POITIERS - FUTUROSCOPE

Institut Supérieur de l'Aéronautique et de l'Espace

ENSMA

ECOLE NATIONALE SUPERIEURE DE MECANIQUE ET D'AEROTECHNIQUE

ISAE-ENSMA

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

The ISAE Group

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

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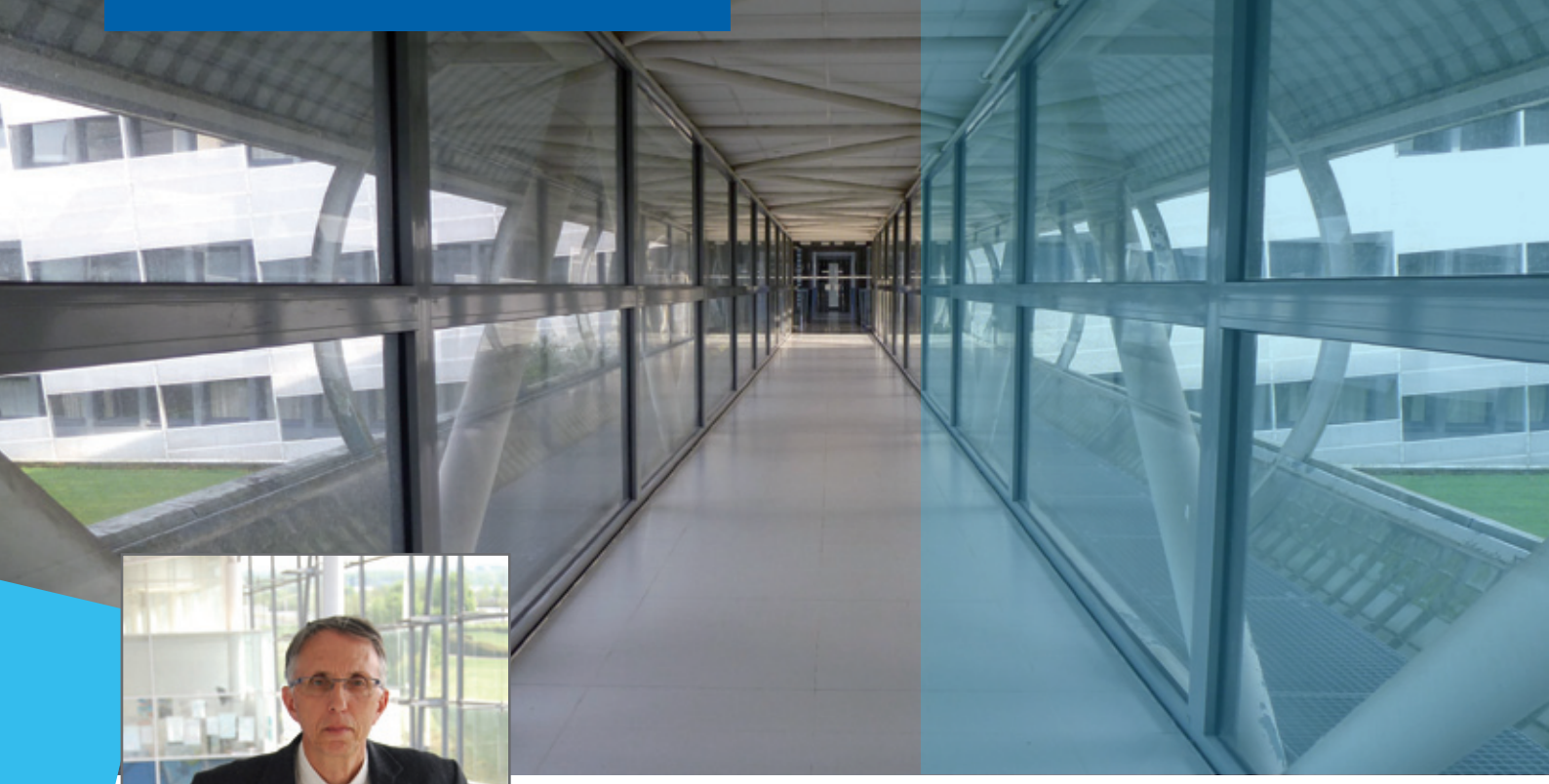
Aéronautics - Space - Transport - Energy



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.

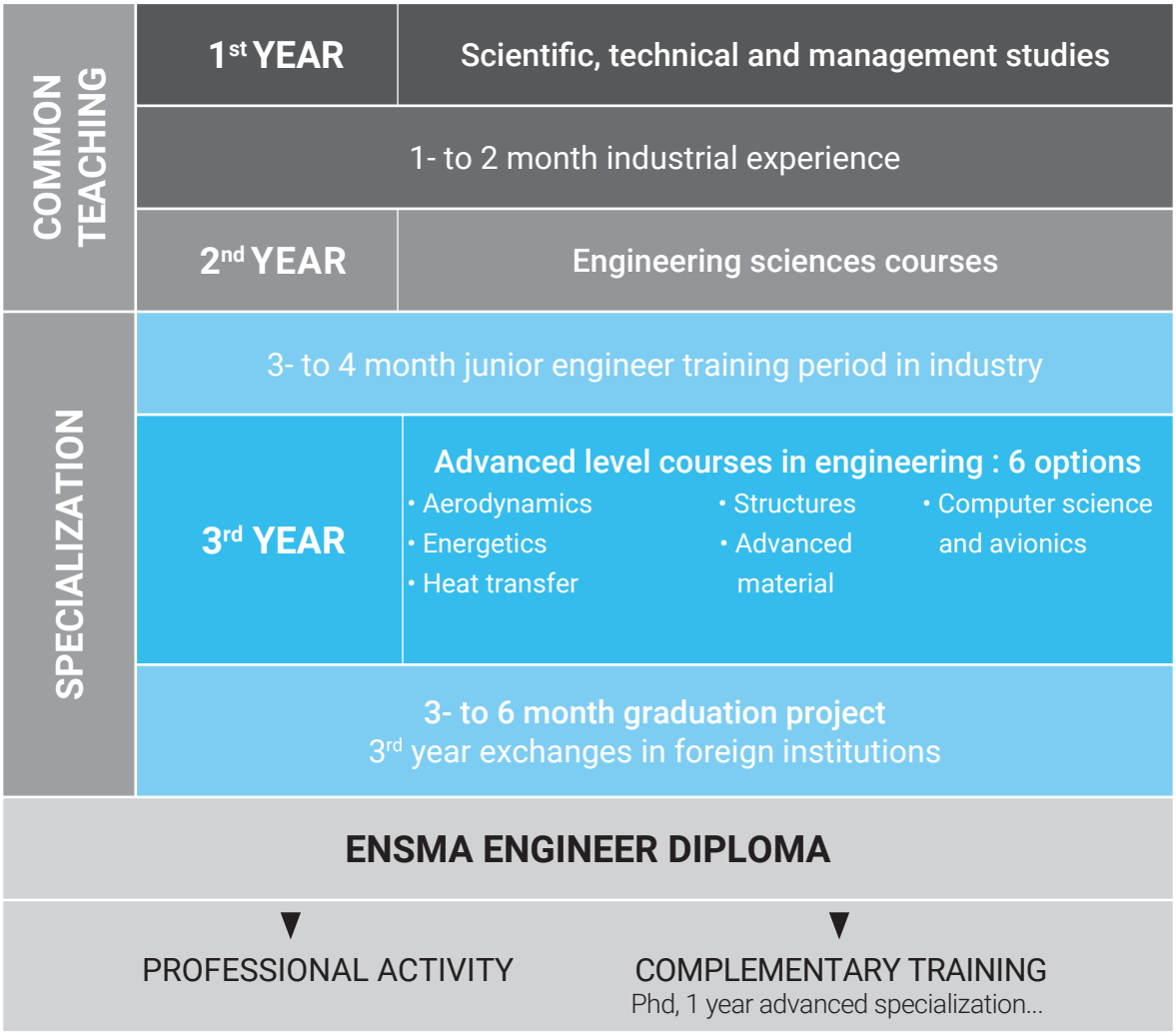
In 2011, ENSMA turns a corner by taking on the name of ISAE-ENSMA. Indeed, ISAE – Institut Supérieur de l'Aéronautique et de l'Espace takes the initiative to give their name to French aeronautical engineering schools by respecting a common charter of values and sharing collective projects of development.

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.
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

TEACHINGS



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.

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.

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.

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 modeling 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.

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.

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.


Henri Poncin's Amphitheatre

FIRST STEPS IN COMPANIES

The 3 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 : a 3-to 6 month placement at the end of the 3rd year
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.

ENSMA graduates are mainly recruited by large national and international companies - Airbus Group, Dassault Aviation, Groupe Safran, Renault, PSA, Thales, EDF, Areva, Alstom, … or by associated service providers such as Altran, Teuchos-Groupe Safran, Altran, Sogeti High Tech, AKKA Technologies…

Contact : stages@ensma.fr

SOME INTERNSHIPS EXAMPLES :

AIRBUS HELICOPTERS, *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

ALTRAN TECHNOLOGIES HORS EST, *Vélizy-Villacoublay*

Structural bio-composites in automobile industry

BOMBARDIER AERONAUTIQUE, *Montréal, Canada*

Development of an acoustics analysis code on noise emission from air traffic

CEA-CESTA, *Le Barp*

Study of laser tests equivalent to hyper-fast impacts

DASSAULT AVIATION, *Merignac*

Analysis of a refined finite elemetns model from a plane zone

SAFRAN CERAMICS, *Le Haillan*

Modeling and thermomechanics optimization of a HP turbine shroud

LIEBHERR AEROSPACE, *Toulouse*

Modeling of wings de-icing in aeronautics

MBDA FRANCE, *Le Plessis*

Study and optimization of metal-cased fragmentation

PSA PEUGEOT CITROEN, *Vélizy-Villacoublay*

Unsteady aerodynamics simulations

RC FORMULA, *Haller, Luxembourg*

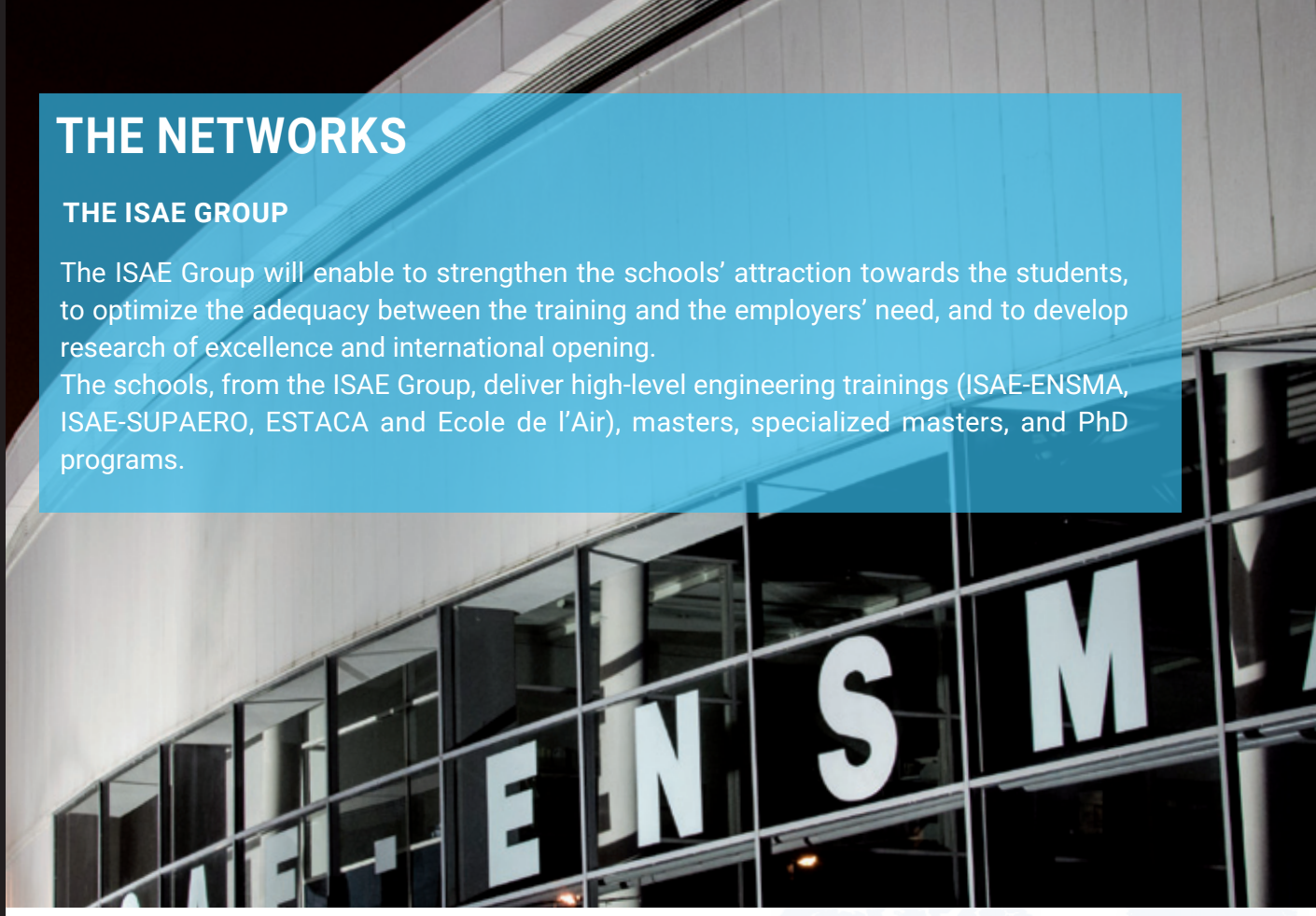
Acquisition, analysis and data processing in car racing : why, how, and issues?

SAFRAN AIRCRAFT ENGINES, *Moissy Cramayel*

Validation of a thermodynamic model of cfm56 5c/p

THALES ALENIA SPACE, *Cannes la Bocca*

Applicability of phase transformation materials for the thermal control of an instrument



THE NETWORKS

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.

ISAE-ENSMA is a public school from the Ministry of Higher Education and Research, holding quality labels from CGE and CDEFI.

A PROGRAM WITH A STRONG INTERNATIONAL DIMENSION

One of the ISAE-ENSMA's main priorities is to promote international student exchanges. Since 2012 an international experience is required to be graduated.

Students spend an average of 6 months abroad by :

- performing an internship in a company, a research organization or a university lab,
- participating in an exchange program from one semester to one year,
- obtaining a double degree.

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).

- 23% of international students (26 different nationalities),
- 57 partner universities giving the chance to many students to spend part of their studies or performing research projects in institutions worldwide (Africa, America, Asia, Europe, Middle-East),
- 13 double degree agreements.

Examples of international internships :

UNIVERSITY OF CALIFORNIA, *Irvine - California*
Dowstream evolution of a moderately high Taylor Reynolds number, for nearly isotropic, homogenous flow

AIRBUS Germany
Coupling of an ESATAN Film Cooling Model for small Rocket Thrusters to the TMG Finite Element Thermal Solver

ITA, *Sao José dos Campos- Brazil*
Application of Shape Memory azilys in aeroservoelasticity

VIETNAM GREEN BUILDING COUNCIL (VGBC), *Hanoi - Vietnam*
Development of a Green Building rating tool for single housing

STRONG INDUSTRIAL PARTNERSHIPS

ISAE-ENSMA has signed partnership agreements with main aeronautical and aerospace groups : SAFRAN Group, MBDA, DASSAULT AVIATION, AKKA Technologies, ALTRAN...

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

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 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 ».

TECHNOLOGY PLATEFORM

ISAE-ENSMA has developed a platform for technological transfer and innovation support, ESPRITT (ESPace de Recherche, d'Innovation et de Transfert de Technologies). Located at ISAE-ENSMA, a space of about 400 m2 has been set up for offices, meeting rooms, computer rooms, relaxing areas, to welcome the people involved in technological transfer and innovation activities, and to support the development of future companies or projects from students.

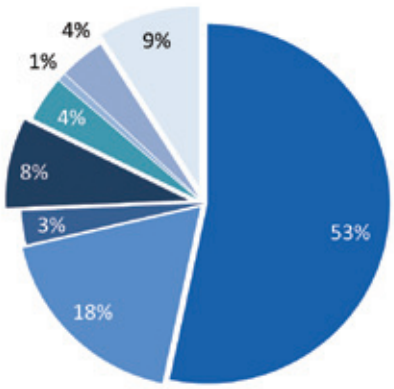
Assembly line A330 A340 Airbus

ENGINEERING CAREERS

An average of **50% of students are hired before graduation**, and 23% get their first job in less than 2 months.

Contact : emploi@ensma.fr

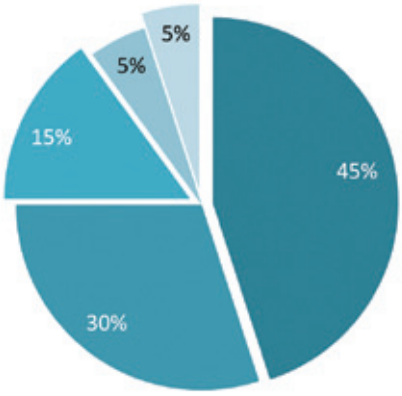
BRANCHES OF ACTIVITY



- Aeronautics/Space/ Defense (53%)
- Consulting companies/ Design consultants (18%)
- Energy (3%)
- Automobile (8%)
- IT services (4%)
- Finance/ Insurance (1%)
- Scientific R&D (4%)
- Others (9%)

The choice of ENSMA graduates to work in aeronautics/ aerospace/defense is in keeping with the wish which most students express when arriving at ENSMA.

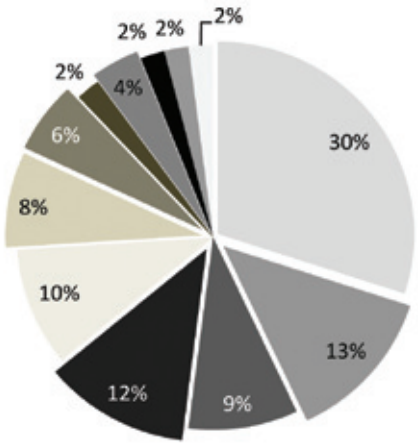
SIZE OF THE COMPANIES



- > 5000 employees (45%)
- 250 to 4999 (30%)
- 50 to 249 (15%)
- 20 to 49 (5%)
- < 20 employees (5%)

On average, more than 75% of the ENSMA graduates begin to work for large or very large companies (250 employees or more).

TYPES OF JOBS



- R&D engineer (30%)
- Software engineer (13%)
- Consultant (9%)
- Design engineer (12%)
- Systems engineer (10%)
- Performance engineer (8%)
- Project manager (6%)
- Production engineer (2%)
- Test engineer (4%)
- Business manager (2%)
- Quality engineer (2%)
- Others (2%)

At the beginning of their careers, a large part of ENSMA engineers work in engineering design.

Sources : the graduates employment survey over the past three years.

ENSMA ENGINEERS TESTIMONIES

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.

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.

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).

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.

Julien HENRY

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

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.

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

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.

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.

Fabien HÖRLIN

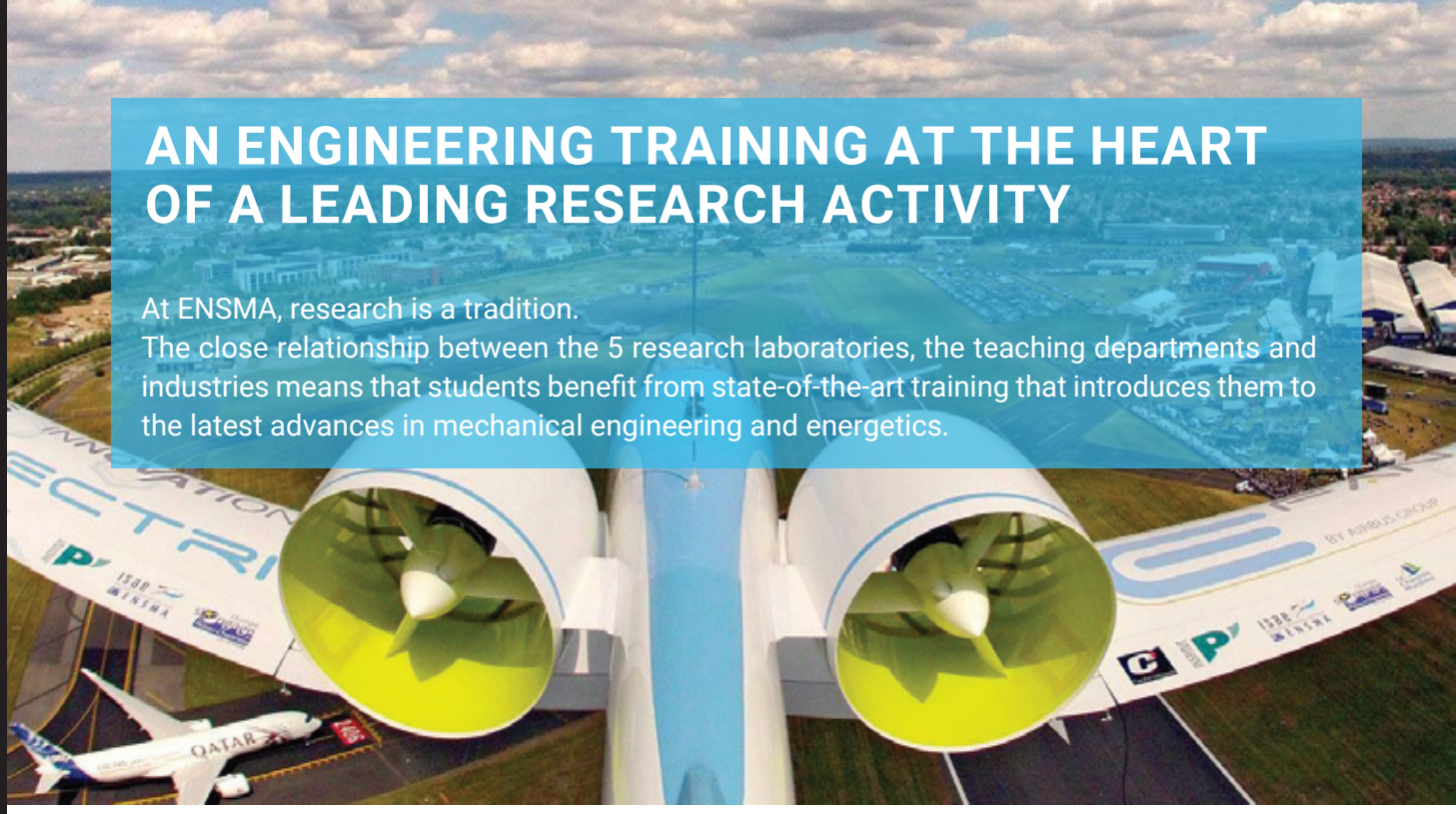
(Class of 2005)
Direct Entry Graduate - Structure
AIRBUS UK

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.

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.



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)

600 people including 200 researchers and 180 PhD students
The 2nd most important French lab in engineering sciences

Pprime Institute (P') is a research unit specific to CNRS created in 2010 in partnership with ISAE-ENSMA and the University of Poitiers. The research activities mainly concern Engineering Sciences and Physics of Materials.

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

LABORATORY OF COMPUTER SCIENCE AND AUTOMATIC CONTROL FOR SYSTEMS (LIAS – EA 6315)

40 teachers-researchers and 40 PhD students

The LIAS laboratory was created January 2012 from the merger of the suite LAII laboratory (Laboratory of Automation and Applied Computer Science) and the LISI lab (Applied Computer Science Laboratory).

Although the laboratory is anchored in the Communication Systems community for the fundamental aspects, the LIAS, through its applications, is naturally open to the engineering sciences either for the new modes of propulsion, energy management, water treatment, complex systems modeling, or the optimization of real-time systems. The complementarity of the automatic control, electrical engineering and computer science disciplines is an added value for the application processing, all related to engineering.

The LIAS is composed of three teams: data and models engineering, embedded real-time systems and automatic control & systems.

www.lias-lab.fr

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.

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

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.

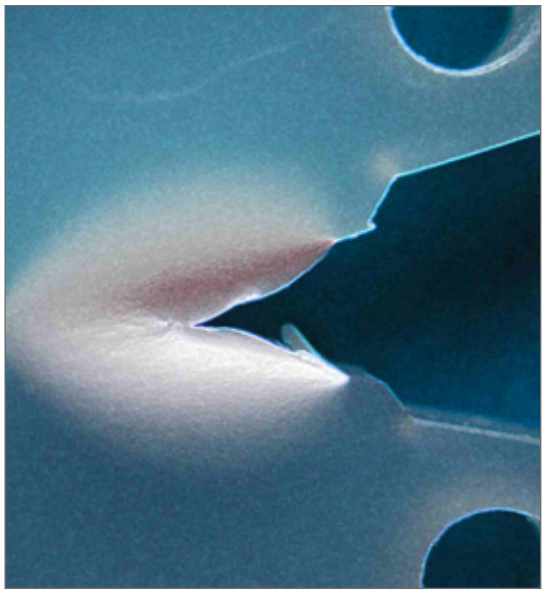
Vulcain 2 - Snecma Groupe Safran

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

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

RESEARCH AREAS

COMBUSTION OF INNOVATIVE PROPELLANTS FOR SPACE PROPULSION– PERGOLA (P' COMBUSTION)

In order to study new storable propellants for rocket engines (lower risk for the user and reduced impact on environment), the Pprime Institute and the CNES are associated to develop a new set on an experimental scale allowing to characterize precisely the combustion of new propellants under pressure, both in terms of ignition and stability of the combustion stability, as well as the propulsion production.

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).

SUPER ALLOYS: HIGH TEMPERATURE CONSEQUENCES (P' MECHANICS AND MATERIAL PHYSICS)

These studies, managed in partnership with SNECMA Moteurs and TURBOMECA, relate to the durability of Nickel-based, mono- or polycrystalline 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.

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).

EXCHANGE BETWEEN CAD SYSTEMS (LIAS)

The laboratory is the source of a data model to allow exchange between heterogeneous CAD systems, CAD model libraries of standard components.

Etude de la propagation d'une flamme en apesanteur - 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.

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. 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 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).

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…

A UNIVERSITY CAPITAL

Square Maréchal Leclerc, Poitiers

Capital of Poitou-Charentes territory, 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.

Poitiers is naturally a very attractive city with around 140 000 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). Poitiers counts nowadays more than 25 000 students out of the 88 000 inhabitants living in the city.

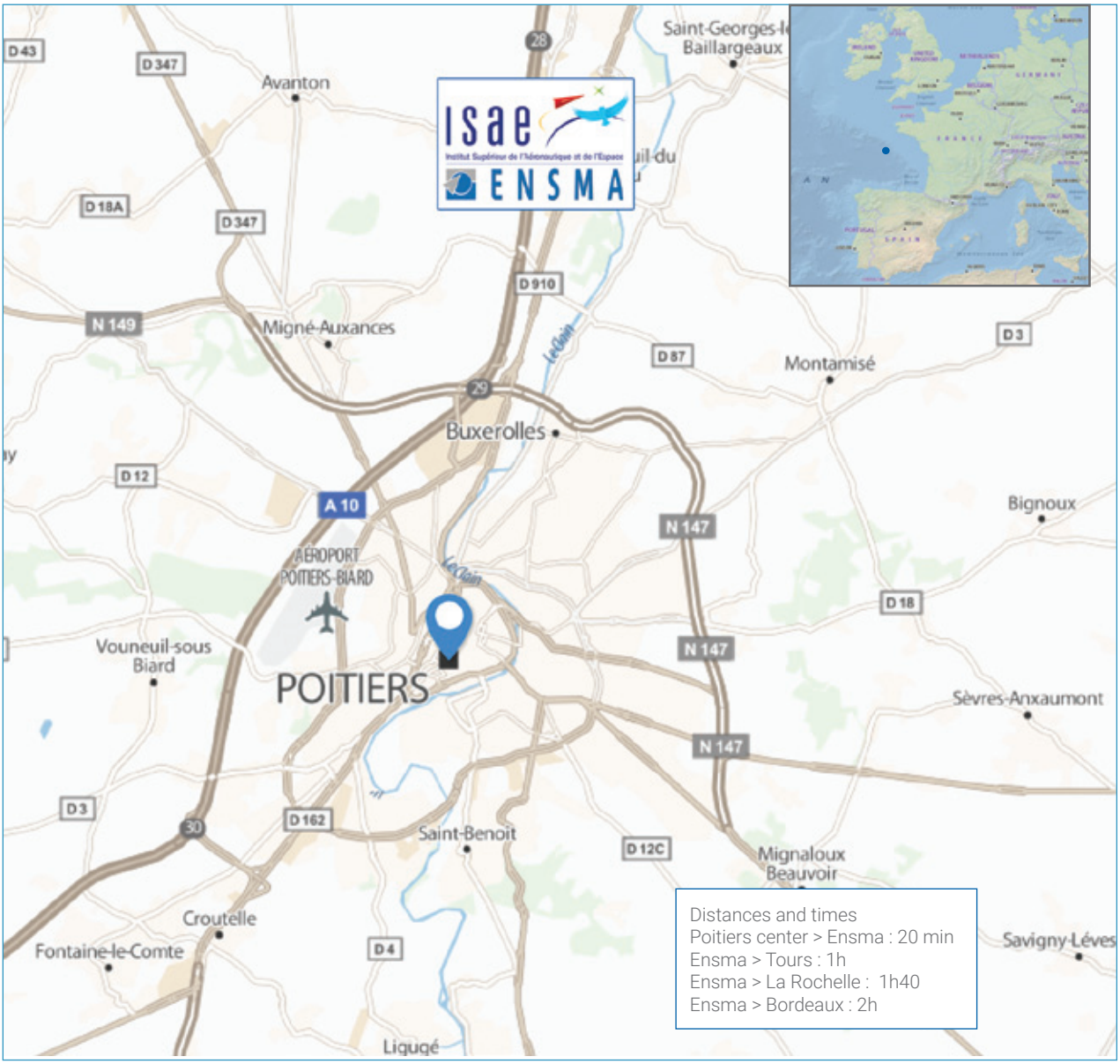
VIENNE, THE COUNTRY OF FUTUROSCOPE

With nearly 2 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 department. Since 1987, 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 Futuroscope park

LOCATION



TOMORROW STARTS HERE AND NOW!

Only 80 minutes away from Paris on the high speed train, the Futuroscope technology centre has already attracted 220 companies (multimedia, call centers, e-business), 6000 employees, almost 2,000 students and 13 research laboratories...

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.

Futuroscope's technology center

ADMISSION SCHEMES

THROUGH CONCOURS

In first year

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 twoyear 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
- 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 also 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)

Masters of science (english-taught)

- Aeronautical Mechanics and Energetics (AME)
- Turbulence

Masters in cooperation

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.
- Air and Ground Transportation
- High Performances Materials
- Computer Science

Apprenticeship training

Engineering degree in Aeronautics and Space from CNAM (apprenticeship), in collaboration with ISAE-ENSMA and in partnership with Aeroteam Poitou-Charentes.

CONTACTS

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Credit lines : Club Photos ENSMA, A. Gouillardon, O. Geay, F. Touchard, M.J. Pichon, M. Vimenet, Pprime Institute, Safran Group, Airbus by fixion, Airbus Group, Dassault Aviation, ESA/CNES/Arianespace/CEF - Futuroscope, ENSMair, Grand Poitiers, Nicolas Mahu.
Conception : Mélody Bellier, Laetitia Bernardi - Imp. Val de Loire

PRIVILEGED PARTNERSHIPS WITH COMPANIES

Airbus, Airbus Defence & Space, Airbus Helicopters

Safran Nacelles, Safran Ceramics, Safran Transmission Systems, Safran Electrical & Power, Safran Landing Systems, Safran Identity & Security, Safran Electronics & Defense, Safran Aircraft Engines, Safran Aero Boosters, Safran Helicopter Engines

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