A woman with long dark hair is focused on working on a small, metallic, spherical robot. She is using a small tool to adjust internal components. The robot has two propellers and various wires and electronic components visible inside its shell. The background is dark and out of focus.

Excellence with passion

# MASTER OF SCIENCE IN AEROSPACE ENGINEERING

*Post-graduate education for  
Aeronautics & Space - 2019*



# **ISAE-SUPAERO GRADUATES:** *more than a century of achievement*

■ **Inventors:** *from the designer of the first jet aircraft to the inventor of the black box*

■ **CEOs and high level executives at Airbus, Dassault, Safran, Thales, ATOS, AXA, IBM, and countless other industry leaders in France, Europe and all over the world**

■ **Directors of major programs such as Caravelle, Concorde, Airbus A320, Airbus A380 and Airbus 350**

■ **Astronauts**

*Three of today's European astronauts attended ISAE-SUPAERO: Samantha Cristoforetti, Italy, ISAE-SUPAERO research project in 2000, Thomas Pesquet, France, ISAE-SUPAERO 2001 graduate, Luca Parmitano, Italy, ISAE-SUPAERO 2009 Advanced Master's program graduate.*

# AT THE FOREFRONT OF AEROSPACE INNOVATION SINCE 1909

*A world leader in aerospace engineering higher education*

We have already trained more than 22 000 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.

**A wide range of degree programs in aerospace engineering:**

**33** programs

**1700** students

**1500** Masters and **200** PhDs

**30%** international students

**60** nationalities are present on campus

An extensive, **active international alumni** network

**An exceptional environment in the heart of Toulouse**

**Europe's leading hub of aerospace industries, laboratories and universities**

**A Public Institution of higher education and research**



# *An innovative curriculum and multidisciplinary approach designed to answer the needs of the aerospace sector*

## **ENCOURAGING STUDENTS INITIATIVE & INNOVATION**



### **Airbus Space Entrepreneurship Prize 2018**

Five students of the Master Aerospace Engineering won the Airbus Space Entrepreneurship Prize 2018. This international team from Spain, Madagascar, Italy and France worked on Greenvest – an energy start-up that aims to apply artificial intelligence to satellite data in order to develop optimal renewable energy hybrid solutions for regional deployments.

ActInSpace is the only contest in the world that offers the chance to work on CNES and ESA patents. Airbus challenged participants to use space technologies to launch a startup with a real impact on daily life.

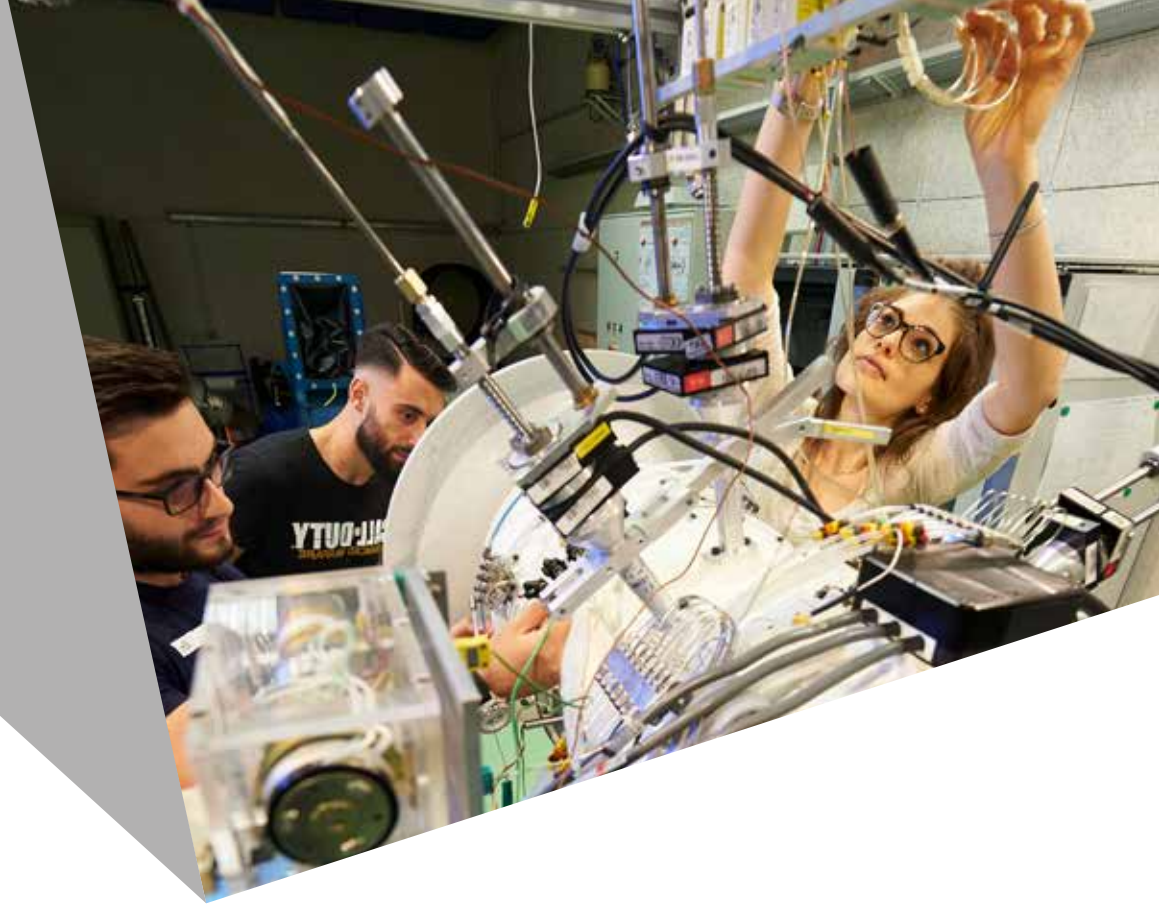


### **The MORE experiment**

A sounding rocket carrying the MORE experiment developed by 6 Master's students was launched from Kiruna, Sweden, on Monday, March 12, 2018, at 3:30 pm.

The purpose of the MORE payload was to measure the behavior of optical fiber transmissions during takeoff and throughout the flight. This experiment is sponsored by the CSUT (Centre Spatial Universitaire de Toulouse – Toulouse University Space Center), where ISAE-SUPAERO is a major player alongside the LAAS (UPS/CNRS). It is part of the NIMPH (Nanosatellite to Investigate Microwave Photonics Hardware) nanosatellite development project, which has the objective of testing optical components (lasers, couplers and optical fibers, etc.) to be used in future telecommunication satellites.





## ***DESIGNING COMPLEX AEROSPACE SYSTEMS***

*Designing complex systems for latest generation aircraft, satellite, or UAV requires the skills of multidisciplinary engineers and systems architects with the most advanced scientific training.*

*Collaborating closely with the aerospace industry, the MSc in Aerospace Engineering program is connected to cutting-edge technologies and delivers courses based on the latest knowledge in a wide range of fields.*

*The curriculum prepares students to become highly skilled, versatile engineers with a deep knowledge in one or more field and the ability to collaborate across disciplines.*

*Prepared to engage in careers with high levels of responsibility, MSc Aerospace Engineering graduates are skilled in project management in an international environment. They are prepared to contribute to new fields of research and to anticipate and shape the latest industrial and technological developments.*

# A multidisciplinary curriculum

*The first semester focuses on the common core curriculum. It takes also in account the background of the students, while the second semester offers a wide choice of nineteen electives.*

*In the third semester, students choose from among seven concentrations spanning the main areas of aeronautical and space systems design.*

Sciences & engineering,  
project management  
& systems engineering,  
foreign languages

## 1<sup>ST</sup> YEAR

### 1<sup>ST</sup> SEMESTER

### 2<sup>ND</sup> SEMESTER

#### COMMON CORE

#### ELECTIVE COURSES

#### RESEARCH

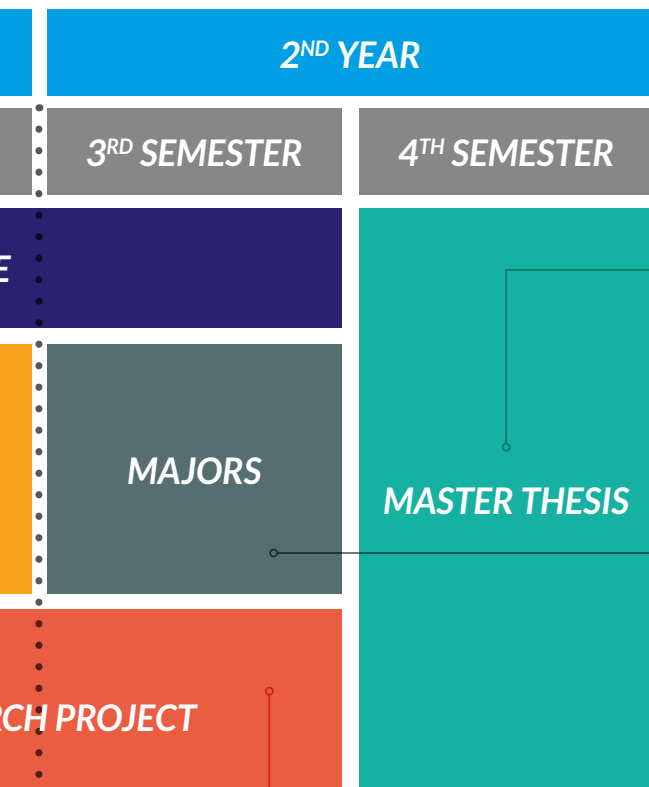
19 electives to broaden  
students' horizons  
in new areas

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FULLY TAUGHT IN ENGLISH

4 SEMESTERS OF 30 ECTS EACH



In a company or a research laboratory

A choice of 7 areas of expertise:

- Advanced Aerodynamics and propulsion
- Aerospace structures
- Aerospace systems and control
- Embedded systems
- Space systems
- Systems engineering
- Next-Generation Satellites services

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

ACCREDITED  
BY THE FRENCH  
MINISTRY  
OF HIGHER  
EDUCATION  
AND RESEARCH  
IN LINE WITH  
THE EUROPEAN  
HIGHER  
EDUCATION  
SYSTEM

INDUSTRY  
CEMENT  
TIONAL)



# Common core

The core curriculum is multidisciplinary with a strong grounding in science and engineering, along with courses in project management and foreign languages

## Sciences & engineering

Objective: to master solid technical and scientific skills in the major disciplines related to aerospace engineering

- Aircraft systems
- Space systems
- Human factors
- Airworthiness
- Control
- Aerodynamics & propulsion
- Flight dynamics
- Aeronautical structures
- Applied mathematics
- Algorithm and computing
- Signal processing
- Cyber physical systems

## Project management & systems engineering

Objective: to develop a global, interdisciplinary approach to the design and development of a product or a system

- Project management
- Systems engineering

## Foreign Languages

Objective: to prepare to work in evolving multicultural, team- oriented environments

- Languages: French as a Foreign , German, Arab, Chinese, Spanish, Italian, Japanese, Portuguese, Russian
- Intercultural Workshop

# Electives

Students select four electives among a choice of nineteen

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



# Majors

Students focus on one of seven areas of expertise including:

- Advanced Aerodynamics and propulsion
- Aerospace structures
- Aerospace systems and control
- Embedded systems
- Space systems
- Systems engineering
- Next-Generation Satellites services

## Pathway Aircraft Design and Operation:

Student attending majors Aerospace structure and Aerospace system and control can follow the pathway Aircraft Design and Operation. In this case they attend two dedicated modules, in semester 2, and they perform their research project in this field.

# Projects

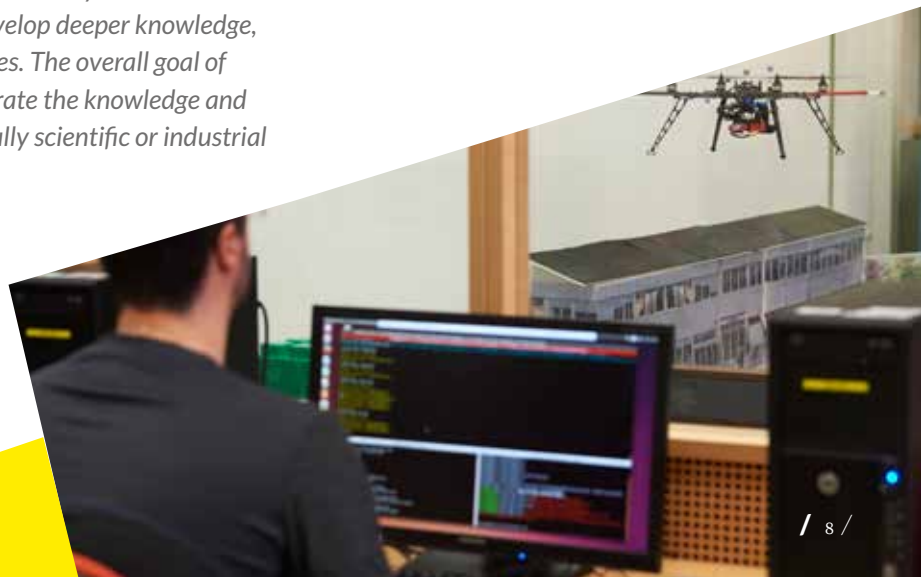
Projects are a key component of the program and are designed to broaden students' scientific, intellectual and social horizons.

## Research project

- This project features a experience of research at graduate level over 2 semesters with a focus on acquiring in-depth knowledge, expanding autonomy, and fostering innovativeness and the ability to think critically.

# Master thesis

- The master thesis is performed either in industry or in a laboratory. It enables the student to develop deeper knowledge, understanding, capabilities and attitudes. The overall goal of the thesis is for the student to demonstrate the knowledge and capability required to address successfully scientific or industrial challenges.



# Acquiring research experience

## **PhD Track:**

Every year, several Master Graduates pursue PHD studies in our laboratories. Msc and PhD programs can be connected in the frame of a PhD Track, supported by Toulouse School of Aerospace Engineering (TSAE).

*Research laboratories host students to complete their research projects*

**360**  
researchers on campus

**6**  
doctoral schools

**An international center  
to host and train doctoral  
students**

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



*A multidisciplinary scientific policy:*

## **5 teaching and research departments**

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

All 5 departments support a micro-aerial vehicle development program at an international level, on the basis of student projects, research and innovation projects, and international competitions.

### **World class research facilities**

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



# *Growing professional experience*



*By the time they have graduated, MSc students will have completed several experiences during which they have a hands-on opportunity to develop team work methods, project management skills, and research practices, as well as working in a multicultural, international environment.*



## **Industrial experience**

- Master thesis (1 semester)
- Optional internship (2 months)



**RAGHU VAMSI DEEPTIHMAHANTHIS:**

*Going ahead with my decision for doing Masters in Aerospace Engineering, ISAE-SUPAERO stood at the top. Interesting course structure, innovative projects, and the location: Toulouse which is considered the hub of Aerospace. I took Aerospace systems and controls as my major for specialization. In my second semester, I got a chance to do my research project for a year on a CNES satellite mission under a CNES Scientist. In my final semester I did my internship in an industry where I gained knowledge and implemented logic, algorithms for the automatic aircraft part design and placement. I understood that my work was going to bring some improvements in the existing industry. Now I am an Aerospace automation engineering developer. In parallel to my work, I am doing my research, which is funding by my company and some ISAE-SUPAERO students are also working with me on this project.*

*India - P3 (Toulouse - FRANCE).*





## International experience

Different options to get an international experience:

- Master thesis (1 semester)
- Optional internship (2 months)

ESTHER SUSANA RUFAT MEIX :

*After deciding that Engineering was the path I wanted to follow for my future career, I was also looking for a deeper connection with the industry and more research opportunities. All of this led me to choose ISAE-SUPAERO, as it offered me the opportunity to attend lectures given by professionals from the industry, to carry out a two-semester research project and also offered different majors which cover all the aspects of Aerospace Engineering. I chose the Structures Major, as it is what I am most passionate about. Therefore, I took theoretical and practical courses focused on structures and materials and learned how to use relevant software necessary to work in this field.*

*As for the Master thesis, I worked at Dassault Falcon Jet in Little Rock, Arkansas (USA). As a part of the Design Engineering team, my tasks focused on the optimization of the cabin dividers of Falcon Aircraft to reduce costs and weight. I chose this internship not only because of how much I value this French company and the project I was working on, but also because I was looking for the experience of an internship in the industry in the United States. I believe this internship in the 2nd year is fundamental, as it ensures that students are completely prepared for a professional career at the end of the MSc program, and that is very important and valued by companies nowadays.*

*Spain – Dassault Falcon Jet (Little Rock – USA).*



## Research and innovation experience

Working in an ISAE-SUPAERO research department or laboratory in France or abroad

- Research project
- Master thesis
- Optional internship

MARTA RASTEIRO DOS SANTOS :

*My decision to enroll the Master of Science at ISAE-SUPAERO was based in two major facts: my interest for Fluid Dynamics and Aeronautics and the high-level education and reputation of ISAE-SUPAERO in this field. During the master, I developed a strongly consolidate expertise in Aerodynamics, Fluid Mechanics and Propulsion, given by the Major of Advanced Aerodynamics and Propulsion, and, at the same time an overall insight of the Aeronautic and Aerospace fields. Currently, I am doing my Master thesis in the ISAE- SUPAERO - Department of Aerodynamics, Energetics and Propulsion - where I joined a research team working in the understanding of the development of a fluid dynamic instability. This internship represents for me a first contact with the research world, where I am having the change to improve my practical capacities and to expand my theoretical knowledge.*

*Portugal (Recipient of Gifas Scholarship Award) - ISAE SUPAERO, Department of Aerodynamics, Energetics and Propulsion (Toulouse -FRANCE).*

# Close collaboration with companies & industry

**250**

companies support our  
development

An alumni network of over  
**22 200** graduates

**1800**

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

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

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

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

**AIRBUS** MECANO ID **ALTRAN** **ROLLSROYCE**  
**ATOS** **ATR** **ACCENTURE** **SOPRA** **STERIA** **CNES** **RENAULT**  
**DASSAULT** **AKKA** **PRAMANA** **AIRFRANCE** **STELIA**  
**DAHER** **THALES** **IAC** **SAFRAN** **ALTEN** **EY** **MBDA**  
**PWC** **THEANO** **ADVISORS** **CYLAD** **ARIANE GROUP**  
**WAVESTONE** **CAPGEMINI** **LIEBHERR**  
**AVENCORE** **AIR LIQUIDE**

...

# For your future a wide range of exciting career perspectives

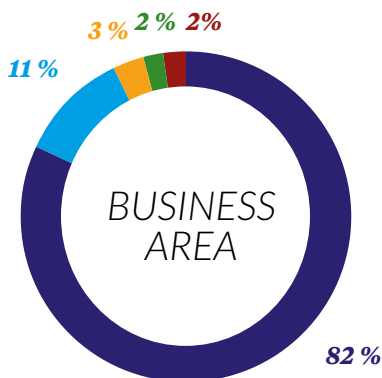
## LARGE JOB OPPORTUNITIES

*Our graduates will work as technical experts, researchers and managers in the fast-expanding aerospace sector and key sectors of the economy, in Europe and all over the world.*

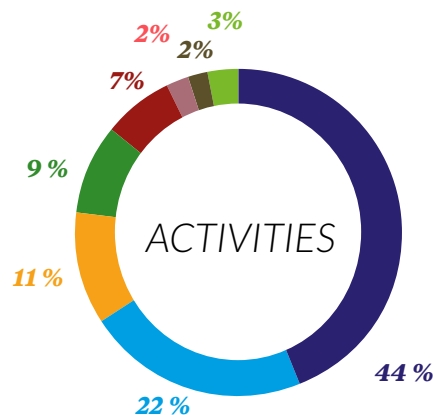
## CLOSE-UP ON THE CLASS OF 2017

**91 %** Hired less than  
four months after  
obtaining the degree

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



■ Aeronautics and Space ■ Teaching & Research  
■ Transports ■ Telecommunication ■ Energy



■ Research and development ■ Survey -expertise and consulting  
■ Research and development (PHD) ■ Supply Chain  
■ Informatics Maintenance and support  
■ Aeronautical Maintenance and support  
■ Telecommunications, I.T Networks ■ Others

## MAIN RECRUITERS

**ALTRAN, AIRBUS, ALTEN, THALES, CAPGEMINI, SAFRAN, P3,...**

# *Join the MSc in aerospace engineering program*



## *Eligibility*

---

**Fully taught in English, the program is particularly suitable for students with a bachelor's degree in aerospace or aeronautical engineering, mechanical engineering and mechatronics.**

- All majors are open to these students: Advanced aerodynamics and propulsion, Aerospace structures, Space systems, Aerospace systems and control, Embedded system, Systems engineering, Next-Generation Satellites services.

**The program is also open to students with a bachelor's degree in electrical engineering, electronics, telecommunications and computer sciences.**

- Five majors are open to these students: Space systems, Aerospace systems and control, Embedded systems, Systems engineering, Next-Generation Satellites services.

**Students with a bachelor's degree in other fields of engineering (industrial engineering, civil engineering...) or in sciences (physics, mathematics, computer sciences ...) may also apply to the program.**

- ISAE-SUPAERO admissions officers will provide them with information on the major open to them.

**For more information on the admissions procedure, please visit:**

[www.isae-supaero.fr/en/academics/master-s-degree-msc/admissions/](http://www.isae-supaero.fr/en/academics/master-s-degree-msc/admissions/)



# Funding

Our Master of Science students can benefit from financial support from ISAE-SUPAERO Foundation and partners.



## ISAE-SUPAERO Foundation scholarship

This grant covers tuition fees and allows students to loan to €7,000 without interest. This amount must be refunded within 2 years after graduation according to a schedule agreed upon with the ISAE-SUPAERO Foundation.

## AIRBUS

### CEDAR Excellence scholarship

The scholarship of the Chair for Eco-Design of Aircraft (CEDAR) by Airbus covers tuition fees and part of living expenses.

## THALES

### ARISE Excellence scholarship

The scholarship of the Chair ARISE, by Thales, for applicants to the MSc Aerospace Engineering (major "Embedded Systems" on the third semester) covers tuition fees and part of living expenses.



### MBDA Program of Excellence for India at ISAE-SUPAERO

This scholarship covers tuition fees and part of living expenses.

## TSAE

### Toulouse School of Aerospace Engineering

Toulouse School of Aerospace Engineering (TSAE), a joint program between ISAE-SUPAERO, ONERA and ENAC aims at promoting graduate and PhD programs in the aerospace engineering domain. Towards this end, it offers scholarships to undergraduate students who wish to enter the MSc in Aerospace Engineering of ISAE-SUPAERO and to pursue in a PhD program.



### GIFAS Program of Excellence

This scholarship covers tuition fees and part of living expenses.




### MBDA Program of Excellence for Indonesia at ISAE-SUPAERO

This scholarship covers tuition fees and part of living expenses.

For more information on financial aid for foreign students in France, visit the Campus France website: <http://www.campusfrance.org>.

Many government scholarships are available as well (CONACYT (Mexico), BECAS CHILE (Chile), COLFUTURO (Colombia), CIENCIA SEM FRONTERAS (Brazil), BEC-AR (Argentina), ...



# ***Campus life in the heart of Toulouse***

## **Toulouse, European Capital of aeronautics and space**

Nearly **90 000** direct jobs in aeronautics and space

The leading French region for research and aeronautics education.

## **4th city and university of France**

Known as «la ville rose», in reference to the color of the city's many historical brick buildings

Repeatedly voted by the French as one of the most desirable places to live in France: exceptional quality of life, a great place to live as a student !



# ***Welcome to our outstanding campus***

Located at the heart of the scientific and university complex, our campus includes 22 hectares along the UNESCO classified, lovely Canal du Midi. Teaching, living and sports facilities – we have it all.



## A complete range of athletic facilities

You will enjoy the pool, gym, climbing walls, fitness center, football and rugby fields, tennis and squash courts.

More than 80 clubs for a dynamic associative life: culture, sports, technical clubs (micro-drones, space club, aeromodelling, robotics, etc.), social and humanitarian actions, event organization, etc.

## Practicing aeronautical sports

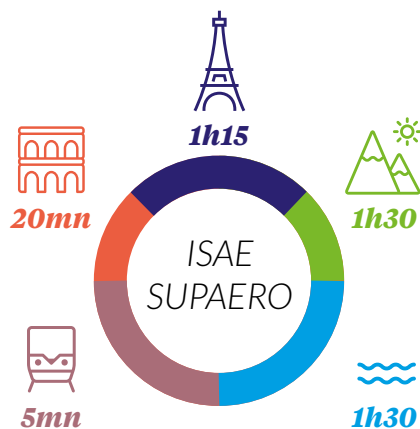
Ten minutes from campus, we have a fleet of 9 planes (TB 20, Robin DR 400). Students have the opportunity to earn a wide choice of flight licenses under very preferential conditions: powered aircraft gliding, parachuting, and paragliding. Every year 35 students obtain a pilot's license.

## Student residences and the Student Center

The 6 entirely new residences offer 1000 housing units, from 14m<sup>2</sup> to 46m<sup>2</sup>.

Residences include common areas such as study rooms, kitchens, and laundry rooms.

The Student Center includes a large main room with a snack bar area, a living room, TV rooms, and rooms for student clubs and activities.



- Paris by Plane
- Downtown by car
- Cycling to the metro
- Mediterranean Sea by car
- Pyrénées mountains by car



The ISAE-SUPAERO Toul'box: a student welcome kit to make life easier right from day one: formalities, setting up a bank account, housing, language courses, cultural activities-find out all you need to know and get started right away!

Find out more at: <https://toulbox.univ-toulouse.fr>  
(Our Packages > Special packs > ISAE-SUPAERO)

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BP 54032  
31055 Toulouse CEDEX 4  
France

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33 (0)5 61 33 80 13

**Contact**

info-masters@isae-supaero.fr

**Website**

[www.isae-supaero.fr/en](http://www.isae-supaero.fr/en)



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