isae
Institut Supérieur de l'Aéronautique et de l'Espace
ENSMA

ECOLE NATIONALE SUPERIEURE DE MECANIQUE ET D'AEROTECHNIQUE

www.isae-ensma.fr

The ISAE Group

1st world center of training and research in aeronautical and space engineering

ISAE-ENSMA

the reference school in aeronautical and space design for CCP, the competitive entrance examination to Grandes Ecoles

POITIERS - FUTUROSCOPE

Founded in Poitiers in 1948, ENSMA has been located since 1993 next to the site of Futuroscope. In fifty years, our school has acquired a reputation for excellence by training more than 5500 high level engineers, supported by a world famous research programme developed through multiple partnerships with large companies, which, in addition, hire many of our graduate students.

The academic training given at ENSMA enables the young graduate engineers to choose jobs in engineering design departments, research and development mainly in the aeronautical and space industries, and more generally in the ground transportation, mechanics and energy industries.

The curriculum is extensive, covering fields such as: fluid and structure mechanics, aerodynamics, energy, thermal science and propulsion, materials and industrial computer science. The school can thus live up to the companies' expectations in terms of reactivity and adaptation abilities.

Thanks to long standing close industrial relations and strong connections with prestigious schools and universities in France, in Europe and throughout the world, our school is ready to take up the big challenges of the next decades in terms of innovation and technological changes and train the engineers of the future who will be able to take responsibilities and to bring performance to the companies of tomorrow.

In 2011, ENSMA turns a corner by taking on the name of ISAE-ENSMA. Indeed, ISAE - Institut Supérieur de l'Aéronautique et de l'Espace created from the merger of SUPAERO and ENSICA- takes the initiative to give their name to French aeronautical engineering schools by respecting a common charter of values and sharing collective projects of development. In 2012, ESTACA and the French Air Force Academy (Ecoles d'Officiers de l'Armée de l'Air) join the ISAE Group. In 2014, ISAE becomes ISAE-SUPAERO and the Ecoles d'Officiers de l'Armée de l'Air become the Ecole de l'Air. The ISAE Group will aim to increase the influence and visibility of its members, to promote high-level engineering training in the aeronautical and space fields.

Francis Cottet – ISAE-ENSMA Director

SUMMARY

Engineering training

At the heart of the company

A leading Research

Environment

Admission schemes, awarded degrees and contacts

Program:
PERFORMANCE, RIGOR, IMAGINATION

A training in mechanics and aeronautics

Extensive fields of competence:

- combining rigorous theoretical training and a thorough technological experience,
- centered on the fields of mechanics and energetics,
- focused on aeronautics and space, ground transportation and energy industries.

A preparation for an engineer's career to:

- anticipate fast technological developments,
- develop innovation abilities,
- take on the new duties and tasks of the engineer,
- ensure the best integration into the companies.

The development of personal qualities to:

- carry out a professional project,
- learn autonomy and team work,
- communicate.

First steps in companies

During their 3 years of studies at ENSMA, students put into practice what they have learned and gain hands-on experience of engineering tasks through 3 compulsory internships. The three internships can be performed either in France or abroad.

Blue-collar internship
A 1- to 2 month placement at the end of the 1st year
During this first internship, students work as blue-collar workers and discover the world of production. They learn to value the importance of human and social relations within a company.

Junior Engineer training
A 3- 4 month placement at the end of the 2nd year
This internship, supervised by an engineer, allows them to discover first-hand what the work of an engineer entails.

Graduation project
Enables the students to supplement their training according to their professional project (industry, research, international ...).
A 3-to 6 month placement that can be carried out in a company, in a university or in a research laboratory.

Engineering design project

Developed in partnership with companies,
these works allow the students to grasp a problem in general.

THE NETWORKS

THE OPENING TO INTERNATIONAL RELATIONS

The teaching of foreign languages is very important in the curriculum of the ENSMA students.

English courses are compulsory. A minimum standard (TOEIC) is required to obtain ENSMA's degree. Students can also study other languages if they wish to.

International exchanges with 53 universities enable many students to carry out internships or part of their curriculum in institutions in Europe, North America, Asia... (23 countries).

A minimum one-month international experience is now required to get the engineering master degree.

The **ISAE** Group

The ISAE Group will enable to strengthen the schools' attraction towards the students, to optimize the adequacy between the training and the employers' need, and to develop research of excellence and international opening. The schools, from the ISAE Group, deliver high-level engineering trainings (ISAE-ENSMA, ISAE-SUPAERO, ESTACA and Ecole de l'Air), masters, specialized masters, and PhD programs.

POLYMECA

This network facilitates foreign student exchanges and students from any of the following schools specialising in mechanical engineering to complete their third year of studies at one of the other partner schools : ENSCI Limoges, ENSEIRB-MATMECA Bordeaux, SEATECH Toulon, ENSIAME Valenciennes, ENSMM Besançon, ENSTA Bretagne, SUPMECA Paris, and ISAE-ENSMA Poitiers.

PEGASUS

The **PEGASUS** network is the brainchild of ISAE-ENSMA, ISAE-SUPAERO and ENAC. It aims to promote aerospace studies in Europe and delivers a « Pegasus Award and Certificate » to our students speaking two languages and who's spent at least 5 months abroad.

INTERNATIONAL **NETWORKS**

In order to facilitate exchanges, ISAE-ENSMA plays an active role as a member of the **GE4** (one or two semesters in the United-States or Russia...), **CREPUQ** (exchange program with Québec) and **PFIEV** networks (program supports the training of Vietnamese students). The school also participates in international programs, **BRAFITEC** (Brazil), **ARFITEC** (Argentina) and **SIAE** Tianjin (China)

Teachings

COMMON TEACHING	1st YEAR	Scientific, technical and management studies
		1- to 2 month industrial experience
	2nd YEAR	Engineering sciences courses
SPECIALIZATION		3- to 4 month junior engineer training period in industry
	3rd YEAR	**Advanced level courses in engineering : 6 options** • Aerodynamics • Energetics • Heat transfer • Structures • Advanced materials • Computer science and avionics
		A 3- to 6 month graduation project 3rd year exchanges in foreign institutions
ENSMA ENGINEER DIPLOMA		
↓ PROFESSIONAL ACTIVITY		↓ COMPLEMENTARY TRAINING PhD, 1 year advanced specialization...

Teachings Departments at ENSMA

FLUID MECHANICS and AERODYNAMICS

The basic concepts are taught as of the first year. The students who wish to deepen their knowledge can follow, in third year, specialized courses: **extern, intern and numerical aerodynamics and turbulence**. The equipment of the school in subsonic and supersonic wind tunnels enables to illustrate the concepts introduced in class.

ENERGETICS and HEAT TRANSFER

After the **thermodynamics of the engines, thermal transfers, combustion and detonics science** are covered. All the areas are thus joined together for the entire study of the industrial facilities. The equipment of the school enables to reproduce the phenomena to study them in real size.

Henri Poncin's amphitheatre

ENGINEERING of INDUSTRIAL SYSTEMS

The technological culture is at the heart of the engineering sector and the **design-manufacturing process of an industrial product**. From practical examples, the offered teaching is based on **CAD using 3-D modelling software** supporting the liaison between different fields (structures calculus, aerodynamics, thermal science...). The aim is to the develop synthesis, innovation and open-minded spirit skills towards industry. Technology is taught in 3rd year of studies through engineering design projects.

MATERIALS and STRUCTURES

The study of **structures and materials**, on macroscopic and microscopic scales, starts in first year. More specific subjects are covered (**plasticity, damages, laminates, polymers, x-rays**...) so that the students familiarize with the modern evaluation methods of the numerical and experimental constraints used in industry.

MANAGEMENT and LIBERAL STUDIES

In a spirit of internationalization, the school delivers training in foreign languages necessary for the future engineers. Moreover, sport activities are integrated into the teaching with weekly courses and several university competitions. Finally, the resource centre and the library offer the students the opportunity to work in quiet places, have access to a range of diverse documents and the use of the new communication tools.

COMPUTER SCIENCE and AUTOMATICS

The study of languages and techniques of scientific and industrial computer science is an important part of the core curriculum. The 3rd year option « Computer science and avionics » (**software engineering, embedded real-time systems, data engineering, human-machine interface**...) trains engineers specialized in the integration of these new tools in this area of interest.

Library

Internships

A 380 - *AIRBUS*

The acquaintance of the professional environment is made through three internships: a blue-collar internship at the end of the first year, a junior engineer training at the end of the second year and a graduation project at the end of the third year. These internships (which can be up to 12 months) are compulsory and give the students the possibility to put into practice what they have learned and gain hands-on experience of engineering tasks.

ENSMA graduates are mainly recruited by large national and international companies (EADS, Airbus, Snecma-Groupe Safran, Dassault Aviation, Renault, PSA, Thales, EDF, Areva, Alstom ...) or by associated service providers, such as ALTRAN or Teuchos-Groupe Safran, Sogeto High Tech, Aéroconseil, etc.

Some **examples**

Contact : **stages@ensma.fr**

BOMBARDIER AERONAUTIQUE
MONTRÉAL, CANADA
Code development for the acoustic analysis of noise pollution generated by air traffic

EUROCOPTER DEUTSCHLAND GMBH
MUNICH, ALLEMAGNE
Analysis and simulation of impacts on carbon composite components

AIRBUS FRANCE
TOULOUSE
Devising of automatic tests for the validation of a380 integration simulators

ALCATEL SPACE
CANNES LA BOCCA
Application of the finite elements method to thermal modelling of satellites

CNES
(Centre National d'Etudes Spatiales)
EVRY
Dynamic studies on ariane 5 and derivatives in pilot study

DASSAULT AVIATION
SAINT-CLOUD
Aerothermal modelling of internal flows of an aircraft

EADS ASTRIUM ST
ST MEDARD EN JALLES
Prédimensioning of landing systems for planetary space probes

PEUGEOT SPORT
VELIZY
Aerodynamic dévelopment of the 307 WRC Peugeot

SNECMA-GROUPE SAFRAN
MOISSY CRAMAYEL
Validation of a thermodynamic model of cfm56 5c/p

Ariane 5 Rocket
ESA/CNES/Arianespace/CEF

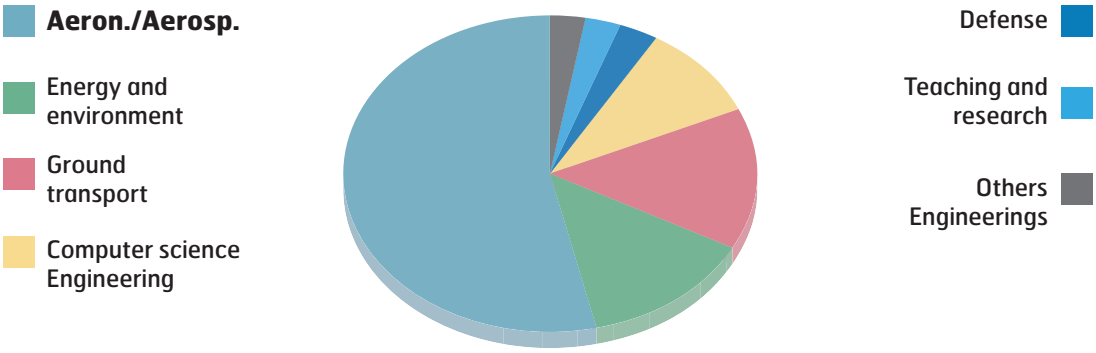
Moteur GE90
SNECMA-Groupe SAFRAN

Engineering **careers**

At the beginning of their careers, ENSMA engineers mainly work in the **field of aeronautics/ aerospace**, within **international companies** where they work in **engineering design** (results taken from the professional integration survey, average on the last 3 classes).

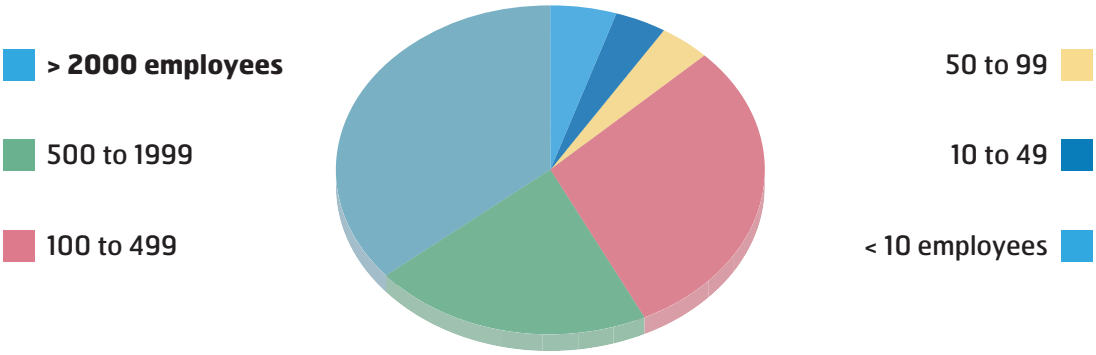
Contact : **emploi@ensma.fr**

Branches of activity



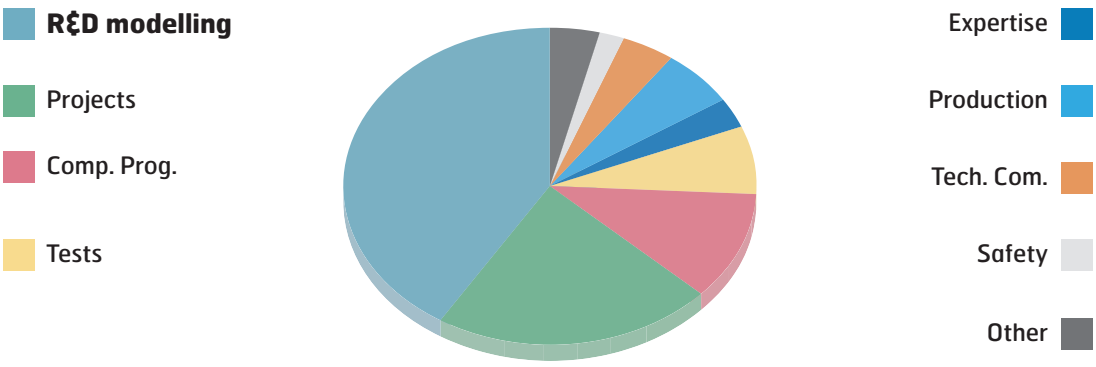
The choice of ENSMA graduates to work in aeronautics and aerospace is in keeping with the wish which most students express when arriving at ENSMA. However, thanks to the broad academic training they have received at ENSMA, others choose to work in other branches, such as mechanical engineering and ground transportation and energy.

Size of the companies (in number of employees)



On average, more than 65% of the ENSMA graduates begin to work for large or very large companies (500 employees or more).

Types of jobs



At the beginning of their careers, more than 80% of ENSMA engineers work in engineering design. Approximately 6% work in a production department, and less than 3% as sales engineers.

Ensma engineers **testimonies**

TEMOIGNAGE

Yann LAROCHE
(Class of 1968)
Special Consultant for the CEO
EDF

40 years ago, I was passionate for aeronautics and I have thus been admitted to ENSMA. Upon graduation, I wanted to take practical responsibilities and I found, with EDF, a dynamic company at the heart of energy problems and what was not yet called sustainable development.

I have developed my skills through various responsibilities abroad or in France and I was, for more than 7 years, until 2008, Executive Vice President, in charge of the Human Resources and Communication.

TEMOIGNAGE

Isabelle DUBOIS
(Class of 1977)
Human Resources Director – Technical Department ***SNECMA - Groupe SAFRAN***

After 5 years spent in nuclear engineering, in Framatome and then Novatome, I have worked in the aeronautical field by integrating Snecma.

My career, in very different industrial fields, was the result of the solid technical training offered by ENSMA that benefits from high-level research laboratories… physics laws that remains the same everywhere, thanks to God!

I have mainly made my career in the R&T world, liking the idea of preparing the future and it has offered me opportunities to work with partners from all over the world (USA, Japan, and Europe).

TEMOIGNAGE

Alain BASSIL
(Class of 1977)
Executive Vice-President Air France Operations CEO
AIR FRANCE INDUSTRIES

Passionate with aeronautics and leading-edge technology, I was graduated from ENSMA in 1977 by having a post-graduated specialization in Advanced Automation at SUPAERO.

It allowed me to join Air France being in charge of the implementation of the first numerical flight simulators. I was then in charge of different technical issues (in charge of the B747 fleets), production issues (airframe overhaul of medium-range aircrafts), strategic planning issues, and management (director of the department for airframe overhaul of Boeing and Airbus long-range aircrafts).

Appointed in 1998 as Deputy Managing Director of Air France, in charge of Air France Industries, the technical and industrial branch of Air France, I have managed the technical aspects of the creation of Air France KLM and the adaptation of the company into this new environment. Since 2010, I am in charge of an extended area of air and ground operations for Air France.

With hindsight, I can tell today that the technical and human training provided by ENSMA allows having an "initial velocity", making easier the adaptation and apprehension of the multiple aspects an engineer has to manage in companies that constantly evolve.

TEMOIGNAGE

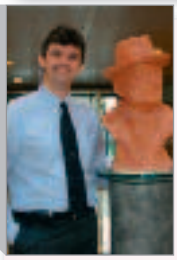
Willy-Pierre DUPONT
(Class of 1982)
Head of Airport Operations
AIRBUS

After 13 years spent in the Pilot Studies department of Aérospatiale, where I had the opportunity to take part in the conception of military freighters, special aircraft and Airbus commercial jetliners, like the A318, A2319, A321, A330-200, A340-500/600, I devoted myself exclusively to the A380, from 1996 onwards.

Having followed this project (UHCA, ASX, A2000, VLCT …) from the very beginning, in the late 1980's, I participated in the attempt to devise a closer framework of collaboration with Boeing (VLCT). I then joined the A3XX leading team which covered a variety of aspects. As a member of that team, I was a witness to the rise of European cooperation in the aircraft industry.

When the program reached its pre-development stage, long before the launching, I was made responsible for airport compatibility, which was not a particularly fascininating aspect, but which quickly became critical for our clients.

TEMOIGNAGE



Julien HENRY
(Class of 1983)
Head of Employment section
Direction of Social Relations and Human Resources
DASSAULT AVIATION

As a young ENSMA graduate, I've had the opportunity to carry out my national military service in the Technical Services of the Aeronautical Programs of the DGA (Direction Générale de l'Armement) as an assistant within the team "program European fighter aircraft". After my engineering internship in Dassault Aviation, I have thus found back this company on the strategic matter which was going to lead to the RAFALE programme. One of my goals was to be hired by this company after graduation, I have joined the direction board, where I had carried out my internship, to commit myself on the Rafale flight control system. After years of programming, simulation and tests, I've had the opportunity to join the engineering and design department on the space preliminary project where I could widen my technical skills by developing futuristic projects like systems of space transports with conventional take-offs.

During these seven years as a design engineer, I have felt the growing need to go beyond the simple technical research activity. In parallel, my sport career (being fruitful by the title of World Champion of Gliding in 1999) led me to get interested in engines and more particularly their individual and collective performances in sport. Such principles perfectly apply at the professional level and are implemented in the Human Resources departments of the companies. I thus naturally integrated the HRD to initially take part in the development of educational tools specifically related to the activities of our airframe manufacturers and then take in charge the social communication before coming to the Head of the Dassault Aviation Employment Section.

TEMOIGNAGE

Céline COUQUET
(Class of 2000)
Engine engineer, Head of adaptation project
RENAULT

After obtaining my scientific Baccalauréat in 1993, I went to university and obtained a Maîtrise de Mécanique, a 4-year degree in mechanics from the University of Poitiers. This qualification enabled me to be admitted to ENSMA, through a special admission system, in 1998.

I chose to specialize in energetics and combustion in my third year and complement my training with a postgraduate advanced research degree in combustion within the Combustion and Detonation laboratory.

When I was 13, I decided that I would work on engines and have never changed my mind since. Aeronautics and automobiles have always been my two passions. They run in the family since my father loves cars too! It was then a matter of choosing the appropriate study path. ENSMA helped me make my dream come true.

I graduated in September 2000, and then joined the Renault facility in Lardy which specialises in the development of the brand's engines. Early 2001, a position as test engineer for single-cylinder engines and combustion was made vacant at Renault Sport in Vitry-Châtillon.

TEMOIGNAGE

Caroline AUSSILHOU
(Class of 1996)
Launcher Protection of Ariane 5
Launch Complex Manager ***CNES***

I had the opportunity to join ENSMA in 1993. During my 3 years there, I greatly appreciated the training I received, which was both comprehensive and geared towards aeronautics, and which combined theory and practice. Furthermore, as ENSMA makes a point of offering its students the possibility to study abroad, through exchanges with foreign universities, I was able to complete both my third year of studies and my graduation project in Melbourne, Australia. This was a great springboard for my career. When I came back at the end of 1996, I had no difficulty finding a job and was hired by IBM France, in the awesome world of microelectronics.

However, I could not long let go of my passion for « flying objects ». In 1999, I joined the Centre National d'ETudes Spatiales, as a member of the department of Ariane Launchers and took part in the development of the new European launcher, the heavy model of Ariane 5.

TEMOIGNAGE

Mehdi BENNABBOU
(Class of 2006)
Motorist Engineer
Consultant for PSA Peugeot Citroën
Diesel and Fuel Motors air inlet and breathing
Team Manager
ALTRAN

During my 3 years at ENSMA, the theoretical and practical teaching I have received was essential to face the professional world's expectations. I graduated from ENSMA in 2006, I had the opportunity to join the Altran group in the Automobile pole where I have worked for PSA Peugeot Citroën as a motorist engineer. The practical courses taught at ENSMA were essential to get into this area I am fond of.

Since 2008, I am in charge of the pole "Motor performances" from the Altran group.

In addition I am in charge of the creation and development of "thermal engines" training of the group.

My interest for associative activities I have developed at ENSMA allowed me to be designated today as the representative of ENSMA-Contact (alumni association) for Île-de-France.

Falcon 7X et A380 – *Dassault Aviation*

TEMOIGNAGE

Fabien HÖRLIN
(Class of 2005)
Direct Entry Graduate – Structure
AIRBUS UK

I have always wanted to become an aeronautical engineer in order to make of my passion for aviation a career. This is precisely what ENSMA enabled me to achieve since I have studied there.

After the first two years of general teaching, I had the opportunity, thanks the ENSMA international cooperation with foreign universities, to spend my last year at the University of Cranfield (United Kingdom), within the framework of the European program called Erasmus. I thus followed there the courses of the master of Aerospace Vehicle Design which allowed me get a double degree from ENSMA and the University of Cranfield.

I was not yet graduated that I had already been recruited by Airbus U.K. to integrate their training course - Direct Entry Graduate Scheme - allowing young graduates to exert responsibilities and acquire experiences more quickly. Therefore, since the end of September 2005, I have already worked on three different posts on several projects in the field of the wings structure: initially in charge of the modifications of design on the A340 500-600, then on the A350 as a designer of the composite skins of the wing and finally as a calculation engineer on the rear longeron of the A350.

My ambition, through this training, is to become an engineer in structure integration in the design of the wings of the future Airbus planes. In these functions, I could already realise the importance and the interest of my training at ENSMA: of course and mainly through vast theoretical background of the courses and the experience gained at the time of the engineering design projects and the lab works, but also through the exercise of associative responsibilities within the school's clubs.

Strong **industrial partnerships**

Poles of competitiveness

Owing to its expertise in aeronautics, aerospace, ground transportation and energy systems, both at academic and research levels, ENSMA has forged ties especially with two poles of competitiveness:

- The "Pôle mondial AESE Midi-Pyrénées/ Aquitaine", the leading French centre of excellence dedicated to aeronautics, aerospace and embedded systems, which is backed by an industry of some 94,000 staff, which forms a community of 8,500 researchers to which the 4,000 students engineers at the French graduate aeronautical schools must be added. ENSMA, together with its partners in GEA, the Grandes Ecoles Aéronautiques, is a founding member of Aerospace Valley, the council which manages the pole of competitiveness.

- EMC2 is rooted in a historical culture of transformation and implementation of materials in Pays de la Loire. The association has around markets and key technologies, all innovation actors. Small and large companies, research organizations (including Pprime Institute), training centers (including ISAE-ENSMA) contribute to the emergence of R & D projects. Serving the French industrial competitiveness, a main objective: to strengthen the territorial ecosystem of innovation and growth, structuring and animating locally six sectors (aeronautics, naval, ground transportation, energy, boating and capital goods) in a common and transverse dimension: advanced production technology.

The industry plays a key role in the **ENSMA engineering training**

- Specialised courses given by industrials
- Collaboration for the engineering design projects and student projects
- Organisation of conferences, professional days and visits of companies
- Participation to the ENSMA careers fair
- **The apprenticeship tax is an essential boost** to guarantee the funding of the technical training.
- **ISAE-ENSMA has signed partnership agreements** with Dassault Aviation and Safran.

Technology plateform

ISAE-ENSMA is equipped with **a support plateform for technological transfer and innovation**. ESPRITT (**ESP**ace de **R**echerche, d'**I**nnovation et de **T**ransfert de **T**echnologies) is an important and identified interface between companies, research laboratories and structures for technology transfer.

Within the ISAE-ENSMA facilities, a 400 m² area was allocated for offices, meeting rooms, computer rooms, staff recreation room, to host the people from this activity, and to develop the future companies or projects from our engineering students.

The 500 k€ funding for this platform was raised thanks to the FEDER contribution up to 50 %.

An engineering training **at the heart of a leading research activity**.

At ENSMA, research is a tradition.
The close relationship between the 5 research laboratories, the teaching departments and industries means that students benefit from state-of-the-art training that introduces them to the latest advances in mechanical engineering and energetics.

The P' Institute
(UPR 3346)

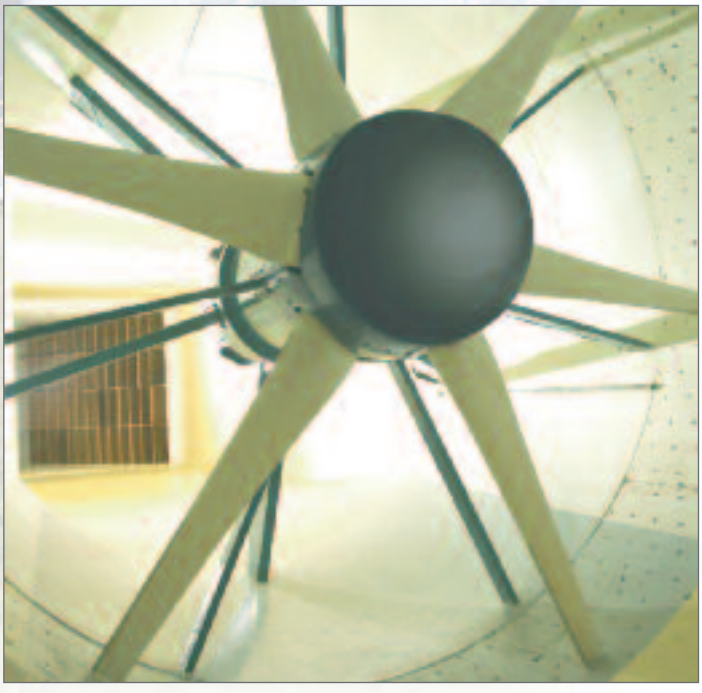
P' is composed of six laboratories in combustion and detonation, aerodynamics, heat transfer, mechanics and physics of materials and mechanical engineering.

A technological platform called the CEAT (research center in aerodynamics and heat transfer), from the University of Poitiers and ENSMA, gathers heavy research facilities as well as the facilities for the supersonic teaching of the school.

www.pprime.fr

The P' Institute
Aerodynamics

The laboratory specializes in fluid mechanics (gases and liquids) at low and very high velocities (super and hypersonic flows). In addition to numerical and experimental studies, research is also done on new theories. The laboratory tackles issues related to aerodynamics, turbulence, flow control and aeroacoustics, which apply to terrestrial, aeronautical and aerospace transport systems. The laboratory is a key participant in a series of French and Pan-European research programs supported by the industries mentioned above. At The laboratory, wind tunnel tests are conducted and other specific test beds are set up for research.



Fan of the concrete wind tunnel

Direct simulation of a mixture of 2 vertical jets at different temperatures

The P' Institute
The Thermal Studies

The purpose of the laboratory is to understand, predict and measure the heat transfers –by convection, conduction or radiation- in solids, fluids, heterogeneous and diphasic media. The main research specialities of the laboratory are natural and mixed convection, aerothermics, and radiation. A novel subject, micro and nano heat transfers, is being researched too.

The laboratory also specializes in applied research for sectors such as the aeronautical, aerospace, transport, food-processing, energy and environmental industries.

Thermal sciences are increasingly concerned with the physics of coupled transfers and interact with other disciplines such as electromagnetism, mechanics, chemistry, biomechanics and nanotechnologies and the many implications they have in numerous systems.

The P' Institute
The Combustion and Detonics

The mission of the laboratory is to conduct basic research on combustion phenomena (flames, reactive turbulent flows, detonations and combustion chemistry), stock propagation in solids and transfers in porous media.

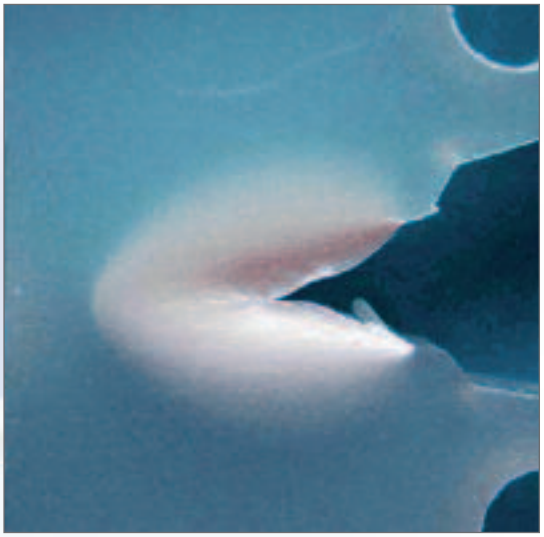
Concurrently, the laboratory develops applications in the fields of propulsion, the safety of industrial facilities and industrial processes, as well as in environmental protection. The laboratory had forged strong links with industry and large organization in the energy and defence areas.

Vulcain 2 – Snecma-Groupe Safran

The P' Institute
Mechanics and Materials Physics

The purpose of the laboratory is to conduct fundamental and applied research into the behavior and the durability of materials tested at different temperatures, in different environments and under different stresses. The emphasis is particularly placed on studying the interaction between the mechanical behavior, the microstructures and the fracture mechanics of specific materials as well as on setting up behavioral laws and performing structural analyses.

Different types of advanced materials (metal alloys, polymers, laminates, ceramics) are studied in their environment by diversified tests (fatigue, flow, heat ageing, shock absorption) coupled with observation methods at different scales and through analytical and numerical modelling. French and Pan-European research programs are developed on these topics in partnership with the transport industries (aeronautical, ground and maritime transport) and the energy sector.



Polypropylene crack – Fabienne Touchard

Laboratory of Computer Science and Automatic Control for Systems
(LIAS – EA 6315)

The LIAS is the result from the merge of two laboratories: the Applied Computer Science Laboratory (LISI, EA 1232) and the Laboratory of Automation and Applied Computer Science (LAII, EA 1219). Besides their complementarity and close expertise, these two laboratories share common applications in the transport, energy, and environment sectors. While merging, they gather all the common forces by showing to their future academic and industrial partners and other parties from socio-economic world their expertise and collaboration skills.

The laboratory is structured around four axes (or teams):

- **theme 1 :** Data and model engineering,
- **theme 2 :** Real-time embedded systems modelling,
- **theme 3 :** Modelling, identification and diagnosis of systems,
- **theme 4 :** Systems analysis and control.

The scientific cohesion is focused on two common research domains: the use of formal techniques and the development of interactive graphic tools.

On-board human-machine interface

In association with the Universities of Poitiers and La Rochelle, ISAE-ENSMA is also involved the PRIDES federation (Regional Program for Research: images, databases, and systems) that gathers 5 research laboratories on sciences and technologies for Information and Communication.

www.lias-lab.fr

Research **areas**

Ariane 5 Rocket - *ESA/CNES/Arianespace/CEF*

Supersonic combustion behind a shock

(P'-Combustion and Detonics)

Formation and stabilization of supersonic combustion behind an oblique shock wave: detached flame regime or oblique detonation. PREPHA contract (Research and Study Program of Advanced Hypersonic Propulsion).

Fire safety

(P'-Combustion and Detonics)

Study dedicated to improve the safety of buildings and to develop models able to predict, in confined space, the spill over of fire and the generated smoke (contracts with CEA, CEE, and EDF).

Supersonic aerodynamics

(P'-Aerodynamics)

Study in supersonic wind tunnel on models at simplified and small-scale: force channel, shock display, reduction of sonic bang...
Numerical simulation of supersonic flows around simple bodies. Optimization methods for the drag reduction (collaboration with ONERA).

Automotive aerodynamics and acoustics

(P'-Aerodynamics)

Experimental study in anechoic wind tunnel of aerodynamic flow and noise around a simplified automotive body.
Development of multisensor and multipoint meteorological systems (pressure-velocity) for analysis and modelling of flow separation, their impacts on the stability of the vehicle and their acoustic emission (programs with CNRS, PSA Peugeot, Citroën, Renault).

Super alloys: high temperature consequences

(P'-Mechanics and Material Physics)

Theses studies, managed in partnership with SNECMA Moteurs and TURBOMECA, relate to the durability of Nickel-based, mono- or poly-crystalline super alloys, for turbine wheels. The purpose is to control the super alloys ageing in extreme temperature conditions and to evaluate the impact on the residual maturity in fatigue, flow and fatigue-flow.

Modelling - *Dassault Aviation*

Durability of carbon fibres composites

(P'-Mechanics and Material Physics)

The study of the damage by thermal cycling of aeronautic laminate composites has been firstly justified by the « civil supersonic aircraft » application. Thanks to an original breadboard developed in the laboratory, this study underlined an important acceleration of the damage processes in presence of oxidizing environment. It gave rise to research activity around the modelling with predictive capacity, managed in partnership with specialists in polymers chemistry and damage mechanics.

Heat transfers in aeronautics

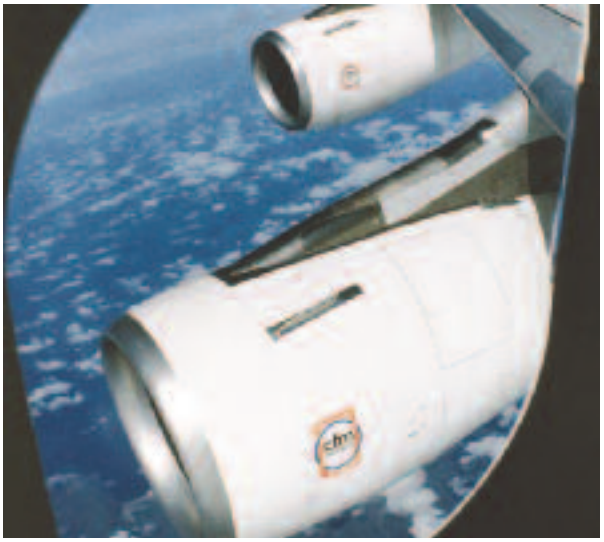
(P'-Thermal Studies)

The cooling of aircraft engines is studied by techniques such as: film cooling, jet impingement, multi punchings.... These studies are managed in partnership with SNECMA-Engines (SAFRAN Group), and also lead to European collaborations (ICTB2).

Thermal comfort

(P'-Thermal Studies)

Fundamental studies carried out in natural and mixed convection allowed to obtain a CNRS certificate for an application related to air-conditioning by an annular flow in closed loop system. The implementation of this jet allows creating, in an unconfined space, comfort conditions relating to the temperature and the moisture.



CFM56-5C - *SNECMA-Groupe SAFRAN*

Exchange between CAD systems

(LIAS)

Le laboratoire est à l'origine d'un modèle de données visant à permettre l'échange, entre systèmes CAO hétérogènes, de bibliothèques de modèles CAO de composants standards.

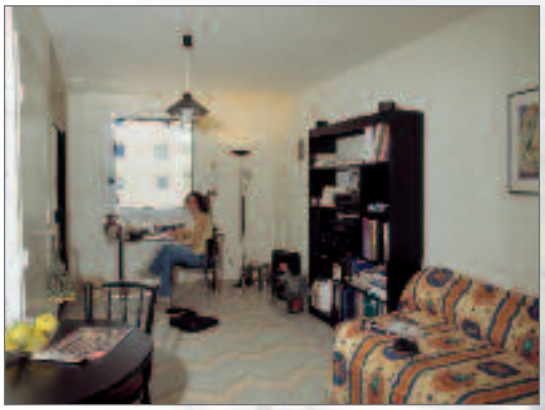
Graphical conception of an application of industrial processes control (LIAS)

This work, managed in collaboration with the National Instruments and Saphir companies, allowed developing a tool for the conception of applications of process control, based on a formal model (GRAFCET or Pétri networks) and implemented with a data flow graphical language.

Study of a flame propagation in a zero-g condition - *ESA/CNES/LCD*

Environment

Located from 1993 on the Futuroscope site, 12 km away from Poitiers, the new buildings with a futuristic architecture allow the students to progress in a highly technological environment.



University residence room

A large number of apartments (CROUS, HABITAT 86... for one, two or three persons with eligibility for housing allowance) and restaurants (university restaurant, brasserie, snack, pizzeria, saladerie...), a bank, a post-office, a bakery and a shopping center enable the students to line on campus.
A bus service provides a regular link with Poitiers which, by the high speed train, is 1h30 away from Paris, 1h40 away from Bordeaux and 1h30 away from La Rochelle. The exit "Futuroscope" links the site to the Paris-Bordeaux highway (A10).

Sport at ISAE-ENSMA

Sports and physical activities have always been part of the school's curriculum. It gathers students from the three years. Among the many possible activities let us quote:

- **collective sports:** basketball, soccer, rugby, handball, volleyball...
- **individual sports:** climbing, body building, tennis, swimming, badminton, cross-country race, athletics...

For all these activities, supervised by three teachers, **the school has exceptional facilities at its disposal:**

- a gymnasium with 3 tennis courts,9 badminton grounds, wall and artificial structure climbing. A body building room can also be found there,
- 4 outside tennis grounds,
- 1 soccer and rugby ground,
- 1 cross-country race trail and an athletics area.

Tournaments are organized every year:

- within the framework of the FNSU (National Federation of University Sports),
- for more than 50 years with the 3 aeronautics schools of Toulouse (ISAE, ENAC),
- with the other ENSIs (Ecoles Nationales Supérieures d'Ingénieurs).

Basketball

" Le Petit Prince " Aircraft

" ENSMArathon Shell " Car

The school **life**

Student life at ENSMA is livened up by **about fifty associations and clubs** managed by the Student Fraternity. Students can thus take part in the activity of their choice.

The different clubs:

■ ***sports:***

ENSMAREGATE takes part in the EHDEC race and the Armorica Cup, and also proposes weekends at sea for the beginners as for the initiates.
ENSMAIR offers its members (conquered by the first flight offered to all new class) to initiate to the pleasure of piloting at reasonable prices.

■ ***sciences:***

MICRODRONE which aim is (in partnership with ONERA and DGA) to demonstrate the technical feasibility and the interest of miniature UAVs.
ENSMArathon SHELL studies and builds a car prototype aiming to covering the longest distance with only one liter of gas.
ENSMA Space project that gathers the space-related projects such as mini-satellites, experimental rockets, high-altitude balloons, parabolic flights...
ENSMA Junior Etudes is an association which provides industrial services in the fields of skills of the school.

■ ***culture:***

CINEnsMASCOPE each year show blockbuster movies, but also old movies with discussion groups.

■ ***with humanitarian vocation***

CSF (Club Sans Frontière) takes part, through direct actions, to the improvement of the living conditions in certain Third World countries and contributes to make known better this part of the world thanks to the organization of many events.

Among the other clubs: karting, rowing, golf, rock'n'roll, chess, photograph, roller skate, plane model, band, gliding, graduation ceremony, 4L Trophy, comics, management, theatre, skiing, and so on...

(Background) Campus
M.J. Pichon 04/06

Climbing wall

Tennis grounds

A university **capital**

Capital of Poitou-Charentes, lively and dynamic, Poitiers combines with talent, quality of life (citizenship and environmental values), economic and university activity. A vast number of cultural and leisure events liven it up throughout the year and it is possible to practice almost all sports activities thanks to numerous facilities.

So, it is quite natural that Poitiers should regularly been mentioned as one of the most attractive French cities of less than 300,000 inhabitants.
It is located at one hour away from the Marais Poitevin and the Cognac vineyards and less than two hours from the beaches of Charente-Maritime and Vendée as well as the Loire Valley chateaux. Thanks to its location, it enjoys the strong influence from other areas thanks to the high speed train (it takes 1:30 from Paris and 1:45 from Bordeaux) and the air connections.

Situated in an area of art and history, the birthplace of Romanesque art, Poitiers has an exceptional wealth of more than 80 buildings listed as historical monuments.

Poitiers is also one of the most ancient universities in Europe (1431). Today Poitiers has 25,000 students and 88,000 inhabitants (125,000 in the metropolitan area).

Main market place at Notre-Dame-La-Grande Church - *Daniel Proux*

Vienne,
the country of Futuroscope

The Futuroscope park - *M. Vimenet/Futuroscope*

With nearly 3 million visitors a year, 1,500 employees and several thousand spin off jobs, Futuroscope has become the main axis for the development of the Vienne département both at the national and regional levels.
Since 1985, its expansion has relied on the presentation of new shows, developed each year, ensuring the international fame of the region.
The Futuroscope Park's activity is original on the theme park market, between entertainment and educational discovery.
The Futuroscope Park's mission is to entertain families and arouse curiosity thanks to the strength of emotion and imagination.
The area of formation, which gathers nearly 8% of French public search, opens the teaching to new technologies and gathers a pole of high technology companies.
Built on the will of innovation, answering to the needs to discover and understand, imagine and apprehend our future, Futuroscope relies on the three essential human activities of today: leisure, formation and work.

Location

Tomorrow **starts here and now!**

Futuroscope's technology center

Only 80 minutes away from Paris on the high speed train, the Futuroscope technology centre spreads over 200 hectares with. 60,000 m^2 of high-tech offices. On the Eruropean Theme Park's doorstep, near Poitiers, this area of advanced telecommunications has already attracted 150 companies (multimedia, call centres, e-business), almost 3,000 students and more than 700 researchers. An original concept from the County Council, the technology centre has become a unique reference site in France, where the activities of tomorrow are starting.

Admission **schemes**

Through Concours Communs Polytechniques

(a nationwide highly competitive examination)

Concours communs polytechniques
1-by preparatory classes
- Maths and Physics course
- Physics and Chemistry course
- Physics and Sciences for the Engineer course
- Technology and Sciences for the Engineer course
- Physics and Technology for the Engineer coursel

2-by a « DEUG » in Sciences, a two-year university degree

Through ATS (Adaptation Technicien Supérieur)

ACCORDING TO ACADEMIC QUALIFICATIONS

Selection on the basis of student's application:
1-in first year:
- for students who have a bachelor's degree (mechanics, applied mathematics, physics, electronics ...)
- for students who have a university technological diploma (specialities: Mechanical and Industrial Automation Engineering, Thermal and Energy Engineering, Industrial Engineering and Maintenance, Electrical Engineering and Industrial Computing, Science and Materials Engineering, Mathematics and Physics).
- for students who have a Bachelor's degree in « Sciences and Technologies » from the University of Poitiers : specialised in maths, physics, mechanical engineering...
- continuing education: for salaried people who have worked 5 years and who have followed a 1-year preparatory class.

2-in second year:
- MS degree or 1st year Master students (specialization: mechanics, physics, mechanical technology, mechanical engineering, materials engineering).

THE SELECTION OF STUDENTS

Among the students of a class:
- 80% have followed preparatory classes (concours communs polytechniques)
- 10% are selected according to their academic qualifications in first year
- 10% are selected according to their academic qualifications in second year

AWARDED DEGREES

- **ENSMA engineering degree**
- Students have the opportunity to get a **double degree**: the ENSMA engineering degree and a degree from the following partners:
  - INSA Centre Val de Loire (Blois and Bourges)
  - INSTN (CEA Saclay and Cadarache)
  - IAE (Poitiers)
  - Schools from POLYMECA
  - EIAE Madrid (Spain)
  - University of Sevilla, ESI (Spain)
  - Polytechnical Institutes of Hanoï and Hô-Chi-Minh-Ville (Vietnam)
  - IIT Chicago (USA)
  - Ohio State University (USA)
  - ETS Montréal (Canada)
  - Politecnico di Milano (Italy)
  - University of Naples (Italy)
  - NUAA, Nanjing (China)
  - SIAE Tianjin (China)
  - UFU Uberlandia (Brazil)
  - University of Cranfield (United Kingdom)
- **Engineering degree in Aeronautics and Space from CNAM (apprenticeship)**, in collaboration with ISAE-ENSMA and in partnership with Aeroteam Poitou-Charentes.
- Together with the University of Poitiers, ENSMA offers **Masters and PhD programs**. These degree programs are closely linked to research laboratories that gather 250 CNRS researchers and teachers.
- **Masters**
  - Air and Ground Transportation
  - High Performances Materials
  - Computer Science
- **Masters (english-taught)**
  - Aeronautical Mechanics and Energetics (AME)
  - Turbulence

Ecole Nationale Supérieure de Mécanique et d'Aérotechnique
Etablissement Public du ministère de l'Education Nationale

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Privileged partnerships with companies

AIRBUS GROUP — Airbus, Airbus Defence & Space, Airbus Helicopters.

SAFRAN — Snecma, Turbomeca, Microturbo, Snecma Propulsion Solide, Techspace Aero, Messier-Bugatti-Dowty, Aircelle, Labinal, Hispano-Suiza, Sagem,Safran Engineering Services, Morpho

ENSMA has developed strong and long-standing links with industry in terms of internships and recruitment, and has also increased the participation of professional guest speakers in the academic activities (courses, engineering design projects), the meetings between the students and the companies (plant tours and presentations, lectures, round tables, career and student fairs), the presence of industrials in ENSMA's board meetings (board of directors, academic activities and research councils), the apprenticeship tax fund raising...

THANK YOU

ISAE Institut Supérieur de l'Aéronautique et de l'Espace ENSMA