE, ENAC and Ecole de l’Air which are the most esteemed aeronautical universities was one of the other reasons. They are very well established and the fact that they are located in Toulouse at the epicenter of the aerospace industry gives them a superior advantage in terms of proximity and providing strong industry links.

According to your experience, which are the strong assets of the Master you did?

The strongest asset of this Advanced Masters is its pragmatic approach. The professors who gave us the lectures on a wide range of technical, regulatory and operational topics were the people directly from the industry who could share the first-hand experience after years of working on the specified domain.

Secondly, the enriching international environment with students coming from all over the world opens a plethora of knowledge and opportunities which develops an individual personally and professionally.

What are your career plans?

After successfully completing my internship at Altran, I offered a position of Consultant Engineer by Altran France to continue my activity at AlTR. Working with a manufacturer has an advantage of its own; it opens up the door to different domains which further enhances the skills knowledge of an individual. I would like to continue my activity and gain expertise in the different fields and gain significant knowledge working with different manufacturers, operators and MROs. Long term goals; I would love to have a MRO of my own. But for that, there is a long way to go!

**Nathalie TITECA-HASEVOETS, Belgium, operational and technical expert” for the SESAR program at IATA - Belgium, Graduated in 2014.**

Why did you choose ISAE and apply for the advanced master «Aviation Safety Aircraft Airworthiness”? What were your objectives?

This particular Master has the advantage of combining courses at ISAE and ENAC universities. Obtaining a degree from these two well-known Toulouse universities was a real challenge for me, as I left school 25 years ago. I wanted to combine my background of airlines Captain and operational/technical expert for international organisations with the strong theoretical and practical training given at those universities.

According to your experience, which are the strong assets of the Master you did?

The scope of the Master is very wide: Aircraft systems, performance, Safety. Human factors and all airworthiness aspects are explained by professionals. An internship period of 6 months is also planned. It gave the opportunity to work for major companies based in Toulouse.

Which are your career plans ?

I am waiting for opportunities in an international organisation like EASA, ICAO, EUROCONTROL, EUROCAE...
Embedded Systems

(ISAE, INP-ENSEEIHT)

Objectives

Embedded Systems are an essential aspect of our daily life, in all domains, from transport systems (aeronautics, space, road, rail and sea), to energy sectors and also to communication systems (e.g. smartphones).

As part of the AeroSpace Valley, Toulouse has established itself as a strong place for the design of advanced critical embedded systems. 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 Group and its subsidiaries, ONES, Continental, Thales.

The Embedded Systems Master Program has been defined to provide the industry with well-trained engineers willing to participate in this challenging environment. The Embedded Systems Master Program is a one-year professional course, designed by the INP-ENSEEIHT and ISAE partners, with the support of the embedded systems industry to prepare students to challenging projects for the aerospace domain.

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, both at system-level and function level design for the engineering of Embedded-Systems, based on strong basics of complementary subjects: 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 and automobile.

The training for this Master’s degree is multidisciplinary. It covers all hardware (electronics, energy, software) computer science, links with network, modeling, analysis and certification) and control issues of Embedded Systems within an integrated system based perspective.

Learning approach

First semester: an academic session of 955 hours of teaching, provided by permanent professors of ISAE and INP-ENSEEIHT and experts from industry bringing current knowledge and experience. Teaching activities include lectures, tutorials, and labs, a multidisciplinary project of one month that aims at integrating the academic session into an industrial case study.

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

Syllabus

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

Hence, the academic session of the Master program consists of a 555 hours long program covering the five disciplinary fields while focusing on the architectural aspect and a set of application-oriented lectures and seminars.

Part 1 - Computer science - 47 h
- Real time language, Architecture description language, Real time operating systems

Part 2 - Control systems - 60 h
- Design and Validation of Discret Event System, Feedback Control, Signal Processing

Part 3 - Electronic - 76 h
- Digital representation of analog signal, Microprocessor and DSP architecture, Architecture and Design of FPGAs and ASIC integrated, Hardware and software synthesis and co-simulation, RF Front-end architecture

Part 4 - Energy - 63 h
- Actuator and converter control, Electromechanical and static energy converters, Autonomous energetic systems, Embedded electrical network

Part 5 - Networks - 63 h
- Embedded networks: an introduction, Specific buses and networks, Real time networks, Design and validation of real time protocols, Architecture of fault-tolerant buses, Dimensioning of an avionic network

Part 6 - Embedded systems engineering - Applications - 117 h
- Real time control of a space system, Hybrid Systems, System Engineering, Real time control of a mechatronic system, Aircraft technics, Introduction to space system (ISS), Automobile technics, Workshops

Part 7 - Embedded systems engineering - Courses - 100 h
- System Dependability, Certification, Embedded systems and computer Security, Optimization, Electromagnetic compatibility, Mechatronics integration, Risk management

Part 8 - ISAE Information system user - 12 h

Part 9 - Multi-disciplinary project - 26 h

Career opportunities

Embedded Systems offer challenging career opportunities. The Master is designed either for young graduates or 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 students for employment as designers, developers, researchers and project managers in design and development of innovative embedded systems.

Companies recruiting our students

Accenture, Airbus Group and its subsidiaries, Altran, Aoste Origin, CS Communications & Systems, DCNS, Motorola, RealiX, Safran, Seditec, Sogeti High Tech, Supra Group, ESA, GE HEALTHCARE TECHNOLOGIES (India), Indian Airforce, Philips R&D (Netherlands), Thales Alenia Space, SIGFOX, …

INCOSE certification in ISAE

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

*Associate Systems Engineering Professional

TESTIMONIES

Nicolas CHATONNAY, France, Graduated in 2014, Software Architect at THALES ALENA SPACE
Why did you choose ISAE and apply for our master? What were your objectives?
After 10 years spent in the mobile phone industry as a software engineer, it was time for me to explore other industrial domains. I wanted to make a pause in my professional career, first to refresh some of my competencies, second to get the key notions on embedded systems and finally to ease my career reorientation from an engineer perspective. It is still good to see other things and to challenge himself. This is why I decided to apply for the Embedded Systems Advanced Master program.

According to your experience, which are the strong assets of the Master you did?
One of the strongest assets of the Master are the conferences held by several engineers and researchers from various industries (automotive, space, aeronautics). I really appreciated to hear their lectures and to dialogue with them. In addition, «Embedded Systems» encompass number of different topics such as software, hardware, networks, security, system engineering, etc. The other strong asset of this master is that it covers all those main topics and provides the student key notions in various domains.

Which are your career plans?
After the master, I was hired in a R&D department of a French satellite manufacturer. I use my previous professional experience and the additional competencies learnt during the Master to propose innovative software architectures in order to address the next challenges of embedded systems in Space industry.

Jon REGUERO, Spain, Graduated in 2013, «Field Application Engineer» at SIGFOX

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

ISAE is very well known because of its excellence on the aeronautics and space domain. I chose this school because I am a passionate of aeronautics and I wanted to get closer to this industry. Moreover, I considered the Embedded Systems advanced master would help me add very competitive skills to my Telecommunication Engineer background.

According to your experience, which are the strong assets of the Master you did?
This master helped me enlarge some competences I already had thanks to my background (RF communications, VHDL programming and networks). On the other hand, I got many classes on different subjects that I didn’t know and that, in my opinion, match the needs of a challenging embedded system industry (Real time programming, control theory, aeronautics and automotive systems etc).

Which are your career plans?
In the short term I would like to stay in France and get a deeper experience on the IoT and embedded systems domain. Later, my plan is to move to the US and join a challenging and innovative project on the same field.

Advanced Masters

MS EMS

Credit photos: © AIRBUS S.A.S 2011 - COMPUTER RENDERING BY FIXION-GWLNSD, Rebellion, Astrium/Masterfilm/2012
**Objectives**

Since fifty years, satellite systems have demonstrated their excellence to collect and distribute data in a vast coverage area for the benefit of thousands of users. Within the global telecommunications industry, space communications display one of the most profitable businesses in permanent evolution. Companies of the sector, both system and service providers, are constantly looking for junior executives offering expertise matching the specifics of space communications.

The Space Communication Systems program is tailored to provide students with necessary and up-to-date knowledge for mastering different aspects of digital communications, signal processing, and networking applied to communication or navigation systems. Such systems are strategic in aeronautical or space applications.

The program, is built upon the following foundations:
- A global approach of system design and analysis by taking into account the environments, the limitations and the constraints, the interfaces and the expected performances.
- Expertise in the disciplines contributing to the design of these systems: signal processing, digital communications, networking, etc.
- Simulation tools and field techniques.
- Development of applications for the space, aeronautical and embedded-system domains.

**Organisation**

**Heads of Program:**
- Prof. Marie-Laure BOUCHERET [email: marie-laure.boucheret@enseeiht.fr]
- Prof. José RADDX [email: jose.raddx@isae.fr]
- Prof. Laurent FRANCO [email: laurent.franc@telecom-bretagne.eu]

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

**Beginning of classes:** September

**Location:** Toulouse: ISAE and INP-ENSEEIHT

**Syllabus**

**Part 1 - General teaching - 186 h**
- Signal processing, Digital communications, Spread spectrum techniques, Coding applied to the satellite channel, Network & telecommunication protocols, Simulation of networks, Simulation of communication systems, Project

**Part 2 - Space and specific techniques - 207 h**
- Orbits and satellite platforms, Propagation & radio-frequency links, Space communications systems, Satellite constellations for communications and navigation Satellite payload, Earth station and terminals, Digital filters banks, Digital communications receivers, Constellations for telecommunication and navigation, Project

**Part 3 - Applications - 140 h**
- Satellite based networks, Embedded systems, Satellite based mobile & aeronautical, communications by satellites, Financial and legal aspects, Overview of applications via satellites, Project management, Project

**Learning approach**

**First semester:** academic session of around 500 hours, provided by INP-ENSEEIHT, ISAE and Télécom Bretagne’s permanent professors and experts from the aerospace industry bringing current knowledge and experience, including:
- Lectures, tutorials, experimental and practical sessions, online exercises, practical works in team, simulation with MATLAB, OMTET++, or specific softwares.
- Demonstrations in laboratory, implementation of digital communication chain with software defined radio, navigation receiver (GPS, sensor hybridization ...), conferences.
- 3 projects carried out in pairs for about 100 hours globally.

**Second semester:** students have to conduct a professional thesis in the aerospace industry or in a laboratory, in France or abroad, supervised by a tutor from the host organisation and from INP-ENSEEIHT, ISAE or Télécom Bretagne. The thesis is concluded by technical and project management repport and a public defense.

**Career opportunities**

This Advanced Master in space communications systems offers students various positions in systems design and project management for space companies and agencies.

**Companies recruiting our students**
- Electronics & telecommunications companies:
  - Alcatel, Airbus Group and its subsidiaries, Thales, Safran, ST Micro

**Electronics & telecommunications companies:**
- Alcatel, Airbus Group and its subsidiaries, Thales, Safran, ST Micro

**Communications operators:**
- Eutelsat, Hispasat, SES, Telespazio

**Space agencies and research centers:**
- CNES, DSNA, DLR, ESA, Algerian Space Agency

**Consulting groups:**
- M3 Systems, Altran, France Development Conseil, etc.

**http://spacecomm.wp.mines-télécom.fr**

**TESTIMONIES**

**Alexandre VANSTEENE, Network & telecommunication engineer at Airbus Defence and Space, Graduated in 2014**

Why did you choose ISAE and apply for the advanced master «Space Communication Systems»?

Before joining the Space Communication Systems advanced master, I graduated from a French engineering school (Computer Science major). I decided to pursue a Master to combine two passions (computer science and aero/aerospatial/aeronautics). Choosing the SCS Master has been quite a natural choice for two reasons: the reputation of ISAE and the perfect match between the knowledge I acquired during my curriculum and the one I wanted to gain.

According to your experience, which are the strong assets of the Master you did?

The Space Communication Systems advanced master offers several advantages. The program is divided in two distinct parts: an academic semester and an internship - allowing to provide both theoretical and practical knowledge. The academic semester allows to get a deep understanding of how a space communication system works. High quality courses are taught by both renowned academic professors and experts from the industry (immersed into industry practice). Numerous tutorials and lab projects constitute a good complement to theoretical knowledge by allowing to manipulate and use state of the art satcom equipments. The advanced master staff is deeply involved to make the program work at its best. To illustrate this point, two visits have been organized (satellite teleport and satellite assembly facilities) giving a sense to what is theoretically studied all the year long.

Which are your career plans?

After going back to China, I will continue my work in CAST. I will use my knowledge learned from ISAE at the aerospace program of China. I will become a general designer of satellite system.

**Daniel Philip VENMANI, India, Graduated in 2010**

I graduated from a French engineering school (Computer Science and Telecommunications). Choosing ISAE as a destination to do my Masters Studies, France, being one of the leaders in wireless communications with Satellite Communications and Telecommunications, bears major concerns like the Airbus Group, Thales attracted me to pursue my Masters in Space Communication Systems.

And, to its credit, ISAE is the best place to begin a career in communications, where in numerous research works are being carried out in domains like Ad-Hoc networks, Wireless Networks, Resource Allocation for satellite links, Radio engineering for satellite systems etc.

ISAE, best known for its exclusive training for engineers in the field of Aeronautical Engineering, is no way inferior for Satellite communications as well. Best professors like Marie Laure Boucheret, Michel Boussquet, Laurent Franck are all known for their excellent academic and research accomplishments in their respective field. World class Labs that are opened throughout the day, easy access to libraries and above all always-smiling and most willingly helpful staff will make the stay more pleasant.

In short, I could conclude that «ISAE- Not so foreign!» to me, as I have all my motherland feelings inherited in it while studying there! Today, I find myself as a Doctoral Candidate with Orange Labs, thanks to ISAE!
Aeronautical Engineering

MS TAS Aero

A major in Aeronautical Engineering and a major in Flight Test Engineering are offered concurrently.

The major in Flight Test Engineering - TAS Aero FTE - focuses on the issues facing aircraft and aircraft equipment manufacturers in the development and certification of new aircraft. This major TAS Aero FTE is particularly suitable for engineers with little or no prior experience in the field and also for those already involved in aeronautics who require further knowledge of the above concerns.

Graduates of this major are capable of working in flight test departments or have the ability to contribute to various kinds of flight testing (certification tests, envelope expansion, performances, handling qualities and aircraft systems...).

Students entering one of those programmes are allowed to participate to certificates (UAV or Human Factors) as optional classes included in the programme.

Organisation

Heads of Program:
- Prof. Philippe PASTOR (major AE)
  E-mail: philippe.pastor@isae.fr
- Prof. Eric POQUILLON (major FTE)
  E-mail: eric.poquillon@isae.fr
- Prof. Jean-Marc MOSCHETTA («UAV systems» program)
  E-mail: jean-marc.moschetta@isae.fr
- Prof. Raphaëlle ROY («Human factors» program)
  E-mail: raphaelled.roy@isae.fr

Duration of studies: One year full time

Beginning of classes: September

Location: ISAE

Teaching language: English

Learning approach

First semester: academic session of around 490h, provided by ISAE’s permanent professors and experts from aerospace industry bringing current knowledge and experience, including:
- lectures, exercises,
- labs with Matlab,
- engineering and design study seminars,
- laboratory sessions,
- written report and oral presentation,
- practical sessions;
- team work and team business game,
- in-flight practical study and industrial visits (Airbus, CEA, etc.).

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

Details in following pages

Career opportunities

More than 1100 students from 55 countries have been trained over the last 30 years and now work as research engineers, designers, project managers, program managers, and consultants, etc.

Companies recruiting our students

Altran, Aerocentaur, Airbus Group and its subsidiaries, ATR, Aéroconseil, CAO Aerospace, Ariad industries, Dassault Aviation, Hurel Hispano/Aircelle, Labinal-Comecad, Latécoère, Mazères Aviation, Sagem, Liebherr Aerospace, SAMP, SEGME, ESA/ASTEC, ONES, DGA (French MoD), Brussels Airlines Fly (Belgium), Censaero (Belgium), CTA (Brazil), Embraer (Brazil), Bombardier (Canada), AVIC (China), CDMAC (China), Hal (India), Chilean Air Force, Indian Air Force, Mig (Russia), RUAG AEROSPACE (Switzerland), TUNIS AIR (Tunisia), Exa Corp (USA), Venezuela Air Force,...
This advanced training program is validated by a certificate.

**Syllabus**

<table>
<thead>
<tr>
<th>Detailed Program</th>
<th>Hour</th>
<th>TAS Aero - AE</th>
<th>TAS Aero - FTE</th>
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<tr>
<td>Aircraft Structures</td>
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<td>Materials for Aerospace structures</td>
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<td>Computer Aided Design (CATIA)</td>
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<td>Flight Control laws</td>
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<td><strong>AERONAUTICAL PRODUCT DESIGN</strong></td>
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<td>Mastery of Aeronautical Products</td>
<td>45</td>
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<td>Integrated Team Project</td>
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<td>Modeling for aeronautical structures</td>
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<td>Composites</td>
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<td>Aviation regulations CS/FAR 23 &amp; 25</td>
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<tr>
<td>Flight test techniques and methods</td>
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<tr>
<td>Human factors in aeronautics</td>
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<tr>
<td>Flight test experimentation</td>
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<tr>
<td>Helicopter in-flight tests</td>
<td>13</td>
<td></td>
<td>✓</td>
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</tbody>
</table>

**Testimonies**

**Jitendra SINGH, India, 2015-2016 student**

"Why did you choose ISAE and apply for the advanced master «TAS Aero-FTE»? What were your objectives?"

I have worked in aerospace industry for over 15 years in India, Europe and USA. I started my career in Indian Defence Organisation, and was also the Program Manager of India’s first Regional jet program (NCAO). In recent years, I was deployed to Military Flight Test environment at Indian Air Force Test squadrums. Therefore, I came to study at ISAE SUPAERO to develop my expertise in the area of Flight testing & certification particularly of Civil aircraft. I would like to thank Mr Philippe Gallois for recommending me the FTE course; his advice was very well timed and helped me make a decision to come to the school. About 10 years ago, I also graduated Masters of Aerospace Engineering from Delft University of Technology (Netherlands), and did internship at ETH Zurich Switzerland.

"According to your experience, which are the strong assets of the Master you did?"

The rigorous program was imparted by the Test Pilots, Fight Test Engineers and Industry Experts from Airbus/Dassault/EPNER/EGA CE/ONERA/Airbus Helicopters. As an FTE, we flew 4 types of aircraft at 3 different airfields with 4 Pilots. We performed various Flight tests Experiments that included Airspeed calibration, Aircraft performance, Handling qualities, Acceptance and Evaluation Flight. Apart from the flight experiments, the ground courses were of high scientific caliber and demanded academic excellence; which was aimed to bring out the best in us. Thanks to Prof Eric Poquillion (the Head of FTE) for his rich experience in Flight testing and certification, who himself is a graduate from EPNER (French Test Pilots School). I am grateful to Supaero that I have an exciting stage at CFM LEAP Flight Test Team to support the flight test campaign of Airbus A320 NEO program at its flight test center in Toulouse.

"Which are your career plans?"

My career plan is to continue to build my expertise in the field of flight testing and contribute to the development and testing of efficient technologies for the field of aviation. I am particularly interested to work in the field of civil / business aviation.

**Samuel BARCHECHATH, France, Planning test for the development aircrafts at Airbus flight test centre, Graduated in 2014**

"Why did you choose ISAE and apply for the advanced master «TAS Aero-FTE»? What were your objectives?"

I thus integrated the specialized master TAS Aero Eng, which offers a very complete training, as we had courses in all the aspects of the aeronautical domain (Structures, Propulsion, Flight controls, Avionics, Maintenance, etc.). Moreover, we had the opportunity to develop relationships with professionals from Airbus, Dassault, Latécoère, etc. On a general point of view, studying in ISAE also enables me to be part of an important network of aeronautical engineers, which is very rewarding for an engineer career.

As for my professional objectives, I firstly want to work in technical jobs in order to acquire a good background, and then after several years orientate my career to manage positions with more responsibilities. Moreover, I really appreciate to work for a big aircraft manufacturer as Airbus, which offers a lot of opportunities."
MS TAS Astro

Space Systems Engineering

Organisation

Head of Program: Prof. Stéphanie LIZY-DESTREZ
E-mail: stephanie.lizy-destrez@isae.fr

Duration of studies: One year full time

Beginning of classes: September

Location: ISAE

Teaching language: English

Learning approach

First semester: academic session of around 500h, provided by ISAE’s permanent professors and various experts bringing current knowledge and experience from research center (ONERA), Space agencies (CNES, ESA), or European aerospace industry (Thales Alenia Space, Airbus Defense & Space / Space Transportation, Airbus Defense & Space/Satellites, Safran / SNECMA, etc.).

This first semester includes:
- lectures, exercises, labs,
- engineering and design study seminars,
- laboratory sessions,
- written report and oral presentation,
- practical sessions, team work and industrial visits.

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

Syllabus

Part 1 - Missions and Systems
Space environment and effects
Mission analysis and orbital mechanics
System Dependability
Satellite design
Satellite based localization systems
Satellite engineering and design
Design of Launchers
Space communications systems
Human Spaceflight

Part 2 - Environment and Space projects
Space project and systems
Space project financial aspects
Financial and legal aspects
Space projects legal aspects (complements)
Aerospace Engineering Environment
Systems Engineering of Space Systems
Integrated Team Project

Part 3 - Sub-systems option
Real time control of a space system
Estimation and filtering
Advanced control and applications

Satellite AGCS
Launchers guidance and control
Satellite electrical systems
On board data handling sub-systems
Satellite thermal control systems

Part 3 – Earth observation systems and applications (ERSOS) option
Remote Sensing, Active & Passive Sensors
Signal and Image Processing
Data Analysis

Applications: Environment and Civil Issues: Oceanography, Atmosphere, Climatology, Land Management, Forest and Vegetation, SIIG, Natural Disaster Management, Cartography & DEM, etc.

Part 4 - Standardization and Conferences
Quality Seminar - Seminar vehicle design: system aspects of atmospheric re-entry - Electrical propulsion conference - Space mechanisms conference - History of Space Exploration conference - Space tourism and suborbital vehicles -

MS TAS Astro students interested in Space Exploration can choose to attend SEEDS classes, supported by ESA (European Space Agency) and offered in partnership with Politecnico de Torino and Leicester University.

After the academic part, in substitution of the master thesis, students lead a project in an International team, during 6 months (2 months in Torino, 2 months in Toulouse and 2 months in Leicester).

Introduction to space Systems - Spacecraft operations
Visits of companies: Airbus Defense & Space, Airbus, CNES...

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: Project Managers of space systems, Experts in industry or public research laboratories, or in Consulting and services companies, etc.

Companies recruiting our students
Altran, Airbus Defense & Space, Aéroconseil, Astek, Atos Origin, Berlin, Eutelsat, Eurologic, GIST, Saipem, Sedecea, SAFRAN, Sopra Group, Transiciel, Thales Alenia Space, CNES, ESA, CTA (Brazil), Inpe (Brazil), DLR (Germany), Instituto Mexicano de Comunicaciones (Mexico), GTD Sistemas de Información (Spain), Hispasat (Spain), Aerospace Computing Inc/AMES (USA), ...

TESTIMONIES

Matías JAUREGUI LORDA - Argentina, PhD at National University of La Plata, Argentina, Graduated in 2014
Why did you choose ISAE and apply for the advanced master TAS Astro?
I chose the Advanced Master «Space Systems Engineering» because I needed to gain knowledge in space engineering, field that is not possible to study in my country. I choose ISAE because is a world class institute.
What were your objectives?
The interaction with professionals that are currently working in the space industry and the possibility to see what they are doing at the moment
Which are your career plans?
I’m doing a PhD right now in space engineering. My plan is to grow as a professional along with my country space improvement.

Arnaud DEMAY - France, Studies Engineer at Communication & System - CNES, Graduated in 2013
Why did you choose ISAE and apply for the advanced master TAS Astro?
I was graduated as a general engineer with an option of mechanical engineering. With the engineering training I followed, I only had experience in aircraft industries. Since I wanted to get a better opportunity to work on space field (which was my main objective), so I decided to apply for this master, particularly due to its complete program on space projects and the quality education ISAE is used to giving.
According to your experience, which are the strong assets of the Master you did?
This advanced master is a complete and mature program because it covers through various issues related to space. Its quality is maintained by ISAE teachers and professional people from different space industries and agencies. Therefore, students are informed of the newest space events and studies. Thus, it allows us to appreciate the international and multi-cultural aspect of team working during different projects such as the Integrated Team Project.

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Objectives

Aerospace, Defense and Space business is, by nature, complex, innovative with high added value. Located at the heart of political, economic, environmental and technological issues, in France, in Europe and worldwide, it requires a prospective vision from decision makers. It is based on specific industrial processes, characterized by long, costly and risky cycles (R & D, production, maintenance & support).

In this context, project management in aerospace environment requires mastering a wide scope of knowledge, know-how and expertise adapted to the specific needs and issues of this challenging worldwide business.

To answer to these concerns, ISAE-SUPAERO, École de l’Air and ENAC gather their expertise to develop the Aeronautics Space and Defense Project (APM) advanced master.

The professionally-oriented APM advanced master provides students with an overview on military or civil international aerospace industry and gives up-to-date skills, cutting-edge knowledge, and necessary competences for successfully leading Project or Program teams in global aerospace and defence industry.

With an emphasis on operations, the program is designed to those beginning their career in management of projects or to professionals aiming at enhancing their competences for a fast career evolution. The program of the APM is taught, by experts or lecturers with extensive aerospace project management experience, with a combination of formal presentations, strategies and case studies. The objective of this practical approach is to provide students with current techniques and tools in project management taking into account industrial, economical or legal specificities of the Aerospace business.

Organisation

Heads of Program:
- ISAE: Prof. Philippe GIRARD
  E-mail: philippe.girard@isae.fr
- École de l’Air: Pierre BARBARIOL
  E-mail: pierre.barbariol@defence.gouv.fr
- ENAC: Prof Nicolas PETEILH
  E-mail: nicolas.peteilh@enac.fr

Duration of studies: One year in full time or two years in part time
Beginning of classes: October
Location:
- ISAE (Toulouse)
- École de l’Air (1 month in Salon de Provence)
- ENAC (Toulouse) - France

Teaching language: English

Learning approach

The comprehensive training program is organised into four teaching parts:

First part: Overall overview of aerospace industry (60 hours)
This part provides the students with an in-depth overview of world-wide aeronautics and space industry enabling them to have an overall understanding of technologies, products, innovation and strategy stakes in the global civil and defense market.

Second part: methodology (200 hours)
This part leads to a good understanding of Project management tools (WBS, planning, needs specification, etc). Models and Methods of Project management for Aerospace context with specificities for high stakes and long cycle programs.

Third part: economic and financial aspects (120 hours)
This part leads to a good understanding of economical stakes for nations or industries and the role of politics. How to evaluate the cost of a long term program, the investment return hope, but also how to manage cost during development or manufacturing phase.

Fourth part: knowledge management in multicultural team project (60 hours)
This part underlines the necessity to integrate and federate competences around a common objective, how to motivate people for a long term project.

How to integrate intercultural management within international Program to avoid conflicts and change resistance.

Career opportunities

APM advanced master program leads students to integrate or to become Head of Aerospace program team. To conceive and pilot complex projects with permanent care of costs and risks control in Aerospace companies or in defense institutions.

Objectives

In each of these parts the risks evaluation and control will be systematically underscored as well as Quality concepts and indicators dedicated to Aerospace context.

Professional thesis

During semester 2, students have to conduct a professional thesis in aerospace industry or in laboratory, in France or abroad, supervised by a tutor from the host organisation and from ISAE or École de l’Air. The thesis is concluded by the preparation of a report and an oral dissertation in front of jury.

Teaching staff

The teaching staff is composed of professors, lecturers and consultants for ISAE and École de l’Air (CReA). Several consultants, experts into project management are invited to deliver their knowledge from their own experience.

On top of that many experts from industries, mostly of the time heads of aerospace programs will illustrate with parts of the courses.

Testimonies

Ludovic FRAUMUR, "Mechanical Systems Engineer «at Arianespace, France, graduated in 2015

1/ Why did you choose ISAE and apply for the advanced master «Aerospace project Management»? What were your objectives?

I decided to apply for this advanced master because it offers a comprehensive training, through 4 main complementary modules.

My objectives were, first to have strong theoretical knowledge about project management, which was a natural complement to my engineering degree (master of science). Then, I wanted to build a real network, by studying in a cosmopolitan environment and in three of the best European engineering schools. But most of all, this year was for me the opportunity to adjust and prepare my professional project.

2/ According to your experience, which are the strong assets of the advanced Master you did?

I think this advanced master has 4 main strengths: the quality and excellence of the lecturers that fit the current aerospace environment, the actual support of the administration team, the diversity of the trainees in terms of diploma, experience, age or nationality, and, last but not least, the living environment, including the opportunity to be part of the student and associative life like I was at SUPAERO Space Section.

3/ Which are your career plans?

I have started my career in an operational and technical job, as a mechanical systems engineer. I believe that, before bearing some managerial responsibilities, it is important for me to know more the launch campaign activities. I will be able after few years to apply for a project management responsibility. Eventually, I would like to create my own structure in order to share with others what I have learnt, in a teaching or coaching activity.

Wichaya CADENE, "A350-Powerplant Recurring Cost Manager" at Airbus, Thailand, graduated in 2012

I've heard a reputation that ISAE is the best aeronautic school in France and students who are graduated from this school are «cream of the cream». Graduating from this school is a preliminary guarantee in your capability before moving to professional career. This makes me believe that diploma from ISAE will strengthen my profile and makes my CV more interesting among thousands of candidates.

My goal is to get a job in aerospace business but I've experience in automotive. I think advanced master in Aerospace Project Management is a key to open a door that I can walk straight into Aeronautic industrial businesses and knowledge in project management can be applied in all kinds of businesses.

Teaching language:
- ENAC (Toulouse) - France
- École de l'Air (1 month in Salon de Provence)
- ENAC (Toulouse) - France

Teaching language: English
Systems Engineering

Objectives

Systems Engineering is an interdisciplinary discipline of engineering combining all sciences and technologies into integrated teams from design, to development, up to operations and disposal of competitive and complex systems. Systems Engineering approach is the capacity to federate and control various, interweaving and complementary engineering activities. This approach goal is to deliver satisfying systems, on-time, within expected budget, with the level of quality and performances meeting requirements of an open and competitive market. Systems Engineering process implements technical processes (requirement engineering, design, integration, verification, validation, etc.) as well as project management processes, agreement processes and enterprise processes.

The Systems Engineering Master degree program is a one-year course split into 2 semesters in ISAE premises - lectures, integrated team project, etc. and 4-5 months of internship.

First semester: academic session of around 580h, provided by ISAE's permanent professors and experts from industry bringing current knowledge and experience, including: lectures, tutorials, industrial study cases. And 45h devoted to the coaching of the Integrated Team Project run all along the semester.

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

Syllabus

Teaching part (First semester)

Part 1: Academics (500h)
- Systems Engineering Introduction (SEI)
- Project Technical Management (PTM)
- Systems Engineering Data Technical Management (SEDTM)
- Systems Modelling and Analysis (SMA)
- Systems Dependability (SDI)
- Systems Performance Assessment & Management (SPAM)
- Optimise, Decide, Justify, Verify & Validate (ODJVV)
- Requirements Engineering (RE)
- Systems Design and Architecture (SDA)
- Introduction to Verification & Validation
- Integrated Logistic Support (ILS)
- Airbus Study Case: Systems Engineering & Certification of the A380 (A380)
- Systems Engineering of Space Systems (SESS)
- DASSAULT Study Case: Systems Engineering at Dassault Aviation (DAV)
- Systems Engineering of Space Systems (SESS)
- DIGA Study Case: System of Systems (SoS)
- Introduction to Space System (ISS)

Part 2: Integrated Team Project (ITP) 45 h of coaching

Career opportunities

For Open-minded students with open mind, who want to achieve systemic vision, who do like working in integrated team, who like challenges, who are convinced that we can have fun while working, this Master will offer huge job opportunities in Systems Engineering.

Systems Engineering is now a real and permanent concern for any business players, from Major Governmental contractors, to equipment manufacturers, to prime contractor integrating systems, and services companies such as Airlines for instance.

Learning approach

The one-year course is split into 2 semesters in ISAE premises - lectures, integrated team project, etc. and 4-5 months of internship.

First semester: academic session of around 580h, provided by ISAE’s permanent professors and experts from industry bringing current knowledge and experience, including: lectures, tutorials, industrial study cases. And 45h devoted to the coaching of the Integrated Team Project run all along the semester.

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

Organisation

Head of Program: Prof. Jean-Charles CHAUDEMAR
E-mail: jean-charles.chaudemar@isae.fr
Duration of studies: One year full time
Beginning of classes: September
Location: ISAE
Teaching language: English

TESTIMONIES

Raphaël FLAMENBAUM, France, Critical Software Engineer at Airbus Space & Defense, Graduated in 2014
Why did you choose ISAE and apply for our master? What were your objectives?
Having a passionate interest in aerospace and aeronautics, once I heard that ISAE SUPAERO offered the possibility to get an advanced master degree in Systems Engineering, I jumped in the opportunity for me to enlarge my field of competences. I knew that with my background in Embedded Systems, given by ENSEIRB-MATMECA Engineering School, I would be interesting to work on larger scale Aerospace systems.

According to your experience, which are the strong assets of the Master you did?
The master offers to work closely with the industrial world. Thus, the student is involved in the real work dealt day to day in high tech and worldwide companies. Hence, once you arrive in your internship or your real job place, you are rapidly operational.
Which are your career plans?
I am currently working on Critical Software dedicated to navigation at the crossroad of Space and Aeronautics and I learn a lot. This would be a stepping board to continue to improve my competences. Then, step by step I hope getting more and more involved in Systems Engineering.

Mahesh MADHAVAN-NAIR, India, SAFRAN Engineering, Graduated in 2013
Why did you choose ISAE and apply for our master? What were your objectives?
For me, ISAE is one of the best institutes in the world to produce world class engineers discovered with high end technologies taught by experts from globally renowned companies and institutes. Basically, I am a Mechanical Engineer specialized in Thermal Engineering. I have been working in Aircraft Mechanical Systems for 6 Years. My initial objective was to capture some specific categories of systems engineering in which I was lagging and not experienced. But, this course gave me an excellent exposure of its theory and its practical applications on different domains. I could also master in the areas in which I was exposed by applying the theory and concepts form the experts.

According to your experience, which are the strong assets of the Master you did?
The interactive mode of this course which has taken as the key factor in the syllabus is the real success for this program. In addition, the academic projects from different organisations scaled my versatility in applying systems engineering in different domains. Thanks to Systems Engineering Department for its course structure. The strongest asset is that one can enter into any domain after experiencing this course and its assistance in obtaining INCOSE certification.

Which are your career plans?
Currently, I am doing my Internship at Airbus, Hamburg. I would like to have a title as “Systems Engineering Expert” in my business card after 5 years from now.

Guoliang SUN, China, Graduated in 2012
I have been working in AVIC as a Radar System Engineer for 6 years. My reasons for applying to the SEN Advanced Master were to have a systematic view of complex system development and also to practice my experiences. The strengths of SEN are:
- the first knowledge of Systems Engineering, I get a lot of knowledge for the system development, system design, verification and so on. I also increase my capability for analysing and solving problems, especially complex problems.
- the quality of the education. The professors are very professional. There are professors from industry. So they can give us practical experiences about their job.
- last but not least, the international atmosphere. We can be involved in an international team during the SEN master program. My plan for the future is to continue the Radar System Engineer at AVIC with the new skills that I gained in ISAE in the Systems Engineering master.

Companies recruiting our students
Altran, Dassault Aviation, Airbus Group and its subsidiaries, EGIS Avia, ArianeSpace, ALEN, AXKA, SediSec, Hispano Suiza, Thales Alenia Space, INPE (Brazil), AVIC (China), COMAC (China), Thales China, Geo-Informatics and Space Technology Development Agency (Thailand).

INCOSE certification in ISAE
At the end of the first semester, all SEN students are encouraged to participate in a one-month complementary program in preparation for ASE® level of INCOSE (International Council on System Engineering) certification. INCOSE certification consists of an exam which has an international-recognized value to validate knowledge and skills in systems engineering.
MS IEVex

Experimental Flight Test Engineering (ISAE, EPNER - the French Flight Test School)

■ Objectives
Under the aegis of the DGA, ISAE and EPNER joined their expertise setting up the first Master’s degree in Flight Test Engineering for pilots and engineers using the synergy of their recognized competences in aerospace education. EPNER is one of the world leader Flight Test School offering high-level courses for Flight Test Pilots and Flight Test Engineers. EPNER offers fixed wing and rotary wing courses for test pilots and engineers.

ISAE and EPNER studied and developed a comprehensive program integrating their competencies and existing courses to provide EPNER flight test courses attendants with a Master’s degree Specialized in Experimental Flight Test Engineering of ISAE besides the EPNER qualification.

The Experimental Flight Test Engineering Master is a 12-month course organized by ISAE and EPNER aiming at providing either flight test Governmental Organisations or Aircraft manufacturers with high-qualified test pilots and flight test engineers. Aware of the necessity to conduct flight tests program in close coordination between pilots and engineers, the original spirit of this program is to prepare pilots and engineers to work in integrated team.

The objectives of the Master is to develop theoretical and applied skills of experienced pilots and engineers for the preparation, implementation and report of flight tests either of aircraft or complex embedded-systems, in the best safety conditions. After graduation, these skilled professionals are able to participate to civilian certification of new or modified aircraft, to aircraft or equipment development program, to military acceptance program, either fixed-wing or rotary-wing.

■ Syllabus

- ISAE part

<table>
<thead>
<tr>
<th>Subject</th>
<th>International attendees</th>
<th>French attendees</th>
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</thead>
<tbody>
<tr>
<td>Mathematics</td>
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<td>✓</td>
</tr>
<tr>
<td>Flight mechanics</td>
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<td>✓</td>
</tr>
<tr>
<td>Automatic control and aircraft control</td>
<td>✓</td>
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<tr>
<td>Visits of companies</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Advanced aeronautical French and aeronautical phraseology</td>
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<td></td>
</tr>
<tr>
<td>Aircraft preliminary design</td>
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</tr>
<tr>
<td>Human factors</td>
<td>✓</td>
<td></td>
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- EPNER part

System engineering introduction
Safety of flight tests
Basics of aerospace techniques
Documentation, procedures applied in flight tests programs
Performances tests
Propulsion tests
Handling tests
Embedded-systems tests
Specific test (fixed-wing): flight envelop extension, certification, acceptance, assessment, etc.
Specific test (fixed-wing): flight envelop extension, specific flights, synthesis activities
Professional thesis

■ Career opportunities
The Master intends to prepare skilled professionals, pilots or engineers for:

- Managers of flight tests implementation, flight envelop extension of aircraft or embedded-systems in close cooperation with design and development offices,
- Managers of flight tests centers.

Organisms recruiting our students
Flight Test Centres, Air Force, Navy, Army, Airbus Group and its subsidiaries, Germany, BWB Germany, Dassault, ESA, Canadian Flight test center...

■ Admission procedure
Selection and admission by the French Ministry of Defence, contact us for more detailed information.

■ Selection and admission by the French Ministry of Defence

TESTIMONIES

CPT Luca S. Parmitano, Air Force Italia, Graduated in 2009, selected by ESA
I was selected by my government for this advanced master which is related to the EPNER test pilot school course. As the master is still taught in French, I wish give advice future students to learn French, it will help in learning the French culture, which in turn will help them to better understand the courses, even when they are in English. Plus, knowing the language will help them enjoy the beautiful city. Regarding my career, let’s say the master helped me get my future job: in September 2009, I joined the European Space Agency to start astronaut training.

American Officer, Graduated in 2011
Why did you choose ISAE and apply for our master ? What were your objectives ?
I came to ISAE as part of the MSEVEX, associated with EPNER. My objectives were to work on mathematics, aviation, and aeronautical engineering subjects in French, in order to expand my knowledge of French engineering practice and begin my training as a Flight Test Engineer. According to your experience, which are the strong assets of the Master you did ?
The greatest strength of the MSEVEX program for me was the wealth of expertise available through our instructors and administrators, even in a short course like ours (only two months, during the summer). I am grateful that so many talented and knowledgeable professors dedicate their summer weeks to working with the MSEVEX students. I also appreciate the inclusion of our Alliance professor and the French language course, because as a foreign student, having an excellent French teacher to complement the purely technical subjects was imperative. I will know more about the specific strengths of the ISAE MSEVEX program working together with the Program A stage at EPNER after I have spent more time at EPNER.

Which are your career plans ?
I will return to the United States in September 2012 to work as a Flight Test Engineer (Rotary-Wing specialty). I will spend at least three years in a TIE-RW job, and then I will build on that experience as an engineer and a field grade officer in the US Air Force.
**MS SAS**

**Structures aéronautiques et spatiales**

**Programme d’enseignement**

Harmonisation - 54 h

Enseignements académiques - 363 h

**Perspectives professionnelles**

Plus de cent-vingt ingénieurs ont été formés à cette spécialisation unique dans l’enseignement supérieur français. Ils occupent aujourd’hui des fonctions d’ingénieurs-recherche ou d’ingénieurs de conception dans des entreprises internationales des secteurs aéronautique, spatial ou du génie mécanique.

Le haut niveau scientifique de la formation MS SAS autorise également des ouvertures effectives vers les métiers de la recherche en mécanique des solides et des structures.

**Les entreprises qui recrutent nos étudiants**

Méthode pédagogique

Premier semestre : environ 400 heures d’enseignement dispensées de septembre à avril dans les locaux de l’ISAE par les professeurs permanents de l’ISAE et par des experts et professionnels apportant les dernières connaissances sur l’industrie dont : cours magistraux, bureaux d’études, travaux pratiques, visites de sites industriels, travail en équipe.

Second semestre : réalisation d’une thèse professionnelle en entreprise, en laboratoire, en France ou à l’étranger d’une durée de quatre à six mois, validée par la soutenance.

Programme d’enseignement

Conception et opérations des aéronefs - 84 h
Développement des avions civils et militaires, des hélicoptères, - Conception moteur : calcul de cycles (design et off-design) – Approche multi-disciplinaire.

Dynamique des fluides - 260 h
Turbulence, instabilité et transition, Dynamique des fluides avancée - Écoulements diphasiques et combustion, Atomisation des turbomachines, Propulsion chimique, Computationnel Fluid Dynamics, Conférences approfondissement, Multiphysique, Étude de cas

Projet ingénierie entreprise - 80 h
Intégrer toutes les dimensions d’un projet : composante technique, gestion de projet et gestion d’équipe

Objectifs

Former des spécialistes moteurs capables de concevoir et d’utiliser des turbomachines aéronautiques et terrestres, des moteurs d’engins spatiaux, ayant une solide formation en énergétique générale et sachant adopter une approche systèmes complexes.

Acquérir des connaissances approfondies en aérotechnique et technologie de tous les systèmes propulsifs (turboréacteurs, turbines à gaz, statoréacteurs, moteurs fusées, moteurs à combustion interne).

L’accent est mis tout particulièrement sur l’aérodynamique interne (turbomachines et combustion).

Organisation de la formation

Chef de programme : Prof. Guillaume DUFUR
Courriel : guillaume.dufour@isae.fr
Durée : un an à temps plein
Rentrée : début septembre
Lieu : ISAE

TÉMOIGNAGES

David TESTA, France, Concepteur en Systèmes d’Equilibrage Axial de turbomachines à hauteur de liquide chez SNECMA VERNON, diplômé en 2014

Pouvez-vous choisir de suivre le Master Spécialisé «Systèmes de Propulsion Aérospatiales» proposé par l’ISAE ?

Ayant initialement suivi une formation d’ingénieur en Mécanique des fluides et ayant un goût très prononcé pour les moteurs d’avions et les turbomachines en particulier, j’ai décidé de suivre le MS Systèmes de Propulsion Aérospatiales afin de compléter et perfectionner mes connaissances sur ce domaine. De plus, c’était une opportunité pour moi de suivre une formation technique de qualité à l’ISAE, une des meilleures écoles de France dans le secteur Aéronautique et Aérospatial. Soucieux d’apprendre en profondeur la conception et la conception des moteurs d’avion ou de fusée pour travailler dans de grands groupes aéronautiques, ce MS m’a permis de monter en compétences sur cette thématique et il m’a été offert de trouver une large palette de métiers entrant en jeu dans la conception d’un moteur.

Selon vous, quels sont les points forts du programme que vous avez suivi ?

- Qualité des enseignements : réelle volonté de la part des intervenants de faire découvrir leur passion à des étudiants curieux et intéressés. J’ai vraiment pu voir que les intervenants avaient au cœur de faire découvrir leurs univers et les problématiques industrielles actuelles aux étudiants.

- Pluri-disciplinarité : beaucoup de disciplines sont abordées dans la formation, offrant une vision d’ensemble des métiers intervenant dans la conception et le fonctionnement d’un système propulsif.

- Bi-dimensionnalité : la formation offre aux étudiants une vision industrielle et de recherche en laboratoire qu’il est important d’avoir à l’esprit dans ce secteur.

- Liberté : la formation fait preuve d’une certaine souplesse dans le choix des projets de recherche, en fonction des métiers intervenants.

Guillaume GARSON, France, ingénieur thermodynamicien aux avant-projets chez SAFRAN SNECMA, diplômé en 2013

Pourquoi avez-vous choisi de suivre le Master Spécialisé «Systèmes de Propulsion Aérospatiales» proposé par l’ISAE ?

J’ai souhaité suivre le MS SPA après avoir eu un parcours pluridisciplinaire et curieux, souhaitant me spécialiser dans un domaine qui m’a toujours tenu à cœur : la propulsion. Ce domaine étant multidisciplinaire, les formations qui lui sont consacrées essentiellement ne sont pas très nombreuses. En discutant avec des connaissances j’ai appris que l’ISAE, dont la qualité d’enseignement dans le secteur aéronautique m’a semblé plus à l’aise, offrait exactement ce que je cherchais. J’ai sauté l’occasion, non sans une certaine appréhension cependant.

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Aujourd’hui, quels sont vos projets professionnels ?

Je souhaiterais parcourir le plus possible le cycle de vie d’un moteur. Je vise, à l’issue de mon stage, débuter ma carrière en tant qu’ingénieur thermodynamicien aux avant-projets. Après quelques années, je pense me diriger vers des activités liées aux encaisses moteur. Par la suite, je souhaiterais rejoindre le support technique au client afin de répondre à des problématiques de mises en services et de suivi des flottes. Enfin, à plus long terme, intégrer progressivement des activités de management d’équipe.

Thomas LAMBOT, France, ingénieur à la NASA, diplômé en 2012

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Télécommunications et Réseaux pour l’Aéronautique et l’espace

Méthode pédagogique

Premier semestre : environ 400 heures d’enseignement dispensées de septembre à avril dans les locaux de l’ISAE par les professeurs permanents de l’ISAE et des experts du milieu professionnel, comprenant :
- cours magistraux, bureaux d’études, travaux pratiques et expérimentaux sur CAO, classes inversées, travail en équipe, simulations sur MATLAB, OMNET++ , SatOrb, ...
- conférences, démonstrations en laboratoire, expérimentations sur plateforme radio-logicielle (rf ISAE.fr),
- deux projets de conception système (aéronautique et spatial), réalisation de développements en simulation et simulation, rédaction de rapports de synthèse et présentation orale.

Second semestre : réalisation d’une thèse professionnelle en entreprise, en laboratoire, en France ou à l’étranger d’une durée de quatre à six mois, validée par la soutenance.

Objectifs

Former les spécialistes de la conception des systèmes de télécommunications dans les domaines de l’aéronautique et de l’espace.

L’accent est mis sur l’utilisation des communications radioélectriques et plus particulièrement des satellites pour les applications liées à l’aéronautique et pour les services grand public. Ces systèmes complexes mettent en œuvre des technologies de pointe couvrant un large spectre de disciplines : physique des milieux et propagation en espace libre, traitement du signal et communications numériques, techniques d’accès et de gestion du spectre radioélectrique, réseaux de télécommunication et intégration aux architectures sol.

Perspectives professionnelles

Les diplômés accèdent à des postes d’ingénieur développement et de conception-système dans l’industrie électronique et des télécommunications en France et à l’étranger, dans les centres de recherche et agences, ainsi qu’au sein de sociétés de service d’ingénierie.

Organisation de la formation

Chef de programme : Prof. José RADDZIK
Courriel : jose.radzik@isae.fr
Durée : un an à temps plein
Rendue : début septembre
Lieu : ISAE
Langue : français mais certains cours sont dispensés en langue anglaise avec d’autres mastères de l’ISAE : les niveaux TOEFL 550 ou IETF 78 ou TOEIC 785 sont demandés comme pour les mastères en anglais.

Missions et performances pour les applications spatiales

- Conception, architecture et exploitation des systèmes orbitaux
- Missions et performances pour les applications spatiales
- Environnement Spatial et sûreté de fonctionnement des systèmes spatiaux
- Technologie d’architecture et en environnement économique et réglementaire
- Informatique, télécommunication et réseau - 240 h
- Architecture informatique et réseau
- Sécurité des systèmes informatiques et réseaux
- Communications numériques (en anglais)
- Systèmes spatiaux
- Communications par satellite pour les mobiles et l’aéronautique
- Internet et services multimédia par satellites
- Constellations pour les communications et la navigation

Enseignements spécifiques aéronautique et accès système - 111h

Techniques télécommunications et réseaux pour l’ingénieur
- Systèmes de communication pour l’aéronautique
- Projet télécommunications spatiales
- Projet en équipe intégrée

La formation est adaptée à l’histoire de l’ISAE.

TÉMOIGNAGES

Quentin BROSSEAU, France, étudiant 2014-2015, en stage au CNES

Pouvez-vous nous parler de votre expérience au CNES ? Quels étaient vos objectifs ?

J’ai postulé en MS car je souhaitais avoir un véritable expérience dans le domaine de l’aéronautique/spatial. Or je n’avais aucune compétence dans ces derniers. Mon objectif était donc d’acquérIR des compétences adéquates et donc pouvoir envisager [en tout cas un peu plus qu’apparaissait] cette carrière.

Cette année m’a permis de découvrir le monde professionnel en participant à des chantier organisé par l’école, mais aussi des conseils des professeurs. J’ai également pu profiter de la proximité de cette dernière avec les entreprises du domaine (l’habitat La Ciotat avant ce qui n’arrangeait pas les choses).

Selon vous, quels sont les points forts de ce programme ?

Nous sommes entourés de personnes ayant une expérience forte dans le domaine. Les relations école-enterprises nous permettent en général de trouver un stage assez facilement dans le domaine, ce qui est un réel tremplin.

Quels sont vos projets professionnels ?

J’espère pouvoir rester une carrière dans le spatial et être embauché chez un des grands du spatial. Actuellement je suis en stage au CNES, je travaille sur le projet REGINA qui consiste à mettre en place un réseau mondial de station GNSS qui réceptionnent les signaux des différentes constellations de satellites afin de les mettre à disposition de la communauté scientifique. J’ai ainsi pu avoir à identifier les différentes solutions possibles pour vérifier l’intégrité des données transmises (ii) a fallu définir des critères de fiabilité et contactant différents organismes quant aux solutions existantes à envoyer puis les tester.

Enfin la seconde partie consiste à réfléchir à l’optimisation de l’acheminement des flux jusqu’au CNES à Toulouse de tous les points de vue (latence, disponibilité, etc...).

Rémy LAZZERINI, France, Manager de production chez Airbus, diplômé en 2013

Pouvez-vous nous parler de votre expérience au CNES ? Quels étaient vos objectifs ?

Étant issu de mon monde des communications terrestres, je souhaitais donner un nouvel élan à ma carrière en me spécialisant dans le domaine de la télécommunications aéronautique. Le Mastère Spécialisé® EAS répondait à mes attentes d’une part par le contenu du programme de formation et d’autre part par la renommée et l’histoire de l’ISAE.

Selon vous, quels sont les points forts de ce programme ?

Les enseignements du programme sont en adéquation avec les technologies que l’on rencontre aujourd’hui dans les entreprises. Les différents points abordés s’appuient sur des exemples concrets, ce qui permet d’acquérIR des compétences très précieuses. Cela est ainsi rapidement opérationnel au sein d’une entreprise.

Quels sont vos projets professionnels ?

Je serai en charge dans quelques mois de la conception des nouveaux systèmes de radionavigation au sein du service d’Airbus dans lequel j’ai effectué mon stage de Mastère Spécialisé®. Ce poste demande des compétences en traitement du signal et en électronique que j’ai pu acquérIR lors de mon année en Mastère Spécialisé®.
Organisation de la formation

Chefs de programme
- Prof. Philippe GIRARD
- Prof. Sihem JOUNI

Courriel : philippe.girard@isae.fr
- jouni@hec.fr

Durée : une année à temps plein

Rentrée : septembre

Lieu : ISAE (Toulouse) et HEC (Paris)

Langue : française mais certains cours sont dispensés en langue anglaise ; une bonne maîtrise de l’anglais est donc demandée.

Méthode pédagogique

Les fondamentaux de la gestion de projets et économie : huit mois d’enseignement intensif d’environ 1000 heures de travail effectuées en salle de classe, en septembre à HEC, d’octobre à décembre à l’ISAE et de janvier à avril à HEC.

Cours magistraux
- Travaux dirigés
- Études de cas individuelles et en groupe
- Débats, conférences et séminaires
- Études de cas informatisées sur tableurs
- Visites de sites industriels ou de projets en cours de réalisation
- Projet de création d’entreprise de quatre mois (étude de cas générale présentée devant un jury de professionnels)
- Projet de cinq mois, réalisé partiellement en entreprise sous forme de missions
- Stage en entreprise d’une durée de quatre mois minimum, validé par la soutenance d’une thèse professionnelle

Programme d’enseignement

Le programme est constitué de douze modules, certains pouvant être dispensés en anglais.

Trois axes verticaux

Le projet
- Structure projet - Connaître les bases du management de projet et les outils de simulation (conduite de projet, analyse des risques, planification, …) - Coûts et financement - Évaluation et techniques de chiffrage, ingénierie financière internationale, marketing et action commerciale, … - Team building - Techniques de constitution et de motivation des équipes - Méthodes Agile et de Lean Startup appliquées aux Management de Projets aussi bien pour les startups que pour les Grands Entreprises
- Méthodes AGILES et de Lean Startup appliquées au management de Projets aussi bien pour les startups que pour les Grands Entreprises
- L’entreprise
- Environnement - Comprendre les fondamentaux du monde de l’entreprise et la manière dont l’entreprise intègre le projet (gestion des investissements, management de l’innovation, …) - Coûtabilité et gestion - Analyse comptable et financière, comptabilité analytique budgétaire - Ressources humaines - Réglementation du travail, sous-traitance, expatriation, techniques de négociation, de motivation et d’argumentation
- L’international
- Droit des affaires - Comprendre et maîtriser la spécificité des projets de dimension internationale - Économie mondiale - Connaître les financements et les possibilités de couverture des risques des investissements à l’étranger - Management interculturel - Prendre en compte la dimension interculturelle dans le monde des affaires.

Trois axes horizontaux

Structurer et définir
- Les grands principes de la décomposition d’un projet en tâches élémentaires - Organigramme - WSJ, phasage, outils de simulation (.plist, …) - Elaboration d’un cahier des charges, d’une spécification technique, …
- Chiffrer et financer
- Estimation des coûts, simulation de rentabilité et financements possibles de projets
- Manager et négocier
- Motivation d’une équipe et outils de communication, ouverture au Leadership.

La possibilité est offerte aux étudiants du MS MGP de suivre l’un des 8 certifications délivrées par HEC et dédiées aux enjeux stratégiques et managériaux de secteurs en plein développement (Innovation Management in Aviation & Space avec Safran, Luxury and Kering, Energy and Finance avec Deloitte et Société Générale, …) – Programme de 100 heures de cours en langue anglaise sur 8 semestres (optionnel).

Perspectives professionnelles

Le MS Management de Grands Projets ouvre des carrières passionnantes vers des métiers porteurs de perspectives d’avenir prometteuses : chef de projet, ingénieur d’affaires / commercial, consultant, responsable logistique / production / exploitation, ingénieur d’études, acheteur.

Les entreprises qui recrutent nos étudiants

TÉMOIGNAGES

Maïmenguy, France, diplômée 2014, consultante chez Solucom en architecture des systèmes d’information

Pourquoi avez-vous postulé au Mastère Spécialisé® « Management de Grands Projets » ? Quels étaient vos objectifs ?

J’ai postulé au mastère MGP pour approfondir les notions de management abordées en école d’ingénieur. Lors de mon stage de fin d’étude, j’étais développeuse. Mais c’est le travail de mon stage qui m’a marqué le plus. Je suis actuellement développeuse chez Solucom en architecture des systèmes d’information. Mon projet est de continuer dans la voie du conseil où je suis confrontée à de nombreux projets souvent complexes et surtout très différents les uns des autres.

Yannick Le Gleut, France, diplômé en 2006, secrétaire coordinateur exécutif à la Vice Présidence des Achats Renault Nissan

Le Mastère Spécialisé® MGP a permis d’accéder rapidement à des responsabilités plus importantes pour me positionner dans la suite d’une carrière. Je suis actuellement secrétaire coordinateur exécutif à la Vice Présidence des achats Renault Nissan (RANFO).
In order to anticipate the aerospace industry needs, ISAE and its subsidiary EUROSAE have developed a dedicated continuing education policy, offering to French and foreign auditors certificates and short courses.

**Certificates**

ISAE-SUPAERO Certificates are offered in the frame of ISAE continuing education programs for professionals who want to reinforce their skills in specific technical domains as ‘‘helicopter engineering’’, ‘‘unmanned aerial vehicles systems’’, ‘‘aeronautical maintenance and support’’, ‘‘earth observation applications’’ and ‘‘human factors and neuromarketing for aeronautics & transportation’’. These programs take from one to three months. They lead to the award of ECTS credits.

**ISAE-SUPAERO short courses**

ISAE-SUPAERO provides short courses (one week duration) derived from Advanced masters modules and professional training managed by EUROSAE, affiliate of ISAE-SUPAERO school.

**Modules from advanced master programmes**

**Aeronautical engineering**

- Flight envelopes
  To study the basic concepts of aerodynamics and flight mechanics and thus provide the knowledge which is essential to understanding the operating techniques and the aerodynamic behaviour of an aircraft in its different flight envelopes.
- Structural operating limits
  To study and calculate the distribution of mechanical stresses and constraints in a material, in order to define the operating limits of a structure or item of equipment.
- Aircraft architecture and load calculation
  To provide the methods and means of calculating load distribution in the various parts of an aircraft (wings, fuselage, landing gear, etc.) as a function of its multiple operating phases, in order to determine the sizing of the structures.
- Propulsion
  To provide the basics required for understanding the aerothermodynamic operation of the various types of engine, for the purpose of engine certification and for certification of the propulsion system on an aircraft.
- Avionics
  The aim of these two modules is to provide a comprehensive view of avionics systems airworthiness issues as a part of the qualification and certification process of Aircraft.
- Aircraft systems
  To study the various types of system (e.g. hydraulic systems) which exist on an aircraft, in consideration of the concepts of safety, by providing multiple networks.
- Qualification tests for on-board equipment and systems used in civil aviation
  This course presents the tests to be carried out in order to obtain the certification of On-Board Systems, with respect to the electrical, electromagnetic, vibrational and climatic environments, particularly as described in DO 160 C, which is the reference document. This course is oriented towards the new conditions dealing with electromagnetic aggressions.
- Helicopter engineering
  - Aerodynamics - flight qualities - performance
    To acquire basic knowledge about the aerodynamic operation of rotors, flight qualities, performance levels, noise pollution and pre-project methods.
  - Helicopter dynamics
    To study vibratory phenomena in depth under the aspects of stability, fatigue, monitoring for safety/maintenance and on-board comfort.
  - Helicopter construction materials and techniques
    To present helicopter production materials and technologies, as well as calculation methods via adapted finite elements.

**Participants**

Engineers and technical managers from civil and military aeronautical industry who need technical knowledge in helicopter engineering.

**Aims of the programme**

To provide high-level of engineering and technical competences for careers in helicopter business world.

**Organisation**

Course duration: 150 hours from January to mid-February
Teaching language: English
Location: AIRBUS HELICOPTERS - Marignane

**Syllabus**

- **Aerodynamics**
  - Flight qualities performance
- **Helicopter dynamics**
- **Helicopter construction materials and techniques**
- **Systems**
- **Prototypes - Tests - Production quality assurance**
  - To present the creation of a helicopter from prototype adjustment to large-scale production

**Short-duration specific training programs managed by EUROSAE**

EUROSAE is the ISAE-SUPAERO subsidiary company specialized in short duration trainings, mainly in aerospace field. EUROSAE provides high level trainings to engineers, technicians and company executives wishing to improve their professional skills in sciences, engineering and management fields. EUROSAE offers more than 250 scheduled training programs, on-demand trainings upon request from enterprises, and specific custom trainings.

**Further information and registration:**

Marie GUBBAL
marie.gubbal@isae-supero.fr
Phone: +33 (0)5 61 33 80 28
www.isae-supero.fr

**TESTIMONY**

Stephen GICHUKI - Airworthiness Inspector - Kenya Civil Aviation Authority

“The training course is one of a kind summarized review of helicopter engineering for a practicing aeronautical engineer or mature engineering student. The training course especially benefits from the great wealth of experience of the specialist facilitators from Airbus Helicopters, diversity of the participants and the on-site plant visits. I found the ISAE–Helicopter Engineering Certificate course valuable for continuous professional development because in a short period I was able to recap on helicopter engineering principles, relevant EASA/ FAA certification regulations and various technical developments influencing the global helicopter industry. As an Airworthiness Inspector working for Kenya Civil Aviation Authority, I will use the knowledge gained in developing suitable strategies for the effective safety oversight of helicopter maintenance and operations. Further, the insight I acquired during the training will be very useful guidance both the governmental and civilian entities in the implementation of their helicopter related activities projects.”

For more information: www.eurosae.com or contact: e.gubbal@isae-supero.fr

Location:
AIRBUS HELICOPTERS - Marignane

**Reference document.** This course is oriented towards the new conditions dealing with electromagnetic aggressions.

<table>
<thead>
<tr>
<th>Particrants</th>
<th>Syllabus</th>
</tr>
</thead>
</table>
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Unmanned Aerial Vehicles “UAV” systems

Participants
Engineers, researchers and technical managers with a good knowledge of aviation technology and who want to specialize in the field of UAV systems.

Aims of the programme
To provide in-depth knowledge in use and conception of UAV Systems, in the respect of air regulation.

Organization
Course duration: 100 hours, in April
Teaching language: English
Location: ENAC - Toulouse
École des Officiers de l’Armée de l’Air - Salon de Provence.

Syllabus

- ISAE Campus
  - “Introduction to UAV systems & missions” (25h):
    - Markets, missions & roadmaps in the world
    - UAS design
    - Subsystems: mission system, payload, datalink,
  - “Payload & Image processing for UAVs” (15h):
    - Electro-optic infrared system
    - Thermal cameras, SAR radars
    - The SLAM approach
- ENAC Campus
  - “UAS Integration in airspace and airworthiness” (15h):
    - Introduction to airworthiness & safety
    - Fundamentals of air traffic management
    - Case studies: UAS classification
  - “UAV Systems and Autonomy” (20h):
    - Software and hardware architecture of UAS
    - Design of control, guidance and navigation systems
    - Case studies: system integration and optimization
  - École des Officiers de l’Armée de l’Air Campus
    - “UAV Operations & Humans factors” (25h):
      - Examples of civil & military applications
      - Human factors, training and lessons learned

TESTIMONY
Chan Vinh Vong, Software Test & Validation Manager Electronic Warfare - Thales Systèmes Aéroportés

“The Certificate is efficient; timely and budget wise speaking. The one-month timeframe is fit for those who have no need in taking a full one-year break for studies with the incurring cost. The curriculum also provides technical knowledge from insiders. After all, UAVs are, and will still be, a hot topic, so it’s best to keep up-to-date with the current trend. Even though some sessions can go deep into specific topics, the courses do provide a good systems view knowledge of UAV systems as a whole. Overall, this compact fast-paced curriculum helped me steer my career into the field of embedded air systems. The training was a great experience, especially the third part at the French Air Force academy. It’s not only about technical knowledge but also networking. Thanks to ISAE, I joined Thales Systèmes Aéroportés, a leader in specialized embedded and UAV systems.”

Aeronautical Maintenance and Support

Participants
Engineers and managers from civil and military industry who want to move towards functions in maintenance and support.

Aims of the programme
To provide high-level of knowledge from engineering basics to management of maintenance Organisation in the respect of international regulation within Integrated Logistics Support methods.

Organization
Course duration: 350 hours, from January to March
Teaching language: English
Location: ISAE-SUPAERO - Toulouse;

Syllabus

- École des Officiers de l’Armée de l’Air Campus
  - “UAV Operations & Humans factors” (25h):
    - Examples of civil & military applications
    - Human factors, training and lessons learned

- Syllabus
  - Integrated logistics support (military aircraft)
  - Maintenance - Influence on design

TESTIMONY
Stéphane Koffi, assistant of the maintenance manager of the panafriican business airline Comfort Jet Services in Lomé - TOGO

“After completing a double master’s degree in electrical engineering and finance, I’ve started my career over 2 years and a half ago as the assistant of the maintenance manager of the panafriican business airline Comfort Jet Services in Lomé (Togo). As I was new to the aviation industry, I needed to master, as quickly as possible, the specificities of a very particular business. After two years of practical experience in the maintenance department of Comfort Jet Services, I decided to attend one academic semester at ISAE-SUPAERO to acquire high theoretical knowledge in aeronautical maintenance management, and it happened to be a great decision. The Advanced Certificate gave me a broad view of all theoretical and practical aspects of aviation regulations, maintenance, quality and safety management within MRO’s and airlines, allowing me to get a strong background and fulfill my new duties of quality assurance engineer in my company.”

Stéphane Koffi, assistant of the maintenance manager of the panafriican business airline Comfort Jet Services in Lomé - TOGO
Earth observation applications

Participants

The certificate is intended for a wide audience. It is accessible to the scientists but also to the participants with no scientific background (policy makers, leader in High Administration, NGO) and who want to get knowledge or specialize in Earth Observation and applications.

Aims of the programme

To provide knowledge and knowhow in the fields related to Earth Observation for environmental issues and civil issues.

Partnership with Thales Alenia Space.

Syllabus

Remote sensing & sensors
Image and data analysis
Meteorology & atmosphere
Oceanography
Hydrology and water cycle
Forest, vegetation & agriculture
Sustainable land management
Cartography & DEM
Geographical information systems.

Course duration: 120 hours, in April.
Teaching language: English.
Location: ISAE-SUPAERO - Toulouse.

Human Factors and Neuroergonomics for Aeronautics & Transportation

Participants

Engineers and managers from civil and military industry who want to develop skills in Human Factors and Ergonomics as well as in the new and growing field that is Neuroergonomics, and Human Factor experts who want to deepen their knowledge on aeronautics and transportation applications.

Aims of the programme

To provide participants with a high-level multi-disciplinary approach to understand human behavior and performance. This course focuses on fundamental and applied concepts to design safer and more efficient systems that integrate the human operator into the loop. Moreover, this course also encompasses a thorough training on the use of the five main physiological sensors dedicated to measure human performance and mental activity. The students learn the know-how of technical, measurements and signal processing issues for each of these sensors. This course emphasizes on practical work using the ISAE flight simulators and real light aircrafts to assess the pilots’ brain activity.

Organisation

Course duration: 120 hours in April
Teaching language: English
Location: ISAE, 10 avenue Edouard Belin – Toulouse

Syllabus

Human Factors & Ergonomics
Human performance, limitation and error;
Ergonomics & physical ergonomics;
Task and activity analysis;
Occupational health, equipment, workplace and environmental design;
Human-System Interface design, evaluation & certification
Situation awareness and countermeasures;
Social psychology (cross-cultural design, hierarchy, motivation).

Neuroergonomics:
Bases in Cognitive Psychology and Neuroscience;
Cognitive modelling;
Vigilance, fatigue and circadian rhythms;
Emotion, stress, workload;
Physiological data (sensors: EEG, fNIRS, eye-tracking, ECG, SCR; signal processing);
Brain-Computer Interfaces (active and passive BCIs, affective computing, neurofeedback, cognitive training & enhancement);
Research tools (literature review, experimental protocol design, statistics).

Application focus on transportation & aviation:
Aviation/Aerospace psychology;
Cockpit design;
Pilot/autopilot conflict;
Air traffic control;
Accident analysis;
Motor vehicle transportation;
UAV operation;
Experimental work using flight simulators and real light airplanes.

Partnership with Thales Alenia Space.
Origin & destination of ISAE Masters’ students

A multicultural student population
Origin of master’s international students in 2016

- North America: 5.30%
- South America: 3.80%
- Africa: 3.30%
- Asia - Pacific: 27%
- Europe & Russia (except France): 20.35%
- France: 40%
- Other: 63%

Large job opportunities

<table>
<thead>
<tr>
<th>Business area</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aeronautics and space</td>
<td>79%</td>
</tr>
<tr>
<td>IT Services</td>
<td>9%</td>
</tr>
<tr>
<td>Automotive</td>
<td>4%</td>
</tr>
<tr>
<td>Consulting</td>
<td>2%</td>
</tr>
<tr>
<td>Energy</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
</tr>
</tbody>
</table>

Fast Insertion into the professional world
78% of graduated found a job within 4 months after graduation.

Effective career development
An active network of 19,000 alumni all over the world

ISAE-SUPAERO is a world-class higher institute for aerospace engineering education and research. Nowadays with a student corpus of over 1600, ISAE-SUPAERO is one of Europe’s largest Aerospace Institute offering graduate and postgraduate programs. Yearly, ISAE-SUPAERO awards around 20% of master’s degrees in Europe in aeronautics and space field. ISAE-SUPAERO 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).
Legal Status: Public Institution of higher education and research.
Endorsements and awards: CTI agreement of the two «Diplôme d’ingénieur», Conference des “Grandes Écoles” for postgraduate Advanced Masters and “Ministry of Higher Education and Research” for Masters of Science.
Faculty: 100 professors and researchers.
Employees: 400.

Key figures
1. «diplôme d'ingénieur» ISAE-SUPAERO in French
1. Master of Science ISAE-SUPAERO in English
1. «diplôme d'ingénieur par apprentissage»
1. CNAM-ISAE (co-op master program)
15. Advanced Masters including so in English
5. Masters in French
6. PhD Programs
More than 1600 students including 1400 masters and more than 220 PhDs
81. International cooperation agreements

A campus fully renovated in 2015
ISAE-SUPAERO campus is located in Toulouse, along the Canal du Midi (UNESCO world heritage).
It is composed of:
- wide range of sports facilities including swimming pool, tennis and squash courts, sports hall, football and rugby fields, climbing wall and fitness room,
- 6 students halls of residence: 1000 rooms and studios apartments, all connected to high-speed network,
- a restaurant.
The campus is located in the Rangueil scientific complex, close to:
- ONERA French aerospace research centre
- CNES - French space agency
- 2 CNRS (National Center for Scientific Research) laboratories
- University and engineering schools.

Useful information
ISAE in few words
ISAE-SUPAERO is a world-class higher institute for aerospace engineering education and research. Nowadays with a student corpus of over 1600, ISAE-SUPAERO is one of Europe’s largest Aerospace Institute offering graduate and postgraduate programs. Yearly, ISAE-SUPAERO awards around 20% of master’s degrees in Europe in aeronautics and space field. ISAE-SUPAERO 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.
Toulouse, European capital of aeronautics and space

Toulouse, European capital of aeronautics and space is the 2nd student city in France (except Paris). The ISAE is established in Toulouse, the European capital of aeronautics and space: Europe’s leading capital for aeronautical activities, also No. 1 in space activities and 2nd world-wide. More than 30,000 people work at 600 establishments linked to the aerospace sector.

Toulouse has more than 450,000 inhabitants: 4th largest French city.

Lively city

Living in the heart of the city and the Midi-Pyrénées region enables students to appreciate this unique environment which you can enjoy while preparing your future.

On the cultural and festive side, Toulouse, its art of living, its museums, theatres, festivals, cinemas, without forgetting its pubs and night clubs, are easily accessible by public transport. Student life in the “pink city” is particularly rich in events and attractions.

Toulouse also means football at the city stadium and rugby at Ernest Vallon stadium, which regularly host major international events.

Between seaside and mountains

Living in Toulouse, France’s fourth largest city, you will also benefit from a privileged environment between the Atlantic and the Mediterranean, as well as being close to the Pyrenees ski resorts.

1h30 from the Mediterranean,
2h30 from the Atlantic ocean,
1h30 from the Pyrenees,
1/2h from the countryside of south-west France

Common ISAE’s admission procedures

Masters of Science
Academic requirements
Applicants must have a bachelor’s degree or equivalent degree, in the following areas:
- engineering: aeronautical, aerospace, mechanical, electrical, electronics, mechatronics, telecommunications, instrumentation, engineering science.
- science: physics, mathematics.

Tuition fees and Funding: see our website

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

Selection and admission
Admission to ISAE’s master at:

Selection and admission are made by an admission committee:
- possible interviews can be organized if necessary

Deadlines for application:
- several admission committees scheduled from January to July, see schedule on our website: http://admissionsmasters.isae-supaero.fr

Language requirements for Masters in English
- TOEFL (IBT): 79 points (Inst. code: 9820),
- or TOEIC: 785 points,
- or IELTS: 6.5 points,
- or CAE.

Language requirements for Masters in French
Language qualification requested: score B2-Common European Framework of Reference for Languages

Your contacts at ISAE
Philippe GALAUP, Head of recruitment and Contractual Relations - Phone: +33 (5) 61 33 80 27
Laurence BALLARIN, Senior Admission Advisor - Phone: +33 (5) 61 33 80 22
Marie GUIBBAL, Senior Admission Advisor - Phone: +33 (5) 61 33 80 28
Mikael LE ROUX, Senior Admission Advisor - Phone: +33 (5) 61 33 80 13
info-masters@isae-supaero.fr

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Crédit photo : © Aude Lemarchand