



Excellence with passion

MASTER OF SCIENCE,
ADVANCED MASTERS &
EXECUTIVE EDUCATION PROGRAMS
IN AEROSPACE ENGINEERING & MANAGEMENT

*Post-graduate education
for Aeronautics & Space - 2020*

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WELCOME TO ISAE-SUPAERO

A word from the Dean of Masters Programs



Innovation, digitization, internationalization and agility are now the key words in aeronautics and space. They have guided the work carried out over the last years with partners at ISAE-SUPAERO to present renewed Masters offer in 2020 that is more than ever in line with industry's needs.

The European aeronautics and space industry is constantly changing to adapt to technological developments and to society's needs: new concepts

in autonomous aircraft, airplanes that are increasingly respectful of the environment, taking human factors into account for increased safety, use of digital technologies (big data, artificial intelligence, cybersecurity) and embedded systems from aircraft design to maintenance, introduction of new production processes, relaunching space exploration, generalized use of space applications, systems approaches and agile project management methods, etc.

The professors, researchers and students at ISAE-SUPAERO work on research and study projects every day to meet these challenges.

They can take advantage of an exceptional range of equipment (wind tunnels, simulators, test aircraft, drone flight area, platforms for space systems, embedded systems, mechanical test machines, etc.) and of the environment offered by the city of Toulouse, the European aeronautics and space capital.

Another essential feature of the aeronautics and space industry is its international dimension. ISAE-SUPAERO, the world leader in aeronautics and space engineering training in terms of the diversity of its programs and the number of diplomas it offers, gives its students the experience of an international campus where more than 60 nationalities are represented. Taught in English and encouraging teamworking, the Master's in Aerospace Engineering and the Advanced Masters at ISAE-SUPAERO train students and professionals from around the world in a multicultural environment that acquaints them with their future work context. They can thus build up an international professional network that will be there for them throughout their careers. This experience of intercultural relations is a decisive asset when entering the workforce and for their rapid advancement.

Active industrial partners with a strong presence

Several partners support the Masters at ISAE-SUPAERO: Airbus, Airbus Helicopters, Airbus Defence & Space, Air France, Altran, CNES, CS, Dassault Aviation, Safran, Thales and Thales Alenia Space for the best known among them, but also innovative small and medium-sized companies such as Hélicoptères Guimbal, Delair-Tech for drones, and Terranis for observation of the Earth in the service of the environment. The engineers and managers of these companies teach and supervise projects in all our programs. ISAE-SUPAERO's students in the Master's in Aerospace Engineering and in the Advanced Masters programs have over 240 internships in industry every year.

ISAE-SUPAERO's close relationship with aeronautics and space companies is also directly beneficial to graduates when they have finished their studies. In 2018, more than 86% of the advanced masters

students together with 83% of Master of Science students found a job in less than 2 months after graduation.

In addition, an average of 73% of them had joined a company or laboratory in France while the others choosing to start their career abroad.

Engineers-architects, experts, managers and entrepreneurs

The Master's in Aerospace Engineering and the 15 Advanced Masters prepare engineers and managers, young graduates or people in mid-career, to become the future leaders of the aeronautics and space industry in these 4 families of trades: engineers-architects, experts, managers and entrepreneurs.

Each program provides specific skills while enabling students to move through a wide range of positions all the way up to the highest levels of the company. In 2019, in order to meet the major industry actors expectations, and with their strong support, our offer was enriched with the creation of new programs.

As a result, ISAE-SUPAERO created two Advanced Masters : «Artificial Intelligence & Business Transformation», in collaboration with the IRT Saint Exupery, and «Management de Projets Innovants et Entrepreneuriat».

Furthermore, the Executive Education offer has been widely developed on space topics such as earth observation, telecommunications and launchers. Several certificates and short courses dedicated to Artificial Intelligence (big data, Business aspects of Artificial Intelligence...) and Project Management (Innovation, entrepreneurship, intrapreneurship...) are also henceforth offered.

An institute open to diverse profiles and pathways

We are open to all talents seeking to share their passion for aeronautics and space. The Institute recruits its Masters students at more than 200 universities and schools in France and just as many foreign universities around the world.

We are looking for excellence – it is our motto and we know that it can be found at all institutions of higher education – and for passion, whether well-established or just emerging, as well as for a diversity of talents, experiences and cultures.

Choosing a Master's degree at ISAE-SUPAERO means more than just adopting a specialization in aeronautics, it means choosing to join a worldwide community of engineers and managers committed to an industrial adventure that began a century ago and which is, more than ever, looking toward the future.

Didier Delorme
Dean of Masters programs

A WORLD LEADER IN AEROSPACE ENGINEERING HIGHER EDUCATION

We have already trained more than 22 700 engineers who are contributing to the development of the aeronautics and space sector in France and around the world. Our engineers' vocation is to become future leaders in the aerospace industry and the world of tomorrow. That is why we have developed an integrated approach with training, research and innovation in partnerships with academic players, many industrial stakeholders and a network of the best international universities.

ISAE - SUPAERO

IS A PUBLIC INSTITUTION OF HIGHER EDUCATION AND RESEARCH

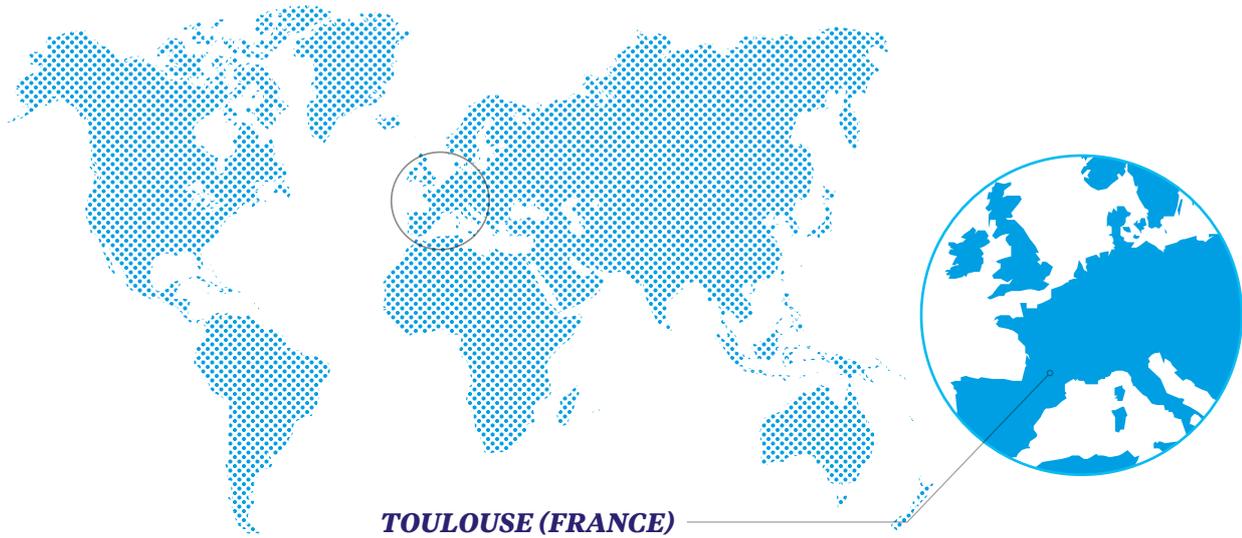
A WIDE RANGE OF DEGREE PROGRAMS IN AEROSPACE ENGINEERING

3 MASTERS PROGRAMS
15 ADVANCED MASTERS PROGRAMS
6 DOCTORAL PROGRAMS (PHD)
16 CERTIFICATES
1700 STUDENTS: 1500 MASTERS AND 200 PhDs
40% FOREIGN STUDENTS
66 NATIONALITIES ARE PRESENT ON CAMPUS
AN ACTIVE INTERNATIONAL ALUMNI NETWORK

AN OUTSTANDING CAMPUS

- Teaching spaces, cutting-edge research equipment
- A complete range of athletic facilities: pool, gym, rock-climbing wall, fitness center, football and rugby fields, tennis and squash courts
- Student residences and the Student Center

A VIBRANT CITY A LIVELY CAMPUS



TOULOUSE (FRANCE)

European Capital of aeronautics and space
4th city and university of France
An exceptional environment in the heart of
Toulouse, Europe's leading hub of aerospace
industries, laboratories and universities.

- Nearly 90,000 direct jobs in aeronautics and space
- The leading region in France for aeronautics education and research



20mn



5mn



ISAE
SUPAERO



1h30



1h30

- Downtown by public transport
- Cycling to the metro
- Mediterranean Sea by car
- Mountains by car



Master of Science, Advanced Masters, Post-Graduate Diplomas, Certificates of Advanced Studies and Short Courses

We have 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, we offer two types of degrees: Master of Science and Advanced Master. We also deliver a range of professional certificates to managers looking to expand their skills in specific areas.

■ Master of Science

The Master of Science is a two-year program undertaken after undergraduate studies, including Bachelor's degree or an equivalent degree. It provides higher qualification for employment or 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.

The two-year ISAE-SUPAERO Master of Science degree program is internationally renowned and highly regarded as an innovative program in science and technologies. Fully taught in English, this 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.

■ Advanced Master's Programs

The MASTERE SPECIALISE® is a collective trademark and label owned by the Conférence des Grandes Ecoles (CGE), a network of 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 programs 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 Organizations in collaboration with ISAE-SUPAERO faculty.



A multicultural student population

■ Post-Graduate Diplomas, Certificates of Advanced Studies and Short Courses

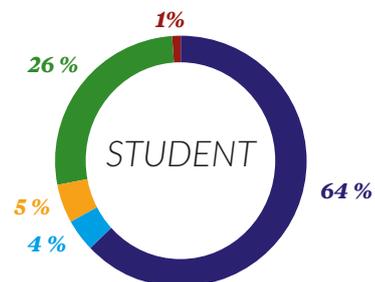
A number of post-graduate diplomas and certificates which are parts of our advanced masters are offered and have a great meaning for professionals who want to grow their skills.

Upon Completion, participants are awarded a diploma from the Institute.

- PG Diplomas
1 semester courses - 45 ECTS
- Certificates of Advanced Studies
from 48 to 120 hours
- Short Courses
from 8 to 47 hours

■ Origin of Master's students 2018

389 total number of students



■ Europe ■ Africa ■ America ■ Asia ■ Oceania

BUSINESS RELATIONS

250

companies support our development



1800

engineers, and/or researchers from leading companies are visiting lecturers. They deliver courses based on the latest industry developments and practices.



The ISAE-SUPAERO Career Center provides support for students entering the workforce

Every year companies receive more than

800

ISAE-SUPAERO students for internships and master thesis. Conferences, industrial visits, internships in companies, forums, recruitment workshops



An alumni network of over

22 700

graduates

More than **30**

partnerships signed with small and medium-sized companies and major industrial players



12



company chairs for teaching and research in innovative programs in safety with Axa, transport aircraft innovative concepts and space with Airbus Group and Ariane Group, in technological innovation with Daher, Embedded systems engineering and architecture with Thales...

FUNDING

Students can benefit from financial support from ISAE-SUPAERO Foundation and partners



AIRBUS



THALES



TOULOUSE SCHOOL OF AEROSPACE ENGINEERING

RESEARCH-DRIVEN LEARNING

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.

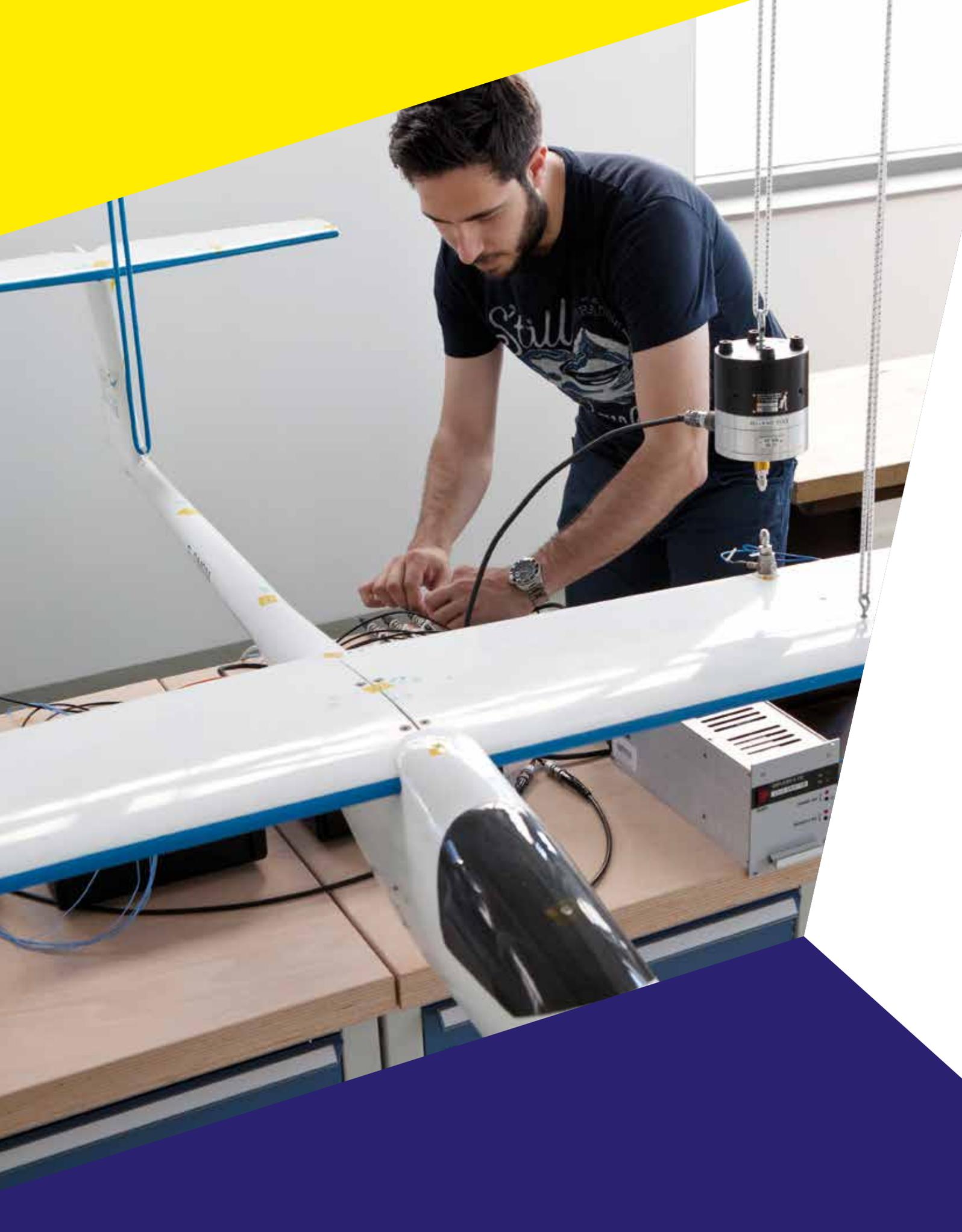
A multidisciplinary scientific policy:

5 training and research departments

- 1** ■ **The Aerodynamics, energetics and propulsion Department** develops its research activities on three axes:
 - Turbomachines and propulsion
 - Aerodynamics
 - Fundamental fluid dynamics
- 2** ■ **The Mechanics, structures and materials Department** is part of the Clément Ader Institute that gathers in a single laboratory all the research capabilities of the Occitanie Region (UPS, INSA, ISAE-SUPAERO, IMT Mines Albi-Carmaux).
ISAE-SUPAERO professors' research is focused on:
 - Mechanical system modelling
 - Materials & composite structures
 - Surface treatment
- 3** ■ **The Electronics, optronics and signal processing Department** is organized into 4 research groups:
 - Signal, communication, antennas, navigation
 - Microelectronic image sensors
 - Space systems for Planetology & Applications
 - Optoelectronics for payloads and aerospace communications
- 4** ■ **The Complex systems engineering Department** concentrates research driven in the multidisciplinary scientific fields:
 - Applied math
 - Communication networks
 - Decision making systems
 - Engineering for critical systems
- 5** ■ **The Aerospace vehicles design and control Department** dedicates to the efficient and safe design and operation of vehicles.
The three research groups:
 - Aerospace Vehicles Design,
 - Decision and Control,
 - Neuroergonomics and Human Factors

Cutting-edge research equipment

- Autonomous system platform for micro-drones and robots
- Critical embedded systems platform
- Flight simulators and neuroergonomics platform
- Wind tunnels, aeroacoustics wind tunnel
- Turbofan Test Bed
- Drop tower, gas guns
- Fleet of 9 aircraft : TB 20, Robin DR 400, Vulcanair P68 Observer...
- Software defined radio room
- Clean rooms for satellite integration
- Ground station for satellite tracking and operation
- Satellite command and control center



Master of Science in Aerospace Engineering



■ Objectives

In order to support its steadily growing and to maintain business competitiveness, the global aerospace industry needs high qualified engineers or researchers. Design complex aerospace systems involve 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 AE 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 AE 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 includes a total of 4 semesters of 30 ECTS each.

The first semester of the MSc AE focuses on the common core curriculum, while the second semester offers a wide choice of electives.

In the third semester, students choose from among seven concentrations spanning the main areas of aeronautical and space systems design including: «Advanced aerodynamics and propulsion», «Aerospace Structures», «Aerospace systems and control», «Embedded systems», «Space systems», «Systems engineering», «Space Imaging Navigation and Communication». Students have extensive opportunities to develop a scientific skills approach through research projects in ISAE-SUPAERO laboratories in second and third semesters along with on-the job skills during internships in the aerospace industry.

Students complete a master's thesis in the fourth semester.

■ 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. It is 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 - 405 h

Sciences & engineering

Aircraft systems, Space systems, Airworthiness, Control, Aerodynamics & propulsion, Flight dynamics, Aeronautical structures, Applied mathematics, Computer sciences

Foreign languages

French as a Foreign Language.

French speakers can choose among: German, Arab, Chinese, Spanish, Italian, Japanese, Portuguese, Russian Intercultural workshop

Systems engineering

SEMESTER 2: 30 CREDITS

Common core - 120 h

Mathematics – Mechanics – Optimization

Foreign languages - Soft skills

Electives - 120 h

- Aeroengines Architecture & Performance - Acoustics - Experimental Approach in fluid dynamics - Software for CFD
- Mechanics of materials & structures - Aircraft structures - Computational solid mechanics - Structure design project
- Software engineering - Simulation for systems engineering - Systems architecture- Space Instrumentation
- Control of dynamic systems & implementation - Aircraft control & guidance - Adaptive control - Real time control of an aerospace system
- MDO - Instrumentation & flight data analysis - Aircraft design methods

4 electives (among 19) 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 - 93 h

Project management - Foreign languages – Requirements Engineering

Students have to select one major among:

Major 1: Advanced Aerodynamics and Propulsion - 220 h

Applied Aerodynamics - Aeroelasticity & Flexible Aircraft - Advanced aerodynamics of turbomachinery - Physics and Modelling turbulence – Aeroacoustics - Numerical fluid mechanics and High Performance Computing - Multiphase Flow and Combustion

Major 2: Aerospace Structures - 208 h

Aeroelasticity & Flexible Aircraft – Aerospace Structures – Computational Solid mechanics – Manufacturing – Mechanics of materials – Space Structures

Major 3: Aerospace Systems and Control - 243 h

Multivariable systems – Control of flexible structures – Robust and optimal control – Systems identification and estimation – Non-linear control – Hybrid control – Avionics – Aircraft Power Architecture – Aircraft & Space Actuation Systems – Preliminary Design – Model & Sizing of Aircraft - Air-conditioning Systems

Major 4: Embedded Systems - 239 h

Architecture and Programming of Software Systems - Real-Time Systems - Model-Based System Engineering - Real-Time Networks - AI and Autonomous Systems - Architecture, Design and Synthesis of Hardware Systems - System Dependability - Certification

Major 5: Space Systems - 270 h

Space environment and effects – Mission analysis and orbital – Space communications systems – Space projects: tools for simulation – Space projects financial and legal – Satellite engineering and design – Advanced control and applications – Satellite AOCS – Launchers guidance and control – Satellite electrical systems – On board data handling subsystems: functions and architectures – Satellite thermal control systems – Estimation and filtering

Major 6: Systems Engineering - 224 h

Systems Dependability – System Engineering Data Technical Data Management – Systems Design and Architecture – Introduction to verification & validation – Systems Modeling and Analysis – Airbus Study case : Systems Engineering & certification of the A350

Major 7: Space Imaging Navigation & Communication - 240 h

Random signal processing and estimation - Electromagnetism - Wireless electronic systems - Satellites and orbits - Digital communications basics - Telecommunications and networks - Broadband satellite communication systems

Remote sensing and sensors - Satellite-based navigation

Research project : 150 h

SEMESTER 4: 30 CREDITS

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

■ Pathway Aircraft

Design and Operation

Students attending majors Aerospace structure and Aerospace system and control can follow the pathway Aircraft Design and Operation.

In this case they attend two dedicated modules, in semester 2, and they perform their research project in this field.

■ Foreign language

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.

■ Organization

Head of program

- Prof. Didier DELORME
didier.delorme@isae-superaero.fr

Head of program major Advanced Aerodynamics and Propulsion

- Prof. Marc JACOB
marc.jacob@isae-superaero.fr

Heads of program major Aerospace Systems & Control

- Prof. Valérie BUDINGER
valerie.budinger@isae-superaero.fr
- Prof. Yves BRIERE
yves.briere@isae-superaero.fr

Head of program major Aerospace Structures

- Prof. Patrice LONGERE
patrice.longere@isae-superaero.fr

Head of program major Embedded Systems

- Prof. Ahlem MIFDAOUI
alhem.mifdaoui@isae-superaero.fr

Head of Program major Space Systems

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

Head of program major Systems Engineering

- Prof. Jean-Charles CHAUDEMAR
jean-charles.chaudemar@isae-superaero.fr

Head of program major Space Imaging Navigation & Communication

- Prof. Damien ROQUE
damien.roque@isae-superaero.fr
- Prof. Marjorie GRZESKOWIAK
marjorie.grzeskowiak@isae-superaero.fr

Duration of studies

Two year full time

Beginning of classes

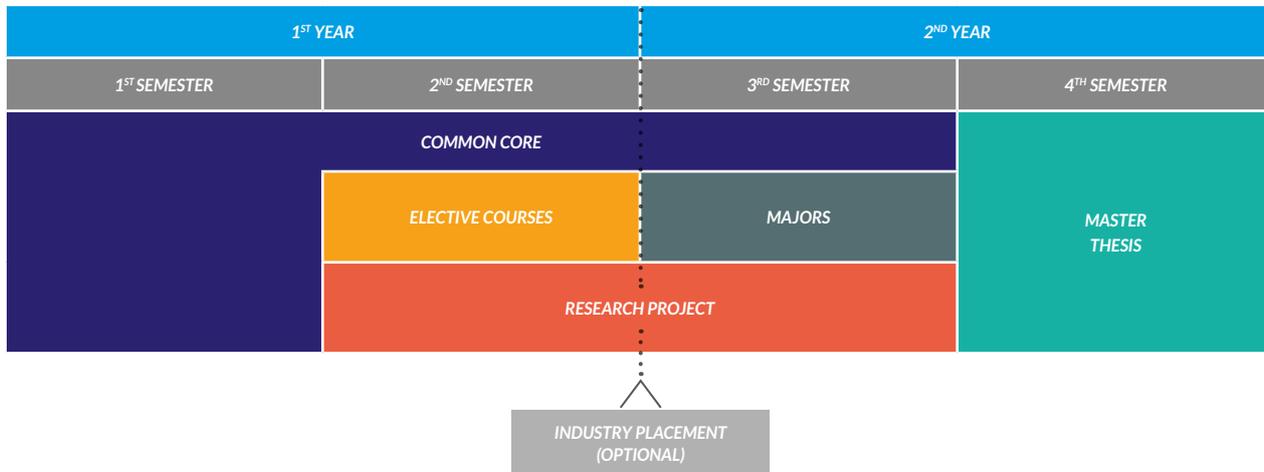
September

Location

ISAE-SUPAERO

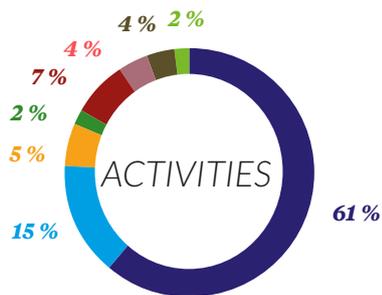
Teaching language

English



■ Career opportunities

85 % Started their career in France
More than 70% work in Toulouse area



- Research and development
- Studies, Advisory and Expertise
- Others
- Informatics
- Maintenance and Support
- Administration, Management Dpt, Finance, Accounting
- Quality Security Operational Safety
- IT Operations / Maintenance

■ Main Companies recruiting our students

AIRBUS, EXPLEO, AKKA ALCIMED, ALTRAN ATOS, THALES ATR, ALTEN BCG, EXPLEO, ALCIMED, ATOS, ATR, BCG

... and many other companies, governmental bodies, universities and research centers all over the world.

ISAE-SUPAERO / TUM double degree in Aerospace Systems Engineering

Technical University of Munich (TUM) and ISAE-SUPAERO share the excellence of their education and research activities to offer a double degree in Aerospace Systems Engineering. Interested students will have to apply for ISAE-SUPAERO MSc Aerospace Engineering and motivate their intention to participate in this double degree program. The first year will be performed at TUM in MSc Aerospace Systems Engineering. The second year will be performed at ISAE-SUPAERO in MSc Aerospace Engineering - major Systems Engineering





Testimonies

THOMAS CARREL- BILLIARD

France – Winfoor Aktiebolag (Lund – SWEDEN).
Graduated in 2018

“ I knew that Aerodynamics was my favorite topic and I decided to make it my major. Several reasons persuaded me in choosing ISAE: the subjects taught, the fact that the program emphasized industry experience with a 6-months mandatory internship and the city of Toulouse.

For my end of study internship, I am currently working for a small-scale R&D company called Winfoor AB, located in Lund, Sweden. We are currently working on a new wind turbine concept. I am more specifically working on some of the structural components of the rotor blade, proposing new designs and doing some FEA analysis on them. There were again several reasons for me to join Winfoor: first of all I wanted to experience what it was like to work in a small company of less than 10 employees and I also wanted to know if I would be interested in pursuing my engineering career in wind energy.

MATTHEW WILSON

South Africa – Flyability (Lausanne - SWITZERLAND)
Graduated in 2018

“ I have wanted, since childhood, to work in aeronautical engineering, bringing flight to those who have yet to experience it. There was not much opportunity for that in South Africa, so I started with a Bachelor in robotics in Cape Town and then chose a Masters at ISAE-SUPAERO to make the transition into the aerospace industry. ISAE-SUPAERO attracted me with its international approach and its industrial networks which both added to the teaching and provided a launching point for our careers after graduation. I majored in Aircraft Systems and Control and, for my 2nd-year internship, worked on the conception and prototyping of new collision-tolerant drone architectures for Flyability SA in Lausanne, Switzerland, which neatly integrated all my preceding training and experience.

ESTHER SUSANA RUFAT MEIX

SPAIN - Dassault Falcon Jet (Little Rock - USA)
Graduated in 2018

“ After deciding that Engineering was the path I wanted to follow for my future career, I was looking for a deeper connection with the industry and more research opportunities. All of this led me to choose ISAE-SUPAERO, as it offered me the opportunity to attend lectures given by professionals from the industry and to carry out a two-semester research project. During the MSc, I chose the Structures Major, so I took theoretical and practical courses focused on structures and materials and learned how to use relevant software necessary to work in this field. As for the Master thesis, I worked at Dassault Falcon Jet in Little Rock, Arkansas (USA) as a part of the Design Engineering team. There, my tasks focused on the optimization of the cabin dividers of Falcon Aircraft to reduce costs and weight. I believe this internship during the 2nd year was essential for me, as it helped me prepare for my future professional career.

After completing the internship in the USA, I started a 1 year graduate program at the European Space Agency (ESA) in Belgium, where I currently work as a systems engineer and project manager for several CubeSat projects. This is an opportunity that I am really enjoying, as I am very passionate about CubeSats and even worked on the ISAE-SUPAERO EntrySat CubeSat as part of my research.



ADVANCED MASTERS



Advanced Masters in the fields of engineering and management are one year degrees taught in English and French.

"Advanced Master" is a specialisation label from the Conférence des Grandes Ecoles (France's top-ranking Engineering Colleges). The rigorous accreditation procedure of the latter guarantees program quality.

The aeronautical industry is looking for more and more engineers capable to manage complex and technical projects.

Thanks to its close links with the aerospace industry, ISAE-SUPAERO develops, enriches and adapts an innovative

training portfolio in order to offer highly employable experts in response to the growing demands of this industry.

These courses are supplemented by tutorials, case studies and team projects, completed by a semester in a company and the realization of a professional thesis.

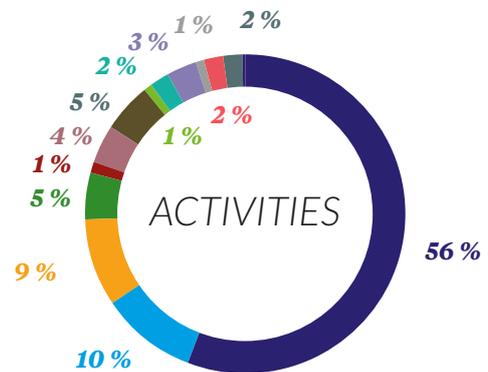
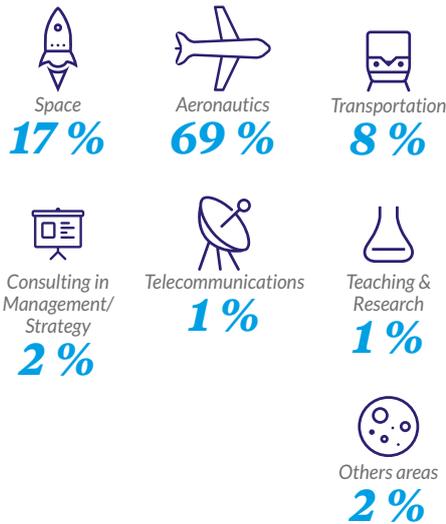
ISAE-SUPAERO offers advanced master's degrees in aeronautic & space, systems engineering, management and financial engineering.

Main companies recruiting our students :

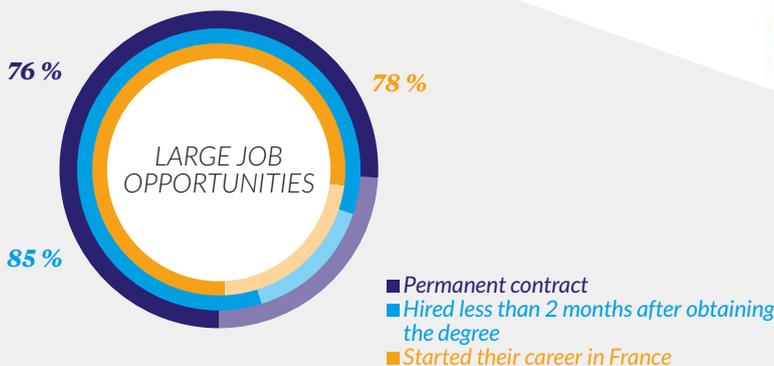
Airbus , Altran , Safran, AVIC, Akka, Thales, DGA EV, Sogeti HighTech, Alten, Assystem, Flying whales

EXCITING CAREER PERSPECTIVES

BUSINESS AREAS



- Research and Development
- Studies, Advisory and Expertise
- Quality and Security, Operational Safety
- Maintenance and Support
- Telecommunications, Information Technology, Networks
- Methods, Production Control
- Administration, Management Dpt, Finance, Accounting, Industrial Property, Patents, Standardization, Certification
- Others
- Informatics
- Information Technology Research & Development
- Business Engineering
- Manufacturing





Aeronautical Engineering majors Aircraft DDesign / Flight Test Engineering



©Dassault Aviation - E. de Malgarve
©Leonardo Velazquez

■ Objectives

The Advanced Master TAS AERO program is dedicated to Aeronautical Engineering and Human Factors. The program includes a common core and one of the following majors: either one focusing on Aircraft Design process and Engineering (TAS AERO-ADE) or the other focusing on Flight Test Engineering (TAS AERO-FTE). The TAS AERO Advanced Master enables students to develop a high level of expertise in engineering science, human factors, current aeronautical technologies and design.

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

- to develop an integrated approach of the product design, while acquiring necessary skills in the disciplines and techniques predominant in the aeronautical sector,
- to make future engineers aware of human factors issues,
- to facilitate work on multidisciplinary projects in aeronautics with a very practical approach,
- to develop skills in project-management, team building and team process at a multinational level,

The major in Aircraft Design Engineering – ADE -focuses on process and tools required during all Design phases from Conceptual to Detailed Design.

The major in Flight Test Engineering - FTE - focuses on the tests to be conducted during aircraft and equipment development and certification.

■ Learning approach

First semester:

Academic session of around 430h, provided by ISAE's permanent professors and experts from aerospace industry bringing current knowledge and experience, including:

- lectures, exercises,
- engineering and design study seminars,
- laboratory sessions,
- written report and oral presentation,
- practical sessions,
- team work and team business games,
- in-flight practical experiment and industrial visits (Airbus, DGA Flight Test, Liebherr...).

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 organization and from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of jury.

■ Organization

Head of program

- Prof. Éric POQUILLON
eric.poquillon@isae-supero.fr

Course duration

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

Course start date

September

Location

ISAE-SUPAERO

Teaching language

English

■ 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, in companies such as Airbus, DGA Essais en Vol, AKKA, ALTRAN, MBDA, Dassault, ArianeGroup...



Syllabus

<i>Detailed Program</i>	<i>Hour</i>	<i>TAS AERO Aircraft Design</i>	<i>TAS AERO Flight Test</i>
STRUCTURES AND MATERIALS			
<i>Aircraft Structures</i>	50	✓	✓
<i>Materials for Aerospace structures</i>	15	✓	✓
FLIGHT PHYSICS			
<i>Aerodynamics</i>	40	✓	✓
<i>Propulsion</i>	20	✓	✓
<i>Flight Dynamics</i>	35	✓	✓
AVIONIC AND SYSTEMS			
<i>Aircraft Systems</i>	35	✓	✓
<i>Flight Control laws</i>	20	✓	✓
<i>Human Factors I</i>	50	✓	✓
FLIGHT TEST ENGINEERING MAJOR			
<i>Flight test technics and methods</i>	30		✓
<i>Human factors II</i>	46		✓
<i>Flight test experimentation</i>	55		✓
<i>Experimental Flight Dynamics</i>	15		✓
<i>Measure and Sensors</i>	12		✓
<i>Flight Test Final project</i>	17		✓
AIRCRAFT DESIGN ENGINEERING MAJOR			
<i>Propulsion Systems</i>	20	✓	
<i>Modeling for aeronautical structures</i>	25	✓	
<i>Computer Aided Design (CATIA)</i>	18	✓	
<i>Aircraft Performances</i>	25	✓	
<i>Aircraft Design</i>	28	✓	
<i>System Engineering</i>	10	✓	
<i>Multicultural project management</i>	12	✓	
<i>Aircraft Design - Final project</i>	29	✓	



Testimonies

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

CLAIRE BRACA
Graduated in 2018
Engineer - DGA flight tests

“ I chose ISAE SUPAERO because it has a very good reputation in the aeronautical industry. With this generalist TAS AERO program, my goal was to specialize, reinforce and acquire skills in aeronautics in order to broaden my possibilities to work for large companies in this industry. Moreover, I have always been passionate by flight tests, as they can combine both theory and practice in aeronautics.

FRANÇOIS PERRINEAU
COHORT 2019

“ I am graduated from a general engineering school (EPF) where I specialized in aeronautical mechanics. During my last year of study, I did my final-year project in the Flight Test & Integration Center department at Airbus Toulouse where I was responsible on aircraft simulators. From this experience and strongly encouraged by my Airbus managers, I integrated the Advanced Master TAS AERO FTE at ISAE SUPAERO. I came to develop my knowledge especially in flight testing but also in human factor, aerodynamics and structure. The program follows a common core with the MS TAS AERO Aircraft Design and flight tests with experiments on the various light aircraft of SUPAERO.

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

Thanks to the TAS AERO FTE advanced master, I have: acquired general expertise in aeronautics and specific expertise in flight tests, applied the theoretical courses in real life thanks to the case studies, acquired as many expertise in fixed wings as in rotary wings, from a general aeronautic point of view as well as in the flight tests.

We were teams of 3 FTE (Flight Test Engineer), we flew a dozen times on 3 different planes with the help of 2 Experimental Test Pilot, Etienne and Stéphane. During these flights, we focused on airspeed calibration, aircraft climb and cruise performance, stability, handling qualities, engine failure, stall, acceptance flight. Concerning the flight test course and the common core, the program is rich and presented by speakers from the aeronautics industry (Airbus, Dassault, DGA, EPNER) accompanied by company visits and laboratory experience (engine bench tests and aerodynamic wind tunnel at SUPAERO).

We also had the opportunity to go for 2 days to the flight test center at Istres base where we visited fighter aircraft such as Rafales, Mirage 2000D and Alfajet. It was a very rewarding experience that will be engraved for life.

Thanks to Prof Eric Poquillion (Head of FTE) for his rich expertise in flight testing and certification, himself a graduate of EPNER (French Test Crew School) and Anne Forget for her work, she keeps us informed of any unexpected changes and answers emails even on weekends!

I will conclude that the FTE Advanced Master is very valuable both on a personal level and in terms of learning and developing the skills of the flight test engineer profession.

What are your career plans ?

I now work within the operations activities for DGA EV (Direction Générale de l'Armement - Essais en Vol) in Istres. I have acquired many specific and cutting edge knowledge on flight tests. In the mid-term, my goal would be to supervise a flight test. This requires numerous technical knowledge that we usually acquire during a second professional experience.

At the end of the advanced master, I found a permanent contract at Airbus Flight & Integration Tests in Toulouse. I am responsible for the analysis of flight tests in aerodynamics, load and stress activities. My work is very recent, but I'm taking care of the preparation of Airbus flight test campaign, monitoring the measurements in real time in telemetry and providing the necessary support to the flight crew.

These activities are similar to those performed during the FTE Advanced Master and also which helped me to get this job.

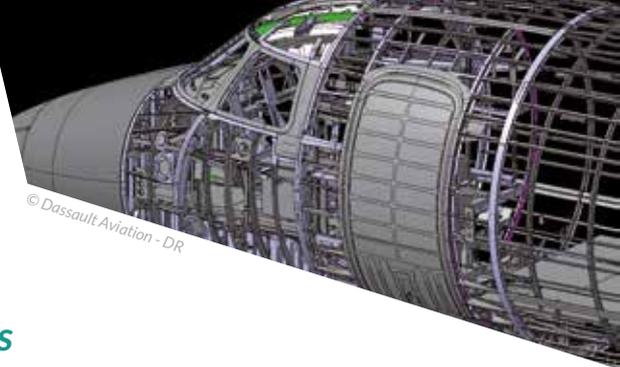
Further, my career plan is to implement new technologies, manage projects, prepare and support future changes in development & testing of aircraft.



Aeronautical and Space Structures



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■ Objectives

In an increasingly competitive international context, the research on innovative materials combined with optimization of calculation methods for structures, and their statistical, dynamic and thermal certification are major assets for industrial architects in the aircraft and spacecraft sectors. The «Aeronautical & Space Structures » prepares engineers with a future career in design, research and development, certification, testing and qualification, in-depth, multi-disciplinary know-how in mechanical engineering applied to structures. This Master program is the european reference in the field.

The program aims to grow expertise in numerical calculation for the most advanced structures, knowledge in materials as well as an understanding of their interferences with the environment (in particular loads and fluid-structure interactions).

The dynamics of flexible structures, modeling and active and passive structural control of complex elements are the core focus of this master program.

The goal of the AES Advanced Master program is to train specialists in the field of design, optimization and certification of light structures who have mastered methods of modeling and analysis of aircraft structures and space vehicles in the industrial context.

■ Learning approach

First semester:

380 hours of courses delivered from September to March on the premises of ISAE by permanent ISAE-SUPAERO faculty and visiting lecturers from industry providing the latest industrial expertise including: lecture courses, design offices, lab work, numerical simulations, CAD, lab sessions, industrial visits.

Second semester:

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

■ Organization

Head of program

- Prof. Yves GOURINAT
yves.gourinat@isae-supero.fr

Course duration

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

Course start date

September

Location

ISAE-SUPAERO

Teaching language

English

■ Syllabus

Part 1: Aerospace structures: methods & tools for engineering & dynamics - 60 h

- Flight dynamics: an introduction
- Aerodynamics: an introduction
- MATLAB standards
- Structural dynamical control: an introduction
- Structural shells-analysis & modeling
- Advanced numerical models

Part 2: Aerospace systems architecture - 82 h

- Aerodynamics loads
- Aircraft structural loads
- Architecture & structure of launch vehicles
- Helicopters: architecture & design
- Satellites: architecture & structures

Part 3: Aerospace structures: dynamics & physics - 138 h

- Finite elements: application to aeronautical structures
- Flexible aircraft: dynamics & aeroelasticity
- Dynamical active control of structures
- Advanced computation of aircraft structures
- Advanced structural dynamics

Part 4: Aerospace programs & technologies - 75 h

- Mechanics of aerospace materials
- Computer Assisted Design & Drawing
- Commercial aircraft: strategies for design & innovative programs

Times project - 25 h

Team Innovative Management for Evolved Strategies

■ Career opportunities

This program, unique in Europe, has trained over 170 engineers. Today, graduates of the program are working as research or design engineers in international companies in the aeronautics, space and mechanical engineering sectors.

The advanced scientific level of the MS AES program also paves the way for career opportunities in research in solid mechanics and structures.

Companies recruiting our students

Aerazur, Airbus Group, Altran, Astek, ASSYSTEM, ATKINS, AXS Analyse de Structures, Air France, CLAIRIS TECHNOLOGIES, Dassault Aviation, DLR (Germany), ESA, Latecoere, SAFRAN Engineering Services, Segula, Sodern, Sogeti, Thales, Thales Alenia Space, Renault, PSA, ...





Testimonies

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

JASON-YANN BACON,

Advanced Master AES PROMO 2016
AIRBUS Mechanical Analyst

After an engineering degree, I decided to join ISAE-Supaero because I wanted to complete my training with a specific program in the field of aerospace. Since my objective was to work as a structural engineer, the AES program was a natural choice.

LUCIE RAFFAITIN,

Advanced Master AES PROMO 2017
Engineer / product support / DT/BEN Safran Nacelles

My previous school is a good mechanical engineering school, but with no dedicated sector (aeronautic, automobile or train...). It left me a taste of unaccomplished in the field I liked: structure in aeronautic.

Moreover, I would like to be a part of the adventure of the world leader in aerospace engineering higher education. So I choose to apply this MS after my engineering school. My objectives were to acquire more technical and specialized knowledge in aerospace structure and to meet researches and engineers.

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

The class, given in small groups, are mostly taught by professional and recognize experts of the industry. Hence, the program is really close to industrial applications.

It was a clear advantage for the beginning of my career. Being familiar with the main aerospace problematics, specifically structural, facilitate the transition from studies to work.

Thanks to this master, I learned the basics of aeronautical sizing, specific vocabulary and use different mechanical softwares.

I met experts of different domain (material and structure) in all aeronautical domain (helicopter, plane) and spatial (rocket and satellite).

I visited different firms such as Airbus, Airbus Defense and Space, CNRS and wind tunnels of ONERA.

Finally, I participated in «student aerospace challenge». All students of the master designed and dimensioned a manned suborbital vehicle. All teachers help us in this European project.

What are your career plans ?

I would like to keep working on challenging projects while taking more technical responsibilities. However, I do not close any door !

During this master, I did an internship in ArianeGroup where I studied topology optimisation of different structure.

Thanks to this internship and previous one, I choose to stay in this domain as a mechanical engineer.

I found a job very quickly in Safran Nacelles. Now I am a mechanical engineer in current program.





Aeronautical Maintenance and Support Engineering & Management



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■ Objectives

Aeronautical maintenance and support ecosystem is a highly competitive and dynamic international environment, facing exciting commercial, economical, strategic and technical challenges, with constant safety concerns.

Encompassing a wide range of complex activities (concurrent engineering, operability analysis, integrated logistics support, lifecycle management, line-base-shop maintenance, repair, modification, support services, supply chain services), it plays a key role for defence and civil aviation. It aims at designing, managing and ensuring aircraft continuing airworthiness and safety at acceptable costs with the best availability, while benefiting from technological innovations to create added-value for stakeholders.

The Advanced Master AMS-E&M delivers the appropriate high-level competencies and know-how in aircraft architecture, maintenance and support delivered by experts, with an exposure to latest techniques and methods, know-how, innovation, regulations and standards applied through this value chain. It prepares attendees to join successfully the competitive and fast changing Maintenance & Support worldwide business.

■ Learning approach

First semester:

Academic session of courses from September to March. 500 h of lectures, projects, tutorials, practical sessions, visits of aeronautical industries.

Second semester:

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



■ Organization

Head of program

- Prof. Joël JEZEGOU
joel.jezegou@isae-supero.fr

Course duration

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

Course start date

Mid September

Location

ISAE-SUPAERO

Teaching language

English

■ Syllabus

Part 1: Aircraft General Familiarization

Aircraft architecture - Structure & Materials - Aircraft General Systems - Avionics - Engines and Powerplant.

Part 2: Maintenance and Support in Aircraft Design

Operability and Maintainability Influence on Design - Integrated Logistic Support (ILS) and Logistic Support Analysis (LSA) - Configuration Management - Development and evolution of a maintenance program (MSG-3) - Ground Support Equipment Project LSA/ MSG-3

Part 3: Maintenance & Health Management Analysis & Modelling

RAMS techniques and modelling - PHM, Predictive maintenance and data analytics.

Part 4: Maintenance Execution & Management

Engines and propulsion system maintenance - Avionics and systems maintenance and troubleshooting - Equipment maintenance and test - Organization and management of a maintenance department - Military maintenance organization - Project MRO.

Part 5: Airworthiness, Safety & Human Factors

Aviation regulation, airworthiness and Safety analysis - Continued & continuing airworthiness - Human Factors and MRO Safety Management System.

Part 6: Customer Support

Customer support and services.

Part 7: Supply Chain & Recycling

Supply chain Airlines economics and liabilities.

■ Teaching staff

Teaching staff is composed of ISAE-SUPAERO's permanent professors and experts from aerospace and aviation industry with aeronautical industrial background (Airbus, Air France, Dassault Aviation, ATR, Sabena Technics, Safran, AKKA Technologies, Star Engineering, Groupe Ortec,...).

■ Career opportunities

Engineering or management position in aircraft-engines-components manufacturers (OEM) and suppliers, airlines, approved maintenance organizations, continuing airworthiness management organization (CAMO), in-service support departments, OEM, supply chain organizations, authorities in civil or military aeronautical industry.

■ Example of positions

Maintenance engineer or manager, maintainability/operability engineer, product support engineer, logistic support engineer.

Companies recruiting our students

Air France Industries, Airbus, Dassault Aviation, French Navy, Sabena Technics, ATR-Aircraft, Groupe ORTEC, Star Engineering, AKKA Technologies, SII, SAFRAN AIRCRAFT ENGINES, Sopra Steria, COMAC (China), AVIC (China), Singapore Air Force, ...



Testimonies

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

LUCIE BONNAURE,

Advanced Master AMS PROMO 2018
Engine Directorate Air France

👂 I choose ISAE-SUPAERO to realize an advanced master because it was for me the insurance to have a formation of quality. I also knew a former student from my school who did this same master two years before and who told me about it. I choose the AMS advanced master because I wanted to work in the civil aeronautical maintenance industry and by reading the program of the courses before to apply, I found it very complete and

interesting (a lot of technical subjects but also courses about the regulation and about aircrafts airworthiness which I knew not much about).

My main objective was to learn as much as I could and to find an internship in an aeronautical maintenance company that could directly lead to an employment afterwards within a maintenance department (service manager).

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

I think the strongest asset of this master is to propose a large range of different subjects around the aircraft maintenance. It is also the occasion to meet a lot of

professionals from different sectors. When you are looking for a job it gives you a pretty good idea of what it is possible to do.

What are your career plans?

I am a part of a program for young employees for a 4 years duration so in the short term I intend to stay in the same company. After that, I would be interested to work abroad depending on the opportunities!



Aviation Safety : Aircraft Airworthiness

(ISAE-SUPAERO / ENAC / ECOLE DE L'AIR)

■ Objectives

Airworthiness plays a pivotal role in aviation safety and development, guaranteeing that design, manufacture, operation and maintenance of aircraft, engines and systems are suitable for safe flight. It is supported by an overall process for which a solid regulatory and technical knowledge is necessary.

The Advanced Mastere ASAA provides the required high-level skills and competencies in the fields of airworthiness regulations, aircraft and systems design and certification, continued airworthiness and operation. It has been designed to meet industry and authorities demand for airworthiness or certification engineers specific profiles.

To further improve safety within a growing aviation industry, and to efficiently and safely introduce in the skies new technologies and innovative aircraft architectures, this program delivers relevant methodologies and keys to enhance certification approaches for civil and military aircraft.

■ Learning approach

First semester:

Academic session of courses from October to March.

A well-structured progressive approach through lectures, projects, tutorials, visits of aeronautical industries, up to an Integrated Team Project to apply learnings on job-based situations.

Second semester:

Students have to conduct a professional thesis or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from ISAE-SUPAERO or ENAC or Ecole de l'Air. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

■ Organization

Head of Program ISAE-SUPAERO

- Prof. Joël JEZEGOU
joel.jezegou@isae-supaero.fr

Head of Program ENAC

- Pascale PUEL
pascale.puel-ext@enac.fr

Head of Program École de l'Air

- Florent BASTIEN
florent.bastien@ecole-air.fr

Course duration

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

Course start date

End of september

Location

ISAE-SUPAERO (Toulouse), Ecole Nationale de l'Aviation Civile (ENAC) (Toulouse), Ecole de l'Air (Salon-de-Provence)

Teaching language

English

■ Syllabus

Part 1: Certification Procedures - 78 h

- Certification Procedures
- Change to Type Certificate

Part 2 - Transverse Certification Items - 88 h

- Safety and Design Requirements for Systems
- Environmental Certification
- Human Factors
- Normal-Category Aircraft and

Part 3: Aircraft Certification - 183 h

- Flight
- Structure
- Avionics
- General Systems & Cabin
- Normal-Category Aircraft and Unconventional Products Certification

Part 4: Integrated Team Project (ITP) - 62 h

- Certification Plan ITP
- Safety and Regulatory Intelligence ITP

Part 5: Continuing Airworthiness and Operations - 43 h

- In-Service Occurrence Management
- Continuing Airworthiness
- Operations & Operational Certification

Part 6: Airworthiness of State Aircraft - 30 h

- Airworthiness of State Aircraft

■ Career opportunities

The program fully matches job market expectations for certification or airworthiness engineer positions. It offers a wide range of job opportunities within civil or military aircraft – engines – systems manufacturers, suppliers, airlines and aviation safety authorities.

Companies recruiting our students

Aeroconseil, Airbus, Air France, ATR Aircraft, Dassault Aviation, DGAC, Assystem technologies, AKKA Technologies, ALTEN, SII Group, National Aviation Authorities, EASA, Transport Canada, French Ministry of Defence, Brazilian Air Force, Flying Whales, COMAC (China), AVIC (China), Lilium GmbH (Germany), AMAC Aerospace (Switzerland), Embraer (Brazil), Hal (India), Blue Bird Aviation (Kenya), Pipistrel (Slovenia)



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Testimonies

Why did you choose ISAE-SUPAERO and apply for this MS?

SOPHIE LE QUELLEC,
Advanced Master ASAA PROMO 2018
Certification Team Leader, SII

I am a General Engineer, having graduated 20 years ago. Throughout my career, I have had the opportunity to work in high standards industries in Naval Defense and Space. Reaching mid-career and

being strongly attracted by aeronautical matters, I decided to be trained in the best aeronautical schools, ENAC and ISAE-SUPAERO in order to get a reputable diploma allowing me to apply to interesting job positions in aeronautics.

What were your objectives?

My first objective was to get a comprehensive understanding of aircraft design and the link with Aviation regulations. I also wanted to work in an

environment where I can mix multidisciplinary technical aspects, regulations, team working, negotiation and contribute to aviation safety.

According to your experience, what are the strong assets of this master?

The lectures were at a very high level of knowledge, quite intensive and very comprehensive, mostly given by experts coming from aircraft industries. I highly

appreciated the multicultural environment with classmates from all over the world.

What are your career plans?

Thanks to this master, I was able to get immediately a job as a Certification Team Leader, working on avionics major modifications on AIRBUS aircraft. My mid-term goal is to join an aircraft manufacturer and to be part

of the team who will get the certification of a new or modified aircraft.





AERONAUTICS

MS HADA

Helicopter, Aircraft and Drone Architecture



WITH AIRBUS HELICOPTERS

AIRBUS

Objectives

The Advanced Master's course in "Helicopter, Aircraft and Drone Architecture (HADA)" is jointly designed and developed by ISAE-SUPAERO and Airbus Helicopters. This 2-semester program provides a high-level of engineering and technical skills for careers in the aircraft, helicopter and drone industries.

This new program provides the basic skills required for aeronautical engineers (architecture, certification and structures) and specific skills to identify problems, come up with alternatives, choose and implement solutions to aircraft, helicopter and drone issues. Drones will be developed as they represent a growing part of the activity in the future aerospace sector. Industrial, regulatory and logistical challenges will therefore emerge. As a result, future aerospace engineers interested in being part of these innovative projects will need to call on and develop new skills and expand their current knowledge. This program offers full training from electronic systems to structures and taking in aerodynamics, flight dynamics and certification while encouraging and taking into account the diversity in the profiles of selected applicants.

This ADVANCED MASTER course takes into account cutting edge techniques required for future aircraft and rotorcraft systems. The present program is a high level Master course recognized by industry and adapted to current and future aeronautical engineering.

Learning approach

First semester:

Academic session from September to March, provided by the tenured professors at ISAE-SUPAERO and aeronautical industry experts with their updated 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 or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

Organization

Head of program

- Prof. Jean-Marc MOSCHETTA
jean-marc.moschetta@isae-supaeo.fr

Course duration

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

Course start date

September

Location

ISAE-SUPAERO from September to January, Airbus Helicopters site (Marignane) from February to March

Teaching language

English

Syllabus

Part 1: Aircraft structures, Aircraft architecture and certification - 120 h

Aircraft architecture - Certification - Computer Aided Design Aircraft Structures

Part 2: Fixed-wing Aircraft - 130 h

Engines and powerplant - Aircraft general -systems - Avionics systems - Flight dynamics

Part 3: Helicopter - 125 h

Helicopter: Aerodynamics, performance and flight qualities Helicopter dynamics - Helicopter materials and construction technics - Helicopter Systems: prototyping, tests and production quality

Part 4: Drone - 120 h

Drone systems: design and mission - Payload and sensors for UAVs - Drone safety and airworthiness - Drone guidance and navigation - Neutral network for control and diagnostics

Career opportunities

This program prepares participants for a wide range of professional opportunities from design, certification and operation of civil and military aircraft, drones and helicopters in France and overseas.

Companies recruiting our students

Altran, Airbus Group, Airbus Helicopters, Safran-Turbomeca, Thales, Dassault Aviation, Gendarmerie Nationale, Helibras (Brazil), AVIC (China) HAL (India), Pawan Hans Helicopters Ltd (India), Airbus Helicopters Mexico, Algerian Air Force, Brazilian Navy, Chile Air Force, Indian Air Force, Pakistan Army, Tunisian Air Force, Sauber f1 team...



X3-CREDIT Airbus Helicopters Anthony PECCHI



Testimonies

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

STELLE CADARS
Cohort 2019

During my studying in engineering school in apprenticeship, I have worked in Airbus Helicopters. After this experience I was determined to work in a helicopters company as an engineer but I didn't have any technical background. ISAE is the most famous school to learn about aeronautic, so it was the best solution to fill my wish.

I have chosen the Master HADA because it's the only one with helicopters lessons and it's a general one without any specialization so it has allowed me to have a good perception of different kind of jobs.

JULIEN VOIRIN
Cohort 2019

Coming from a non-specialized engineering school, INSA Rouen Normandie, and being really fascinated by flying systems, for me it was obvious to apply for ISAE Supaero which is one of the best engineering school in the aeronautical field, in France. Therefore, I was sure that this school would open many doors for my future career.

MS HADA perfectly met my expectations since my goal was to discover and learn all about flying systems. My second interest was to have a first contact with an innovative and new system : Drones.

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

The strongest assets of this master are: the quality of the lectures taught by specialist engineers from several companies. They are passionate about their jobs and they don't hesitate to take time to transmit us their experiences. It gathers all fields regarding aircraft, drone and helicopters (regulation, design, dynamics, avionics, systems, performance etc). And then, there are lot of visits planned in severals companies in Toulouse and in AH in Marignane.

The strong assets of MS HADA master are numerous: the proximity with industries (experience at Airbus Helicopters), with teachers/ engineers who were really easy to interact and always there to dedicate their time in moments of need. The fact we obtain an overview of all the systems in three different categories (planes, helicopters, drones), that companies value this program, giving us a chance to find good internships and opening the gates for the best jobs out there. And last, but not least, the fact that this master is entirely taught in english.

What are your career plans ?

I have been lucky to perform my internship in Airbus Toulouse in the Flight Test department. My plans after graduation is to join AHD for two reasons: I always wanted to work as a flight test engineer for helicopters, and thanks to this Master I have discovered the drone area, so I hope I will work as well on the taxi drone project in Donauwörth !

I plan to stay to stay in the aeronautical domain. I want to continue working in the design office with dimensioning of aeronautical structures, as I'm doing during my internship at Dassault Aviation. My initial plan is to gain a strong technical luggage in mechanics and, throughout the years, be able to evolve in my career inside Dassault Aviation.





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AERONAUTICS

Experimental Flight Test Engineering

(ISAE-SUPAERO / EPNER - THE FRENCH FLIGHT TEST SCHOOL)

■ Objectives

Under the aegis of the DGA, ISAE-SUPAERO 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-SUPAERO 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-SUPAERO besides the EPNER qualification.

The Experimental Flight Test Engineering Master is a 12-month course organized by ISAE-SUPAERO 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.

The course is split into two periods:

- 2-month courses in basis sciences and French aeronautical communication skills organized at ISAE-SUPAERO campus, in Toulouse,
- 10-month Experimental Flight Test courses, for fixed wing or rotary wing for pilots and engineers, given at EPNER in Istres.

■ Organization

Head of program

- Prof. Éric POQUILLON
eric.poquillon@isae-supaero.fr

Course duration

One year full time : 2 months of preparation courses and 10 months of technical courses

Course start date

June

Location

ISAE-SUPAERO and EPNER-Istres

Teaching language

French

■ Learning approach

Academic session consists of around 450h of ground and simulators courses, provided by ISAE-SUPAERO and EPNER's permanent professors and experts from industry bringing current knowledge and experience.

And around 110 flight hours on more than 20 airplanes for fixed-wing stream and 15 helicopters for the rotary-wing stream.

All along the program, students conduct professional theses, assessment of aircrafts or embedded-systems. These theses are concluded by the preparation of a report and an oral dissertation.



■ Syllabus

ISAE-SUPAERO part

	International attendees	French attendees
Mathematics	✓	✓
Flight mechanics	✓	✓
Automatic control and aircraft control	✓	✓
Visits of companies	✓	✓
Advanced aeronautical French	✓	
Aeronautical phraseology	✓	✓
Aircraft preliminary design		✓
Human factors		✓

■ 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.

■ Admission procedure

Selection and admission by the French Ministry of Armed Forces, contact us for more detailed information.



Testimonies

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

RICE WILLIAMS
Cohort 2019

💡 This course was the only option and a great way to practice the French language in the sector of aviation while refreshing math and science I hadn't seen in 10 years. I was hoping to get a head start for EPNER.

According to your experience, what are the strong assets of the master?

They're aren't many language programs that have an aviation and science emphasis so this is a great way to refresh math, science, and learn the french words that go along with studying at EPNER.

What are your career plans?

I hope to become a test pilot for the United States of America.

EPNER part

Systems engineering introduction – Safety of flight tests

Basics of aerospace technics

Documentation, procedures applied in flight tests programs – Performances tests

Propulsion tests

Handling tests

Embedded-systems tests

Specific test (fixed-wind): flight envelop extension

Certification, acceptance, assessment, etc. – Specific test (fixed-wind): flight envelop extension - Specific flights, synthesis activities – Professional thesis

Companies recruiting our students

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





MS PGDip

Systemes de Propulsion Aérospatiale



■ 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 mécanique des fluides et sachant adopter une approche systèmes complexes.

Acquérir des connaissances approfondies en aérothermique et technologie des systèmes propulsifs (turboréacteurs, turbines à gaz, statoréacteurs et moteurs fusées).

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

■ Méthode pédagogique

Premier semestre :

Environ 450 heures d'enseignement dispensées de septembre à avril dans les locaux de l'ISAE-SUPAERO par les professeurs permanents et par des experts et professionnels apportant les dernières connaissances de l'industrie dont : cours magistraux, bureaux d'études, travaux pratiques, visites de sites industriels, travail en équipe.

Second semestre :

Les étudiants doivent réaliser une thèse professionnelle en entreprise ou dans un laboratoire, en France ou à l'étranger, supervisée par un tuteur de l'ISAE-SUPAERO et de la structure qui l'accueille. La thèse se finalise par la rédaction d'un rapport et la soutenance d'un oral devant jury.

■ Programme d'enseignement

Bloc 1 : Conception et opérations des avions - 84 h

Les grands enjeux aéronautiques - Etat de l'art de la propulsion aéronautique - Mission et Environnement des avions - Conduite du vol et facteurs humains - Enquêtes accidents et réglementation - Conception moteur: De la mission à la spécification (civil et militaire) - Performances et cycles (on- et off-design) - Méthodologies de design et d'expérimentation - Intégration à l'avion (contraintes et tandem avion/moteur, focus nacelle et systèmes annexes) - Approche multidisciplinaire - Avants projets et innovations incrémentales et en rupture.

Bloc 2 : Dynamique des fluides - 280 h

Turbulence, instabilité et transition - Computational Fluid Dynamics - Dynamique des fluides avancée (compressible et instationnaire) - Aéroacoustique- Aéroélasticité - Propulsion chimique et électrique - Écoulements diphasiques et combustion - Aérodynamique des turbomachines - Étude de cas en conception (d'une chambre de combustion ou d'un étage de turbomachine).

Bloc 3 : Projet ingénierie entreprise - 98 h

Intégrer toutes les dimensions d'un projet : composante technique, gestion de projet et gestion d'équipe.

■ Organisation de la formation

Chef de programme

- Prof. Guillaume DUFOUR
guillaume.dufour@isae-supaero.fr

Durée

Un an à temps plein : 6 mois de cours théoriques et 6 mois de thèse professionnelle ou mission en entreprise.

Rentrée

Fin août

Lieu

ISAE-SUPAERO

■ Perspectives professionnelles

La plupart des ingénieurs issus du MASTÈRE SPÉCIALISÉ® occupent des postes de cadres supérieurs chez les motoristes ou avionneurs du secteur aéronautique et spatial, au sein de SSII ou encore dans le domaine de l'énergétique générale auprès d'entreprises publiques et privées.

La formation peut aussi permettre la poursuite en thèse doctorale.

Les entreprises qui recrutent nos étudiants

AQYLON, ALTRAN, DGA, SAFRAN AIRCRAFT ENGINE, SAFRAN ENGINEERING SERVICES, AIRBUS GROUP, DAHER, ...





Testimonies

Pourquoi avez-vous choisi l'ISAE-SUPAERO et postulé à ce Mastère Spécialisé®? Quels étaient vos objectifs ?

JEANNE FÉLIX FAURE

Advanced Master PROMO 2017
Ingénieur aérodynamique Safran Aircraft Engines

Après mon école d'ingénieur (ENSEIRB-MATMECA de Bordeaux), j'ai réalisé que les postes d'ingénieurs auxquels j'aspirais me seraient accessibles uniquement si je complétais ma formation de façon pertinente. J'avais un attrait particulier pour les postes d'aérodynamicienne dans l'aviation.

Il me fallait donc acquérir des connaissances techniques et une maîtrise pratique, sur des problématiques pointues au cœur de l'aérodynamique des avions.

L'orientation vers les turbomachines est devenue une évidence lors de mes recherches d'emploi. Ce monde est un microcosme de phénomènes extrêmement riches pour un ingénieur en mécanique des fluides.

Selon votre expérience, quels sont les atouts majeurs de cette formation ?

Le premier atout le plus évident du master est qu'il regroupe un panel d'intervenants et de professeurs hautement qualifiés et travaillant au cœur de problématiques actuelles du monde de l'aviation et des turbomachines. Cela change fondamentalement la dynamique d'apprentissage et la pertinence des interventions, mêmes les plus brèves.

La deuxième grande qualité de ce master est l'ensemble de projets prévus dans le parcours. Personnellement, ils m'ont permis de sortir avec un bagage technique que je pouvais directement appliquer dans le milieu professionnel. C'est très rare. Je suis arrivée en stage et je me suis tout de suite sentie à ma place. Pas de grand saut entre la formation et le monde professionnel, ça procure beaucoup de confiance en soi et ça se voit ! Les opportunités s'offrent à vous !

Quels sont vos projets de carrière ?

C'est ma deuxième année à Safran et j'ai actuellement deux casquettes : aérodynamicienne dans la conception moteur et ingénieur d'essai. Je mène les deux de front, en plus d'encadrer une intérimaire et une stagiaire.

Un projet moteur dure 15 ans et la montée en compétence peut paraître longue dans un grand groupe comme Safran. Pourtant, j'ai l'impression d'avoir déjà réalisé des projets vraiment divers à ça ne saurait s'arrêter.

Une fois que j'aurai l'expérience suffisante, piloter des projets en toute autonomie sera sûrement la prochaine étape. Une entreprise comme Safran offre la possibilité de travailler sur l'ensemble du moteur au cours d'une carrière, mais aussi de passer de la production, à la conception, à la vente : les portes sont ouvertes !





SPACE

MS SPAPS

Space Applications and Services

WITH AIRBUS DEFENCE & SPACE

AIRBUS



© CNES/ill./DUCROS David, 2018



■ Objectives

The first objective of this program is to give students a broad understanding of space systems and their environment, constraints and capacities in the fields of earth observation, communications and navigation.

The second objective of the program is to help students, using real-life examples and experimental work, to grasp the value of space systems for the creation of space applications and services. Students will propose and design tools and solutions in areas such as the environment, agriculture, transport or urban planning. They will be able to specify a complete telecommunications system according to user needs: Internet access, Internet of Things, fixed or mobile terminals ...

Students will be able to both better understand the performance of space systems and identify user needs, as well as develop new services and applications. The know-how in the digital domain have a central place in the training with topics like big data, cloud computing, digital communications, software radio.

■ Organization

Head of program

- Prof. José RADZIK
jose.radzik@isae-supaero.fr

Course duration

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

Course start date

End of September

Location

ISAE-SUPAERO Toulouse

Teaching language

English

■ Syllabus

Part 1: Space systems - 43 h

Space systems introduction

Part 2: Digital techniques - 59 h

Big data and cloud - Digital communication and networking basics

Part 3: Earth observation - 100 h

Remote sensing and sensors - Image processing and data analysis - Earth observation applications and services

Part 4: Navigation and positioning - 22 h

Navigation and positioning

Part 5: Space Communications - 111 h

Telecommunications and networks - Broadband satellite communication systems - Satellite broadcasting - Telecommunication satellites for mobiles - Satellite communication business

Part 6: Space economics , regulations & services - 46 h

Space economics and regulations - Services and integrated applications

Part 7: Tutored project - 80h

■ Learning approach

First semester: 6 months of courses delivered in Toulouse, mainly at ISAE-SUPAERO

Second semester: mission to be completed in a laboratory, an SME, in large companies.

Company internship, professional thesis:

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

Overseen by an academic advisor and in-company tutor, the project entails the acquisition and development of knowledge and skills within a professional framework.

The subject, which must be approved by the academic advisor and the Director of the Advanced Masters programs, must:

- Give the student the opportunity to prepare for professional activities targeted by the program,
- Be a genuine issue of concern to experts working in the field.
- Must be related to the needs of companies in activity sectors covered by the program.

Students who have already acquired professional experience prior to the program, may complete their project in a research center or laboratory.

■ Career opportunities

This Advanced Master degree offers career opportunities in a wide range of fields:

Jobs related to cross disciplinary use of space data (observation of the earth and its atmosphere, telecommunications, data positioning, data from scientific missions and exploration) in complex information systems,

Consulting jobs to identify and define requirements, and implement application solutions using space data,

New jobs related to new space challenges.

The Advanced Master «Space Applications and Services» guarantees a high level of expertise required for today's and tomorrow's international space-related jobs.

Program graduates go on to work as Project Leaders, Business Engineers, Business Development Managers, Consulting Managers, Research Engineers, Expert in Space Applications.

Companies recruiting our students

Thales Alenia Space, Airbus, CNES, SES ASTRA, AKKA Technologies





Testimonies

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

JULIE AUTULY
Graduated in 2018
Digital Transformation Office Oceania - Airbus

“ I choose ISAE because it is a well-known engineering school around the world and the MS SPAPS offered both a general space education and an openness to the world and its current challenges, through space applications.

ROMAIN BOULAIS SINOU
Cohort 2019

“ I decided to apply for the SPace APplications and Services Advanced Master – SPAPS, because of its tight links with companies (and mainly with Airbus). Moreover, in a reconversion context, **my main objectives were to integrate a training within which practice was prevailing and which would increase my employability in the space field.**

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

The strong assets are its close connexion to industry, the teaching quality and the enthusiasm its subject drives.

The strong assets of this training are not only its tight links with companies, as mentioned above, but also the diversity of modules offered: remote sensing, signal treatment, image processing, machine learning, telecommunications and broadcasting. I have been provided with a wide knowledge being confronted with main space applications issues. This was a unique opportunity to use these new skills in the appropriate context.

Which are your career plans ?

I will be finishing my one-year contract at ESA by the end of October. Nothing is settled yet, but I might go on with a VIE, still in the aerospace sector.

I plan to become an IMINT (IMagery INTelligence) or GEOINT (GEOspatial INTelligence) engineer.





Space Systems Engineering



OPTIONAL PATHWAY «SPACE EXPLORATION»



■ Objectives

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

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

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

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

■ Learning approach

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

This first semester includes:

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

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

■ Organization

Head of program

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

Course duration

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

Course start date

September

Location

ISAE-SUPAERO

Teaching language

English



SEEDS

Space Exploration Development Systems

The SEEDS (Space Exploration Development Systems) international placement is an optional extra project. The student will work in multidisciplinary teams on space exploration research projects, designed in collaboration with advisors from the space industry.

ISAE-SUPAERO's partners in SEEDS are the Politecnico di Torino in Italy and the University of Leicester in UK. All three institutions have strong links with the space industry, a heritage of space research and exploration, and high-level expertise in the delivery of teaching. The student will spend two months at each institution and will be required to cover basic travel and subsistence costs. The course is taught in English at all three sites.

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



Testimonies

Syllabus

Part 1: Missions and Systems 155 h

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

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

Part 2: Space Programs 160 h

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

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

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

Career opportunities

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

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

Companies recruiting our students

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

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

PAULINE DELANDE
Graduated in 2019
OPERATIONS ENGINEER - CNES

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

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

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

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

What are your career plans ?

Now that my internship at CNES (French Space Agency) is over, I would love to work as a System Engineer on space projects in relation with Advanced Concepts, Space Exploration or Human Spaceflight missions. My dream is to work for a Space Agency and/or launch my own company one day.





© Dassault Aviation - E. de Malglaive

■ Objectives

Systems Engineering is an interdisciplinary discipline of engineering combining all sciences and technologies into integrated team 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 professional course of study, designed in partnership with the industry. This program aims at providing worldwide industry with skilled professionals in Systems Engineering able to specify, design, deploy and maintain competitive and complex systems, fit to purpose, in various industrial sectors: space, aeronautics, air traffic control, land transport systems, maritime transport, health industry, energy, communication systems, etc.

■ Organization

Head of program

- Prof. Jean-Charles CHAUDEMAR
jean-charles.chaudemar@isae-superaero.fr

Course duration

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

Course start date

September

Location

ISAE-SUPAERO

Teaching language

English

■ Learning approach

First semester: academic session of around 500 h, provided by ISAE-SUPAERO'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 or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

INCOSE

INCOSE certification in ISAE-SUPAERO

At the end of the first semester, all SEN students are encouraged to participate in a one-month complementary program in preparation for ASEP* 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.



■ Syllabus

Teaching part (First semester)

Part 1: Outlines, Topics and Fundamentals - 41h

Systems Engineering Introduction, Introduction to Space Systems, Project Management Introduction, Introduction to verification & validation,

Part 2: Roles : Processes and Specialities - 167 h

Requirements engineering, Systems modelling and Analysis, Systems design and architecture, Integrated Logistic Support, Project Technical Management

Part 3: Deployment, Methods & Tools - 165 h

Systems Engineering Data Technical Management, «Optimise, decide, justify, & Validate», Systems Dependability, Systems performance Assessment & Management

Part 4: Industrial Applications, Study cases - 97 h

- Airbus : Systems Engineering & Certification of the A350
- Dassault : Systems Engineering at Dassault Aviation
- DGA : System of systems (systems engineering methods and tools, introduction to space system)

Part 5: Integrated Team Project (ITP) - 45h

■ Career opportunities

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.

Systems Engineering jobs are characterized by many disciplines:

- multidisciplinary - mechanics, electronics, information technology, etc,
- strong interface with project management,
- permanent concerns all along the life cycle of a system. Need of Systems Architects is increasing for both industries developing, producing and maintaining large complex systems (aircraft, ships, military and defence systems, cars, etc.) and other industries developing and producing smaller high technology products (cameras, mobile phones, printers, computers, etc.). This Master program offers students great opportunity to join Engineering Team Systems within industries in different economic sectors.

Companies recruiting our students

Safran, CAST, Luxembourg Space Telecommunication, Dassault Aviation, Airbus Group and its subsidiaries, EGIS Avia, Arianespace, ALTEN, AKKA, Seditec, Safran Transmission Systems, Thales Alenia Space, INPE (Brazil), AVIC (China), COMAC (China), Thales China, Geo-Informatics and Space Technology Development Agency (Thailand).



Testimonies

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

GEOFFROY LE COURTOIS DU MANOIR
Cohort 2019

I graduated in 2007 and have been part of Thales since 2015. Before starting the training program, I was working as a systems engineer for airborne equipments. My activities were related with maintenance and customer support services. I was in charge of developing and validating solutions in accordance with the stakeholders' needs. I liked my job very much because of the autonomy I had, driving experts and suppliers from a set of needs towards one solution. However, as I am passionate about aerospace, and since my job was focused on ground support equipments, such as transportation cases, hand maintenance tools and test

benches, I felt a discrepancy between my work and the field I like. Also, despite having learnt Systems engineering online with MOOCs and by the practice, I pinpointed the need for a real and in-depth training :

*to get a big picture of the activities involved in the V-cycle,

*to grab the appropriate methods and tools,

*and to understand the challenges to come.

I chose to apply to the Systems Engineering Advanced Masters program at ISAE-Supaéro to further excel in my job, to get hands on aerospace systems engineering projects and to get the chance to go working abroad.

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

Teachers are mostly coming from industry and are working on aerospace systems engineering projects. **The messages delivered are consistent with the skills, methods and tools the aerospace industry is currently looking for.** Some researchers also take part in the teaching team. Being passionate people, they bring more theoretical knowledge with expertise on specific matters. They open doors to future interesting challenges.

*ISAE-SUPAERO is the reference engineering degree school in France and Europe about aerospace training. ISAE is also very well known in companies and provides strong assets when negotiating a job offer.

*ISAE-SUPAERO owns an alumni network with 25K former engineers, settled in most well-known companies, on the edge leading technology. Teachers and professional classmates are also a great way to expand one's network and plan a professional career.

What are your career plans ?

I would be happy to work in the USA on space exploration projects, developing solutions enabling human spaceflight.





SYSTEMS

MSEMS

Embedded Systems

(ISAE-SUPAERO / INP-ENSEEIH)

© Dassault Aviation - C. Cosmao



■ Objectives

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

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

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

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

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

■ Organization

Head of program

- Prof. Janette CARDOSO
Janette.cardoso@isae-supaero.fr
- Prof. Jean-Luc SCHARBARG
jean-luc.scharbarg@enseeiht.fr

Course duration

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

Course start date

September

Location

ISAE-SUPAERO and INP-ENSEEIH

Teaching language

English

■ Learning approach

First semester:

An academic session of 546 hours of teaching, provided by the tenured professors at ISAE-SUPAERO and INP-ENSEEIH and industry experts with their up to the minute knowledge and experience. Teaching activities include lectures, tutorials, lab work and a one-month multidisciplinary project aimed at integrating the academic session into an industrial case study.

Second semester:

Students have to conduct a professional thesis or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from INP-ENSEEIH or from ISAE-SUPAERO. The thesis is concluded by the preparation of a report and an oral dissertation in front of a jury.

■ Syllabus

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

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

Part 1: Embedded Systems - Core - 180 h

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

Part 2: Energy - 63 h

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

Part 3: Networks - 67 h

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

Part 4: Embedded Systems Design - 160 h

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

Part 5: Embedded Systems Applications - 50 h

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



■ Career opportunities

Embedded Systems offer challenging career opportunities. The course is designed for both young graduates and experienced engineers seeking a postgraduate program to enhance their technical and managerial skills. The skills acquired in this Master's course can be applied to any industrial sector in which embedded systems are used: aeronautics, space, road, rail and sea, energy industry, communication systems, etc.

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

Companies recruiting our students

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

INCOSE

INCOSE certification in ISAE-SUPAERO

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

*Associate Systems Engineering Professional



Testimonies

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

ISLAM ANOUAR

India, Embedded systems engineering, Graduated in 2017

“ I have had a passion for aerospace subjects for a very long time. After graduating from the École Centrale d'Electronique in Paris, I decided to round out my training with a sector of expertise at ISAE-SUPAERO. The embedded systems used in the aerospace field are complicated and complex, and to be able to envisage my engineering career in this field with peace of mind, I needed high-level training.

HARIPRASATH SHANMUGASUNDARAM

India, Cockpit Design Engineer at ALTRAN, Graduated in 2016

“ I worked for 5 years in an aerospace industry, I wanted to leap forward towards international career. I choose ISAE-SUPAERO, because of its reputation, position among the top institutions of France and its excellence in aeronautics and space domain. Moreover, I considered the Embedded Systems Advanced Master would help add competitive skills to my Electronics Engineer background.

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

The close ties that this institution has forged with research centers and contracting companies in the aerospace sector give us opportunities to talk to many key individuals. These discussions have been rewarding for me as they have encouraged me to take an innovative approach to designing aerospace systems. I was lucky to have found a job before completing my studies at ISAE-SUPAERO. Today, I work as an embedded systems engineer at Thales. My training has enabled me to take on my first job with peace of mind and to quickly become operational.

The course provided me end-end competencies to build embedded system. The courses are taught by experts from both industries (Airbus, Thales, etc) and research establishments (ONERA, etc). Indeed, it was interesting to learn from their experiences and contributions. The innovative assignments and application oriented lab sessions provided opportunities



Artificial Intelligence & Business Transformation

WITH IRT SAINT-EXUPÉRY

■ Objectives

A manager in charge of the transformations needed to monetize data, notably using AI, is commonly known as a "Data Evangelist". This Advanced Master targets a new profession through part-time training for high-potential technical specialists and managers (from scientific disciplines) with several years of work experience. Upon completion, students will be equipped with a solid culture in AI (along with the related big data) and will be able to work on the operational, intermediate or strategic level to manage projects where these new technologies play a role and teams in related new professions, such as big data engineers, data analysts, data miners and data scientists.

■ Learning Approach

The program comprises 3 blocks:

- a **168-hours teaching block** for upgrading technical skills in AI, covering bulk data management and machine learning from a theoretical point of view (understanding solutions and large families of algorithms) and from a practical point of view (manipulations on simple examples, assessment of complexity and limits).

- a **119-hour teaching block** on business transformation by and for AI, covering the current impact of AI on various sectors, the implementation of a data value strategy and managing change in an AI context.

- a **72-hour block** of practical work to obtain high-level skills in business transformation through AI, with long-term examples covering all aspects of the training, whether strategic and tactical aspects from a business point of view, or a technical approach to move from data acquisition to a valuable product..

Five principles will be followed in all courses to adapt them to the students in training:

- Connections between the techniques and business;
- Developing concrete use cases;
- Discovering a variety of fields of application;
- Interactive teaching;
- Knowledge acquired is applied to a project on a common theme.

■ Organization

Head of the program

- Prof. Carlos AGUILAR-MELCHOR
carlos.aguilarmelchor@isae-supaero.fr

Course duration

One week a month for 10 months

Course start date

Please contact us

Location

ISAE-SUPAERO (Toulouse) for 90%
and HEC Montréal (Québec) for 10%

Teaching language

English

This Advanced Master is organized in a partnership with IRT Saint Exupéry. IRT Saint Exupéry is the product of a public/private partnership co-financed by companies in the aeronautics, space and automobile sectors and the French State through its Programme d'Investissement d'Avenir (PIA - Investment Program for the Future).

Since its creation in 2013, an increasing share of its research programs have been enriched with contributions from "modern" artificial intelligence, in other words based on statistical machine learning, for applications in on-board aerospace and automobile systems.

■ Syllabus

The associated program will comprise a core curriculum for all students, organized into 3 blocks:

Part 1: Artificial Intelligence Internals - 168 h

Data Integration and Exploration, Big Data Processing, Optimization Topics for AI, Machine Learning and Data Analytics, Sequential Decision Making in AI, AI certification, Robustness and Dependability.

Part 2: Business Aspects of Artificial Intelligence - 119 h

Introduction to Modern AI, The Business of Data, Data Value Creation, Change Management.

Part 3: Practical skills - 72 h

Hands-on practice

Professional Thesis:

Students will do personal work for a period of 4 to 6 months, leading to the individual defense of a professional thesis.

This thesis may be prepared at the student's company or during an internship, notably at IRT Saint Exupéry, for students who do not have an employer at the time of the course.

The subject of the professional thesis will be sought out and chosen by each student with support from ISAE-SUPAERO, validation by the Professor/Academic Advisor and approval by the Director of the Advanced Master programs.

■ Career prospects

This program is organized with support from such major corporations as AIRBUS, AIRBUS HELICOPTERS, APSYS, COLLINS AEROSPACE, CONTINENTAL, DASSAULT AVIATION, ESI Group, STELIA, THALES ALENIA SPACE and CERFACS.







Aerospace Project Management

(ISAE-SUPAERO / ÉCOLE DE L'AIR / ENAC)



■ Objectives

Aeronautical, Space and Defense business is, by nature, complex, innovative with high technical added value. Placed 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, Ecole de l'Air and ENAC gather their expertises to develop the Aerospace Project Management (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.

■ Learning approach

First semester: 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 experience, with a combination of formal presentations, in-class exercises and study cases. The objectives of this practical approach are to provide students with current techniques and tools in project management taking into account industrials, economical or legal specificities of the Aerospace business.

The teaching staff is composed of professors, lecturers and consultants from ISAE-SUPAERO and Ecole 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, most of the time heads of aerospace programs, will illustrate parts of the courses.

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

■ Organization

Head of Program ISAE-SUPAERO

- Prof Philippe GIRARD
philippe.girard@isae-supaero.fr

Head of Program Ecole de l'air

- Prof Pierre BARBAROUX
pierre.barbaroux@ecole-air.fr

Head of program ENAC

- Prof Nicolas PETEILH
nicolas.peteilh@enac.fr

Course duration

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

Course start date

End of September

Location

- ISAE-SUPAERO (Toulouse)
- ENAC (Toulouse)
- École de l'Air (5 weeks in Salon de Provence - October November)

Teaching language

English

■ Syllabus

The comprehensive training program is organized into four teaching parts:

Part 1: Overall overview of aerospace industry - 50 h

The first part provides the students with an in-depth overview of worldwide aeronautics and space industries enabling them to have an overall understanding of technologies, products, innovation and strategy stakes in the global civil and defence market.

Part 2: Methodology - 190 h

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.

Part 3: Economic and financial aspects - 150 h

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 costs during development or manufacturing phase.

Part 4: Knowledge management in multicultural team project - 60 h

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.

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.



■ 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 in

Companies recruiting our students:

AIRBUS, Air France, AVIC, Liebherr Aerospace, Reliance Defence, Scalian, Safran Electronics & Defense, Elron Consulting, Jet Aviation, RUAG Aerospace Structures....

PMI

PMI Certification

The APM program offers you to get PMI Certifications: CAPM or PMP. In an increasingly changing world, professional certification ensures that project managers to meet the demands of space projects through the globe. By offering an additional month of training, you will be specially prepared to CAPM or PMP exams. Volunteers will have opportunity to complete the APM diploma with a PMI certification well known and appreciated through the world and which open door to success. Teachers for preparation are certified themselves and experts of PMBOK reference.



Testimonies

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

PAVITHRA MANGHAIPATHY
Cohort 2019

At my masters program at Georgia Tech we had a presentation from ISAE-SUPAERO and even before that while I was researching Global Aerospace Programs I had come across ISAE several times. Having the chance to talk to my professors and also interact with the panel at the presentation solidified my decision to apply because I was looking for a global program. As for the APM Advanced Masters, I sat and thought about where I wanted to be in the Aerospace Industry, I had an American Degree which was very research focused but I wanted to gain a better understanding of the Global industry situation. In order to do so, the MS APM course at ISAE offered a package that was very broad and I felt as though I could benefit from the learning experience.

SEBASTIAN WIINBLAD-RASMUSSEN
Graduated in 2017
Project Manager - Airbus Helicopter

Having graduated with an Aeronautical Engineering degree from the University of Glasgow, I wanted to add a professionally orientated Management degree to my profile. As the leading Aerospace Engineering school in France, and located at the heart of European Aerospace industry in Toulouse, ISAE-SUPAERO was an obvious choice. The fact that this degree is coupled with training at ENAC and Ecole de l'air made this course even more attractive.

My objective was firstly to acquire insight into how large, multinational Aerospace projects are run and to get industry experience in this field. Secondly, it was my objective to use this course and the experience it would provide as a stepping stone into a technical Project Management position within the Aerospace industry.

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

I think the strongest asset of the Masters is that it covers a lot of topics. While that may seem a bit daunting, it really offers the chance to see the industry for what it is and appreciate it's vast diversity. The Aerospace Industry is very complex and is very unique in its own right, combine that with the turnover and rate of development, I think this master puts it all into perspective and helps you really plan out a path.

Firstly, the APM course offers access to a wide range of industry and Project Management consultant experts, providing insight into both the Aeronautical and Space sectors. These professionals also provide an understanding of what it takes to become a Project Manager and what key skills industry looks for in graduates and experienced project professionals alike. Furthermore, **the variety of modules provides a broad understanding of how the industry is structured and the interactions between key actors.**

Secondly, the variety of professional backgrounds and nationalities within the course itself serves as an important learning experience for the real-world challenges that multi-national Aerospace programs face today.

What are your career plans ?

Currently, I want to invest all my energy into understanding how I can contribute to design and innovation now that I have both a technical and non-technical basis and reach a balanced approach. Even in the long term, I want to focus on streamlining innovation to be more open, inclusive and efficient.

I am currently working as Project Manager within the Chief Engineering Department for the H145 program at Airbus Helicopters in Germany. In this role, I plan to take on increasingly complex and large-scale development projects or potentially to move to another Airbus division as the next challenge. It is my long term goal to continue to develop my technical Project Management skills and work towards a Head of Program or Chief Engineer position within the European Aerospace industry.



Management de Projets Innovants & Entrepreneuriat



■ Objectifs

Le but de ce Mastère Spécialisé® est de développer simultanément l'esprit d'innovation et l'esprit entrepreneur, tout en apprenant à manager des projets d'innovations technologiques, de « bout-en-bout » (de la génération d'idées à la mise sur le marché).

Ce programme s'inscrit dans la dynamique du développement de l'entrepreneuriat technologique dans lequel l'ISAE-SUPAERO est engagé, notamment avec la création d'un espace d'innovation (Innov'Space) et l'incubation de startups dans ses laboratoires.

Ces actions sont réalisées en relation étroite avec les grandes entreprises partenaires de l'école qui encouragent en parallèle le déploiement de nouvelles méthodes de management de leurs projets innovants dans un esprit d'intrapreneuriat. Il prépare aux métiers suivants :

Métiers	Fonctions clés
Entrepreneur (Startuper)	Aller de l'idée à l'industrialisation jusqu'à la mise sur le marché d'un produit technologique innovant.
Chef de Projets Innovants (Intrapreneur)	Conduire des projets d'innovations technologiques au sein d'entreprises ou d'organisations avec des méthodes agiles et des approches telles qu'elles sont appliquées dans une start-up.
Responsable du Développement Technologique et de l'Innovation (CTO en charge de l'innovation technique et du déploiement de technologies)	Valoriser l'usage des nouvelles technologies comme levier de croissance au sein d'une entreprise, d'une start-up ou d'une organisation.

Des entreprises très variées soutiennent et participent à ce Mastère Spécialisé®, partageant toute la conviction de l'importance du développement pour les ingénieurs et les managers comme pour les entrepreneurs d'un esprit résolument ouvert à l'Innovation. Cette diversité permettra aux étudiants de bénéficier du dynamisme et de l'expérience de plusieurs secteurs industriels favorisant ainsi le transfert de bonnes pratiques.

■ Méthode pédagogique

Le programme est constitué d'un tronc commun organisé en 4 blocs :

- Bloc 1 : faire émerger des projets innovants - 85 h
- Bloc 2 : formaliser et structurer ce type de projets (y compris les soft skills) - 115h
- Bloc 3 : concrétiser et entreprendre - 115 h
- Bloc 4 : enseignements dirigés pour accompagner le Fil Rouge (Projet Innovant Exploratoire) dans lequel tous les concepts vus en cours pourront s'intégrer et démontrer leurs plus-values - 36h

Les projets innovants exploratoires, qui se déroulent tout au long du 1er semestre, pourront être proposés par les étudiants eux-mêmes dès lors qu'ils seront porteurs d'un projet personnel, ou bien par l'ISAE-SUPAERO ou encore par des partenaires extérieurs.

Les étudiants seront invités à travailler en groupe dans cette expérience pédagogique. Tout au long de ce Fil Rouge, le corps enseignant de l'ISAE-SUPAERO offrira un accompagnement de type coaching pour suivre la maturation du projet et en particulier dans la phase de démonstration de sa faisabilité technique.

Les compétences des chercheurs de l'ISAE-SUPAERO et des acteurs de l'écosystème toulousain de l'innovation impliqués dans le programme, ainsi que les laboratoires de l'école seront accessibles aux groupes quand cela s'avérera nécessaire.

■ Organisation de la formation

Chef de programme

- Prof. Philippe GIRARD
philippe.girard@isae-supaero.fr

Durée

Une année à temps plein : 6 mois de cours théorique et 6 mois de thèse professionnelle ou mission en entreprise.

Rentrée

Octobre

Lieu

ISAE-SUPAERO (Toulouse)

Langue d'enseignement

Française mais certains cours peuvent être dispensés en langue anglaise, une bonne maîtrise de l'anglais est donc demandée.

Programme d'enseignement

Bloc 1 : faire émerger des projets innovants - des nouvelles technologies à l'idée créatrice

Portfolio des nouvelles technologies (39 heures) :

Drones et véhicules autonomes, Propulsion, Matériaux avancés, Fabrication additive, Neuroergonomie & Facteurs humains, Traitement des données spatiales, Technologie web nouvelle génération, Machine Learning & Artificial Intelligence, Big Data, datascience, opendata : applications aéronautiques, Systèmes embarqués, Réseaux de communication, Données et services sécurisés, Blockchain, Cloud computing et services.

Idéation & Exploration - 46 h

Design thinking, Créativité, Veille technologique et concurrentielle.

Bloc 2 : formaliser et structurer un projet innovant - de l'idée créatrice au projet

Management de projet - 49 h

Conduite et gestion de projet - Généralités, Conduite et gestion de projet - Déploiement opérationnel, Boite à outils du Chef de projet, Planification de projet, Méthodes Lean

« Soft Skills » - 66 h

Leadership, Communication et Image de soi, Négociation, Argumentation et Art de pitcher, Intelligence collective.

Bloc 3 : concrétiser et entreprendre (méthodes et outils) - du projet à l'entreprise - 115 h

Initiation à la logique comptable, Choix d'Investissement, Lean Startup, Étude de marché, Financement (levées de fond), Business model design, Propriété Intellectuelle, Aspects juridiques de la création et de la gestion d'entreprise, Marketing de l'innovation, Intrapreneuriat, Open Innovation, Méthodes Agiles et Scrum.

Bloc 4 : Coaching entrepreneurial, digital et technique - 36 h

Thèse professionnelle : d'une durée de quatre mois minimum, validée par une soutenance et un rapport, et effectuée dans le cadre d'une mission en entreprise (stage ou emploi) ou bien au sein de l'InnovSpace de l'ISAE-SUPAERO pour les porteurs de projet de création d'entreprise qui pourront ainsi bénéficier d'un support de l'école.

Cette formation se fait avec le soutien d'entreprises telles que : AIRBUS, DGA, ALTRAN, IoT VALLEY, Clinique Pasteur, CLS, COMAT, COVARIANS, NEOPTERA, PRAGMA Consult, des clubs d'entreprises innovantes : GALAXIE, GIPI, des start-ups : DIODON, DRONEAERO, FRISBEE, SPEERYT, U-SPACE.





Advanced Manufacturing Processes for Aeronautical Structures

(ISAE-SUPAERO/IMT MINES ALBI-CARMAUX)

■ 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. Estimations indicate that the annual increase of large commercial airplanes will induce a doubling of the number of aircrafts 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 complex parts and to take over, on their own, the qualification processes.

The Advanced Master course AMPAS, is designed by IMT 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 mechanical engineering, material science or equivalent and who would like to gain a major chance to be recruited by aeronautical industry.

■ Organization

Head of program

- Prof. Jean-José ORTEU
jean-jose.orteu@mines-albi.fr
- Prof. Anis HOR
anis.hor@isae-supaero.fr

Course duration

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

Course start date

September

Location

IMT Mines Albi - Carmaux, Campus Jarlard, (70% of courses)
ISAE-SUPAERO, Toulouse (30% of courses)

Teaching language

English

■ Learning approach

First semester:

Academic term of 520h and 45 credits, provided by permanent professors of IMT Mines Albi and ISAE-SUPAERO 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

- practical sessions
- industrial conferences
- industrial and workshop visits
- multidisciplinary project of 100h
- written report and oral presentation

Second semester:

Students have to conduct a professional thesis or make an internship in an industry or in a laboratory, in France or abroad, supervised by a tutor from the host organization and from IMT Mines Albi or ISAE-SUPAERO. The thesis is concluded by the preparation of a 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. aluminum, titanium and long fiber reinforced polymer composites) and their related forming routes in aeronautical industries. It is also devoted to gain knowledge in aircraft architecture, on aeronautical supply chain specificities, lean manufacturing, quality management and certification requested to be able to take over technical and organisational responsibilities in industry.

A team project (100 hours) will demonstrate the ability to address an aeronautical part processing following the theoretical and professional skills.

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 - 100 h

Physical phenomena description and modelling 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 - 106 h

Material behaviour and mechanical models - Cold and hot sheet forming processes - Surface treatments - Subtractive and additive manufacturing - Sheet forming simulation

Part 4: Industrial Organisation and management - 84 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 - 100 h

© AIRBUS S.A.S. 2012-Photo by E'M company / P. Masclet



■ Career opportunities

The 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 sector.

Career opportunities are numerous and growing over the world, in tier 1 and tier 2 subcontracting companies, as well as in aircraft manufacturers, aeronautical maintenance 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 EFW (Dresde), AIRBUS OPERATIONS SAS, ALTEN, AKKA Engineering Process, ARMINES, AVIC COMAC, Fabrica Argentina de Aviones, FORMTECH (Breme), SAFRAN Power Unit, SAFRAN Helicopter Engines, VENG SA (Argentina), P3 GROUP, SAFRAN Aircraft Engineering, SAFRAN Electronics and Defense, SAFRAN Nacelles, DUQUEINE Atlantique.



Testimonies

Why did you choose this Advanced Master?

KATERINA HRADSKA

France, Project leader, SAFRAN Helicopter Engines, industrial development, graduated in 2017

“ I am really passionate of aeronautics so I wanted to work in the aeronautical field and I chose the manufacturing sector because it is where I wanted to develop my knowledge.

ROGELIO CECENA

Aerospace simulation engineer in Expleo group
Graduated in 2016

“ I chose ISAE because of its international renown in aerospace engineering. I had a first experience back home with aircraft manufacturing and I got very interested on developing further my career in that area. I was highly motivated about going to study to the very heart of the European aeronautical industry. In addition, I always wanted to go live abroad, to work and experience a new culture.

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

I think the strength of this Advanced Master is that it covers the entire aspect of the manufacturing field. **Actually, there is a good balance between theory and practical use, thanks to the several transverse projects, and a constant support from the teachers within a very friendly environment.**

I think that the combination of theoretical and practical experience was very good. Hands-on experience becomes even more important when the subject is manufacturing and AMPAS gives the student plenty of opportunities to experience this through practical sessions, laboratories and lectures inside the main aeronautical factories of the region. **Many of these lectures were given by persons heavily involved with the industry and therefore were relevant and added value to the course.** I really enjoyed the final collaborative manufacturing project where you get to put in practice the majority of the subjects that we learned in the master.

What are your career plans ?

After this Advanced Master you can work in any sector of the aeronautical industry. For example working with suppliers and aircraft components, like carbon fibre materials and metal sheets or you can work with companies, which produce engines and other semi-final aircraft components, such as Safran. You can also work in the aircraft manufacturing industry, with companies like Airbus, Boeing, Embraer and others, or helicopter industry as well. So there is a large choice in this field.

After my internship I wanted to stay in Safran, in the engine area, so I tried to find some similar job opportunities. But before I could apply for something, they asked me if I wanted to pursue my career with them. So, I stayed in Safran Helicopter Engines working in the field, and now I have just been moved to the Design Office.

In France, I got the opportunity to fulfill my dreams of getting a Master's degree and also living and working in another country. In the mid-term, I would like to keep gaining experience and knowledge in engineering and at some point, go back to my After my internship I wanted to stay in Safran, in the engine area, so I tried to find some similar job opportunities. But before I could apply for something, they asked me if I wanted to pursue my career with them. So, I stayed in Safran Helicopter Engines working in the field, and now I have just been moved to the Design Office.



© Dassault Aviation - A. Daste



EXECUTIVE EDUCATION

POST-GRADUATE DIPLOMAS, CERTIFICATES OF ADVANCED STUDIES AND SHORT COURSES



ISAE-SUPAERO provides executive education programs for professionals who want to reinforce their skills in specific and technical domains such as :

- Aeronautics
- Digital
- Manufacturing
- Project Management
- Space
- Systems

Advanced Masters

please refer to p 16 to 47.

Post Graduate Diplomas

(1 semester – 45 ECTS) are dedicated to professionals who cannot take time off from their obligations for a one-year period. The following 8 Advanced Master courses are accessible in the form of 6-months post graduate diplomas:

- Aeronautical Engineering
- Aeronautical Maintenance & Support – Engineering & Management
- Aeronautical & Space Structures
- Helicopter, Aircraft and Drone Architecture
- Systems Engineering
- Space Systems Engineering
- Space applications and Services
- Management de projets Innovants et Entrepreneuriat





Certificates of Advanced Studies

(from 48h to 120h)

aim at developing new skills in a current or innovative area of expertise. They consist of a set of specific skills blocks of approximately 100 hours over 1 month.

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Short Courses

(from 8h to 47h)

are specialised training modules lasting a week as refresher or to explore a subject in greater depth. 16 Certificates of Advanced Studies and 52 Short Courses are offered in the following topics :



AERONAUTICS

- AEC of avionics & systems
- AEC of flight & structure
- Airworthiness & Human Factors for maintenance
- Helicopter Engineering
- Human Factors
- UAV Systems



DIGITAL

- Big Data
- Modern Artificial Intelligence
- Business Aspects of Artificial Intelligence



PROJECT MANAGEMENT

- Preparation for « PMI Certification »



SPACE

- Earth Observation
- Satellite telecommunication network
- Launchers



SYSTEMS ENGINEERING

- Fundamentals of systems engineering

These shorter training courses meet the time constraints of executive and managers.

For companies who wish to make « bespoke » training available to their engineers, tailored to their needs, **EUROSAE**, a subsidiary of ISAE-SUPAERO, will respond to their request.

Your contacts :

Thibault BREMAUD - Head of Executive Education & ECATA administrator

Natalia PERTHUIS - Executive Education Coordinator

Catherine DUVAL - Senior Admission Advisor

Info.exed@isae-supero.fr



Admission procedures

■ MASTER 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

■ POSTGRADUATE DIPLOMAS

Academic requirements

Same requirements as for Advanced Masters

■ CERTIFICATES OF ADVANCED STUDIES AND SHORT COURSES

Academic requirements

- English level equivalent to B2 - Common European Framework of Reference for Languages
- Technical and scientific background assessed case by case

LANGUAGE REQUIREMENTS FOR MASTERS IN ENGLISH

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

■ SELECTION AND ADMISSION

Selection and admission are made by an admission committee:

Possible interviews can be organized if necessary

Deadlines for application:

Applications open in october 2019 for intake in september 2020. Several admission committees scheduled from January to July, see schedule on our website

Application website :

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



Funding

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

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

LANGUAGE REQUIREMENTS FOR MASTERS IN FRENCH

Language qualification requested

Score B2-Common - European Framework of Reference for Languages

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



Your contacts

Philippe GALAUP,

Head of recruitment and Contractual Relations
Phone: +33 (5) 61 33 80 27

Mikael LE ROUX,

Senior Admission Advisor/Masters programs
Phone: +33 (5) 61 33 80 13

Catherine DUVAL,

Senior Admission Advisor/Aerospace sector
Phone: +33 (5) 61 33 80 37

Caroline ARMANGE

Senior Admission Advisor / Advanced Masters
Phone : + 33 (5) 61 33 80 25



Address

ISAE-SUPAERO
10, avenue E. Belin
BP 54032
31055 Toulouse CEDEX 4
France

Telephone

33 (0)5 61 33 80 13

Contact

info-masters@isae-sup aero.fr

Website

www.isae-sup aero.fr/en



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