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

2022
Contents

Welcome to ISAE-SUPAERO ........................................... 3
A world leader .............................................................. 4
Master of Science, Advanced Masters,
Executive Education .................................................... 6
Business relations ............................................................. 9
Research-driven learning .................................................. 11

MASTER OF SCIENCE - MSc
MSc in Aerospace Engineering ........................................ 13

ADVANCED MASTERS - MS  18

AERONAUTICS

/ TAS AERO .......................................................... 19
Aeronautical Engineering
Majors Aircraft Design / Flight Test Engineering

/ AES ............................................................ 22
Aeronautical & Space Structures

/ AMS EM .......................................................... 24
Aeronautical Maintenance & Support
Engineering & Management

/ ASAA ............................................................. 26
Aviation Safety: Aircraft Airworthiness
With ENAC / ECOLE DE L'AIR

/ HADA .............................................................. 28
Helicopter, Aircraft & Drone Architecture
With AIRBUS HELICOPTERS

/ IEVEX ............................................................ 30
Experimental Flight Test Engineering
With EPNER

/ SPA .............................................................. 32
Systèmes de Propulsion Aérospatiale

SPACE

/ SPAPS ......................................................... 34
Space Applications and Services
With AIRBUS DEFENCE & SPACE

/ TAS ASTRO .................................................. 36
Space Systems Engineering
& Space Exploration optional pathway

SYSTEMS

/ SEN ............................................................ 38
Systems Engineering

DIGITAL

/ EMS ............................................................. 40
Embedded Systems
With INP-ENSEEIHT

/ AIBT ............................................................ 42
Artificial Intelligence and Business Transformation
With IRT SAINT-EXUPERY / TBS

PROJECT MANAGEMENT

/ APM ............................................................. 44
Aerospace Project Management
With ECOLE DE L'AIR / ENAC

/ MGPIE ........................................................... 46
Management de Projets Innovants
et Entrepreneuriat

MANUFACTURING

/ AMPAS ........................................................... 48
Advanced Manufacturing Processes
for Aeronautical Structures
With IMT MINES ALBI-CARMAUX

EXECUTIVE EDUCATION PROGRAMS

Advanced Masters and
Post-Graduate Diplomas ........................................... 50

Certificates of Advanced Studies ..................................... 50

Short Courses .......................................................... 51

ADMISSION PROCEDURES  52

Your contacts ............................................................ 54
A pioneering spirit and the potential for innovation are part of aeronautical engineers’ DNA, especially those at ISAE-SUPAERO, encouraging us to go ever further. We are convinced that it is possible to transform the aerospace sector in the coming decades to make it a major component of a sustainable society. Space will play an ever greater role in monitoring the state of our planet, and air transport will be decarbonized in order to be able to continue meeting the long-distance transportation needs of future generations with no climate impact.

We have a duty to get to work on this immediately:
• To play our role in the aerospace sector by accepting our responsibility for preparing the future and foreseeing the necessary transformations;
• To meet the expectations of our current and future students and of our co-workers;
• To stay faithful to our history and our motto, “Excellence with Passion”, by training engineers who will be on the cutting edge of the transformations in the aerospace sector.

We have therefore made the commitment to mobilize our educational skills and our scientific expertise to contribute to building sustainable aeronautical and space components, notably to invent the decarbonized air transport of the future. This commitment is laid out in our renewed Sustainable Development strategy:
• Making the Institute a committed player in sustainability for mobility in aviation and in the space sector by training engineers and executives capable of meeting this challenge, and by orienting our research and innovation activities in this direction.
• Giving our future graduates the keys to contribute to the public debate on energy transition and a sustainable society, using a scientific approach and a mastery of complex systems.
• Pursuing the reduction of the carbon footprint left by our activities and our campus. Deploying this strategy will also be an opportunity to bring our community together for an ambitious collective project that is indispensable for the future. Join us and together let us take a lasting commitment to pursuing new horizons!

Olivier Lesbre
President of ISAE-SUPAERO
Didier Delorme
Dean of Masters programs
A WORLD LEADER IN AEROSPACE ENGINEERING HIGHER EDUCATION

We have already trained more than 24,100 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 HIGHER EDUCATION AND RESEARCH INSTITUTION

A WIDE RANGE OF DEGREE PROGRAMS IN AEROSPACE ENGINEERING

- 3 Masters Programs
- 15 Advanced Masters Programs
- 6 Doctoral Programs (PhD)
- 17 Certificates

1800 STUDENTS: 1500 Masters and 260 PhDs
30% OF FOREIGN STUDENTS
59 NATIONALITIES ARE PRESENT ON CAMPUS
AN ACTIVE INTERNATIONAL ALUMNI NETWORK

AN OUTSTANDING CAMPUS

- Teaching spaces, cutting-edge research equipment (see p. 10)
- 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

The "Bienvenue en France" accreditation

The "Bienvenue en France" label accredited by Campus France, distinguishes French higher education institutions, that have developed reception measures for international students at French higher education institutions, and represents a promotional and outreach tool for the institution. ISAE-SUPAERO is one of the few institutions receiving the ‘3 stars’ certification. The certification demonstrates the quality of the reception at our school.
A VIBRANT CITY
A LIVELY CAMPUS

TOULOUSE (FRANCE)
European Capital of Aeronautics and Space.
Most attractive city to study in 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

ISAE-SUPAERO

- 5mn Cycling to the metro
- 20mn Cycling to city-center
- 1h15 Paris by plane
- 1h30 Pyrénées mountains by car
- 1h30 Mediterranean Sea by car
- 2h Europeans cities by plane

London Roma Lisboa Amsterdam
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**

120 ECTS

The Master of Science is a two-year program undertaken after undergraduate studies, including Bachelor’s degrees or an equivalent. 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 Masters Programs**

75 ECTS

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.
Executive Education

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.

- **9 Post-Graduate Diplomas (PGDip)**
  1 semester courses - 45 ECTS

- **17 Certificates of Advanced Studies (CAS)**
  from 44 to 102 hours
  provide ECTS

- **55 Short Courses**
  from 12 to 51 hours

---

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

---

**A multicultural student population**

**Origin of Master’s students 2021**

- **357** total number of students

- **68%** Oceania
- **20%** America
- **8%** Africa
- **3%** Asia
- **1%** Europe

---

*STUDENT*
The first automatic treatment solution that protects Soil, Plant and People

Dron’Aero SAS is a young company housed at ISAE-SUPAERO’s Innovspace. Bacchus Spray has been developed as part of an experimental plan to evaluate the drone technology as a tool for organic vineyard treatments on steep slopes. Works on steep vineyards are exhausting and volunteers are scarce: the drone provides a simple and effective solution!

After 2 years of existence, the company counts among its clients renowned wine-growers in Jurançon, Banyuls, Cornas and Ampuis. The start-up is currently in the specific development phase of the patented Bacchus Spray concept.

The technological challenges are numerous, as are the commercial stakes.

Focus on the Mermoz Project

Faced with the climate emergency, aeronautics must be reinvented today. This will involve technological breakthroughs, of which hydrogen is one. This is why we are working, in collaboration with Delair Tech, on the design of a liquid hydrogen drone, the MERMOZ drone, capable of long distance flight with no CO2 emissions.

Through this innovative project, we are anticipating the changes that will affect the next generation of more environmentally friendly aircraft. This project is already arousing a great deal of enthusiasm on the part of our students, who are reminded of the days of the aviation pioneers and discovering new meaning for their future professional careers.

ISAE-SUPAERO has signed the Grenoble agreement supported by the COP2 Etudiant which aims to accelerate the ecological transition of higher education.

Check out all our innovative projects in line with the ecological transition here
BUSINESS RELATIONS

250 companies support our development

An alumni network of over 24,100 graduates

1365 engineers, and/or researchers from leading companies are visiting lecturers.

11 company chairs for teaching and research in innovative programs

More than 30 partnerships signed with small and medium-sized companies and major industrial players

Every year companies receive more than 800 ISAE-SUPAERO students for internships and Master theses. Conferences, industrial visits, internships in companies, forums, recruitment workshops

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

Career Center:
A major asset in helping our students enter the workforce
The Career Center’s mission is to accompany students from all training programs entering the workforce by creating bridges with businesses. More than 1,250 jobs and internship offers were posted on the Institute’s Job Board.

CAPGEMINI
ARIANE GROUP
IAC
SIEMENS
DASSAULT
AVENCORE
AIRBUS
THALES
MBDA
AIR LIQUIDE
ATR
CYLAD
COLLINS AEROSPACE
STELIA AEROSPACE
ATOS
CONTINENTAL
WAVESTONE
ALTRAN
SAFRAN
NAVAL GROUP
ALTEN
RENAULT
AIRFRANCE
PWC
LIEBHERR
DAHER
EY
AKKA technologie
SOPRA STERIA
MECANO ID

Fondation ISAE-SUPAERO
Reseaux d’affinites publique

AIRBUS
MBDA
THALES
GIFAS
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
- 6m high 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
- Drones of all shapes and uses
- Additive manufacturing machine

Inaugurated in 2020, the InnovSpace is a dedicated area for start-ups and student projects. The building houses a prototyping workshop where users can benefit from an easy access to machines dedicated to mechanics, electronics, 3D printing... there also is a digital and video laboratory with augmented reality.

This is the perfect place to favorize exchanges between students, alumni, research professors and entrepreneurs and to facilitate innovation.
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 - DAEP**
   - develops its research activities on three axes:
     - Turbomachines and propulsion
     - Aerodynamics
     - Fundamental fluid dynamics

2. **The Mechanics, Structures and Materials Department - DMSM**
   - 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 - DEOS**
   - is organized into 5 research groups:
     - Microelectronic Image Sensors
     - Photonics, Antenna, Microwave and Plasma
     - Navigation, Communication, Radar
     - Communications and Information Theory
     - Space Systems for Planetary Applications

4. **The Complex Systems Engineering Department - DISC**
   - 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 - DCAS**
   - dedicates to the efficient and safe design and operation of vehicles.
   - The four research groups:
     - Aircraft design
     - Space systems design
     - Decision and control
     - Neuroergonomics and human factors
THE 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 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 one out the seven majors in 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 program is designed with a combination of lectures, tutorials, study cases and projects to be performed in an industrial environment or in ISAE-SUPAERO’s laboratories. It is taught in English.

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

The last semester consists in a master thesis to be prepared 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, Human factors, Aviation safety airworthiness, Control, Aerodynamics & propulsion, Flight dynamics, Aeronautical structures, Applied mathematics, Algorithm and computing, Signal processing, Embedded systems, Air & space law, Sustainable aviation, Climate sciences

Foreign languages and soft skills
French as a Foreign Language
French speakers can choose among: German, Arabic, Chinese, Spanish, Italian, Japanese, Portuguese, Russian

Soft skills for innovation

Project management & systems engineering

SEMESTER 2: 30 CREDITS

Common core - 103 h

Mathematics – Mechanics – Optimization

Foreign languages - Soft skills

Electives - 120 h

- Acoustics – Mechanics of materials & structures – Space instrumentation – Object-oriented software development – Aircraft design methods
- Aeroengines Architecture & Performance – Aircraft structures – Control dynamic systems & implementation – Simulation for systems engineering – Instrumentation & flight data analysis
- Experimental Approach in fluid dynamics – Computational solid mechanics – Signal processing and digital electronic basics – Systems architecture and programming – Adaptive control
- Software for CFD – Structures design project – Real time control of an aerospace system – Cloud and network computing – MDO

4 electives (among 20) 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 - 98 h**
During the third semester, it is split into two parts focusing on space environment and mission or sustainable aviation.

**Space common core:**
- Foreign Language - Project Management - Space environment & effects - Mission analysis and orbital mechanics - Space law

**Aeronautics common core:**
- Foreign Language - Project Management - Aviation & environment - Aviation law

**Major 1: Advanced Aerodynamics and Propulsion - 208 h**
Advanced Aerodynamics - Aeroelasticity & Flexible Aircraft

**Major 2: Aerospace Systems and Control - 231 h**
Multiple-Input, Multiple-Output systems - Control of flexible structures - Robust and optimal control - Systems identification and estimation - Non-linear control - Hybrid control - AI methods and tools for Automatic Control - Aerospace Power Systems & Architecture - Aircraft & Space Actuation Systems - Preliminary Design Model & Sizing of Aircraft Air-conditioning Systems

**Major 3: Aerospace Structures - 204 h**

**Major 4: Embedded Systems - 241 h**

**Major 5: Space Systems - 275 h**

**Major 6: Space Imaging, Navigation & Communication - 233 h**
Fundamentals of electrical engineering - Random signal processing and estimation - Microwave and antenna engineering - Satellite communications and navigation - Digital communications - Land mobile satellite transmission - Satellite-based navigation - Telecommunications and networks - Earth observation - Remote sensing and sensors - Image processing and data analysis

**Major 7: Systems Engineering - 225 h**

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 in Aerospace Structures, Aerospace Systems & Control and Systems Engineering majors can follow the Aircraft Design and Operation pathway.

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-supaero.fr

**Head of program major Advanced Aerodynamics and Propulsion**
- Prof. Erwin-Ricky GOWREE erwin-ricky.gowree@isae-supaero.fr

**Heads of program major Aerospace systems & control**
- Prof. Valérie BUDINGER valerie.budinger@isae-supaero.fr
- Prof. Yves BRIERE yves.briere@isae-supaero.fr

**Head of program major Aerospace structures**
- Prof. Patrice LONGERE patrice.longere@isae-supaero.fr

**Head of program major Embedded Systems**
- Prof. Ahlem MIHDAOUI alem.mihdaoui@isae-supaero.fr

**Head of Program major Space systems**
- Prof. Joan-Pau SANCHEZ CUARTIELLES joan-pau.sanchez-cuartielles@isae-supaero.fr

**Head of program major Systems engineering**
- Prof. Jean-Charles CHAUDEMAR jean-charles.chaudemar@isae-supaero.fr

**Head of program major Space Imaging Navigation & Communication**
- Prof. Damien ROQUE damien.roque@isae-supaero.fr

**Duration of studies**
- Two years full time

**Beginning of classes**
- September

**Location**
- ISAE-SUPAERO

**Teaching language**
- English
Career opportunities

85% Started their career in Europe

more than 45% work in France

Main companies recruiting our students

AIRBUS, Thales Group, CNES, ESA, DLR, ALTRAN, ACCENTURE
GMV, Capgemini, ATOS, ATR, BCG, Sopra Steria… 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
Since I started my Bachelor in Aerospace Engineering, I was sure that I wanted to develop my career in the space sector. I also felt very attracted by the idea of living a new experience in a different country and growing in an international environment. After obtaining information about the various options, I concluded that ISAE-SUPAERO would be the perfect place to achieve my goals. In the heart of the European aerospace industry, this Master seemed to me to be a unique opportunity to get into the sector and continue my education in a well-recognized institution.

In my view, one of the strongest points of the Master is the direct contact with the aerospace sector and its actors. It is very useful and enriching to learn directly from researchers and workers from different companies and have access to their experiences.

I did my last semester internship at Airbus Defense and Space Toulouse. Thanks to this opportunity, I was able to acquire significant experience in many areas. I not only greatly widened my technical knowledge and competences in the space sector, I also grew as a person in a professional environment, improving my soft skills and working as a team player.

After my graduation, I had the opportunity to work for GMV France in Toulouse. And currently, I am working on GALILEO, the European global navigation satellite system, as a performance engineer for the ground mission segment.

In this sense, I am very satisfied with my efforts as I finally achieved my goal of working on the space sector, doing a job where I can apply all the skills that I acquired during my studies and where I can continue building my professional career.

Testimonies

PALOMA GUINEA-GONZALVO
Spain
Space Systems major

I chose ISAE-SUPAERO because the Master has a great combination of academic, research and professional points of view, with a mix of lectures, interaction with PhD students, and links to amazing industrial partners that are within reach in Toulouse. I also wanted to move to France for personal reasons, while pursuing higher education studies.

One of the strong assets of the MSc that comes to mind is the number of points of contact with the post-graduation world. Plenty of lectures are given by professionals - which can be a bit disorienting at the beginning, but has lots of advantages. We also learn how to elaborate and present our work as students in a very mature way - thanks to the many practical projects that we have during the courses.

Last but not least, it is an International Master: students create amazing bonds with people literally from all around the world. In the long run, we end up having true friends, research partners, colleagues who will pursue their careers on different continents while staying in touch, and that is invaluable.

Internships in 2020 were affected by the pandemic for a lot of students. In my case, I was lucky to be offered a plan B by Exotrail, a Toulouse startup working (among other things) on space mechanics and mission analysis software. And the experience was amazing! I moved to London in February 2021, to start working as a Flight Dynamics Engineer at OneWeb.

It is not easy to be sure about career goals in the long run, nowadays. Research still fascinates me, so I am considering switching to that after some experience in industry. What is great about ISAE-SUPAERO is that it really does open many doors: professors are always available to chat about one’s interests, and I am currently discussing possible research contracts or PhD offers - in different domains related to space technology.

HARI PRASATH
India
Space Systems major

I was looking for a college that has a good course structure and also has well-established connections with industries. ISAE-SUPAERO is one such reputed university. I had the chance to connect with people from the industry, which in time helped me to get my first job in the space sector despite the Covid situation. Specifically, I loved my space systems course as it covered almost all the topics of space engineering and gave me a broader perspective of the field.

I did my internship at a US startup company, working remotely from home. It dealt with the effects of radiation exposure on the DNA on the surface of the moon.

Currently I am working as a scientific engineer in Stellar space studies. I would like to continue and to progress in the space sector, with my career goal being to become a prominent player in the space sector in the future.

FEDERICO BISCARO
Italy
Space Imaging, Navigation and Communication major

When I started applying for Masters, I was looking for a college that has a good course structure and also has well-established connections with industries. ISAE-SUPAERO is one such reputed university. The reason why I chose the MSc in Aerospace Engineering at ISAE-SUPAERO is because it is a 2-year international program that gets you involved in research and/or professional environments with the possibility to adapt the academic plan according to your personal interests. In my case, I selected the Structures Major and performed an internship on Topology Optimization at Airbus.

Afterwards, I was hired by the company as a Structure Analysis Engineer and since then, I have been collaborating in Research & Technology projects as well as In-Service activities.

Additionally, I am a temporary-professor at ISAE-SUPAERO and in my free time I perform non-profit volunteer activities to underscore the importance of education.

ROSALYNE ANGELICA CARDENAS SIERRA
Mexico
Aerospace Structures major

In my case, I was lucky to be offered a plan B by Exotrail, a Toulouse startup working (among other things) on space mechanics and mission analysis software. And the experience was amazing! I moved to London in February 2021, to start working as a Flight Dynamics Engineer at OneWeb.

It is not easy to be sure about career goals in the long run, nowadays. Research still fascinates me, so I am considering switching to that after some experience in industry. What is great about ISAE-SUPAERO is that it really does open many doors: professors are always available to chat about one’s interests, and I am currently discussing possible research contracts or PhD offers - in different domains related to space technology.
Advanced Masters in the fields of engineering and management are one-year degrees taught in English or French.

"Advanced Master" is a specialisation label from the Conférence des Grandes Écoles (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 aeronautics & 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**

- Space: 20%
- Aeronautics: 29%
- Transportation: 5%
- Defense: 12.5%
- Others: 33.5%

**ACTIVITIES**

- Research and Development: 49%
- Studies, Advisory and Expertise: 8%
- Informatics: 6%
- Maintenance and Support: 6%
- Administration, Management Dpt, Finance, Accounting: 6%
- Methods, Production Control: 4%
- Supply chain: 4%
- Marketing: 9%
- Others: 6%

**LARGE JOB OPPORTUNITIES**

- Permanent contract: 74%
- Hired less than 2 months after obtaining the degree: 49%
- Started their career in France: 82%

*Figures for 2020
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 a 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

## Detailed Program

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>STRUCTURES AND MATERIALS</strong></td>
<td></td>
</tr>
<tr>
<td>Aircraft Structures</td>
<td>50</td>
</tr>
<tr>
<td>Materials for Aerospace Structures</td>
<td>15</td>
</tr>
<tr>
<td><strong>FLIGHT PHYSICS</strong></td>
<td></td>
</tr>
<tr>
<td>Aerodynamics</td>
<td>40</td>
</tr>
<tr>
<td>Propulsion</td>
<td>20</td>
</tr>
<tr>
<td>Flight Dynamics</td>
<td>35</td>
</tr>
<tr>
<td><strong>AVIONIC AND SYSTEMS</strong></td>
<td></td>
</tr>
<tr>
<td>Aircraft Systems</td>
<td>35</td>
</tr>
<tr>
<td>Flight Control Laws</td>
<td>20</td>
</tr>
<tr>
<td>Human Factors I</td>
<td>50</td>
</tr>
<tr>
<td><strong>FLIGHT TEST ENGINEERING MAJOR</strong></td>
<td></td>
</tr>
<tr>
<td>Flight Test Technics and Methods</td>
<td>30</td>
</tr>
<tr>
<td>Human Factors II</td>
<td>46</td>
</tr>
<tr>
<td>Flight Test Experimentation</td>
<td>55</td>
</tr>
<tr>
<td>Experimental Flight Dynamics</td>
<td>15</td>
</tr>
<tr>
<td>Measure and Sensors</td>
<td>12</td>
</tr>
<tr>
<td>Flight Test Final Project</td>
<td>17</td>
</tr>
<tr>
<td><strong>AIRCRAFT DESIGN ENGINEERING MAJOR</strong></td>
<td></td>
</tr>
<tr>
<td>Propulsion Systems</td>
<td>20</td>
</tr>
<tr>
<td>Computer Aided Design (CATIA)</td>
<td>25</td>
</tr>
<tr>
<td>Aircraft Performances</td>
<td>25</td>
</tr>
<tr>
<td>Aircraft Design</td>
<td>28</td>
</tr>
<tr>
<td>System Engineering</td>
<td>10</td>
</tr>
<tr>
<td>Multicultural Project Management</td>
<td>12</td>
</tr>
<tr>
<td>Aircraft Design - Final Project</td>
<td>29</td>
</tr>
</tbody>
</table>

## COMMON CORE

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Design - Final Project</td>
<td>29</td>
</tr>
</tbody>
</table>
Testimonies

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

LUCIE BEAUDUN
Graduated in 2020
Research Engineer | ISAE-SUPAERO

I decided to apply for the TAS AERO Advanced Master because I would like to be specialized in Aeronautics. Therefore, this Master was the perfect compromise: development of my aeronautical knowledge with the theoretical part and improvement of my professional experiences through the practical part.

FRANÇOIS PERRINEAU
Graduated in 2019
Flight Test Analysis Engineer | Airbus

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 ISAE-SUPAERO.

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

This Master is international and includes a lot of team projects, pair working and presentations. Therefore this is a great opportunity to improve our English and to reinforce relationships and social links with our classmates. Furthermore, each course is taught by experts from industries such as Airbus, ONERA and ISAE-SUPAERO, which is valuable.

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 ISAE-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?

If I have the opportunity, I plan to join a big company in aircraft industry as a System Designer Responsible such as Airbus or Dassault Aviation for instance.

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.
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-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
ISAE-SUPAERO

Teaching language
English

Syllabus

Part 1: Aerospace structures: methods & tools for engineering & dynamics - 62 h
- Flight dynamics: an introduction
- Aerodynamics: an introduction
- MATLAB standards
- Structural dynamical control: an introduction
- Strutural shells modeling and recycling
- 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?

Hugo De Bastos
Graduated in 2019
Engineer in Aerodynamic studies | ArianeGroup

I Choose ISAE-SUPAERO because it’s one of the most important school in aeronautic and aerospace engineering. The proximity and the relation of the school with Aerospace industry also were an advantage I took in consideration. I apply to the MS “Aeronautical and Space Structure”, because it covers many aspect of mechanics in aeronautics and space domain. My objectives were to get a different view of engineering than my previous school, I also wanted to improve my knowledge in mechanics to have a complete education.

Simon Lemay
Graduated in 2020
Structures & mechanics engineer | CNES (French Space Agency)

I first discovered space activities and products throughout my end-of-study mechanical engineering internship at the mechanical analyses department of Airbus Defence & Space in Toulouse. This experience fascinated me and enabled me to discover a whole new world that I didn’t know before and even wouldn’t have imagined to work in. It convinced me to have my career in that field. To do so, I first wanted to improve my theoretical knowledge about space structures and mechanics and graduate in that specific field to complete my general mechanical engineering degree. ISAE-SUPAERO’s AES (Aeronautical and Space Structures) Advanced Master seemed to be the best way to do so and it was according to all the testimonies that I collected.

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

Firstly, this Advanced Master meets my expectations, because I learned a lot in mechanics and the way to approach engineering was different.

Then, the strongest assets of this Master are the personnel and the teachers. For many of them, the classes were a dialog with the teachers (for example during Yves Gourinat’s lessons), which was very interesting and helpful for the young engineer we were. The quality of the courses also was a very good point and many of us discovered unexpected affinities for some of the disciplines in Aeronautics and Space engineering.

According to me the strongest assets are the teachers and the close-relations the school has with industrials in the aerospace field. Many of the teachers are engineers working in industry and giving classes specifically at ISAE-SUPAERO. This involves a very different approach of teaching compared to other schools. Most of the courses are taught as they are applied currently in the industry, which is great. On the other side, ISAE-SUPAERO’s permanent professors are experts in their field and provide advanced theoretical knowledge.

What are your career plans?

My first plan was to work in Space industry, in mechanics studies, which is a success. In the future I would like to see many different technical aspect, to try to work in a foreign country or/ and in French Guiana.

I had the chance to complete my professional master’s thesis at the CNES in Toulouse, which was a great experience. I had even more chance to get a permanent contract in the same department after my internship. For sure having graduated from ISAE-SUPAERO helped me a lot to obtain that position. My plans now are to continue to work and learn my job as a Structures & Mechanics engineer at CNES and to make my best to contribute to the development of the great space industry that we have in France and Europe.
Aeronautical Maintenance and Support
Engineering & Management

- **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 decommissioning), 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 October to April.
  450 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-supaoer.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**

  **Part 2: Maintenance and Support in Aircraft Design**
  Operability and Maintenability Influence on Design - Integrated Logistic Support (ILS) and Logistic Support Analysis (LSA) - Configuration Management - Development and evolution of a maintenance program (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 maintenance - Systems troubleshooting - Equipment maintenance - Organization and management of a maintenance department - Military maintenance organization - Project MRO.

  **Part 5: Airworthiness, Safety & Human Factors**

  **Part 6: Support & Service**
  Customer support and services - Aircraft financing and Stakeholders liability - Supply chain and logistics - Aircraft Decommissioning.
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, Daher).

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. 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, Sopra Steria, COMAC, AVIC, Singapore Air Force, Air Calédonie, Air Archipels...

Testimonies

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

GUILLAUME CONTI
Graduated in 2020
Airframe project manager | Sabena Technics

After my engineering degree, I have decided to work for two years to discover the world of customer services and I became very interested in Aircraft maintenance. Nowadays, engineering schools deliver generalist training and in my opinion specialized master are very useful to bring value to your career and help the transition between studies and professional world, so my objective was to attend additional classes to get specialized in aircraft maintenance. I naturally applied to ISAE-SUPAERO which is the only school at the cutting edge of aeronautic.

ABRAHAM NELSON
Graduated in 2020
Customer Manager - Maintenance program Engineering / AIRBUS SAS

I first discovered space activities and products throughout my end-of-study mechanical engineering internship at the mechanical analyses department of Airbus Defence & Space in Toulouse. This experience fascinated me and enabled me to discover a whole new world that I didn’t know before and even wouldn’t have imagined to work in. It convinced me to have my career in that field. To do so, I first wanted to improve my theoretical knowledge about space structures and mechanics and graduate in that specific field to complete my general mechanical engineering degree. ISAE-SUPAERO’s AES (Aeronautical and Space Structures) Advanced Master seemed to be the best way to do so and it was according to all the testimonies that I collected. Prior to my tenure with ISAE-SUPAERO, I had been working for the Airline / MRO Engineering Industry several years. My desire was to enhance my knowledge boundaries and educational qualification to obtain an in-depth understanding that would help me obtain an overall picture of the aeronautical maintenance and support industry.

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

According to me the assets of the Advanced Master are the strong and efficient support from ISAE-SUPAERO administration, the non-academic classes focusing on the real needs of the industry, the exciting projects and incredible factory tours and finally the strong network of former students.

The strength of the AMS Master is that not only it enhanced my knowledge, but it also prepared me to be industry ready by instilling in me the current and future practices of the industry. All my professors were well established pillars from the Aeronautical Industry. A great example to this factor is that my current boss in Airbus was a professor from ISAE-SUPAERO.

What are your career plans?

To be part of working parties teams, to be a specialist of base maintenance and to support French forces aircraft maintenance

I was sure at a very young age that the aviation / aerospace industry will keep constantly upgrading and endlessly expanding. I am zealous to be a good part of this amazing industry to learn, grow and contribute towards its expansion and evolution.
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 Master 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
- Prof. Jean-François PETIT
  jean-francois.petit@enac.fr

Head of Program École de l’Air
- Prof. Vincent MARTIN
  vincent.martin@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), ENAC (Toulouse), École 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 Unconventional Products Certification

Part 3: Aircraft Certification - 183 h
- Flight
- Structure
- Avionics
- General Systems & Cabin

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), Pilatus (Switzerland), Daher…
Testimonies

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

UMAIR SUFYAN  
Graduated in 2020  
Chargé de certification | Aura Aero

My main objective for the master’s program was to enhance my knowledge in the field of aircraft certification and airworthiness. My aim was to transition from my current position in the field of continuing airworthiness towards aircraft certification and airworthiness. This master’s program not only offered a comprehensive course for my needs but also allowed me to be close to a hub of aviation activities in Europe. ISAE-SUPAERO and ENAC are well established institutions with strong roots in the aviation sector. Joining a program here came with the opportunity to be able to learn from, interact with and be approachable to the large number of companies that are partners with ISAE-SUPAERO.

THABO CHARLES MOATE  
Graduated in 2020  
Certification Engineer | South African Civil Aviation Authority

A scholarship was offered through a collaborative effort between the Governments of South Africa and France, to learn a more advanced skill in aviation safety and aircraft airworthiness to complement my daily duties. This programme proved to be more relevant for the advanced subject matter and practical experience it offered.

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

The ASAA program is conducted by a large number of professionals who are experts in their respective domains in the industry. The best part about the program was being able to learn from them in real world scenarios. The course contents were tailored to meet the exact needs of the industry which gives students the required knowledge to start a career in Airworthiness and be successful.

MS ASAA gives the learner the most basic principles that build up to the complex level of safety requirements but in a simplified and more concise manner. This further gives the learner an experience as both an innovator in the industry (to show compliance with the regulations) and as a regulator (to find compliance with the requirements) in certification of aviation products.

Each subject matter is taught by the most experienced industry experts and students get to visit their place of work to see what they have experienced in class. The most interesting part was conducting a professional thesis through an internship at Aura-AERO, a technologically innovative aircraft manufacturer based in Toulouse, France.

What are your career plans?

ISAE-SUPAERO also gave me the opportunity to work on learning about certification of innovative technologies. In my current company we are developing such an aircraft aimed to meet the needs of the future. My aim is to continue working in this domain and develop the methods necessary to certify innovative designs.

There are three areas/regions of interest; South Africa: To take up a leadership or managerial role in line with the strategic intent and mandate of the SACAA. The MS ASAA programme has further skilled me in how aviation safety and airworthiness matters are handled and keep up to date with current events and developments in aviation. Southern African Development Community (SADC) and rest of Africa: It is imperative that the rest of Africa be accustomed to the international standards and safety requirements as set by ICAO and respective NAAs or organisations such as SASO and AFCOC through the transfer of skills and working groups. Globally: to be involved in the certification of innovative, technological advancement such as fully electric aircrafts, to also be in a working relationship with world-class civil aviation regulators.
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 projects. Drones and Urban taxis 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 including the new challenges associated with urban mobility. 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 thesis committee.

Organization

Head of program

- Prof. Jean-Marc MOSCHETTA
  jean-marc.moschetta@isae-supaoero.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

Teaching language

English

Syllabus

Part 1: Aircraft structures, Aircraft architecture and certification – 100 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: Helicopters – 150 h
Helicopter: Aerodynamics, performance and flight qualities
Helicopter dynamics – Helicopter materials and construction technics - Helicopter Systems: prototyping, tests and production quality

Part 4: Drones – 120 h
Designing drone systems - 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...
Testimonies

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

ESTELLE CADARS
Graduated in 2019
Quality Assurance Manager | Aviaco France

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-SUPAERO 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
Graduated in 2019
Structural Design Engineer | Dassault Aviation

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 several 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.
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 course in basic sciences and French aeronautical communication organized at ISAE-SUPAERO campus, in Toulouse,
- 10-month Experimental Flight Test course, 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-supaoer.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.
What are your career plans?

I hope to become a test pilot for the United States of America. Continue to work as a flight test engineer.

Testimonies

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

PATRICK CALLAGHAN
Cohort 2021

This was a part of the flight test program at EPNER.

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

World class instructors with real world experience
Friendly, helpful support staff
Excellent facilities.

What are your career plans?

I hope to become a test pilot for the United States of America.
Continue to work as a flight test engineer.
Objectifs
Former des spécialistes capables de concevoir et d’opérer des turbomachines aéronautiques et terrestres, ainsi que des moteurs d’engins spatiaux dans le contexte industriel actuel. L’aérodynamique interne, la combustion et la modélisation des architectures propulsives en constituent le noyau central. L’ensemble des enseignements théoriques, pratiques et de groupes, associés à la mission en entreprise, visent à développer une expertise en simulation numérique des écoulements turbulents, compressibles et instationnaires, en lien avec l’aéroacoustique et l’aéroélasticité, au cœur des problématiques les plus avancées dans le domaine des turbines à gaz et de la propulsion spatiale au sens large. Au travers d’études de cas et de projets proposés en collaboration avec les industriels du secteur, la formation développe également les compétences spécifiques en énergétique avec une approche systèmes complexes et les compétences transversales pour la gestion de projet, essentielles dans le secteur d’activité de la propulsion.

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 : Architecture globale des systèmes de propulsion - 114 h
Les grands enjeux aéronautiques - Etat de l’art de la propulsion aéronautique - Mission et Environnement des aéronefs - 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’aéronef (contraintes et tandem avion/moteur, focus nacelle et systèmes annexes) - Approche multidisciplinaire - Propulsion spatiale, chimique, électrique - Avants projets et innovations incrémentales et en rupture.

Bloc 2 : Aérodynamique interne - 240 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 - 96 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-supaeuro.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.

Les entreprises qui recrutent nos étudiants
AQYLON, ALTRAN, DGA, SAFRAN AIRCRAFT ENGINE, SAFRAN ENGINEERING SERVICES, AIRBUS GROUP, DAHER, ...
Testimonies

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

ARTURO VICEN-VERA
Graduated in 2020
ISAE-SUPAERO - DAEP

I chose this MS for its reputation and because ISAE-SUPAERO is the best aeronautics engineering school in France, with close ties to the industry. The MS SPA is closely related to my Master’s Degree and I believe it is good way to enter the aeronautics sector.

VALÉRIAN MICHEL
Diplômé en 2020
Ingénieur en thermique spatial dans le cadre de la mission DRAGONFLY | CNES – LATMOS

Tout d’abord, pour approfondir toutes les connaissances que j’avais pu acquérir en aérodynamique, en turbomachines et en systèmes propulsifs. De plus, avant d’effectuer ce MS, je n’avais pu apprendre au sujet de l’industrie aéronautique qu’au travers de stages ou de cours de pilotages : effectuer un MS m’a donc permis d’acquérir un véritable background académique. Enfin, la renommée internationale de l’ISAE-SUPAERO n’a fait que renforcer mon envie d’y effectuer un MS.

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

This Advanced Master is a very complete program, and the lectures are given by specialists. It has given me a very wide view of what the challenges are today, and how the sector might evolve in the near future.

Le MS SPA présente de nombreux atouts majeurs : tout d’abord il offre une grande diversité des enseignements, ce qui permet aux étudiants d’aborder toutes les problématiques majeures liées à la conception aéronautique. De plus, l’intervention à la fois d’enseignants chercheurs mais aussi de très nombreux ingénieurs du milieu industriel permet d’aborder un même sujet sous différents points de vue, ce qui fait du MS SPA une expérience enrichissante !

Which are your career plans?

I have just started an internship and do not expect to be in the job market before 2021.

À court terme, je souhaite poursuivre dans le monde de la recherche. Et pourquoi pas, dans quelques années, retomber dans le monde de l’industrie...
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. Raphaël GARCIA
  Raphael.Garcia@isae-supaoer.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 positionning

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, AKKA Technologies, ESA, Euroconsult...
Testimonies

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

VILLE MESKUS
Graduated in 2020
Supporting the development of innovative Earth Observation products in Europe | ESA

I've always been passionate about human activities in space, but I didn't work in the field before starting this program at ISAE-SUPAERO. After doing my previous Master's Degree in Industrial engineering and management in Finland, I worked in several countries for different industries as a consultant and in product management. Then I decided to go after my passion and applied for several different aerospace schools. Ultimately I chose ISAE-SUPAERO for its position as one of the top aerospace schools in the world and its location in the centre of the European aerospace industry.

I chose this Advanced Master’s program as I believe we need to enlarge the human footprint in space in order to accelerate our technological progress and safeguard both our species and Earth. In order to do that, we need to push our boundaries further and find more ways to benefit from the space frontier. This is a program to do exactly that. The fact that we would have close cooperation with industry players such as Airbus was a key point in ensuring that how we approach this domain is up to date with industry demands and the latest knowledge.

My objective upon joining the program was to get a thorough deep dive into how we can design and build satellites and use them to extract value from space. The program gave me exactly that: I was given all the keys I need to make an international career in space industry.

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

The two strongest highlights for me were the extensive cooperation with Airbus, CNES (the French government space agency) and other key partners, as well as getting a complete view on the whole value chain of the satellite business. Our learning reached from the basic technical details of designing and building satellites and their payloads all the way to how to use those payloads to create and operate a business. In practical exercises, we used the same tools that the industry is using professionally.

BASILE GOUSSARD
Graduated in 2020
Earth Observation Engineer | Promethee

I got a diploma from IMT Atlantique (previously Mines de Nantes) which gave me a very good understanding of the industrial world, as well as the mathematical background needed to work on various issues such as quality control for the aerospace sector. But still, I had the feeling to miss something... I wanted to have a deeper knowledge of space systems but not only. I also wanted to understand how space could help humankind thanks to day-to-day real-world applications such as GPS, broadcasting, and more specifically earth science linked to earth observation!

ISAE-SUPAERO is clearly the best school on such topics thanks its ability to mix expertise such as space systems, image processing, big data, and earth science.

So, the objective of the Space Application & Services advanced master was clear. Understanding the potential of the space sector to help humankind and be part of it after!

Which are your career plans?

For the rest of my career and life, I want to play a major part in the expansion of humanity into space. As long as I'm helping us do that, I know I'm doing exactly what I've always wanted to do. I believe attending this program has been a key stepping stone for me towards this path.

I got immediately attracted by the earth observation. Indeed, this domain is such existing for 2 reasons:

- Earth observation brings an understanding of our planet. This understanding is mandatory in the context of global warming.
- Earth observation is evolving a lot thanks to three groundbreaking innovations:
  - the huge number of data (and free data thanks to the European Commission and the Copernicus program),
  - the cloud computing capabilities which gave people the possibility to work on large scale data
  - Algorithm like machine learning and deep learning are now easy to build.

My career plan is to provide citizens, governments, and companies tools and solutions to fight against climate change and I'm convinced that earth observation has a key role to play in this.
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, in 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 aspects, economic and legal concerns of space projects.
- to acquire high interdisciplinary knowledge related to technical, legal and economic aspects of international space programs

Organization

Head of program
- Prof. Stéphanie LIZY-DESTREZ
  stephanie.lizy-destrez@isae-supaoer.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: 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

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

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.

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, Nexeya, Safran, Sopra Group, Thales Alenia Space, CNES, ESA, DLR (Germany), Instituto Mexicano de Comunicaciones (Mexico), GTD International (Spain)…
Space Exploration and Development Systems

The SEEDS (Space Exploration and 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

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

KEVIN DANANCIER
R&D Engineer in Satellite Electrical Power Systems | Thales Alenia Space

My first contact with the space domain was during my end-of-study project for my first engineering school, Polytech. I was already passionate about space, but this internship strengthened my will to continue working in this field. I naturally headed towards ISAE-SUPAERO, as I knew from media, colleagues and relatives for being the best aerospace engineering school. I didn’t even hesitate as my objectives were to become a system engineer and work on passionate and futuristic projects, which totally corresponds to the TAS ASTRO Advanced Master. But what caught my attention was the SEEDS program. A 6-month project with around 25 European students and many experts and researchers from space industry is the kind of experience you never forget. I personally worked as a system engineer on Human missions aiming to build sustainable habitats on the Moon and Saturn’s natural satellite (Titan).

CLARA MORICEAU
Project engineer | MEDES-IMPS

At the end of my studies in INSA Rouen Normandie, during which I specialized in applied mathematics and computer science, I was lucky enough to do an internship at CNES, the French Space Agency, in their orbital mechanics section. This internship was amazing and confirmed my interest for the space area. I therefore decided to pursue my studies in order to expand my knowledge in this sector and open my possibilities. The Space Systems Engineering Advanced Master (TAS ASTRO) was the perfect opportunity to discover a wide range of subjects as the courses cover topics from satellites & launchers to space project management. In addition, this Advanced Master offers the possibility to join the SEEDS program, an international project held with 2 other universities in Europe on the topic of space exploration, which I was very curious about.

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

I came to this Advanced Master without any education in space systems. After only 6 months of courses, I ended up having a huge wealth of knowledge and skills covering the whole space domain. From ground segments to satellite sub-systems, through launchers, financial and legal aspects, operations, space environment,... This asset comes from the perfect organization of this Master and the proximity between ISAE-SUPAERO and space industry, without forgetting the omnipresence of English, opening the way to international opportunities.

In my experience, the strongest asset of the Advanced Master is its multidisciplinary approach! After the 6-month courses, one can have a very good overview of space systems in general, which is essential when being a systems engineer, but also for experts as it gives an understanding of a space project as a whole. In order to materialize the courses, the students are asked to run a project for a couple of months which consists of designing a satellite or a space system. It really allows making the link between the theory and its application. Moreover, the SEEDS program is an incredible opportunity to work with students from Europe and learn about human and robotics exploration during another 6 months. Both projects also help the students to learn how to cooperate as part of a team and to work with industrial partners and space agencies, a real asset to then find a job!

Which are your career plans?

I currently working as a R&D Engineer in Satellite Electrical Power Systems and thanks to the system engineering skills and knowledge from TAS ASTRO, I hope to become a system engineer, in a few years, working on future space projects in early phases, in relation with advanced concepts, space exploration or Human spaceflight missions, which is really the core of the TAS ASTRO Advanced Master.

Thanks to the SEEDS project and an internship at ESA on the topic of human spaceflight, I now have a strong interest for exploration! In the future, I hope I can contribute to it by working on projects which aim at increasing our knowledge about men and women living in space, for the future of space exploration but also for Earth applications, alongside with space agencies. I would also like to be an operations engineer for satellites, rovers or even astronauts, eventually for the upcoming lunar and mars missions!
Objectives

Systems Engineering is an interdisciplinary discipline of engineering combining all sciences and technologies into integrated teams from design, to development, up to operations and disposal of competitive and complex systems.

Systems Engineering approach is the capacity to federate and control various, interweaving and complementary engineering activities. This approach goal is to deliver satisfying systems, on-time, within expected budget, with the level of quality and performances meeting requirements of an open and competitive market. Systems Engineering process implements technical processes (requirement engineering, design, integration, verification, validation, etc.) as well as project management processes, agreement processes and enterprise processes.

The Systems Engineering Master degree program is a one-year 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-supraero.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.

Syllabus

Teaching part (First semester)

Part 1: Outlines, topics and Fundamentals - 41 h

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

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) - 45 h

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...
- 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)...

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

FLORIAN ROSELLI
Graduated in 2020
Human Spaceflight Engineer | MEDES for CNES/CADMOS (French Space Agency)

As a general engineer, my deepest ambition was to combine my great interest for space and aeronautics to my field of study and professional career. I decided to apply for the Systems Engineering (SEN) Advanced Master while I was completing my last year of engineering studies in HEI-Lille. As a prestigious school in France and Europe about aerospace training, ISAE-SUPAERO seemed the obvious choice to me. The strong international alumni network, partner universities and companies offer an excellent environment to evolve and give rise to ambitious ideas.

The SEN Advanced Master seemed to be the most relevant with my background and ambition. Indeed, I was looking to broaden my skills in system design and architecture, requirements engineering and to acquire an overview on the multiple aspects of a project. Most of all, I deeply desired to inspire from other ways of working in order to become an active part of the rise of new challenges regarding space exploration/research and aeronautics.

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

I find the balance between academic lectures and the practical skill-set taught by lecturers, who have varied and wide industrial experience, as one of the strongest points of this masters at ISAE. All the lectures are augmented by industrial examples of how different concepts are applied in actual SE practice. Training in different MBSE tools and frameworks was really interesting as well. Application of what is taught and discussed in the lectures through the course projects and the semester-long Integrated Team Project, provides a very strong foundation for budding Systems Engineers.

Which are your career plans?

I am currently working at CNES the French Space Agency, for MEDES (Space Medicine), as Human Spaceflight and Operation Engineer. I first develop projects and experiments from various universities, scientists and companies for their implementation on board the International Space Station. Then my role is to support in real time the on orbit operations realized by the astronauts.

I will most likely pursue my career in the operational field and more specifically towards Human Spaceflight to become an active part of the challenges that the space exploration offers.

PRAKHAR AGARWAL
Cohort 2020/2021
Intern in (Re)Architecture with Environmental Concerns | Altran

I was keen to pursue Systems Engineering since my under-graduation days, when we were working on a Sounding Rocket. And later, while working at Indian Space Research Organization (ISRO), I could easily identify that I can ace at Systems Engineering and thus had strong inclination to formally learn, grow and apply myself in the domain. After exploring the MS degree courses available across the globe, I found the curriculum and course structure at ISAE-SUPAERO to be best suited for my requirements. It is a one-year course covering Systems Engineering and MBSE with a primary basis in aviation and space sectors; majority of the tenure is dedicated to learning through application; lecturers are drawn from industry; alumni network of ISAE-SUPAERO is very strong; and definitely ISAE-SUPAERO is one of the top institutes in aerospace studies and research. All of these factors made ISAE-SUPAERO my obvious choice.

I find the balance between academic lectures and the practical skill-set taught by lecturers, who have varied and wide industrial experience, as one of the strongest points of this masters at ISAE. All the lectures are augmented by industrial examples of how different concepts are applied in actual SE practice. Training in different MBSE tools and frameworks was really interesting as well. Application of what is taught and discussed in the lectures through the course projects and the semester-long Integrated Team Project, provides a very strong foundation for budding Systems Engineers.

I intend to grow myself as an expert Systems Engineer and Architect, through projects that add significant and sustainable value to humanity, be it in any industry. My background does lure me back to the space industry; nevertheless I am happy to explore a new industry through my internship, and later in future.
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-ENSEEIHT and ISAE-SUPAERO partners with the support of the embedded systems industry to prepare students for challenging aerospace projects. This program focuses on a multidisciplinary approach and prepares students by passing on in-depth and comprehensive knowledge of the technologies underpinning embedded systems with an emphasis on aerospace. The program focuses on both theoretical and concrete aspects and aims at:

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

Learning approach

First semester:
An academic session of 546 hours of teaching, provided by the tenured professors at ISAE-SUPAERO and INP-ENSEEIHT 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-ENSEEIHT 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

Part 4: Embedded Systems Design - 160 h
- Real time control of an space system - Hybrid Systems - Model-Based System Engineering and Architecture - Real time control of a mechatronic system - System Dependability - Certification - Embedded systems and IT Security - Optimization

Part 5: Embedded Systems Applications - 50 h
- Aircraft technics - Introduction to Space Systems - Automobile technics - Workshops
Career opportunities

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

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.

Testimonies

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

SHIN YESL
Graduated in 2019
Embedded Systems Engineer | UBLU Digital Services

Wanted to change my career path to aeronautics and before starting the new path I’d like to study a bit more on the subject to specialise my knowledge.

GUSTAVO VALLEJO GARCIA
Graduated in 2020
Embedded Systems Developer In the NAVBIES research team of ISAE-SUPAERO

The original idea was to reach a higher level of competitiveness within the automotive sector. I wanted to develop certain specific skills in embedded systems that I had identified as determinants for my career. Thereby I decided to enroll in the EMS program at ISAE-SUPAERO, which suited me perfectly!

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

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

The content of the EMS program provides the graduates with powerful tools which perfectly match the real needs of a wide variety of industries, especially in Automotive, Aeronautic, and Aerospace.

Coursing this program represents a big challenge. It demands hard work and a lot of coffee because of its vast content taught in a short period. And it certainly is worthy if you are looking to boosting your professional career in the industry!

What are your career plans?

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

Now, I want to gain solid experience in the development of navigation systems. It’s a domain that has completely captivated me!

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...
Artificial Intelligence & Business Transformation

WITH IRT SAINT-EXUPERY / TBS EDUCATION

NEW - MS AIBT

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:

168-hour 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).

112-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.

70-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.

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

Part 3: Practical skills - 70 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.

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.
## Course duration

<table>
<thead>
<tr>
<th>Professionals (weeks / month)</th>
<th>Apprentices and young graduates (weeks / month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>October to June</td>
<td>October and November</td>
</tr>
<tr>
<td></td>
<td>December to June</td>
</tr>
</tbody>
</table>

Apprentices and young graduates, contact us for more information.
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. Emilie SOUFFLET
    emilie.soufflet@ecole-air.fr

- **Head of program ENAC**
  - Prof Nicolas PETEILH
    nicolas.peteilh@enac.fr

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).

- **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.

- **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.

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)
- Ecole de l’Air
  (Salon de Provence - 5 weeks in October November)

Teaching language

English
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.

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

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 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
Graduated in 2019
Project coordinator | Swedish Space Corporation

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-SUPAERO 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-SUPAERO offered a package that was very broad and I felt as though I could benefit from the learning experience.

MARK ESPAGNET
Graduated in 2020
Project Manager Connectivity Services | Eutelsat

Joining the MS APM was for me a way to develop complementary knowledge to those of an engineer. Indeed, project management skills are key in today fast changing environment and they allow being proactive in the success of your company. In addition, a path as an R&D engineer was not what I sought and the APM training was a way for me to show it to recruiters and companies from the aerospace sector.

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

1. Meeting students with different backgrounds, from all over the world, with or without any professional experience brings a lot of diversity and allow to grow-up your way of thinking as a future project manager
2. All courses in English, learning project management vocabulary and best-practices in English
3. Support by a strong APM-network
4. Gathering general knowledge/culture of the Aerospace sector

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.

It is difficult to say right know. To grow as a Project Manager in a challenging, at the forefront, and international environment, to be able in a close future to draw an ambitious career path in the space industry.
**Objectifs**

Le but de ce Mastère Spécialisé® est de développer simultanément l’esprit d’innovation et l’esprit entrepreneurial, 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 (InnovSpace) 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.

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**

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.

- Développement d’un drone d’intervention premiers secours
- Donner accès aux jeux vidéos aux personnes paralysées via le développement d’une manette utilisable à l’aide des neurosciences

Les étudiants seront invités à travailler en groupe dans cette expérience pédagogique. Tout au long de ce Projet Innovant Exploratoire, 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.

**Programme d’enseignement**

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

- **Portfolio des nouvelles technologies - 39 h**
  - 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, data science, open data : 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 - 115 h**

- **Management de projet - 49 h**
  - Conduite et gestion de projet - Généralités, Conduite et gestion de projet - Déploiement opérationnel, Boîte à outils du Chef de projet, Planification de projet, Méthodes Lean
- **+ Soft Skills » - 66 h**
  - Leadership, Communication, Négociation, Argumentation et Art de pitch, 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 entrepreneuriel, 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.**

**Organisation de la formation**

**Chef de programme**

• Prof. Philippe GIRARD
  philippe.girard@isae-supaoer.fr

**Durée**

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

<table>
<thead>
<tr>
<th>Métiers</th>
<th>Fonctions clés</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneur (Startuper)</td>
<td>Aller de l'idée à l'industrialisation jusqu'à la mise sur le marché d'un produit technologique innovant.</td>
</tr>
<tr>
<td>Chef de Projets Innovants (Intrapreneur)</td>
<td>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.</td>
</tr>
<tr>
<td>Responsable du Développement Technologique et de l'Innovation (CTO en charge de l'innovation technique et du déploiement de technologies)</td>
<td>Valoriser l'usage des nouvelles technologies comme levier de croissance au sein d'une entreprise, d'une start-up ou d'une organisation.</td>
</tr>
</tbody>
</table>

**Testimonies**

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

**CHRISY-SOLÈNE RAHARISON**  
Consultante en Management de l’innovation | FI Group  
Promotion 2020 / 2021

J’ai choisi le Mastère Spécialisé® MGPIE – Management de projets innovants et entrepreneuriat car je voulais acquérir des compétences en management de projets et en gestion d’une start-up. Je ne savais pas si je voulais me lancer dans l’entrepreneuriat ou faire de l’intrapreneuriat. J’ai pu trouver ma voie tout au long du Mastère. De plus, l’ISAE-SUPAERO a une renommée en France et à l’étranger qui fait la différence sur le CV.

**LEA MICHEL**  
Stage Chef de projet | Naval Group  
Promotion 2020 / 2021

Après un diplôme d’ingénieur spécialisé dans l’aérospatiale à ELISA Aerospace, j’ai ressenti le besoin d’approfondir mes connaissances et mes compétences en gestion de projets. J’ai choisi l’ISAE-SUPAERO pour la qualité technique de son enseignement ainsi que sa spécialisation dans le domaine aéronautique et spatial, en cohérence avec mon parcours d’ingénieur. J’ai plus précisément opté pour ce Mastère en raison de son enseignement conséquent en gestion de projets, mais également afin de découvrir le monde de l’entrepreneuriat et intrapreneuriat qui étaient pour moi des domaines peu connus et susceptibles de compléter utilement mon parcours.

Mon projet professionnel est de devenir chef de projet en m’appuyant sur mes compétences techniques en ingénierie ainsi que sur les compétences de gestion de projets développées durant mon Mastère.

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

Le Mastère m’a permis d’ancrer et d’approfondir les connaissances et compétences nécessaires pour un entrepreneur ou un intrapreneur. Le projet innovant exploratoire te permet d’appliquer directement les cours de la meilleure manière qui soit : en équipe sur un projet technologique innovant qui te tient à cœur. Tu acquerras une vraie expérience entrepreneuriale ! De plus, tous les sujets sont permis, du spatial au médical en passant par ... la pointe de danse classique.

Le plus grand atout de ce Mastère est le projet PIE. Ce projet réalisé par groupe de 4/5 étudiants commence quelques mois après notre arrivée. L’objectif est de définir un produit innovant et de mener les différentes étapes de ce projet comme la création d’une start-up. Ce projet nous a offert l’opportunité de mettre en application toutes les méthodologies abordées lors des cours et de les appliquer à un cas concret. Il nous a également permis de découvrir le fonctionnement d’une start-up et ses enjeux.

Le deuxième atout de ce Mastère est selon moi la grande diversité de ses intervenants. En effet les enseignants viennent d’entreprises différentes utilisant des méthodologies de gestion de projets diverses. Nous avons également bénéficié de coachs au cours de notre projet PIE, qui nous ont aidés à mener à bien notre projet en nous faisant bénéficier de leur expérience et de leurs connaissances.

**What are your career plans?**

Avant d’entrer au MGPIE, je souhaitais travailler dans le domaine spatial, mais le mastère m’a ouvert les portes à d’autres secteurs encore peu connus mais à l’avenir prometteur comme par exemple le conseil en management de l’innovation. Ici, la technique est au service de la stratégie : j’ai une vision globale de l’entreprise et l’objectif est de la guider vers l’avenir. J’utilise au quotidien les notions et les soft skills appris durant le Mastère. J’aimerais continuer à pouvoir guider et conseiller les projets et entreprises innovantes que ce soit dans un incubateur ou dans la cellule innovation d’une entreprise.

Mon projet professionnel à court terme est focalisé sur la gestion et le management de projets à l’international. Grâce à mes connaissances en gestion de projets acquises lors de ce Mastère combinées à mes compétences techniques développées en école d’ingénieur, je suis à même d’appréhender la technicité d’un projet tout en utilisant les méthodologies adaptées afin de le mener à bien.

A moyen terme, j’envisage également de créer une Start Up pour développer des produits innovants permettant d’aider les personnes en difficulté.

L’Eléa Aerospace, j’ai ressenti le besoin d’approfondir mes connaissances et mes compétences en gestion de projets. Mon projet professionnel est de devenir chef de projet en m’appuyant sur mes compétences techniques en ingénierie ainsi que sur les compétences de gestion de projets développées durant mon Mastère.

Cette formation est réalisée 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...
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-SUPAERO 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.

### 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-SUPAERO 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.

### Learning approach

**First semester:**

Academic term of 520h, 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
**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...

---

**Why did you choose this Advanced Master?**

**ABDUL KHADER MOHAMMED**  
Cohort 2020/2021  
Intern in Additive Manufacturing at ICA | ISAE-SUPAERO

I chose ISAE-SUPAERO because of its deep understanding and expertise in Aerospace/Aeronautics, its strong academic pedigree, global reputation, industrial collaboration, international outlook and networking. I was always fascinated by materials and their transformation through manufacturing. I understood the importance of aerospace manufacturing through my undergraduate academics and work experience. Furthermore, I wanted to pursue my career in Aerospace with expertise in manufacturing, quality and project management. This led me to ISAE-SUPAERO and particularly the AMPAS advanced master. ISAE-SUPAERO is the place where I wanted to pursue my master’s degree, and I applied only to ISAE. AMPAS provided holistic background in various domains of Aerospace with industrial collaboration in a multi-cultural environment. I wanted to gain further knowledge and experience in the various domains of Aerospace in an international environment.

**EDGAR SILVA**  
Cohort 2020/2021  
Intern as system engineer | Safran Seats

I chose this master because it fits my skills, I know that ISAE-SUPAERO is a recognized school in the aeronautical sector, my clear objective has been to use this master as a springboard and find a job in the aeronautical sector where I can develop my professional career.

---

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

The strong assets are the faculty (academic and industrial), its infrastructure and equipment, pedagogies, teaching modules/subjects, the collaboration of IMT Mines Albi and ISAE-SUPAERO with the industry, industrial visits, the Integrated Team Project and travelling between Albi and Toulouse.

In my opinion, the practical assignments that are imported during the course are of great importance because you can put into practice everything you have learned during the course.

---

**What are your career plans?**

Currently, I am doing my internship in the subject of Additive Manufacturing. By building on my Master’s degree and work experience, I want to continue my career in Aerospace field in Europe.

I would like to continue working in the aeronautical sector, probably continuing with the work I have done during my internship.
EXECUTIVE EDUCATION

ADVANCED MASTERS, POST-GRADUATE DIPLOMAS (PGDIP), CERTIFICATES OF ADVANCED STUDIES (CAS) & 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
• Project Management
• Space
• Systems

ADVANCED MASTERS
75 ECTS
Please refer to p 18 to 48.

POST GRADUATE DIPLOMAS (PGDIP)
(1 semester – 45 ECTS) are dedicated to professionals who cannot take time off from their obligations for a one-year period. The following 9 Advanced Master courses are accessible in the form of 6-months post graduate diplomas:

• Space Systems Engineering (TAS ASTRO),
• Space Applications & Services (SPAPS),
• Aeronautical & Space Structures (AES),
• Aeronautical Engineering (TAS AERO),
• Helicopter, Aircraft & Drone architecture (HADA),
• Flight Test Engineering (TAS Aero-FTE),
• Aeronautical Maintenance & Support (AMS-E&M),
• System Engineering (SEN),
• Management de Projets Innovants et Entrepreneuriat (MGPIE).

CERTIFICATES OF ADVANCED STUDIES
(from 44 to 102h)
provide ECTS

17 Certificates of Advanced Studies which 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.

SHORT COURSES
(from 12h to 51h)

55 Short Courses are specialised training modules lasting a week as refresher or to explore a subject in greater depth.
CERTIFICATES & SHORT COURSES

For companies who wish to make « bespoke » training available to their engineers, tailored to their needs, **EUROSME**, 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
Claire JUANEDA – ECATA & Digital learning coordinator
Info.exed@isae-supaero.fr

**ECATA:**
the European Consortium for Advanced Training in Aerospace.
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

■ 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

■ EXECUTIVE EDUCATION

- 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 on a case by case basis.

LANGUAGE REQUIREMENTS FOR MASTERS IN FRENCH

Language qualification requested
Score B2-Common - European Framework of Reference for Languages

LANGUAGE REQUIREMENTS FOR ALL MASTERS (including for Masters taught in French)

<table>
<thead>
<tr>
<th>Test</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOEFL (IBT)</td>
<td>88 points</td>
</tr>
<tr>
<td>TOEIC</td>
<td>785 points</td>
</tr>
<tr>
<td>IELTS</td>
<td>6.5 points</td>
</tr>
<tr>
<td>CAE/FCE</td>
<td>170 points</td>
</tr>
<tr>
<td>Linguaskill</td>
<td>170 points</td>
</tr>
</tbody>
</table>

(Inst. code: 9620)
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 2021
for a start of classes in September 2022.
Several admission committees are scheduled from January to July,
see schedule on our website

Application website:

Funding
Information on tuitions fees and funding
on our website
Your contacts

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

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

Justine DE PERRY
Senior Admission Advisor / MSc in Aerospace Engineering
Phone: +33 (5) 61 33 80 55