Advanced Manufacturing Processes for Aeronautical Structures
(ISAE-SUPAERO/IMT MINES ALBI-CARMAUX)

**Objectives**
The Aeronautical industry market is facing a rapid and continuous increase worldwide as shown by the record breaking contracts recently signed by both Airbus and Boeing. These two industry leaders forecast an increase of close to 5% in activity over the next years. Estimations indicate that the annual increase of large commercial airplanes will induce a doubling of the number of aircrafts by 2030. Nearly sixty percent of the turnover is subcontracted all over the world and concerns mostly production and manufacturing activities. As a consequence, most aeronautical subcontracting companies will have to increase their production rates but also to keep up to date with technological changes; moving from metallic processes toward composite materials processes. Moreover the aircraft manufacturers have changed their supply chain structure in the last years, and subcontractors are now required to manage more complex parts and to take over, on their own, the qualification processes.
The Advanced Master course AMPAS, is designed by IMT Mines Albi and ISAE with the support of aeronautical industry partners. It will give a specialization to master level students allowing them to take over high level responsibilities in airframe structure manufacturing plants. It is especially well suited to students who have followed general studies in mechanical engineering, material science or equivalent and who would like to gain a major chance to be recruited by aeronautical industry.

**Organization**

**Head of program**
- Prof. Jean-José ORTEU
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- Prof. Anis HOR
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**Course duration**
One year full time: 6 months of courses and 6 months of professional thesis or internship.

**Course start date**
September

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

**Teaching language**
English

**Learning approach**

First semester:
Academic term of 520h and 45 credits, provided by permanent professors of IMT Mines Albi and ISAE-SUPAERO and expert practitioners from aerospace industry to bring current knowledge and experience. The teaching, balancing academic lessons with more applied practice, includes:
- lectures and exercises
- process simulation sessions
- laboratory sessions

**Syllabus**
The academic course consists of modules aiming to provide a deep knowledge of the three main material families used in airframe structures (i.e. aluminum, titanium and long fiber reinforced polymer composites) and their related forming routes in aeronautical industries. It is also devoted to gain knowledge in aircraft architecture, on aeronautical supply chain specificities, lean manufacturing, quality management and certification requested to be able to take over technical and organisational responsibilities in industry.
A team project (100 hours) will demonstrate the ability to address an aeronautical part processing following the theoretical and professional skills.

**Part 1: Aircraft, material and process basic scientific knowledge - 130 h**
- Flight Dynamics AMPAS - Aircraft and airframe architecture
- AMPAS - Computer Aided Design (CATIA) - Aluminium and titanium alloys
- Epoxy and thermoplastic composites - Assembly processes - Material and processes qualification - NDT for metallic and composite materials - Optical techniques for assembly aid

**Part 2: Composite structure forming and machining processes - 100 h**
- Physical phenomena description and modelling related to thermoset based manufacturing - Raw material and composite quality control - LCM/RTM processes - Autoclave Vacuum Bagging (monolithic - sandwich) processes - Composite material trimming, drilling and assembly - RTM/Infusion Simulation

**Part 3: Metallic structure forming and machining processes - 106 h**
- Material behaviour and mechanical models - Cold and hot sheet forming processes - Surface treatments - Subtractive and additive manufacturing - Sheet forming simulation

**Part 4: Industrial Organisation and management - 84 h**
- Supply chain structure and Organisation - Materials management and Lean manufacturing - Supply chain improvement and collaborative processes - Quality requirement, management and tools

**Part 5: Integrated Team Project - 100 h**
Career opportunities

The Advanced Manufacturing Processes for Aeronautical Structures Master course offers challenging career opportunities for young engineers or more experienced engineers, who require a postgraduate program to enhance and/or focus their technical and management skills towards aeronautical industry sector.

Career opportunities are numerous and growing over the world, in tier 1 and tier 2 subcontracting companies, as well as in aircraft manufacturers, aeronautical maintenance companies. Graduated AMPAS students can find employments as process, industrialization, production, quality, research and innovation engineer, product, project and production manager ...

Companies recruiting our students

AIRBUS GROUP EFW (Dresden), AIRBUS OPERATIONS SAS, ALTEN, AKKA Engineering Process, ARMINES, AVIC COMAC, Fabrica Argentina de Aviones, FORMTECH (Bremer), SAFRAN Power Unit, SAFRAN Helicopter Engines, VENG SA (Argentina), P3 GROUP, SAFRAN Aircraft Engineering, SAFRAN Electronics and Defense, SAFRAN Nacelles, DUQUEINE Atlantique.

Testimonies

Why did you choose this Advanced Master?

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

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

ROGELIO CECENA
Aerospace simulation engineer in Expleo group
Graduated in 2016

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

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

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

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

What are your career plans ?

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

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

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

Advanced Masters

Academic requirements
A master’s degree, or an equivalent degree in science or engineering (or in management for advanced masters in management), or bachelor degree completed by 3 years of professional experience
Tuition fees: see our website
http://admissionsmasters.isae-sup​aero.fr

Selection and admission

Selection and admission are made by an admission committee:
Possible interviews can be organized if necessary

Deadlines for application:
Several admission committees scheduled from January to July, see schedule on our website

Language requirements

Language requirements for Masters in French

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

Application website:
http://admissionsmasters.isae-sup​aero.fr

Language requirements for Masters in English

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<tr>
<th>TOEFL (IBT)</th>
<th>TOEIC</th>
<th>IELTS</th>
<th>CAE/FCE</th>
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<tr>
<td>85 points</td>
<td>785 points</td>
<td>6.5 points</td>
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NOTA BENE: Volume of teaching hours and contents of the programs are provided for information only and are subject to change

Funding
Information on tuition fees and funding can be found on our website
https://www.isae-sup​aero.fr/en/academics/advancedmasters/financing

Your contacts

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