

# GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



## AUVERGNE-RHÔNE-ALPES AEROSPACE 2018



*Introduction - R&D - Electronic Systems - Materials  
Industry 4.0 - SMEs Prospects - Capability Index*



**AEROSPACE  
CLUSTER**  
A cluster  
from Auvergne-  
Rhône-Alpes  
region  
AUVERGNE-RHÔNE-ALPES

# A leading **aerospace network**

**Major aerospace players responsible for systems  
and equipment design and production**

**World class suppliers offering  
a large range of products and services**

**Efficient educational network  
and an high level aerospace research hub**

**350** INDUSTRIAL PLAYERS

**30 000** JOBS

**€ 3.3** BILLION ANNUAL SALES



**INNOVATIVE MATERIALS AND PROCESSES**

**ADVANCED EMBEDDED SYSTEMS**

**EFFICIENT MRO SOLUTIONS**



[WWW.AEROSPACE-CLUSTER.FR](http://WWW.AEROSPACE-CLUSTER.FR)

# Dear Reader,



Welcome to the Auvergne-Rhône-Alpes Aerospace report, produced in partnership between Global Business Reports and the Auvergne-Rhône-Alpes Aerospace Cluster. We hope that this first comprehensive publication of the regional industry will provide you with a better understanding of the sector, its key decision-makers, and the opportunities and challenges that it offers.

Globally famed for its beautiful landscapes, bountiful nature and rich cultural and commercial history, the Rhône-Alpes region was recently merged with Auvergne, positioning the region to be a new power economy. The region benefits from its geographical position providing access to the European market, strong talent pools with the network of specialised universities, innovation capabilities with major Research Centers, diversified and strong industry and above all, a high quality of life. The region's president, Laurent Wauquiez, has set ambitious plans for growth in aerospace in particular, building on the presence of many global players already positioned here, including Michelin in its Clermont Ferrand headquarters since the 19th century, Constellium with its world-class Issoire mill and Lord's recent arrival to manufacture in the region.

However, the drive for innovation is most evident amongst the region's SMEs and universities that alone or via collaborations are producing innovative products in electronic systems, materials, MRO and beyond. As the SMEs shake up the sector with their lightweight, more efficient or time-saving solutions, many are also facing a challenge to meet the ramp-up demand from primaries which opens the doors for consolidation or internationalization often as a necessity to survive.

France's President Macron has publicly declared that the aerospace and defence industries will be key economic drivers for the country during his office. Moreover, in 2017, at the Paris Airshow, the Auvergne-Rhône-Alpes region's President Laurent Wauquiez and CEO of Dassault Aviation, Eric Trappier, signed their commitment to advance the regional industry in precision mechanics, machining, mechatronics and the advanced production processes within the region. The ultimate aim is to position the Auvergne-Rhône-Alpes region within the top five clusters in Europe in the coming five years, but this requires communicating the region's capacity on a global stage.

Hence, this report provides a comprehensive insight into the ecosystem of the region's aerospace sector after speaking with over 50 leading executives from the industry, as well as quantitative data to highlight the region's potential. Following launch at the Lyon Aerospace Techdays, the report will be distributed to international decision-makers via GBRs network and our conference partners so they too can understand the region's offering.

Enjoy the read,



**Francois Bergez**  
President Of Cluster  
Auvergne-Rhône-Alpes Aerospace Cluster



**Alice Pascoletti**  
General Manager  
Global Business Reports (GBR)

## Introduction to Auvergne-Rhône-Alpes

- 8. ARA – France's other aerospace valley
- 10. Interview with The Region Auvergne-Rhône-Alpes
- 11. Interview with the Auvergne-Rhône-Alpes Aerospace Cluster
- 12. Interview with Auvergne-Rhône-Alpes Enterprises Agency
- 13. Industry Executives Survey Results: Auvergne-Rhône-Alpes Aerospace
- 14. The Research Tax Credit Scheme: Spurring on Innovation
- 16. Insights: The Search for Talent
- 17. Interview with Ingenierie@Lyon

## Electronic Systems

- 20. Electronics: The Current Trends
- 22. Interview with Thales Helicopter Avionics  
Interview with Secaero
- 23. Interview with Crouzet Aerospace  
Interview with SKF Aerospace
- 24. Interview with Teledyne e2v
- 25. Interview with Zodiac Aerospace  
Interview with Eldec France

## Materials

- 28. Thinking Outside the Box: What is it made of?
- 30. Interview with Constellium
- 31. Interview with Sintex NP
- 32. Interview with Safran Landing Systems  
Interview with Michelin
- 33. Interview with DBC
- 34. Cutting Edge Technologies  
Interview with Jet Cut
- 35. Insights: Cutting and Treating

## Industry Prospects

- 38. Industry 4.0: Can Auvergne-Rhône-Alpes keep up?
- 40. Interview with Inoprod
- 41. Insights: Industry 4.0 in Auvergne-Rhône-Alpes
- 42. Insights: SMEs stepping up to the primary expectations
- 43. Editorial & Management Team Credits
- 44. Capability Index
- 50. Participating Companies Directory



**Auvergne-Rhône-Alpes Aerospace 2018**  
Industry Explorations  
Global Business Reports

This research has been conducted by  
Laura Brangwin and Sarah Crompton Donnelly

Edited by Mungo Smith  
Graphic design by Gonzalo Da Cunha

A Global Business Reports Publication  
For updated industry news from our  
on-the-ground teams around the world,  
please visit our website at [gbreports.com](http://gbreports.com),  
subscribe to our newsletter by signing up  
to our VIP list through our website,  
or follow us on Twitter: @GBReports

# The Research Tax Credit Scheme

Opportunities to advance innovations in France and the Region

14 -17

# Capabilities Index

Find your partner in the Auvergne-Rhône-Alpes

44-49

# Electronic Systems

The region's expertise in innovating in this sector

18 - 25

# Materials

Experts share their insights on composites vs traditional materials

26 - 35





# Auvergne-Rhône-Alpes

- International Boundary
- Region Boundary
- National Capital



0 50 100 200 Kilometers





# Introduction to Auvergne- Rhône-Alpes

"The Auvergne-Rhône-Alpes region is very dynamic: it has a GDP of €235 billion, which is 12% of the GDP of France, and we anticipate continued growth in the coming years. We want to prepare companies in the region to contribute to and take advantage of this growth, so we are working to simplify the landscape for SMEs and to gather together all of the strengths of the new region of Auvergne-Rhône-Alpes in order to foster the cross-fertilization of companies."

- Cécilia Tejedor,  
Director General,  
Entreprises Auvergne-Rhône-Alpes

# ARA - France's other aerospace valley

8

With a GDP of \$2.4 trillion, France is the third largest economy in Europe and the sixth largest in the world. France has a strong international reputation in a number of key industries,

including energy, agriculture, automobile and aerospace. According to the International Air Travel Association (IATA), revenues generated by the global commercial air travel industry have grown by US\$254 billion in the past 10 years. The French aerospace industry has both contributed to and benefited from this growth. With leading OEMs Airbus and Boeing ramping up production to meet increased demand, French companies across the entire aerospace value chain are preparing for continuing growth over the coming years.

While the primaries of the French aerospace industry, such as Airbus and Dassault, are based in the French “Aerospace Valley” in Occitanie and Nouvelle Aquitaine, in the southwest of the country, the region of Auvergne-Rhône-Alpes is fast becoming an equally relevant hub. Formed by the merger of the regions of Auvergne and Rhône-Alpes during the territorial reform of French Regions in 2014, Auvergne-Rhône-Alpes sprawls across 70,000km<sup>2</sup> of southeastern France, stretching from the Swiss and Italian borders to the centre of the country. The region is as dynamic as it is large, generating 11.4%

of the national GDP of France. Its GDP of €240 billion makes it the second richest region in France and the eighth richest region in Europe. It is one of the most highly developed industrial regions in Europe, with over 500,000 of its inhabitants employed in industrial jobs, earning its reputation as one of the “Four Motors for Europe”, alongside Baden-Württemberg in Germany, Lombardy in Italy and Catalonia in Spain.

The region is a hub not only for industrial activity, but for research, design, and innovation.

With over 40,000 of the region’s residents working in research-based roles and over 600 laboratory facilities, it is ranked the second highest region in France in terms of research output, and the fifth highest in Europe. It is second only to Île-de-France in terms of the number of patents filed each year, with 20% of all of the patents applied for in France coming from this region.

The region boasts a particularly strong offering to the aerospace industry, both in France and internationally, as it is home to a large number of thriving Tier 1 and Tier 2 suppliers for Original Equipment Manufacturers (OEMs) as well as many SMEs (PMÉs) offering more niche products and services. Following Laurent Wauquiez, the regions’ president’s pledge to promote the region as “one of the five leading regions

in aeronautics within five years” (Le Bourget), and the partnership agreement and action plan he signed with Dassault Aviation in 2017, the industry in the region looks set to grow. The action plan pledges to develop aerospace industry apprenticeship programs within the region and to sponsor start-up companies in underrepresented sectors of the industry.

## Support for companies within the region:

Ample support is available to help SMEs grow, including access to European research funding schemes and, perhaps most significantly, from the government agency Entreprises Auvergne-Rhône-Alpes. The agency was founded in May 2017 upon the merger of the regions of Auvergne and Rhône-Alpes and exists to nurture business development in the region. Director General Cécilia Tejedor stresses the key ways that such a private-public partnership can offer business development support: “We are working to simplify the landscape for SMEs and to gather together all of the strengths of the new region of Auvergne-Rhône-Alpes in order to foster the cross-fertilization of companies. We are identifying companies with high growth potential and offering them support in a number of



## Auvergne-Rhône-Alpes regional GDP

**244**  
billion dollars

which is

**11.6%**  
of the national GDP  
of France

**3.3**  
billion dollars  
is generated by the  
aerospace industry



ways, whether it be with HR and training, financing, investment, strategizing innovation projects, or boosting internationalization.”

In addition to offering training and financing, the agency also supports SMEs to benefit from opportunities that they may otherwise not have the resources to access, such as research grants and business meetings with international companies. “Increasing the number of SMEs benefiting from European funding is one of our Key Performance Indicators” Tejedor explained, “and we attend aeronautical business shows and set up meetings with international companies who could potentially be interested in coming to work in France. We encourage them to come to Auvergne-Rhône-Alpes by showcasing the strengths of companies in the region”.

### Prepared to meet the needs of the future:

With leading OEMs requiring their suppliers to increase their production capacity in order to meet their own production ramp-up needs, companies in the Auvergne-Rhône-Alpes region are developing innovative ways to improve production capacity and manufacturing efficiency. Companies like GO2CAM and Inoprod assist manufactur-

ing companies in incorporating Industry 4.0 into their processes, offering service such as Computer Assisted Manufacturing (CAM) techniques and software providing digital simulations of manufacturing plants in order to maximize efficiency. Others, like Groupe Roux-Jourfier, offer companies the opportunity to incorporate “collaborative robotics” into their plants, both to perform entirely automatic processes and also to work collaboratively alongside human operators to perform more complex tasks. These advancements promise to create a more efficient industry, ready to meet ramp-up production demand.

While there may be an increase in automated processes being incorporated across the industry, companies nonetheless require a skilled workforce to meet their needs, especially as many look to expand. With many aerospace companies across the Auvergne-Rhône-Alpes region currently reporting difficulties finding adequate numbers of sufficiently qualified staff, there are a number of educational institutions across the region working to address this skill shortage. Séverine Durieux, director of operations at the Campus Aéronautique Auvergne-Rhône-Alpes, explained that her institution is committed not only to creating the next generation of top-class engineers, but also to encouraging them to follow careers within the aerospace indus-

try and equipping them with the necessary specialist skills: “We offer very specific aerospace diplomas, such as a professional baccalauréat focused on the aerospace industry, in order to encourage our students to follow careers in aerospace as opposed to other industries such as the automotive industry, which is an equally attractive industry for young, qualified talent.”

Karim Chibane, transfer technology director at ESISAR Grenoble INP, explained that students studying at his institution are ready to meet the demands of working in the aerospace industry immediately upon graduation, stressing the invaluable influence of the work experience placements they undertake with industry partners: “We have already bridged the gap between the high level of theoretical knowledge that students have after graduation and the industrial experience that they need to acquire to succeed and excel in the workplace.”

With Auvergne-Rhône-Alpes boasting a strong collection of companies across the entire aerospace value chain, a wealth of research facilities, a local government committed to the advancement of the industry and a commitment to creating the skilled workforce the industry so desperately needs to meet increasing demand, it will not be long before the region is known as France’s second Aerospace Valley. ■



## Annabel André- Laurent

10

Vice President of Enterprise and  
Economic Development  
**THE REGION AUVERGNE-  
RHÔNE-ALPES**

### What makes the region attractive for international investors in aerospace?

The aeronautics sector has a strong presence in Auvergne-Rhône-Alpes with nearly 700 companies, including 350 specialist companies (equipment manufacturers and suppliers) bringing together nearly 30,000 direct jobs and representing €3.3 billion in sales.

Auvergne-Rhône-Alpes is the second region of France and the seventh European region for economic growth and development. It contains 600,000 companies, of which 98% are small and medium-sized businesses backed by a few major international groups including Michelin, SEB, Constellation, Aubert and Duval,

Safran, Salomon, Nestlé, Sanofi Pasteur, Limagrain etc.

### How does the government support SMEs in their development?

The Region has established an ambitious policy to boost transformations related to the industry of the future. In this context, it supports SMEs and ESI's (Intermediate Sized Enterprises), including the regional aeronautics sector, with innovative technological development and with their organizational changes related to additive manufacturing (3D printing), robotics and intelligent production lines, as well as financial engineering for projects.

The Region also supports the investment of industrial companies in the form of a subsidy for material investments and for projects such as the creation of new sites or major challenges of modernizing production tools. The Region subsidizes nearly €1 million of the "industrial performance phase 2" program proposed by GIFAS after subsidizing phase 1. This program benefits about 100 SMEs which, organized in clusters around a client, are trained to achieve the objectives of industrial excellence and therefore better meet the needs of the sub-contracting chain.

### What is the government's strategy for facilitating the internationalization of businesses in the region to access global export markets?

The Region finances the Aerospace Cluster PDI by up to €50,000 in 2018, which offers several international missions per year to member companies, such as the Aerospace & Defense meeting in Seville, Mission MRO Malaysia-Singapore, Passport North America (commercial actions, ADDS Seattle Convention) and others.

### How is the government supporting educational institutions within Auvergne-Rhône-Alpes, and working to ensure that there is a sufficient level of qualified talent to service the industry in the region?

Industry is one of our main economic activities in our Region. Different departments, such as Ain, Haute-Savoie and Isère have developed a real activity in this sector. In order to support industries in our Region, Auvergne-Rhône-Alpes Region has decided to focus its training offer on « hard to fill » jobs. In this context, the lo-

cal government has decided to support the industry through apprenticeships and on-going vocational training.

On the base of this policy, Auvergne-Rhône-Alpes can continue to develop its industry thanks to qualified professionals.

### Which international regions do you see as most competitive with Auvergne-Rhône-Alpes, and what differentiates the region from these competitors?

The presence of a rich technological and industrial landscape within the Auvergne-Rhône-Alpes Region enables us to compete as a global player and this is a hallmark which differentiates us from other French Regions. We have a unique capacity of regional industry manufacturers to supply all aeronautical materials and structural components.

Also, beyond the basic sub-contractor / end customer relationship, many of these industrialists enter co-contracting agreements with their end customers in order to actively participate in the design and technological development of the end product. This contributes to consolidating and sustaining their commercial relationships.

The Region is well known for its very broad skills in embedded systems, including electrical control. For example Dassault and LORD FLY BY WARE for flight controls. The Region also has substantial aeronautical maintenance skills and knowhow.

We constantly endeavour to spur the growth and development of our industrial companies and enable these industries to forge stronger ties with their end customers, be they local or foreign. We enable industries to prepare for the future through innovation and on-going technological upgrading. We also raise awareness amongst industrialists of the need to invest in machines which reduce the environmental impact and we can financially participate in their purchase when such machines go beyond compliance requirements.

### What final message would you like to communicate?

Come and discover the wealth of our Region and enjoy our unique geographical position, quality of life, excellent infrastructure and our industrial power. The Auvergne-Rhône-Alpes Region is there to help corporations with a range of offers and resources to support various initiatives and create strong synergies on our territory. ■



## François Bergez

President

**AUVERGNE-RHÔNE-ALPES  
AEROSPACE CLUSTER**

### **Please introduce the Cluster and its role within the aerospace for our international readers.**

Aerospace Cluster is the non-profit organization gathering the aerospace players of our region, Auvergne-Rhône-Alpes. It plays an active role with its programs supporting companies to meet high performance levels, to develop innovative projects, to address international markets, but also branding the regional aerospace know-hows at international events. Furthermore, the Cluster is a gateway for international aerospace global players to discover and identify new innovative and high performance solutions developed by the regional players.

### **France is increasing its aerospace and defence activity globally, and many members in the Auvergne-Rhône-Alpes are looking abroad for growth. How does the Cluster support its members on their internationalization strategies?**

Many among our 200 members realize direct international sales, mainly in Europe North America, Asia and the Middle East. To help them to grab new opportunities the cluster has been developing an annual international development program for the past 10 years. Supported by regional funding, it allows companies to attend international events such as business conventions and trade fairs, to take part in trade missions and to meet international decision-makers. The Cluster is also the place where companies share can share feedback and best practices, learn about international opportunities, and discuss common strategy and global offers. In 2017, we organized the participation of 95 companies to 11 missions, of 184 participants to seven workshops, in addition to our participation at the Paris Air Show where more than 150 regional players were exhibiting.

### **How does the Cluster facilitate research and development projects for its members?**

We develop a support policy to allow members to share ideas, identify trends, build partnerships, select funding opportunities and address it successfully. We manage to bring to maturity from 15 to 25 projects each year, which then become candidates for European, national or regional funding. Moreover with our Aerospace Tech-days initiative we offer a unique platform to valorize innovations, products and services to international decision-makers. For the third edition in June 2018, we will be pleased to present more than 30 new projects lead by regional companies and their partners.

### **Finding qualified talent can be a challenge for niche companies, what developments in the region are supporting this agenda?**

This year the regional aerospace industry needs to recruit more than 1,500 people. It is an everyday challenge we face with strength and determination. We act by

launching different initiatives to encourage training and recruitment. We encourage young people we meet on forums to gain an interest to the industrial careers and aeronautics. We assist companies to recruit by taking part in job dating within the region. We can also train jobless people according to companies' needs.

### **As the ramp up sets in, companies across the value chain feel pressure to optimize operations in a cost-effective manner, how does the Cluster help members remain competitive?**

The aerospace supply-chain is at a turning point, engaged in a deep transformation where consolidation, increased production rates, digitalization, and new technologies must be seen as opportunities. Our role is to bring the right level of information and analysis to allow everyone to make the right strategic decisions, to realize the right investments, to develop the most relevant projects and bring more added value and satisfaction to customers.

### **The region is home to over 350 companies working in the sector. What makes the region so attractive for new investors?**

In Auvergne-Rhône-Alpes we offer a unique aerospace technologies pedestal for all global players. Recent success and contracts signed by regional companies with prestigious customers such as Airbus, Boeing, Gulfstream and Safran demonstrate that we are attractive and competitive. We need now to promote our offering and capabilities globally.

### **Do you have a final message for your members?**

Auvergne-Rhône-Alpes has incredible assets to meet aerospace's current and future challenges. Its competencies and innovation capability are evident not only in the fields of materials and structures, embedded systems, maintenance, in digital technologies, but also in the quality and vision of women and men who run the companies. We are a region fully mobilized to support the development of its aerospace industry, and together we have the ability to tackle this very exciting period and succeed. ■



## Cécilia Tejedor

Managing director

### AUVERGNE-RHÔNE-ALPES ENTREPRISES AGENCY

#### **The Auvergne-Rhône-Alpes Entreprises Agency launched May 2017. Can we begin with an introduction and explanation of why it was established?**

The agency Auvergne-Rhône-Alpes Entreprises was founded in response to a change in French law which mandated that French departments could no longer directly foster the development of SMEs in their territory, and that power was instead transferred to local governments. Many French departments had, over the previous years, developed small agencies to foster the development of their businesses, which became redundant when this law was passed. The president of the Auvergne-Rhône-Alpes region, Laurent Wauquiez,

did not want all the expertise and value of these agencies to be lost, so he decided to create a large regional agency to take on the ex-local agencies as its subsidiaries. Auvergne-Rhône-Alpes Entreprises is a legal merger of 15 such structures that had previously been managed on a departmental level. The agency was created at around the same time as the merger between the regions of Auvergne and Rhône-Alpes, and since its founding on the 18th May 2017, has served the whole joint region. The agency is run by a board of directors and a supervisory board. The supervisory board is composed of 56 board members, half of whom are elected politicians, and half of whom are representatives from companies, associations, universities and research institutions, and it is led by two co-presidents, one of whom is Laurent Wauquiez, the president of the Auvergne-Rhône-Alpes region, and the other who is Jean-Dominique Senard, the president of Michelin.

#### **What are the specific aims of Auvergne-Rhône-Alpes Entreprises?**

The Auvergne-Rhône-Alpes region is very dynamic: it has a GDP of €241 billion, which is 12% of the GDP of France, and we anticipate continued growth in the coming years. We want to prepare companies in the region to contribute to and take advantage of this growth, so we are working to simplify the landscape for SMEs and to gather together all of the strengths of the new region of Auvergne-Rhône-Alpes in order to foster the cross-fertilization of companies.

We are identifying companies with high growth potential, and offering them support in several ways, whether it be with HR and training, financing, investment, strategizing innovation projects, or boosting internationalization.

#### **What specific assistance do you offer aerospace companies?**

We initiate a lot of business-to-business contact for companies in the aerospace sector. We are committed to helping aerospace companies that are looking to internationalize; for example. We attend aeronautical business shows and set up meetings with international companies who could poten-

tially be interested in coming to work in France, and we encourage them to come to Auvergne-Rhône-Alpes by showcasing the strengths of companies in the region. The president of the region, Laurent Wauquiez, also extensively travels to encourage international investment. He recognizes that attracting international business is a long-term goal and so we are working together to launch a tender to develop a network of countries that are a high-priority for internationalization, such as the US, Canada, China and Germany. We will offer support with the logistics of companies from these countries setting up international business in the region, such as investing in organizing business visits to receive international companies to meet local companies.

We will also be investing in market intelligence research, and preparing a detailed catalog of the key sectors here in our region that we will display on our website and local social networks and distribution channels.

#### **What specific support is available for SMEs and start-ups?**

There are many ways but I would like to dwell on one in particular regarding our ability to facilitate their access to European grants and funding schemes, such as Eurozone 2020 and Instrument Expertise. It is difficult for SMEs to access these schemes alone as they often do not have sufficient resources to dedicate to lengthy and complicated application procedures, but as a result of so many agencies merging together, Auvergne-Rhône-Alpes Entreprises has a wealth of experience in completing successful applications and is perfectly placed to help companies across the entire region. This is one of our goals and increasing the number of SMEs benefiting from European funding is one of our Key Performance Indicators.

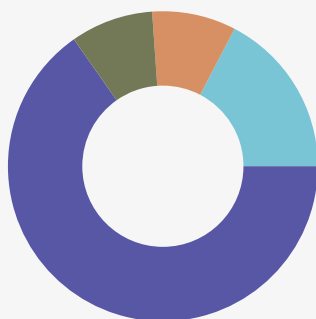
#### **Do you have a final message for the readers of our publication?**

Auvergne-Rhône-Alpes Entreprises is here to gather the strengths of the region because we are stronger together. We look forward to nurturing the growth of companies in the whole region into the future thanks to our range of expertise spread across the various territories. ■



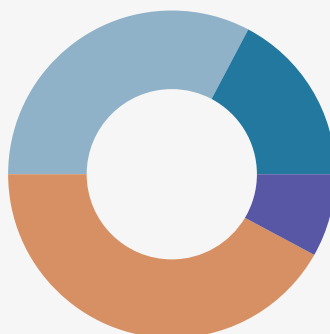
## INFORMATION ABOUT YOUR COMPANY

1. Please indicate the type of company you represent within the aerospace industry



- PME
- ETI
- Grande Entreprise
- Start-up
- Institution

2. The main sector in which you operate



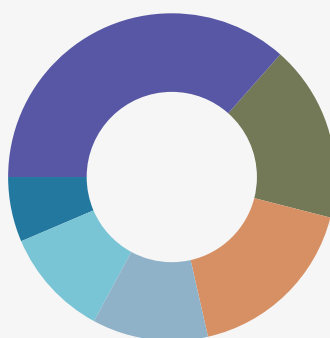
- Ingénierie (Engineering)
- Conception de systèmes (System design)
- Conception & Fabrication (Design and build)
- Fabrication (Build to print)
- Services
- Recherche et Formation
- Institution

3. Does your company serve the international market?



- Yes
- No

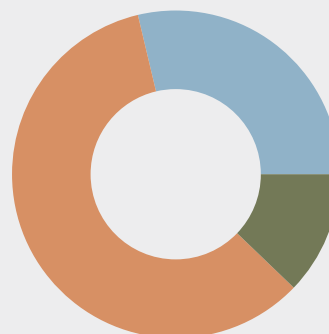
4. If yes, what other markets does your company serve?



- Europe
- Asia
- North America
- South America
- Middle East
- Africa

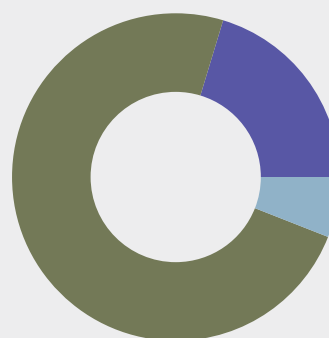
## INNOVATION

1. The access to funding for research and development is easy



- Very easy
- Easy
- Neither easy nor difficult
- Difficult
- Very difficult

2. The research tax credit system effectively supports R&D and the recruitment of qualified talent



- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

# The Research Tax Credit Scheme:

## Spurring on Innovation

14

France's continuing strength as a hub for innovation is encouraged by the French government's generous Research Tax Credit Scheme, which covers 30% of all R&D expenses up to €100 million, and 5% of expenses over €100 million. The scheme is available for companies of all sizes operating in France, across all sectors, and aerospace companies within the Auvergne-Rhône-Alpes region are taking particular advantage of the scheme to fund their research.

Karim Chibane, director at research and educational institute Esisar Grenoble INP, explained how the Research Tax Credit Scheme has enabled stronger links between his institute and aerospace companies within the region: "While participating companies benefit from the program by having access to our research resources and talent, they also receive significant financial benefits from partnering with us as a result of government incentives such as the research tax credit system, which awards tax discounts to companies that collaborate with academic structures for research."

The aerospace sector of the region is investing heavily in research spending supported by the Research Tax Credit Scheme. "Last

year, our industry research projects brought in revenue of €15.4 million, with 25% coming from the aeronautics sector," said Manuel Collet and Régis Dufour, directors at research cluster Ingénierie @ Lyon, which is home to over 1,800 researchers and conducts partnership research for companies in the region.

Companies at all levels of the value chain are not only benefiting from this funding individually, but also finding that it enables greater collaboration between leading companies and SMEs. Christian Bardot, VP at Thales Helicopter Avionics, said: "We take advantage of the Research Tax Credit Scheme, and work with SMEs and institutions to access funds in France and Europe which alone may be a challenge for them to obtain. In Valence, we are taking advantage of the technological advancements to co-design with the agile SMEs of the region." SMEs in particular have found the scheme profitable and far easier to access than other sources of funding, as explained by David Perret, general manager at Eldec: "We have benefited hugely from the French Research Tax Credit Scheme; it grants us a tax discount of around half a million euros a year, and we have between three and

Source: Chambre de Commerce et d'Industrie  
Auvergne-Rhône-Alpes

## 2<sup>nd</sup>

most populous region in France  
after Île-de-France

with a population of  
**7.8 million**

(12% of the population of France)

There are

## 300,000

students in the region

The most industrialized region  
in France, with over

## 500,000

people in industrial jobs

There are

## 40,000

researchers in the region  
(which makes it the second region  
in France for research activity)

## 2<sup>nd</sup>

most dynamic region  
in France in terms of  
import and export activity  
(over 12% of France's exports  
come from this region)

Image courtesy of Teledyne e2v



five students working with us at a time. We have found it difficult to access European funding schemes as it is necessary to be in partnership with leading companies and research bodies to apply.”

### A workforce for the future

Beyond making intensive research accessible to SMEs that would otherwise find it cost-prohibitive, the Research Tax Credit Scheme also supports the education and training of the skilled workforce the region so desperately requires. Companies across the region report a struggle to attract and retain sufficiently qualified staff in high enough numbers, with SMEs facing particular challenges. “Big companies will always be attractive to graduates, but it is very difficult for SMEs to recruit sufficiently qualified engineers today because the entire European market needs around twice as many engineers than we currently have,” explained Chibane.

The Auvergne-Rhône-Alpes region faces a further particular challenge in terms of the relatively rural and remote locations of many of its hubs. Patrick Besnier, president at DBC, explained: “Finding enough qualified staff is a major issue for us. We are striving every day to find people to work with us and, although we are offering very high salaries, it is a struggle. The industry is not attractive enough for young people, and particularly the industrial locations that many aerospace businesses are based in are unattractive to young people who prefer to be based in cities.”

With many companies in the region reporting a desire to take on more staff in the coming years as they expand their operations in the region, the pressure is on to create a workforce to meet this demand. Chibane is confident that his institution, which runs work experience and industry placement schemes with its partner institutions, is ensuring not only that its students develop the necessary skills to meet industry needs, but also that they are prepared to take on jobs specifically within the region. “Our partner companies also benefit in the longer term because in building relationships with young engineering talent, they are ensuring that they will not be affected by the shortage of qualified talent that so many other companies are facing,” he explained. ■

# The search for talent: bridging the gap between education and industry



"We recognize that different aspects of the industry require differently trained and qualified human resources; for example, designing the subsystems of an aircraft requires a very different skill set to working on a completed aircraft. Further to this challenge of educating a sufficiently diverse workforce is preparing students to enter an industry that is constantly evolving and changing. We are anticipating the full introduction of Industry 4.0 in the aerospace industry, the development of more advanced machinery, and an increase in additive manufacturing techniques. Our students are exposed to all of these advancements and are prepared for these work environments."

**- Séverine Durieux, Director of Operations, Campus Aeronautique Auvergne-Rhône-Alpes**



"Although Toulouse is traditionally known as the centre of space development in France, a large proportion of the inner elements of satellites are developed here in Grenoble, and we have a wealth of knowledge and experience across the entire space development and instrumentation services value chain. We are not in competition with any other European aerospace centers but work in collaboration and provide complementary services, and we will continue to do so."

**- Mathieu Barthélémy, Head of Aeronautics, Centre Spatial Universitaire de Grenoble**



"From speaking myself with other industry managers, we seek a link between local government and industry that prepares candidates to work at a level we require. All candidates that we recruit require training from our side and therefore a link with government equipping candidates with the skills required to work in the industry will go a long way in growing the aerospace industry in this region."

**- Benoît Noel, General Manager, Timet Savoie**



"Big companies will always be attractive to graduates, but it is very difficult for SMEs to recruit sufficiently qualified engineers today because the entire European market needs around twice as many engineers as we currently have."

**- Karim Chibane, Technical Director, Esisar Grenoble INP**





MC

# Manuel Collet

Chairman  
**INGÉNIERIE @ LYON**

## Can we have a brief overview of the institute and its recent activities?

We were founded in 2006, and in 2007 became a member of the Association Instituts Carnot, which is a national multi-disciplinary research network. We currently have over 1,800 researchers conducting partnership research for companies, promoting innovation, and developing technology transfers, mainly in the aerospace industry.

Each Carnot Institute is recognized for its high scientific standard and commits to developing R&D activities to promote industry innovation, building on our strong relationships with local industry leaders, Safran and Airbus, and also a number of SMEs. We offer different services to larger companies than SME's to cater to their different budgets. Larger companies tend to use us as a more general research and development wing, whereas smaller companies will approach us with smaller, more specific and targeted projects.

## What industry-wide trends are driving your research?

The reduction of nitrogen oxide emissions is the principal driving factor. To achieve this, aerospace companies are primarily looking to develop and use more lightweight materials, as lighter aircraft translates into less overall fuel consumption.

The move towards electric engines is also a major driving factor. A particular example of engine development and innovation is with the ultra-high-bypass (UHB) turbofan engine. This is when you have a very large fan compared to the size of the engine, which offers high speed and performance. We are looking at how to develop this kind of engine so that it has the maximum fuel efficiency.

Smart materials and smart machinery will also be a big focus. The internet of things, in terms of aeronautics, remains a broad field to be explored and developed. Whereas in the past we would build patches to be connected to existing systems, now we need to integrate those systems directly into the materials we are using. We are working towards a method where the intelligence is all built directly into the systems themselves.

## Are there any examples of government funding that has supported your research, or made it more widely accessible?

We are involved with a six-year government funded program called AIRCAR, which was launched in 2016. AIRCAR aims to use R&D innovation to strengthen the competitiveness of the SME market. The program is led by ONERA, the aeronautics, space and defense research lab, and there are seven other Carnot institutes involved in this program, and we are mapping the skills of the scientific and technological platforms available and offering them to SME's. We want to propose solutions to the problems that SME's have that are not always strictly research-based problems. We respond to any scientific and technological needs that the companies might have.

We are also involved with the PHARE project, which is working to develop rotating machine platforms for the control of environmental risks. This project received €3 million in 2016 from the French National Research Agency (the ANR), and is also supported by Safran, who we have a very strong relationship with. Multidisciplinary projects like this bring together different leading laboratories and benefit from funding from multiple sources.

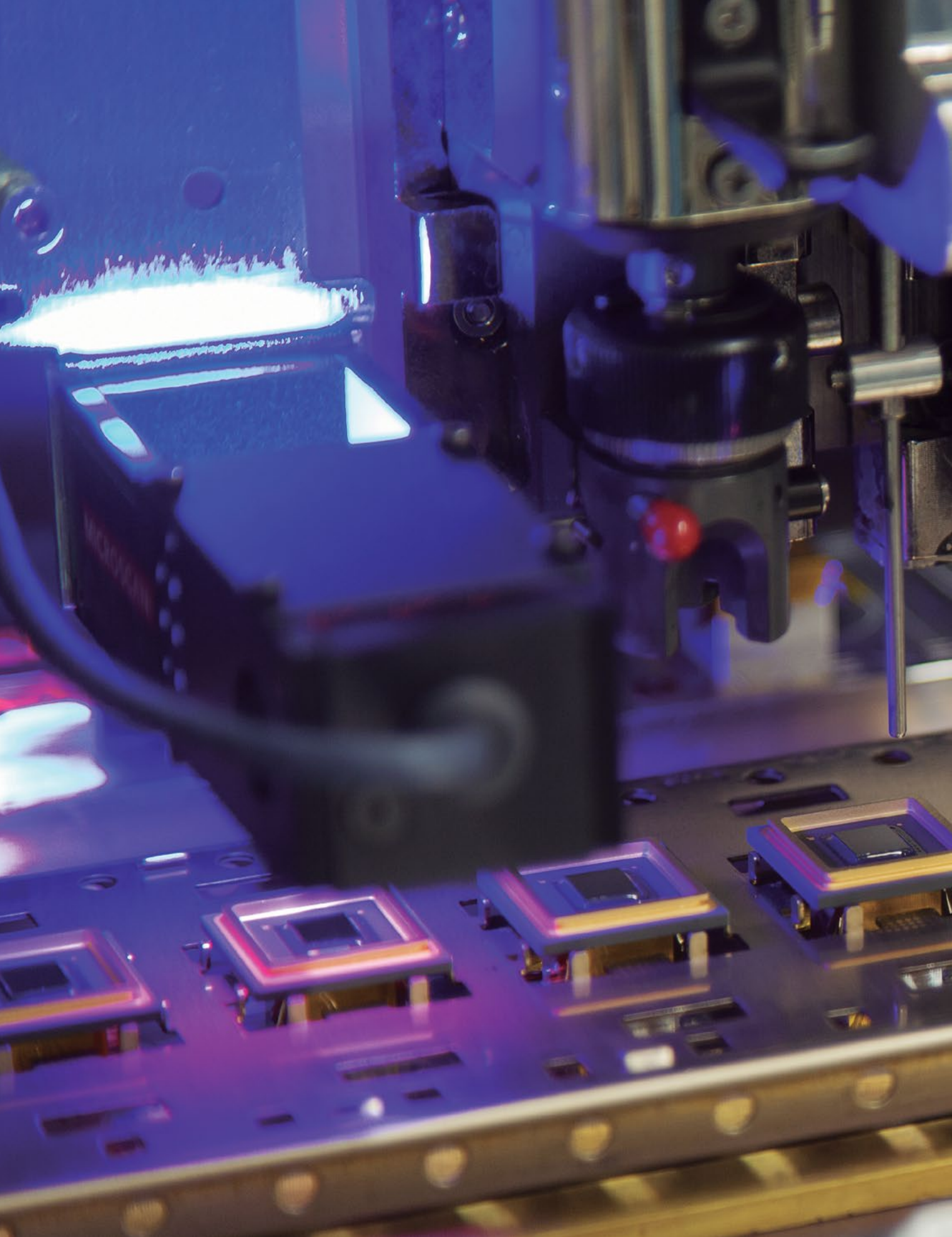
## Do you have a final message for our readers in the aerospace community?

Ingénierie @ Lyon has a high level of scientific and technological skills which are directly applicable to the aeronautic sector. We are here to lend you our creativity and scientific excellence to strengthen your capacity for innovation.

To larger companies: we want to coproduce knowledge in order to obtain large-scale innovation. We will listen to you and shape our research around your needs.

To smaller companies: our knowledge, experience and expertise is also accessible to you. We are here to respond to individual technological needs, to consult on your problems, and to create innovative solutions.

We have the laboratories and we have the skilled engineers who are ready to work. ■







# Electronic Systems

"The internet of things and Industry 4.0 are creating business opportunities for us because the level of hyper-connection between processes that is becoming increasingly common requires advanced electronics to relay information within computers and other networks. It is a very interesting time for us, and we are working on the developments in a number of ways, including safety issues, which we are very skilled in."

- M. Xavier Benoit,  
VP Technique, Innovation, Quality,  
Centum Adeneo



# Electronics:

## The current trends

"

The objective for aerospace companies is always to consume less fuel, which typically is achieved by making the aircraft lighter. We are the motor company of choice in this regard as the industry leader in creating motors that are both highly powerful and very small. Developing lighter motors are imperative in reducing the weight of aircraft; for example, a commercial aircraft could have two or three motors per business/1 st class seat. With around 100 business seats per aircraft, a reduction of even 100 grams per motor accumulates to a large weight saving over the whole aircraft.

**- Michael Niemaz,  
Key Account Manager Aerospace,  
Maxon MDP Motor France**



"

20

The global trend of the increased use of electronic components within aircraft manufacturing.

is showing no signs of slowing down, with the global market of electric components for aircraft applications expected to reach US\$10.9 billion in 2021, up from US\$7.7 billion in 2016 (Markets and Markets). Electronic components are predicted to be the highest growth sector within the c-class aerospace parts market between 2018 and 2023 (Stratview Research)

With aircraft production on the rise globally, and around 20% of the manufacturing cost of a new commercial aircraft generated by the electronics within it, there is a huge potential market and companies within the Auvergne-Rhône-Alpes region are clamoring to gain market share.

The region has the potential to excel in the aircraft electronics market because of its easy access to research and development facilities and its wealth and breadth of companies experienced in the electronic component field.

This increase in electric components has influenced the business strategies of companies across the value chain in the region. For companies looking to develop more advanced electrical components for aerospace applications, the infrastructure is there to

support them in Auvergne-Rhône-Alpes. "The internet of things and Industry 4.0 are creating business opportunities for us because the level of hyper-connection between processes that is becoming increasingly common requires advanced electronics to relay information within computers and other networks," explained Xavier Benoit, VP technique, innovation and quality at Centum Adeneo.

Many companies with access to research and development facilities are earnestly turning their focus to developing high-end solutions for the aircraft electronics market. The aim is to create parts that are more technologically advanced, capable of intelligently gathering and utilizing data, and capable of communicating with one another - all while simultaneously being mindful of the golden rule of aircraft manufacturing: the lighter, the better. Manuel Collet and Régis Dufour at educational and research institute Ingénierie @ Lyon, said: "Smart materials and smart machinery will also be a big focus [in the near future]. The internet of things, in terms of aeronautics, remains a broad field to be explored and developed. Whereas in the past we would build patches to be connected to existing systems, now we need to integrate those systems directly into the materials we are using and we are

working towards a method where the intelligence is all built directly into the systems themselves."

Companies that are already experienced in the electronic aircraft component space are focusing on the incremental innovation of their existing product lines in order to remain ahead of the curve. Alain Lacroix, sales director at Meggitt Sensorex, said: "We eventually want to replace all of our own products with more sophisticated products, mostly using MEMS sensors inside our systems. In this way, we can incorporate a smart sensing approach, allowing the end user to detect far more precise information with the sensors."

The company's approach is mindful of the barriers that currently exist when incorporating electronics into aircraft manufacturing, and is working to overcome them: "We will also be creating sensors that can withstand far higher temperatures, of up to 400 degrees celsius, which will open up possibilities for more applications."

Specific niches within the electronic aircraft parts market are particularly well-catered for within the Auvergne-Rhône-Alpes aerospace cluster, such as electronic actuators, which is one of the highest growth sectors within electronic components, with the compound annual growth rate for the glob-





Image courtesy of Thales

al aircraft actuator market predicted to be 9.5% between 2018 and 2022 (Markets and Markets). The demand for actuators is not only growing but evolving in tandem with wider trends in the aerospace industry, and here too more technologically advanced solutions are increasingly required. Michael Niemaz, key account manager aerospace at MDP Maxon Motors France, said: “The shift towards electric aircraft has necessitated the replacement of hydraulic equipment with a mixture of hydraulic and electric, or fully electric actuators.”

### Old problems: new solutions

Embedded systems designed to solve some of air travel’s oldest problems are being developed in the Auvergne-Rhône-Alpes region, as demonstrated by Frank Moreau, director of Michelin Aircraft Tires, speaking about the PresSense project that Michelin and Safran unveiled at the Le Bourget Paris Air Show last year, which has developed smart sensors for aircraft wheels. “The project was conceived in response to a problem that has always faced the commercial aircraft industry. Aircraft tires increase in temperature during flight, but the tire pressure can only be accurately

tested and measured when the tire is cold, and there are very strict rules on how long a tire must be left for after positioning and stopping at the gate. Typically, for commercial aircraft, it takes around three hours after stopping and positioning at the gate for the tire to cool to the required temperatures for pressure testing. We decided to develop a method of measuring temperature and pressure simultaneously, so that as soon as an aircraft lands we can determine the tire pressure, and then use algorithms to calculate exactly what the tire pressure will be when the wheel has cooled down. Electric sensors are embedded within the tire itself and will be able to measure far more data than previous methods of tire pressure testing,” he said.

### New solutions: future challenges?

While the increase in demand for electrical parts, smart technology and embedded systems provides opportunities for companies to develop more innovative solutions, it also brings with it an entirely new set of security risks for the future of the industry. Karim Chibane, director of technology transfer at ESISAR Grenoble INP, stresses

that his institution has identified and is working to tackle these risks: “Embedded systems and the internet of things bring so many advantages in terms of manufacturing and operational efficiency, but they also present an entirely new type of hacking and security risk, both for individual companies and government bodies. We anticipate a shortage of qualified talent in this area in the coming years as there are currently very few electrical engineers specialized in security, so we are investing in this area of training and technology transfer in order to fill the gap.”

With companies in Auvergne-Rhône-Alpes at all stages of the value chain, from industry leaders such as Michelin, working in partnership with Safran, to more niche SMEs, developing the electronic components of tomorrow’s aircrafts, it is safe to say that the region has earned its reputation as a hub for innovation. The region still faces challenges: it remains to be answered whether the qualified talent in the region will entirely meet demand, especially in promising high-technology fields such as electronics. Similarly, only time will tell whether the high cost of production in the region and the small volumes of niche products being produced will meet the cost-effective demand from the US and Asia. ■

# Christian Bardot



VP  
**THALES HELICOPTER  
AVIONICS**

**Thales has over 2,300 employees in the Auvergne-Rhône-Alpes region. Could you introduce the role the Thales' Valence sites and how it fits into the global company structure?**

From the Valence office, together with our offices in UK, US and Australia, we serve the worldwide civilian and military helicopter market, plus we have here our Navigation centre of excellence. We see Valence as an innovation hub for avionics, along with our hubs in Bordeaux and Montreal, and the hub we are currently looking to develop in Asia.

**How has Thales Helicopter Avionics responded to the helicopter industry pilots' demands to bring integrated solutions to the market?**

The systems within our new generation connected cockpit bring advanced technologies to simplify and save task workload for the pilot so they can focus on the mission in hand. We worked with pilots in developing the TopOwl® and Scorpion Helmet Mounted Sight Display for rotor wing and fixed wing aircraft. We use our center of excellence in aircraft navigation

and flight management systems in Valence to look at how the helicopter flies, how we can add MEMS sensors and enhance GNSS systems or develop advanced algorithms to improve systems for both the civil and military customers.

**How does Thales Helicopter Avionics collaborate with local SMEs and institutions on R&D initiatives?**

We take advantage of the Research Tax Credit scheme, and work with SMEs and institutions to access funds in France and Europe, which alone may be a challenge for them to obtain. In Valence, we are taking advantage of the technological advancements to co-design with the agile SMEs of the region. For example, we have Project ALMEE developing aluminum addition layer manufacturing for electronic equipment. In addition, we are working on Project Next4MEMS to develop MEMS accelerometer and gyrometer sensors in collaboration with Asygn, an electronic expert in integrated circuits for inert sensors and Tronics, the French and global leader in MEMs foundry and high-performance MEMs inertial sensors. ■

# Bernard Lucereau



President  
**SECAERO**

**Could you explain Secaero's structure and company expertise in the optronic and maintenance space?**

Aerotech Group was recently renamed Secaero, after its acquisition at the end of 2017 by the leading French group Secamic. For over 30 years, Secamic has provided spare parts in over 22 countries, and it is one of the leading French companies exporting military aircraft and helicopter

spare parts and providing global logistic and operational support. Secamic also provides global aircraft maintenance services, and works mainly in the military and helicopter sectors, providing purchase and resale, MRO, and technical support services. Secaero will now take advantage of Secamic's global network and complement their capabilities with our maintenance and modernization expertise in helicopters.

Secaero is also a market leader in night vision technology, which was developed internally.

**How does Secaero ensure that its supply chain is a smooth and sustainable process?**

We usually work very closely with our suppliers throughout the OEM process and we try to capitalize on their experience in the industry. We need to plan very far in advance to ensure that we anticipate what the industry's future requirements may be. The supply chain process differs drastically, depending on which product is needed. All in all, we have a strong team that has control over the entire supply process.

**What are your future growth prospects and potential challenges?**

Our major growth prospects in the short to medium term will be South American and African markets for maintenance and modernization services. We will also expand our capabilities in the fixed wings market. Secaero also has the ability to grow with its existing clients and customers with ongoing maintenance, technical assistance and offering them additional complementary products. It is essential that Secaero focuses on being proactive with its product offerings and maintenance instead of being reactive. This could also be seen as Secaero trying to create a more integrated product offering and solution for clients. Other growth prospects would be to grow our partnerships with and through complementary businesses partners. Product development, structure and modernization of our offerings and capabilities is our path forward. Our goal is to be a leader in MRO activity by 2020, and the growth of our group will therefore come through new acquisitions. ■

# Cedric Errard



VP Sales and Marketing

**CROUZET AEROSPACE**

## Can we begin with an introduction to Innovista sensors and the Crouzet brand?

Crouzet designs, manufactures and supplies components such as switches, position sensors, actuators and electrical protection and cockpit control solutions. We serve mission critical applications where reliability and quality are paramount to our customers. Aerospace is our single largest market, accounting for a third of the company's revenue. We design specifically to meet our customers' application needs, and we have a deep understanding of the environments that they are working in. As a result of this expertise, 80% of our revenue is generated by adapted and customized products.

Although we are a medium sized company, we remain a Tier One supplier to all of the major OEMs; we serve Airbus, Boeing, Bombardier, Embraer, and Airbus Helicopters. We are a leader in all of the product lines that we supply, with an annual revenue of €142 million.

## Leading OEMs are putting increasing pressure on their suppliers to bring their prices down - how are you responding to this?

At Crouzet we focus on innovation to continuously deliver better value to our customers with solutions that lower the total cost of ownership.

## Larger companies such as Airbus and Boeing are pushing for a consolidation of the supply chain in order to increase efficiency and decrease prices. As a medium size company are you looking to acquire other companies to add to your portfolio?

As Crouzet has an efficient and high-performing supply chain it is ready to accept these challenges, and act as a platform for other companies to participate in this journey. One of the key focuses for Crouzet is to look for acquisitions or partnerships with other companies, in a strategic and sustainable manner and so we have taken on an M&A director to help us achieve this goal. ■

23

# Yves Maheo



Product Development Manager

**SKF AEROSPACE**

## Could you introduce our readers to SKF Aerospace's global offering and its significance in the Auvergne-Rhône-Alpes region?

SKF Aerospace represents 5% of the company's business with 3,000 employees and 12 manufacturing sites: two in France, seven in the USA, two in UK and one in Italy. For research and development, we have two centers; in Europe in Valence, Rhône-Alpes and one in the USA in Jamestown, New-York. In Valence Innovation Centre, we employ 50 people.

In both Europe and North America, we provide aero-engine bearing solutions, whereas in Europe we have a strong presence also in airframe aerostructure bearings and composite products.

## Black Design will launch end of 2018, replacing the steel processes with a 2D material made from carbon fiber and resins. How does SKF continue responding to market demand for increased composite material application?

SKF Black Design is a different design approach to work with composites and explore their potential for function inte-

grations across all interfaces where SKF products feature. We are looking to make products lighter to reduce fuel cost and consumption, as well as reduce the energy lost, especially with rolling bearings due to issues of friction or heating.

The end of product life is a key industry topic, on whether it will be possible to recycle or reuse the growing number of composite materials, even though aerospace is not a high-volume user compared to the automotive industry. Thermoplastic seems easiest to recycle; researchers are also working to separate resins and carbon fibers at the end of the life of the product.

## How does SKF recruit a team that has the qualified expertise to bring these innovations to the market?

We have a special relationship with the National Institute of Applied Sciences Lyon (INSA) to work with third-year mechanical engineer students to prepare them for work in the industry. Through SKF's Global Trainee Program we recruit potential new talent who gain experience across different organizations within the company over a period of two years. ■



# Nicolas Chantier

Marketing Manager  
**TELEDYNE E2V**



AREA:  
**LANDING SYSTEMS**

MAIN ACTIVITY:  
**DESIGN AND BUILD**

## Could you outline how Teledyne e2v and specifically the Grenoble site fit into the global company strategy?

Teledyne corporation has a current revenue of US\$2.6 billion, which is split among four segments: instrumentation represents 35%, digital imaging 29%, aerospace and defence electronics 25%, and engineered systems 11%.

Teledyne strategy is about bringing enabling technologies to professional growth markets.

As such, the Teledyne e2v Grenoble acquisition by Teledyne has contributed into enlarging the corporation portfolio of technologies in a complementary manner, as well as enabling Teledyne to continue to increase its footprint outside the USA in order to be a truly global player.

Last but not least, Teledyne recognizes the importance of mastering supply chain and manufacturing when it comes to serving demanding professional markets with the latest technologies. As such, the manufacturing capability out of Grenoble is a perfect fit.

## How does Teledyne e2v differentiate itself in the aerospace and defence market?

We are the only semi-conductor company in Europe EN9100 certified for aerospace and defence, and Sensitron in the USA is the only other company in the world also certified. The certification acts as a point of differentiation and has a positive effect for our business, especially in the aircraft industry. Our market share is primarily the

United States representing over 50% of our business from Grenoble, Europe comes second and Asia third.

Our products play a key role in differentiation as well. Our biggest line is the microprocessors, and we supply for a variety of aerospace and defence electronically controlled systems, including flight computers on the majority of global aircraft and engine controls. Within the heart of the systems or engine controls, there is always an embedded computer with a microprocessor that we supply to aerospace and defence standards with specific reliability requirements that the regular commercial manufacturers would not provide.

## What are the latest innovations coming from the Grenoble product lines?

For the microprocessors line we work with a major US manufacturer, NXP, whose products we qualify to aerospace and defence standards, bringing added value by adjusting the level of reliability for each product application case by case. The Qormino® family is our latest innovation in computing modules, integrating processors with 4GB memory, which saves precious engineering hours and risks for our customers: they can focus on engineering differentiators for their customers and ultimately significantly reduce time to market.

A second product line from Grenoble is our data converters that we design in house and which operate at extreme microwave signal frequencies. The main value for our customers is that we push the digital boundary much closer to the antenna on any RF system, digitizing more radar and telecommunication systems. This business has collected a number of world firsts since 22 years in data conversion technology, the latest one being an unprecedented digital to analog converter operating in K-band frequencies; this is known as the EV12DS4xx series.

## The Auvergne-Rhône-Alpes region has programs to unite the private sector with qualified talent at universities to meet industry needs. How has this impacted Teledyne's business?

Signal processing has an academic history here with French mathematician Joseph Fourier, after whom the Grenoble University of Science was originally named. There used to be a disconnect between industry and the academic world but this gap has narrowed significantly in recent years locally.

We are very happy with the stream of talent coming out of the local universities; they are very good engineers who contribute to our differentiation.

We can see other regions where our competition struggles to find that level of talent locally compared to what we can do, so the programs are a bonus to being in the Auvergne-Rhône-Alpes region.

## As a large player in the region, how do you see the market structure developing in the coming years, and what are Teledyne e2v's growth plans?

We see at Cluster meetings that the primary aircraft manufacturers have high expectations for SMEs. They no longer wish to deal with numerous small entities and would rather see talented SMEs be acquired by a larger group, which is happening. We felt some of that pressure ourselves as a midcap when we were e2v and becoming a large cap, now part of Teledyne, has been received positively by customers to meet their growing demands. Our current growth plan is focused on differentiation and we may make further acquisitions when relevant to our strategy. ■





# André Gauthier



Site Director Roche la Molière  
**ZODIAC AEROSPACE**

## Could you give an introduction to Zodiac Aerospace?

Zodiac Aerospace is a French group headquartered in Paris, which this year was acquired by the Safran Group. We have more than 35,000 employees worldwide, and design and manufacture products for aircraft interiors such as cabin parts and seats, as well as aircraft systems such as fuel systems, electrical power distribution systems, and oxygen systems.

## What is the competitive landscape like and how does Zodiac Aerotechnics differentiate itself from its competitors in France?

The competitive landscape is strong, and we differentiate ourselves through our lean manufacturing techniques and our cutting edge product technology.

## Have there been any key recent technological advancements that have improved Zodiac Aerotechnics manufacturing processes or product lines?

Over the past ten years we have invested heavily in a new product line for aircraft fuel tank inerting systems. We had our first

inerting systems certified earlier this year with Embraer E2.

## What role does Zodiac Aerotechnics expect to play in the growth of the aerospace industry in the Auvergne-Rhône-Alpes region?

Zodiac Aerotechnics growth over the past few years has already significantly contributed to the growth of the aerospace industry in the region: five years ago we had less than 300 employees, and today we have around around 500. We have expanded our physical presence by building new facilities and developing our existing premises by adding extensions and new workshops. This growth has allowed us to support the growth of a strong local supply base and to foster strong vendor relationships. I am also a board member of the Aerospace Cluster in Auvergne-Rhône-Alpes, and this role allows Zodiac Aerotechnics to be open to discussions with local businesses, and to be able to promote the local industry in a clear and transparent way. We are proud of playing a leading role in the development of the local business environment, and will continue to do so into the future. ■

25

# David Perret



General Manager  
**ELDEC FRANCE**

## Can we begin with a brief introduction to Eldec and the Crane brand?

Eldec France was created in 1992 by a spin-off of the Swedish group ABB. At that time, Eldec was based in Washington in the US, and we were then created as Eldec France. Eldec was acquired by Crane Co in 1994. Within aerospace, we offer six solutions: landing solutions, sensing solutions, fluid solutions, cabin solutions, power solutions and microwave solutions.

## What is the current R&D focus at Eldec?

We are currently focusing on three main areas: developing new fuel solutions, developing new ways to reduce the weight of aircrafts, and developing ways to decrease the installation time of our products for our customers.

## How has the business landscape changed in aerospace over the past few years, and what challenges have arisen?

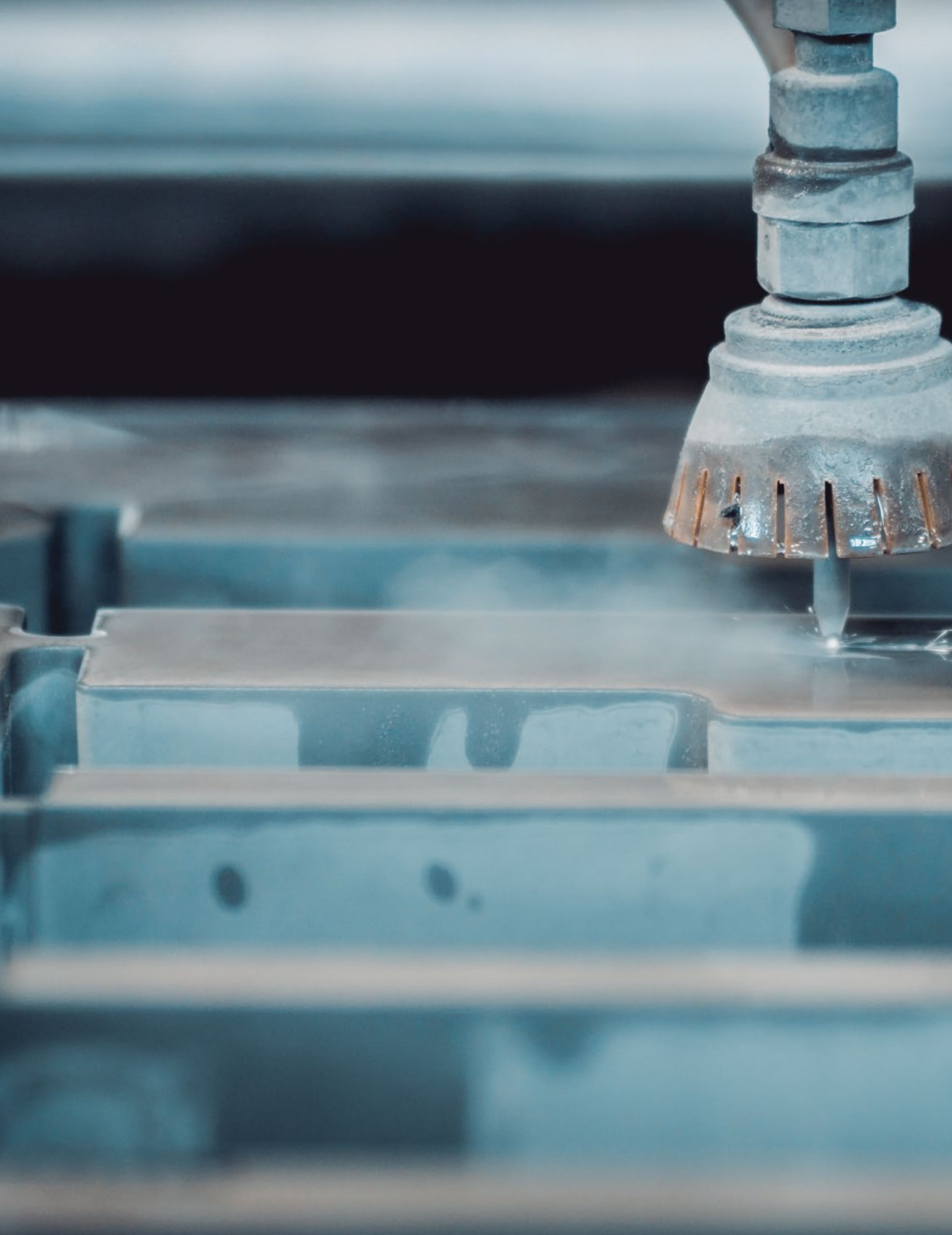
Ten years ago, aircraft companies were making very small profit margins, whereas suppliers like us were making a much larger margins, but today this has completely reversed. Aircraft companies are always

asking for lower and lower prices from suppliers, and as a result we are facing a vertical integration of the supply chain in aerospace.

Strategies are changing across the industry because of the fact that leading companies now prefer to develop products themselves by acquiring smaller companies, such as in the case of Safran with the acquisition of Zodiac. This has certainly affected us over the years; 20 years ago we were Tier One supplier, then we became Tier Two and now we are Tier Three. We are now in a situation where we need to find the right balance. With the new strategies being developed at the moment, it is possible that Airbus or Boeing will want to buy technology directly from us, so perhaps in the next 10 years we will become a Tier One supplier again.

## How easy is it to access funding opportunities for R&D?

Most significantly, we have benefited hugely from the French research tax credit system; it grants us a tax discount of around half a million euros a year, and we have between three and five students working with us at a time. ■





# Materials

"While in the short term, composite materials are good for the environment because they enable the production of lighter airplanes that consume less fuel and emit less CO2, there needs to be more work done to ensure that they are disposed of in an environmentally responsible and sustainable manner in the future."

- Gilles Duqueine,  
President & CEO,  
Duqueine



# Thinking Outside of the Box:

## What is it made of?

28

Aircraft manufacturers have been focusing their efforts on creating lighter aircraft since the aerospace industry's very beginnings. A lighter aircraft requires less power, therefore consumes less fuel, is thus cheaper to run, and can become a more competitive product to sell to end-users. However, in recent years, the demand for lighter aircraft has intensified not for economic reasons, but because of a pressure to reduce global man-made carbon emissions. The direction of today's aerospace industry is heavily influenced by Resolution A38-18, adopted by the International Civil Aviation Organization (ICAO) in October 2013, which outlines a shared aim of achieving carbon-neutral growth in the sector from 2020 onwards. With 192 member states around the world represented by the organization, this goal is common to all of the world's leading OEMs. The international aerospace community's efforts to reduce carbon emissions are already enjoying some success. Technological advancements in aircraft design and manufacturing over the years have, as a general rule, greatly increased fuel efficiency: aircraft produced today are around 80% more fuel efficient per passenger kilometer travelled than those produced in the 1960's (ICAO). As a result, while global passenger numbers may be growing at a steady rate, emissions are not proportionally increasing. Passenger growth is growing at 5% per year, and aviation emissions are growing at around 3% per year (Intergovernmental Panel on Climate Change, IPCC). The overall increase in carbon emissions, however, still has a noticeable effect on global carbon emissions, with the IPCC forecasting that the aviation industry's share of global man-made CO2 emissions will increase from around 2% to around 3% by 2050, if no further emission reducing measures are made.



It is clear that there is still significant progress to be made if the ICAO's target is to be met, which presents both opportunities and challenges for research-heavy aerospace clusters around the world, including Auvergne-Rhône-Alpes. With no primary in the region, but instead suppliers at all levels of the value chain, the pressure is on to develop innovative aircraft parts that will contribute to the goal of creating lighter, more fuel-efficient aircraft.

### Composite materials: unrealized potential

Arguably the most impactful trend in the aerospace industry in terms of emission reduction has been the increase in the use of composite materials in aircraft manufacturing. While aircrafts produced in the 1990's contained 5-6% of composite materials by weight, aircrafts produced in 2017 contained, on average, close to 50% composite materials by weight (Composites Manufacturing Magazine). Composite materials are so valued in aerospace manufacturing because of their combination of lightweight, high-strength, low electrical conductivity and durable properties enables a significant reduction in the weight of aircraft. Composite materials are no longer restricted to the aircraft fuselage, and companies within the Auvergne-Rhône-Alpes region are focusing their R&D on the application of composite materials in smaller aircraft parts. Yves Maheo, product development manager at SKF Aerospace, said: "We are looking to make products lighter to reduce fuel cost and consumption, as well as reduce the energy lost, especially with rolling bearings due to issues of friction or heating. For us, it is a



Image courtesy of DBC



good opportunity to utilize our long-term experience with composites, but engineering skill and an open mindset are also key to get the best from composite materials if you want them to outperform a conventional black metal design.”

The potential for composite materials in aircraft goes beyond simply creating lighter replicas of aircraft parts traditionally manufactured from metal. Gilles Duqueine, director at Duqueine Rhône-Alpes, explained that it is possible to manufacture several parts at once, in such a way that they are already connected and do not need to be joined together later by the OEMs themselves. “We are focusing on developing composite solutions which are more complete, so that we can replace several metallic parts with one composite part, which saves on production costs as well as weight within the aircraft,” he said.

Further research is required when using composite materials for applications beyond aircraft fuselages, such as within the aircraft engines or electrical systems, and companies across the Auvergne-Rhône-Alpes region are pioneering this research: “The current research focus is developing composite materials that are specifically adapted to meet the technical needs of the aerospace industry, such as those that can be repeatedly exposed to extreme temperatures without suffering a deterioration in quality or performance. The main difficulty we are facing is developing methods to transform materials that can then later be effectively manufactured in larger quantities”, explained Jean-Michel Deck, VP of development at Compose.

The increased use of composite materials in aerospace manufacturing is significantly affecting demand for other products and ser-

vices across the industry in Auvergne-Rhône-Alpes, as explained by Franck Picard, operational director at Acnis International: “Titanium is doing particularly well at the moment as it works well alongside composite materials. The increase is significant: whereas 10 years ago, titanium represented 7% of the weight of a commercial aircraft, today it represents closer to 15%, and is continuing to increase.”

### Alternatives:

Composite materials are not the only option. Constellium sees potential in the development of aluminum alloys. The company is participating in the Airbus Wing of the Future program, which is based in the UK and aims to explore the best materials and manufacturing and assembly techniques for aircraft wings. “We are working to develop a metallic wing with the same performance as a composite wing but at a significantly lower cost,” explained Rafael Carbonell, VP sales, aerospace and transportation at Constellium. “Recycling aluminum scrap is part of Constellium’s legacy and we have built a strong supply chain so that most of the aluminum that has ever been created is in use or is recycled,” he added.

### Today’s solution, tomorrow’s problem?

While composite materials enable the manufacturing of lighter aircraft, Gilles Duqueine cautions against the potential short-sightedness of hailing composite materials as the answer to all of the aerospace industry’s environmental sustainability needs: “In the future, our customers will face the challenge of disposing of old composite materials, which are non-recyclable. While in the short term, composite materials are good for the environment because they enable the production of lighter airplanes that consume less fuel and emit less CO<sub>2</sub>, there needs to be more work done to ensure that they are disposed of in an environmentally responsible and sustainable manner in the future.”

Eric Pisani, CEO at Sintex, also recognizes this problem and comments that his company is steering towards a more sustainable future: “We are focusing on thermoplastic composites which have the advantage of being recyclable. I believe that, even if the materials cannot be recycled within the aeronautics industry, these materials could be reused for other applications in the automotive industry, for example.”

Today’s solutions have the potential to create their own challenges tomorrow, but with companies within the research-heavy Auvergne-Rhône-Alpes region demonstrating an awareness of the current limitations and future drawbacks of composite materials, it seems almost certain that the region will play a leading role in overcoming them. ■



## Rafael Carbonell

Vice President Sales,  
Aerospace and Transportation  
**CONSTELLIUM**

30

### Could you outline Constellium's activities in the Auvergne-Rhone-Alpes region for aerospace?

We have two major facilities in Auvergne-Rhone-Alpes: the Issoire plant and CTEC. The Issoire plant is a large world-class rolling mill with only one other mill with the same ranking globally, and we produce mostly for aerospace but also other industry transportation markets with our team of 1,500 employees. Although Issoire serves the global markets and we are a global leader, we are strongly rooted in the Auvergne-Rhone-Alpes region and many partner suppliers and customers from the clusters openly participate in our success. Close to Grenoble, we have the Constellium Technology Centre (CTEC), which is one of the world's leading aluminum research centres. This works for all the different business sectors of Constellium, including aerospace, researching across different metallurgy topics and customer applications. In aerospace, the research

centre particularly benefits from the high-tech clusters in Lyon and Grenoble and from the nearby universities.

### For Constellium, what is the strategic advantage of manufacturing in the Auvergne-Rhone-Alpes region and how do you stay competitive?

At Issoire, we are geographically extremely well located to serve the global market and can get a truck to our European aerospace customers within a day. France is also a competitive destination for manufacturing with regards to energy costs. The initial investment for a plant the size of Issoire can be 2 billion euros, including a lot of capital expenditure on machines, because given the quality requirements of aerospace, we are a highly process-focused industry. The key drivers in making a rolling mill competitive are technical knowhow and maintaining equipment at a high level of readiness and performance; it is really productivity that matters and on this front France has many competitive industries.

### What are the current drivers and focus for Constellium's R&D?

Our research centres focus on making the same structure at a lower weight, driven by density of material, mechanical characteristics around strength, durability and corrosion resistance.

A key innovation from the Auvergne-Rhone-Alpes is Constellium's Airware® Al-Li alloys that can offer 10% to 20% performance improvement which . We launched our pilot cast house in CTEC, and in our new facility in Issoire we have nearly 100 people employed to manufacture the Al-Li alloys. They have had great commercial success being used for most of the internal structures in the A350, also with the Bombardier C series and Space X Falcon amongst various other space and defense applications.

### How has Constellium taken on the increasing competition from composite materials in aircraft?

For example, we are working on the Wing

of the Future program in partnership with customers to develop a metallic wing with the same performance as a composite wing but at a significantly lower cost. The Fuselage of the Future is already flying in the Bombardier C series and the 777X kept the metallic fuselage, so we have clearly shown metallic fuselages are superior compared to carbon fibre fuselages for smaller aircraft.

### How important a role does recycling aluminum play for Constellium?

Recycling aluminum scrap is part of Constellium's legacy and we have built a strong supply chain so that most of the aluminum that has ever been created is in use or is recycled. Recycling makes the most sense when you have high purity alloys: when you are adding lithium, silver and a lot of copper. Recycling from our Al-Li, or customers' scrap is fundamental for sustainability, but moreover is economically advantageous in respect to the buy to fly ratio, as the final aluminum architecture can remove 90% of the material. Ultimately, recycling improves cost-benefit trade-off for customers and makes it more competitive.

### How has Constellium positioned itself for the ramp up and are you seeing competition from developing markets?

Our ramp up was earlier in the decade when we saw increased build rate in wider aircraft, so we are well-positioned for the current single-aisle production ramp up and do not see a big growth in aluminum - just 2% per annum. For our customers, we have helped reduce time to market by introducing the free-machining, where we remove material and prepare the piece to go into their machines. We are seeing local metallic solution supply models being discussed in emerging markets that could be competition for us but that is yet to be taken to the real sustained delivery phase. Hence, we have a huge capital investment behind us to support growth and bring in Airware® Al-Li technology. Moreover, Constellium's growth market is automotive, following the trend that sees aluminum replacing steel. ■



## Eric Pisani

CEO  
SINTEX NP

EMPLOYEES:  
> 500

TURNOVER:  
> 100 M€

AREA:  
MATERIALS

MAIN ACTIVITY:  
DESIGN AND BUILD

### Could you introduce the company and the recent performance operating internationally in the aeronautic space?

The Sintex NP group made €266 million in sales in 2017, 8% of which was generated by the aerospace industry. We supply Airbus and its suppliers from our plants in France as well as in Tunisia and Morocco, to be close to our key players and customers in these countries. The last three years have been very dynamic with growth linked to new aircraft such as the A350 program or the new LEAP engine.

**To what extent has the search for lighter materials been the main R&D driver for Sintex NP? As a result, what new inno-**

### ventions are the company able to bring to the market?

We are finding that developments in composites are driven by a search for light-weight materials and this is the main reason why the percentage of composites is increasing in aeronautics. The other driver for this is the cost saving element. When comparing traditional thermoset composites manufacturing with a thermoplastic process, there is a cost advantage because of a capacity advantage through reducing cycle times. Moreover at Sintex NP we are able to propose through this thermoplastic technology integration of functions directly into the mold.

For R&D we work a lot with universities in the region, mainly with INSA. Our R&D department is working on developing overmolding of Continuous Fibre Reinforced Polymers (CFRP), combining the mechanical functions of CFRP and integration of functions through injection moulding. In thermoplastic composites we are known by customers in aeronautics as an expert, especially for small and mid-size parts.

### How do you carry out testing and what role does accreditation play in giving Sintex a competitive edge?

Manufacturing testing is mostly realized internally, for example non-destructive testing (NDT) using ultrasonic or dye penetrant testing are carried out with COSAC-COFREND certified operators. This process is also NADCAP accredited.

We believe that mastering processes in house is key to gaining a competitive advantage. We also try to bring something new to the market, which is why we invest heavily in R&D with an emphasis in the development of thermoplastics composites applications. Even though aeronautics is not our main business segment, in terms of R&D investment, most of our resources are allocated to this sector.

**Could you talk about the importance of sustainable development as a company as well as the challenges faced when a product reaches the end of its lifespan.**

### What will happen to the materials?

We try to take care of all of these challenges and indeed, recycling is a key one for aeronautics. We are focusing on thermoplastic composites which have the advantage of being recyclable. I believe that even if the materials cannot be recycled within the aeronautics industry these materials could be reused for other applications in the automotive industry, for example.

### How do you view the market's move toward consolidating to meet ramp up demands?

As far as Sintex NP is concerned, we have made many acquisitions in the last 25 years and were able to develop at a 10% annual growth rate in Europe, which cannot be done through organic growth alone. Ten years ago, we acquired a company called AIP, located in the Lyon region enabling us to grow in aeronautics. AIP has brought its expertise in machining and 3D printing of components. The market conditions are a lot slower in the aeronautics industry compared to others, but we still intend to play a role in the consolidation of the supply chain.

### What is the growth strategy for Sintex in the coming years?

We have ambitions to further develop our company through organic and inorganic growth and, as a result, we hope to extend the industry in the region. We pay a lot of attention to our local network. But a big driver in the midterm would be to have manufacturing capabilities in North America. For us to be considered as a key player in this industry you need to cover both Europe and North America.

### What final message would you like to communicate to our global readers about Sintex and the future of the company?

We are working towards becoming a global player in the aeronautics supply chain through our technical expertise in the processing of thermoplastic composites and our high investment in innovation. ■

# Jean-Luc NoirJean



European Hub & Villeurbanne Site Director  
**SAFRAN LANDING SYSTEMS**

**Could we have an introduction to the carbon brakes activity and the Villeurbanne site?**

We are part of the aerospace wheels and brake division of Safran Landing Systems. Our expertise is in the carbon-carbon composite used for airplane braking systems.

Our site is the original site that started the development and manufacturing of this product in 1986. The main production is for the aerospace business but we are also working on diversified products, such as the Formula One race cars braking application. The research and technology development for the carbon-carbon material product line has been maintained located on the site since the beginning. We are now preparing for entry into service the fourth generation of material.

**To what extent is Safran Landing Systems implementing a more preventative maintenance approach?**

For many years we have been working to execute preventive maintenance on 95% to 99% of our production machines on a regular basis. We have now started to deploy Total Predictive Maintenance using our IT systems so we can learn from previous experiences to improve.

**With the increase of composite materials in airplane structures, do you think the industry is prepared to manage sustain-**

**able solutions for the end of product life?**

In this respect, we are more advanced than other companies in the composite industry. We have been using carbon composites for over 30 years for the braking applications and we have made improvements to the material so that we can reuse our carbon material after several cycles under our refurbishment process, to minimize the waste materials. Moreover, we resell our fiber chutes to suppliers who are able to make tissues, and we can reuse them in our processes to close the loop and reduce waste, which is good for our business as well as the environment.

**How does Safran Landing Systems collaborate at a regional level for research and development?**

Today, we work closely with the region's universities for our research and development projects. In particular, we work with INSA Lyon also based in Villeurbanne because of their focus on tribology, and we work with local laboratories and other companies of Safran, such as Safran Ceramics. ■

# Frank Moreau



Director of Michelin Aircraft Tires  
**MICHELIN**

**Could you give an introduction to Michelin's operations within the aerospace sector?**

Michelin is a worldwide organization, with a long history of working in the aerospace industry. In 1981, we introduced the first radial tire in the history of aircraft tire manufacturing, and since then have con-

tinued to develop new technologies and solutions for the industry. Today we follow the growth of the global aircraft industry closely, and we work in all aspects of tire design and manufacturing, and have design teams and factories based in France, the US and Thailand.

**Michelin and Safran introduced their partnership project PresSense at the Paris airshow last year. Could you introduce our readers to the project and its development?**

Aircraft tires increase in temperature after the landing, but the tire pressure can only be accurately tested and measured when the tire is cold. We decided to develop a method of measuring temperature and pressure simultaneously, so that as soon as an aircraft lands we can determine the tire pressure, and then use algorithms to calculate exactly what the tire pressure will be when the wheel has cooled down. Electric sensors are embedded within the tire itself and will be able to measure far more data than previous methods of tire pressure testing.

**What are Michelin's main goals for the next three to five years?**

The aircraft industry is currently experiencing a period of organic structural growth, with the global number of aircraft expected to double in the next twenty years, and Boeing and Airbus both facing enormous backlogs. We know that we must be very agile in order to meet the increasing demand. We are also anticipating the cost pressure on the market due to the increasing competition between air framers on one hand and the airlines on the other. Within this context, we are developing both new affordable products and new manufacturing schemes – including digital and industry 4.0 and new technologies. In the longer term, as a result of the Michelin Economy Circular strategy (Reduce – Reuse – Recycle - Renew), we are also developing specific R&D initiatives, particularly with new equipment and partnership programs, such as that we have with Safran. ■



# Patrick Besnier

President  
DBC



EMPLOYEES:  
50 - 99

TURNOVER:  
10 - 20 M€

AREA:  
MATERIALS

MAIN ACTIVITY:  
BUILD TO PRINT / PRODUCTION

## Can we start off with an introduction to the company and its operations in the aerospace industry?

DBC has been working in machining, bar turning and precision mechanics in the aeronautics, auto-motive, hydraulics and medical sectors since 1956. We were a relatively small company until 1994, and since then have grown to a staff of 120 and a turnover of €18 million. We have a wide range of technologies at our disposal, with single and multi-spindle cam-controlled lathes, and our wide range of technology sets us apart from around 500 competitors within France.

## You invest a minimum of 10% of your revenue into your machine fleet every year. How has it involved in recent years - have you been incorporating more of Industry 4.0 into your processes?

The incorporation of 'Industry 4.0' in and of itself is not a driving factor at DBC. Companies across the value chain are talking about it and focusing on it as a main goal, but we believe that upon examination, 'Industry 4.0' as a blanket term is misleading. Just because a piece of equipment might be classified as 'Industry 4.0' does not mean that it is going to translate into improved efficiency, a reduction in cost or an increase in production capacity.

## How are you coping with the pressure to bring your prices down?

We focus on having first-class production quality, because we actually find that our customers are willing to pay a little more for our products. We work on factors like our on-time delivery record in order to ensure that we have a great reputation to set us apart from our competitors, and to encourage repeat business.

## Do you have the capacity to meet the increased demand of the production ramp-up?

As we have doubled our turnover in the last five years and we are working on increasing our production capacity by building an additional 2500 square meters of production space. The site will be completed in the July of this year.

## How do you find recruiting qualified staff within the region?

Finding enough qualified staff is a major issue for us. We are striving every day to find people to work with us, and although we are offering very high salaries, it is a struggle.

The capacity of students that universities and technical colleges can take for courses relevant to the aerospace industry is not high enough. The industry is not attractive enough for young people, and particularly the industrial locations that many aerospace businesses are based in are unattractive to young people who prefer to be based in cities. It is a real problem for us, and one that we cannot solve alone. ■

**MACHINING YOUR MECHANICAL SOLUTIONS**

CONTACT: PATRICK BESNIER CONTACT@DBC.FR  
+33 450 34 58 04 WWW.DBC.FR

# Cutting edge technologies

## Jocelyn Lardet

Industrial Director  
**JET CUT**

EMPLOYEES:  
**20 - 49**

TURNOVER:  
**5 - 10 M€**

AREA:  
**MATERIALS**

MAIN ACTIVITY:  
**BUILD TO PRINT**



### Could we start with an introduction to the Energie Metal group and in particular Jet Cut?

Jet Cut provides water jet cutting services primarily for the aerospace sector, which generates 80% of its revenue. Water jet cutting is an alternative to other forms of cutting such as laser cutting, plasma cutting and sawing, whereby high-pressure water is used to cut metal and composite materials.

We introduced water jet technology within the aerospace industry in collaboration with Airbus and from here we have developed a very strong partnership with them which has extended into further projects. Our main clients are composites parts manufacturers and other metallic subcontractors manufacturing titanium, steel, special alloys and aluminum parts through milling and forging technologies.

We have three main products that we use water jet cutting for: the first is aerostructure parts of an aircraft, the second application is for aircraft cabins, and the third application is aircraft engines.

### What are some of the benefits of using water jet cutting over other forms of cutting?

The main benefit is the reduction of material waste because our technology is able to cut materials of any shape and thickness using nesting optimisation. An additional benefit is to avoid causing any damage where the cut is made. We do not change the structure of the material that we use, whereas techniques like laser or plasma cutting drastically alter the properties of the material at the place of the incision.

### How do you ensure that your processes will be compatible with materials of the future for the aerospace industry?

We are constantly developing our technologies around new materials, and we spend a lot of time and capital on R&D for new materials that could be used in the future.

### Do you anticipate any competition within this industry?

The water jet market is still very narrow but we do anticipate competition to increase as demand increases, and so we are doubling the size of our plant in preparation for this. We have launched an ambitious investment plan to optimize product quality and productivity to offer the best service to our clients. ■

The collaborative spirit of the Auvergne-Rhône-Alpes region is exemplified in the approaches towards material cutting and treating services. One of the region's competitive advantages is not only that composite materials are being widely developed, manufactured and used here, but that innovative methods of cutting and treating them are available close by. As traditional methods of cutting, such as laser, are inappropriate for using with composite materials as they damage their structural integrity, more compatible methods have been developed by companies within the region, such as high pressure water jet cutting at Jet Cut. After the cutting and shaping of materials has been completed, surface finishing services to extend the service life of the finished parts are also widely offered within the region.

Companies such as BINC Industries are treating mechanical parts for Tier 1 and Tier 2 suppliers with their patented MMP technology and delivering operational efficiency improvements of up to 1.5%. ■

# Cutting and Treating



"The current research focus is developing composite process solutions that are specifically adapted to meet the technical needs of the aerospace industry, such as those that can be repeatedly exposed to extreme temperatures without suffering a deterioration in quality or performance. The main difficulty we are facing is developing methods to transform materials that can then later be effectively manufactured in larger quantities."

**- Jean-Michel Deck,**  
**Business Development,**  
**Compose**

35



"When a tool is first designed on a computer, it has no structural flaws or weak points, however, when it is created in reality there are so many factors involved that there will always inevitably be a tiny weak point. Our software will identify the most fragile parts of engineering tools and anticipate which repeated actions will cause them to break and adapt the method of production in order to avoid putting too much pressure on the weakest points."

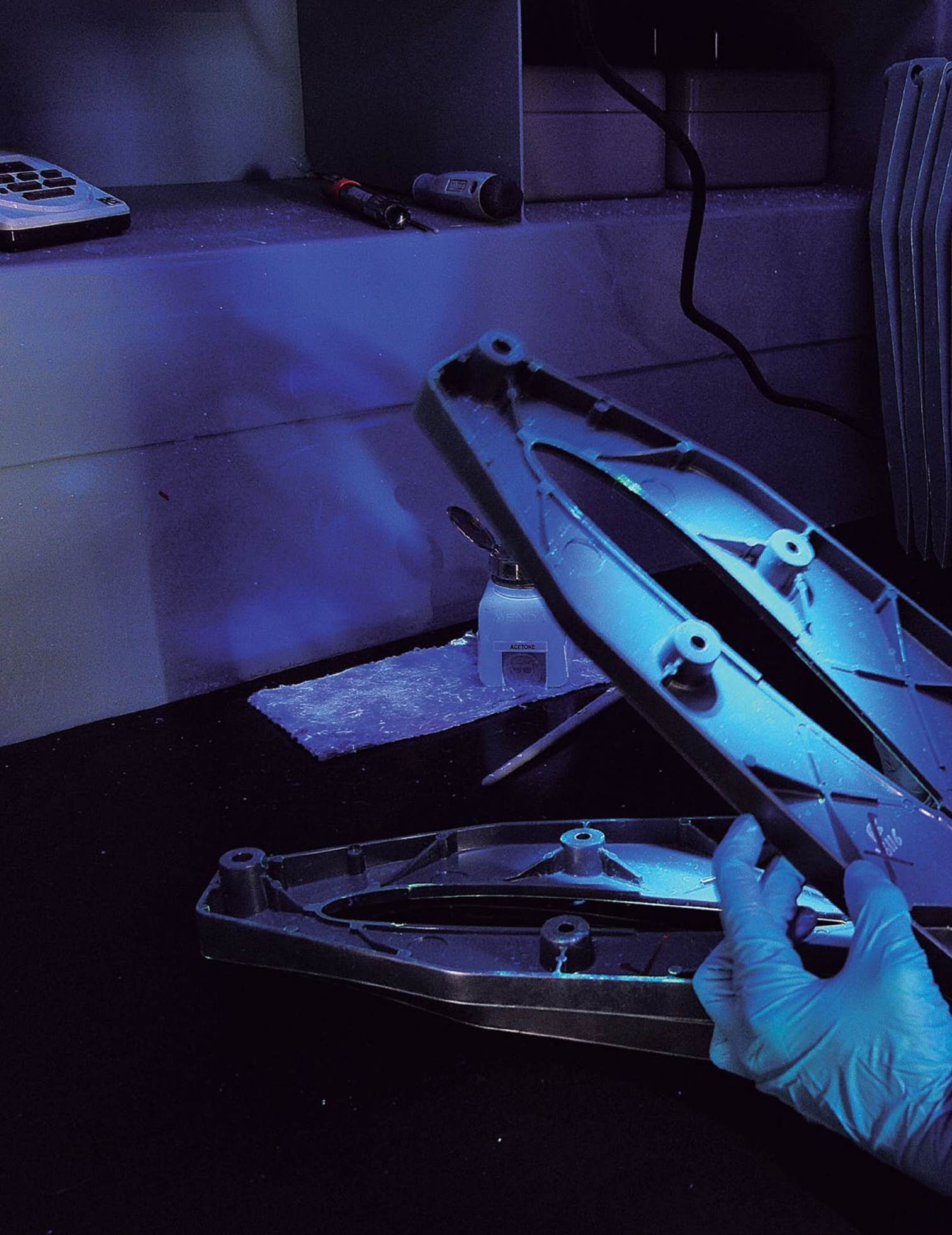
**- Eric Gerval,**  
**President,**  
**Go2Cam**



"A couple of years ago, we did a study with the engineering department of NASA to explore ways of improving turbine engines in commercial aircraft. They wanted to improve the surfaces of different components and, after being treated with MMP technology, the component improved the turbine efficiency by 1.5%. This improvement is huge - it translates into a drastic reduction of fuel consumption and an increased lifetime of the component."

**- Frédéric Bajard,**  
**C.O.O.,**  
**Binc Industries**









# Industry Prospects

"When we started, we exported none of our products, and now we export nearly 12%. Now, as OSG's subsidiary, we enjoy their channel of distribution and their support, with presence in Belgium, Spain, and Poland. Our priority has been to access Airbus countries, as 50% of our turnover comes from Airbus related work."

- Jean-François Bain,  
International Sales Director,  
Groupe Desgranges

# Industry 4.0:

## Can Auvergne-Rhône-Alpes keep up?

38

With global passenger travel growth over the last five years averaging 6.2%, and aircraft demand massively surpassing supply, the global aerospace industry is constantly searching for ways to increase production capacity. Many OEMs are adopting more digital and hyperconnected technologies into their manufacturing processes, globally dubbed 'Industry 4.0'. The use of digital technology in aircraft manufacturing is not new, at least when it comes to OEMs. Airbus' utilization of the complex Dassault Systemes' 3D Experience software platform for the manufacturing of the A350 XWB series demonstrated the transformative potential that Industry 4.0 has for aircraft manufacturing, creating a single platform for design, simulation and manufacturing, where employees and suppliers can instantaneously collaborate with one another on digital simulations of the manufacturing process. Airbus' utilization of this software represented not only an adoption of Industry 4.0, but also one of its major pushes towards a consolidation of the aerospace supply chain. The software connected up to 4,000 people per day, with 85% of that number coming from their supply chain. One of the principal aims was to remedy a lack of communication that had previously plagued the aerospace supply chain that extended design time, included errors that drove up costs. This collaborative approach demonstrably provided positive results.

The OEM design and assembly process has thus become altogether more connected, and the success of this more collaborative approach is driving OEMs to encourage suppliers at all levels of the value chain to

adopt a similarly collaborative spirit to their own individual operations.

Smaller companies (SMEs) must integrate this connectedness within their own operations which brings a new set of challenges. SMEs face more hurdles than OEMs in incorporating Industry 4.0, because, while adopting new technologies may offer clear long-term benefits, it can be a costly process. Nowhere is this more apparent than in the Auvergne-Rhône-Alpes aerospace cluster, with its lack of primary companies and its abundance of SME players.

An abundance of SMEs producing niche products might be considered as a strength offering high-level innovation, but if fully incorporating Industry 4.0 proves too cost-prohibitive for them, they may also hinder the region's chances of achieving its aim of becoming one of the top five aerospace clusters in Europe.

So far, companies within the region are generally making positive steps towards incorporating Industry 4.0. The facilitators of this progress are primarily located within the region itself: a thriving market has emerged of companies geared towards assisting other SMEs to incorporate Industry 4.0 in an affordable and sustainable manner.

### Digital twin and simulation technology: trickling down to the SME space

While "digital twin" technology, which simulates manufacturing plants and is able to calculate the most efficient methods of production possible based on available resources, may once have been the reserve of

OEMs and Tier One suppliers, it is becoming increasingly accessible to companies further down the value chain in Auvergne-Rhône-Alpes. Companies such as Inoprod have identified the specific needs of the SMEs in the region and developed ways of applying their technology to SME operations. Pascal Dubuis, CEO, outlined how his company's expertise in dynamic flow simulation technology, among other tools, can facilitate a level of operational analysis and forward-planning that would otherwise require months of observation and human mental labor: "In just a few minutes, we are able to simulate several months of production and thus predict how the plant will be operating and what its future performance will be, such as its ODT. This is particularly useful at the moment with the production ramp-up in the aeronautics industry because we are able to calculate a company's capacity to meet demand and advise on where they should invest their resources in order to increase their capacity," he said.

Niche software solutions for companies further down the aerospace supply chain are also becoming popular. GO2Cam, a Lyon-based company, develops software that calculates the most optimal route for a cutting tool to take more quickly and accurately than a human operator can. "We know that suppliers in the aerospace industry are facing increasing pressure to reduce their costs and we offer a unique and cost-effective solution to help them do so," explained CEO Eric Gerval.

The company is mindful of the real need for a quick and easily quantifiable ROI that SMEs with limited budgets have: "Our customers can expect a very fast return on investments. Using the software results in production savings in two ways: firstly, we can typically reduce the production time of specific parts by 10% to 20%, with no changes to the machines or tools used. Secondly, we can dramatically reduce the frequency and cost of repairing and replacing cutting tools," he added.

### Robotics: the way forward?

The use of robotics and automated processes in manufacturing is also rapidly increasing in the region. Groupe Roux-Jourfier



helps companies introduce “collaborative” robots that are capable of working closely alongside human operators to increase operational efficiency. “There has been a significant increase recently in companies requesting robotics to assist with welding processes. Three years ago, we had no aerospace customers in this area, but today they generate around 50% of RJ Industrie’s revenue”, disclosed Franck Kerrachi, mission leader at Groupe Roux-Jourfier.

#### **Family companies: tradition versus the future**

The incorporation of Industry 4.0 also brings less obvious benefits to companies

within the Auvergne-Rhône-Alpes region, beyond a straightforward maximization of resource potential: it may offer a lifeline to small family companies committed to remaining in France and to avoid outsourcing work to best-cost countries. As Yann Ginon, project manager at Kalistrut, said: “It is a challenge to be competitive when manufacturing in France because salaries and general operating costs are higher. We are reacting to this challenge by incorporating more of Industry 4.0 into our processes and we working on making our manufacturing more automatic.”

While an awareness of the benefits of incorporating new technologies prevails in smaller companies, it is a strategy that is proving cost-prohibitive for some smaller

family businesses in the region. These companies are choosing to take a more collaborative approach in order to avoid being left behind in the region’s technological development. This is demonstrated by MGB and Lathuille Hudry, two small family companies in Annecy that recently co-invested in some shared additive manufacturing (3D printing) equipment. “Investment in new technology such as 3D printing technology, which is around €1million, can be cost-prohibitive so we prefer to share the risk by partnering. We are far stronger when we work together,” explained Bertrand Duby, sales manager at MGB.

While more automated manufacturing will certainly bring costs down for smaller companies by reducing the need for human operators, for companies producing more complex parts, the need for high-skilled staff can never be entirely eliminated. A balance must be found between the automated and the human, with test-benching becoming predominantly automated and able to work 24 hours a day, and final assembly and quality and safety tests performed by human operators.

#### **An alternative way forward?**

While the majority of companies within the Auvergne-Rhône-Alpes region appear to be prioritizing the incorporation of Industry 4.0 in their strategies for the near future, acceptance of the benefits of such a system is not universal. Some industry leaders, such as Patrick Besnier, president at DBC, believe that incorporating Industry 4.0 is not necessarily the best way to move forward. “The incorporation of ‘Industry 4.0’ in and of itself is not a driving factor at DBC. Companies across the value chain are talking about it and focusing on it as a main goal, but we believe that upon examination, ‘Industry 4.0’ as a blanket term is misleading. Just because a piece of equipment might be classified as ‘Industry 4.0’ does not mean that it is going to translate into improved efficiency, a reduction in cost or an increase in production capacity,” he explained.

The company is instead choosing to focus on sourcing manufacturing equipment from German suppliers. ■





## Pascal Dubois

40

CEO  
**INOPROD**

EMPLOYEES:  
**1-19**

AREA:  
**INDUSTRY OF THE FUTURE**

MAIN ACTIVITY:  
**ENGINEERING & DESIGN**

### Can we start off with a brief introduction to Inoprod and the services it provides to the aerospace industry in Auvergne-Rhône-Alpes?

Inoprod is an engineering consultant based in Auvergne-Rhône-Alpes that helps industrial companies to optimize their manufacturing processes and supply chain management, with around 20% of our business in the aerospace sector. We can create new manufacturing plants, optimize existing plants, and thus secure the CAPEX investments of our customers. We use dynamic flow simulation technology, through different digital tools. Thanks to this expertise we are able to create digital twins of manufacturing plants and calculate the interaction between all of the processes and resources within it.

The capabilities of this simulation software are very advanced. Thanks to the expertise of our engineering team, we are able to represent the flows of materials and pieces in 2D & 3D and build all the KPIs needed for decision making. In just a few minutes, we are able to simulate several months of production and thus predict how the plant will be operating and what its future performance will be, such as its ODT. This is particularly useful at the moment with the production ramp-up in the aeronautics industry because we are able to calculate a company's capacity to meet demand and advise on where they should invest their resources in order to increase their capacity.

Our projects can help operators work better and more safely; we can assess all of the work stations within plants and calculate their maximum resource capacity in terms of human resources, energetic power, robots and all other types of machinery. We also simulate the impact manufacturing machinery is having on the people who are operating it in order to avoid musculoskeletal problems arising from labour within manufacturing sites. We calculate the safest and most ergonomic ways for operators to use equipment by simulating them in a virtual environment and then downloading the settings directly to the equipment. This means that there is less human risk involved and time is saved in production.

### OEM's are pushing for a consolidation of the supply chain in order to meet ramp-up demand. How can Inoprod contribute to a consolidation of the supply chain?

We contribute by helping small and medium companies in aerospace significantly increase their production capacity. For example, we were recently working with a company that produces engine parts for the Airbus A321Neo program and that was having big problems with meeting ramp up demand. When they came to us, they were able to produce less than 100 parts per year. After working with us they are now producing 3000 parts per year. We spent one month assessing their site and developing a model for their future operations, which we then helped them to implement.

We are also in discussion with major companies in the ASD sector. For example we worked with the Ariane Group to help them develop their manufacturing processes for building the new Ariane launcher.

### Companies across the value chain in the aerospace industry are increasingly incorporating Industry 4.0 into their processes. What role is Inoprod playing in this development?

We are a strategic partner in the implementation of Industry 4.0. For example, we met with Airbus recently, who confirmed that it is important for them to have a robust supply chain and guaranteed delivery times, which will only be possible with the integration of digital bricks as we propose them. Small companies need to prove that they can answer Airbus' needs and we can help them do that. We are the only company that offers this kind of engineering and simulation services, so we expect to play a leading role in this development.

### What is the future strategy for Inoprod?

We are expanding into the North American aeronautical market, particularly Canada. We have our first customers there now and we expect to attract more quickly as the Canadian aeronautic industry is increasingly committed to incorporating Industry 4.0 into their processes and we are best placed to partner with them on this. Before the end of this year, we hope to have a subsidiary in Montreal in order to be near to our customers and offer them the best possible service. ■



# At a glance: Industry 4.0 in Auvergne-Rhône-Alpes



"We implemented operational excellence with lean techniques across the company[...] This enables us to have around 80% of our manufacturing carried out in Lyon with high qualified manpower; we are proud to keep our manufacturing in France."



- Jean-Manuel Pauchet,  
Managing Director,  
SIC Marking Group

"Our strategy for the next three years is to develop and improve the way that we use connected systems and big data in industrial systems. We have been studying additive manufacturing for almost 10 years now, and have recently been testing the use of robotics in 3D impression processes."



- José Alba,  
Director,  
2matech

## SMEs: stepping up to primary expectations



"Partnerships are increasingly becoming essential for the survival of smaller companies because big companies like Zodiac and Safran need suppliers that they can rely on, and they have made it very clear that there is a minimum size of company that they are willing to work with."

**- Bertrand Duby, Commercial Director, MGB**



"Leading companies now prefer to work with larger suppliers because they are concerned that smaller suppliers do not have the capacity to meet increased demand, so we have benefited greatly from becoming a family member of the OSG Group, as we are now no longer seen as a small company."

**- Emmanuel Saint Supery, President, SMOG**



"SN Auvergne Aeronautique now has the competitive edge of being part of the Figeac Aero Group. We are not limited at all in the types of customers or projects that we can consider taking on, because if we do not have a certain type of machinery or a particular resource that a project might need, we are able to quickly find it with the support of the Figeac Aero Group."

**- Bernard Lavergne, President, SN Auvergne Aeronautique**



"In order for an SME to successfully work with leaders such as Airbus, it needs to be generating revenues of over €20 million; this is going to be a big barrier over the next few years for SMEs across France, but Compose is committed to meeting this goal. We see this as a huge opportunity to grow and develop rather than as a barrier. The interesting thing with this market is its future potential, as this industry is always growing and developing."

**- Jean-Michel Deck, Business Development, Compose**

## EDITORIAL AND MANAGEMENT TEAM

**Project Director:** Laura Brangwin (lbrangwin@gbreports.com)  
**Project Journalist:** Sarah Crompton Donnelly (scromptondonnelly@gbreports.com)  
**Editor:** Mungo Smith (mungo@gbreports.com)  
**Operations Director:** Miguel Pérez-Solero (mperezsolero@gbreports.com)  
**Graphic Design:** Gonzalo Da Cunha (gonide@gmail.com)  
**Graphic Design (adverts):** Özgür & Deniz (ozgur@gbreports.com)  
**General Manager:** Alice Pascoletti (apascoletti@gbreports.com)

Your opinion is important to us, please be in touch to share your comments on this report! For updated industry news from our on-the-ground teams around the world, please visit our website at [gbreports.com](http://gbreports.com), subscribe to our newsletter through our website, or follow us on Twitter: @GBReports

## THANK YOU

We would like to thank all the executives and authorities that took the time to meet with us.  
Also, special thanks to:

**AUVERGNE-RHÔNE-ALPES AEROSPACE CLUSTER**

**LA REGION AUVERGNE-RHÔNE-ALPES**



COMPANY	ENGINEERING & DESIGN	SYSTEM DESIGN AND BUILD	DESIGN & BUILD	BUILD TO PRINT	SERVICE	MATERIALS	MECHANICS AND METALLURGY	ELECTRICAL AND ELECTRONICS (HARD AND SOFT)	PLASTICS AND COMPOSITES	PAINTING, COATINGS AND SURFACE TREATMENTS
2MATECH	o					o	o			
ACOEM	o								o	
APOJEE	o							o		
AVNIR AIRPORT	o									
AVNIR ENGINEERING	o					o	o	o	o	
AXEAL CONSULTANT	o						o		o	
CEREBRUM INGENIERIE	o						o	o		
CFD NUMERICS	o					o	o		o	
CNEP (Centre National d'Evaluation de Photoprotection)	o								o	o
EVIATEK	o						o			
GO2CAM INTERNATIONAL	o						o			
INFLUTHERM	o						o		o	
INOPROD Services	o									
InS SA	o						o		o	
SOGILIS	o							o		
TECHNI-MODUL ENGINEERING	o								o	
UF1	o						o			
VIBRATEC	o						o			
AIR LIQUIDE ADVANCED TECHNOLOGIES		o					o	o		
LORD FLY-BY-WIRE SYSTEMS France		o						o		
NTN - SNR ROULEMENTS		o					o			
SAFRAN ELECTRONICS & DEFENSE		o						o		
SECAERO		o					o	o		
SKF Aerospace		o					o		o	
THALES AVIONICS		o						o		
VISION SYSTEMS AERONAUTICS		o						o	o	
ZODIAC AEROTECHNICS		o					o	o		
2MI - Modèles et Moules pour l'Industrie			o				o		o	
ADDUP			o				o			
AEROFORM FRANCE			o						o	
AEROPLAST GROUP			o						o	
AMPHENOL SOCAPEX SAS			o					o		
AUBERT & DUVAL			o				o			
BONNAVION SECURE SYSTEM			o				o			
BROCHIER TECHNOLOGIES			o			o		o		
CADNUM			o			o	o			
CARBONE FORGE			o						o	o
CARI ELECTRONIC			o					o		
CEDRAT TECHNOLOGIES S.A.			o					o		
CENTRALP			o					o		
CENTUM ADELTEL			o					o		
CHOMARAT TEXTILES INDUSTRIES			o			o				
CMI SLETI			o				o			o
COMPOSE			o						o	
CONDAT			o				o			
CONSTELLUM ISSOIRE			o				o			
CORIMA TECHNOLOGIES			o						o	
CRANE AEROSPACE & ELECTRONICS - ELDEC France			o					o		
CRISTAL INNOV			o			o				
CROUZET AUTOMATISMES			o					o		
DAM/DACTEM DEVELOPPEMENT			o					o		
DAXEN			o						o	
DESGRANGES OUTILS COUPANTS			o							
DIAMOUTILS			o							
DIALEX SAS			o			o			o	
DUQUEINE RHONE-ALPES			o						o	
EFR SAS (European Furnace Ropion SAS)			o				o			
EOLANE SAINT AGREVE			o					o		
FB PACK			o			o			o	
FOURS INDUSTRIELS B.M.I.			o			o	o			o
GARDNER - AIRIA AEROSPACE GROUP			o				o		o	
GGB France EURL			o			o	o		o	
HEAT CONCEPT			o				o			
HERATEC SAS			o				o		o	
HEXCEL COMPOSITES			o			o			o	
INVENTEC PERFORMANCE CHEMICALS			o					o	o	
ISI			o				o			
ISOJET EQUIPEMENTS			o							
KALISTRUT AEROSPACE			o				o			o
LE CRENEAU INDUSTRIEL			o				o			
MDP – MAXON MOTOR FranceNE-ALPES			o					o		

TOOLING	TESTS AND CONTROL	INDUSTRIAL PROCESS (MACHINES)	MRO	GROUND SUPPORT EQUIPMENT	TRAINING	RESEARCH	LOGISTICS	COMPUTER SERVICES	OTHER SERVICES	ISO 14001	ISO 9001	EN/AS/ JISQ 9100	NADCAP	PART 21	PART 145	ISO 17025	WEBSITE
		o									o		o			o	www.2matech.com
		o								o	o						www.acoemgroup.com
		o		o						o	o	o					www.apojee.fr
		o					o		o		o						www.avnir-airport.com
		o									o						www.avnir.fr
o		o						o									www.axeal.com
		o						o									www.cerebrum-ingenerie.fr
						o					o						www.cfd-numerics.com
						o					o						www.cnep-ubp.com
o		o				o					o	o					www.eviatek.com
		o						o									www.go2cam.net
						o											www.influtherm.com
		o						o	o		o						www.inoprod.com
								o									www.ins-sciences.com
																	www.sogilis.com
o		o									o	o					www.techni-modul-engineering.eu
o						o	o				o	o					www.uf1.fr
	o	o			o	o					o	o					www.vibratec.fr
o	o										o	o		o	o		airliquideadvancedtechnologie.com
	o		o							o	o	o		o	o		www.lord.com/emea/
			o							o	o	o	o	o	o		www.ntn-snr.com
	o		o		o	o					o	o		o	o		sagem.ds.com
						o				o	o	o		o			www.skf.aerospace.fr
										o	o	o		o	o		www.thalesgroup.com/fr
											o	o		o	o		www.vision-systems.fr
										o	o	o		o	o		www.zodiacaerospace.com
o											o						www.2-m-i.com
		o			o				o								www.addupsolutions.com
		o	o	o	o						o						www.aeroform-france.fr
o											o	o					www.aeroplast.fr
											o	o					www.amphenol-socapex.com
o	o					o				o	o	o	o			o	www.aubertduval.com
o	o									o	o						www.bonnaivon.fr
											o						www.brochier technologies.com
o											o						www.cadnum.fr
											o	o					www.carbone-forge.com
		o									o	o					www.cari-electronic.com
																	www.cedrat-technologies.com
										o	o	o					www.centralp.fr
		o				o					o	o					www.centumadétel.com
												o					www.chomar.at.com
		o															www.sleti.fr
o		o									o	o					www.compose-tools.com
											o						www.condat.fr
										o	o	o	o				www.constellium.com
o											o				o	o	www.corima-technologies.com
							o				o	o			o	o	www.craneae.com
																	www.cristalinnov.fr
										o	o	o		o	o		www.crouzet.com
		o									o						www.dam.fr
																	www.daxen.fr
o											o						www.nexam.aero
o											o						www.diamoutils.com
o		o									o						www.diatex.com
											o	o	o				www.duqueine.fr
																	www.fours-efr.com
							o				o	o					www.eolane.com
											o						www.bmi-fours.com
										o	o	o	o	o	o		www.gardner-aerosapce.com
									o		o	o					www.ggbearings.com/fr
											o	o					www.heatconcept.fr
o											o	o					www.heratec.fr
											o	o	o				www.hexcel.com
		o									o	o					www.inventec.dehon.com
o		o									o						www.isi-process.com
		o															www.isojet.com
		o								o	o	o	o	o			www.kalistrut-aerospace.com
																	www.creneau.fr
									o		o	o					aerospace.maxonmotor.fr

COMPANY	DESIGN & BUILD	BUILD TO PRINT	SERVICE	MATERIALS	MECHANICS AND METALLURGY	ELECTRICAL AND ELECTRONICS (HARD AND SOFT)	PLASTICS AND COMPOSITES	PAINTING, COATINGS AND SURFACE TREATMENTS	
MECACONCEPT	o				o				
MECAPOLE	o				o			o	
MEGGITT SENSOREX	o					o			
MGB	o				o	o			
MICHELIN AIRCRAFT TYRE	o			o					
MIJNO PRECISION GEARING	o			o	o				
MODELAGE MECANIQUE DU DAUPHINE - MMD	o				o				
MPM (METAL VALUE PRESSES & MACHINES)	o				o				
NEFAB PACKAGING France	o								
NICOMATIC	o					o			
NSE	o					o			
OROS S.A.S.U	o					o			
PETERCEM	o					o			
PLANSEE TUNGSTEN ALLOYS - CIME BOCUZE	o				o				
PORCHER INDUSTRIES	o			o			o		
RADIALL	o					o			
REEL	o				o				
REXIAA	o				o		o	o	
SAFRAN LANDING SYSTEMS	o						o		
SAINT-GOBAIN PERFORMANCE PLASTICS France (BU PROCESS SYSTEMS)	o			o			o		
SAT EQUIPEMENTS THERMIQUES INDUSTRIELS	o								
SCAIME	o					o			
SFH	o								
SIC MARKING	o				o				
SINTEX NP	o						o		
SLICOM TECHNOLOGIES	o				o			o	
SMW-AUTOBLOCK	o				o				
SOFILETA	o			o			o		
SOFIPLAST	o							o	
SUNAERO	o						o		
TECALEMIT AEROSPACE	o				o		o		
TELEDYNE - E2V	o					o			
TEXPROTEC	o			o			o		
THERMOCOMPACT / GROUPE THERMOTECNOLOGIES	o				o			o	
TIMET SAVOIE	o			o	o				
TIVOLY	o				o				
TRONICS MICROSYSTEMS	o			o	o	o			
UGITECH	o			o	o				
AMDI	0	o			o				
ANTHOGRYR		o			o		o	o	
ATELIERS D'ENGRENAGES DE PRÉCISION (AEP)		o			o				
BALLAND-GAILLETON SAS		o			o				
BERGHEAUD		o			o				
BILLARD ENGRENAGES		o			o				
CATTIN SAS - Usinage numérique de précision		o			o		o		
COURBIS INDUSTRIES		o			o		o		
CTMI		o		o			o		
DBC		o			o				
DECOPREM (ALPES USINAGE)		o			o				
DOMAERO		o			o				
EFITAM		o			o			o	
EKTRO		o				o			
GABRIEL MAUVAIS SARL		o							
GMP-ATIM Technologies		o			o				
Groupe BRIZARD INDUSTRIES		o			o				
GROUPE RJ		o			o				
GUERPEL		o			o				
ICA 63 - INGENIERIE CHAUDRONNERIE AERONAUTIQUE		o							
ICM INDUSTRIE		o					o		
JET CUT		o			o		o		
LASER RHONE-ALPES		o			o	o			
LATHUILLE HUDRY SAS		o			o				
LEPTONS TECHNOLOGIES		o		o	o				
LOIRE INDUSTRIE		o			o				
MARCEL INDUSTRIE		o			o				
MDV		o			o				
MICROWELD		o			o				
MINITUBES		o			o				
MISSLER SOFTWARE		o							
MOULINAGE DU SOLIER		o					o		



TOOLING	TESTS AND CONTROL	INDUSTRIAL PROCESS (MACHINES)	MRO	GROUND SUPPORT EQUIPMENT	TRAINING	RESEARCH	LOGISTICS	COMPUTER SERVICES	OTHER SERVICES	ISO 14001	ISO 9001	EN/AS/ JISQ 9100	NADCAP	PART 21	PART 145	ISO 17025	WEBSITE
		o						o			o						www.mecaconcept.com
										o	o	o	o				www.mecapole.fr
										o	o	o		o			www.sensorx.fr
										o	o	o					www.mgb.fr
						o			o								www.aircraft.michelin.com
o		o									o						www.mijno.com
		o							o		o						www.mmd.fr
			o														www.mpmfrance.com
				o			o			o	o						www.nefab.fr
		o									o	o					www.nicomatic.com
	o			o					o	o	o	o		o	o		www.nse-groupe.com
	o										o						www.oros.fr
											o	o	o				www.petercem.com
											o	o					www.plansee.com
						o					o	o					www.porcher-ind.com
											o	o					www.radiall.com
			o	o							o	o					www.reel.fr
											o	o		o	o		www.rexiaa-group.com
						o					o	o		o	o		www.safranmbd.com
											o	o					www.psaerospace.com
		o															www.sat-thermique.com
											o	o					www.scaime.fr
		o															www.sfh.fr
											o						www.sic-marking.com
o	o					o				o	o	o	o				www.nief-plastic.com
o		o									o						www.slicom-group.fr
											o						www.smwautoblock.fr
		o							o		o						www.sofileta.com
		o	o	o	o						o						www.sofiplast.fr
						o					o						www.sunaero.com
						o					o	o	o				www.tecalemit-aerospace.fr
									o	o	o	o					www.teledyne-e2v.com
o											o	o					www.texprotec.com
											o	o	o				www.thermocompact.com
o											o	o	o				www.timet.com
											o						www.tivoly.com
		o					o				o						www.tronicsgroup.com
										o	o	o				o	www.ugitech.com
																	www.amdi.fr
o											o	o					www.anthogyr-manufacturing.com
o											o	o					aep.fr/
o											o	o					www.groupe-gailleton.com
											o	o					www.bergheaud.fr
											o	o					www.billard-engrenages.com
											o						www.cattin-usinage.com
o											o	o					www.courbis-industries.com
											o						www.ctmi.fr
											o	o					www.dbc.fr
											o	o					www.decoprem.net
o										o	o	o					www.domaero.fr
o											o	o					www.efitam.com
											o						www.ektro.fr
o		o															www.mauvaissarl.fr
											o	o					www.gmp-atim.com
											o	o					www.brizard-industries.com
o		o									o	o					www.groupe-rj.com
o	o										o						www.gueripel.com
					o						o	o					ingenierie-chaudronnerie-aeronautique.com
											o	o					www.icmindustrie.com
											o	o					www.jetcut.fr
											o	o					www.laser-rhone-alpes.com
											o	o					www.lathuille.fr
o		o									o	o	o				leptons-technologies.com
										o	o	o	o				www.loire-industrie.fr
											o	o					www.marcel-industrie.com
o											o	o					www.sasmdv.com/
											o	o					www.microweld.fr
								o			o						www.minitubes.com
																	www.topsolid.com
									o								www.moulinagedusolier.com

COMPANY	ENGINEERING & DESIGN	BUILD TO PRINT	SERVICE	MATERIALS	MECHANICS AND METALLURGY	ELECTRICAL AND ELECTRONICS (HARD AND SOFT)	PLASTICS AND COMPOSITES	PAINTING, COATINGS AND SURFACE TREATMENTS	
NEONICKEL		o			o				
NOVARESSORT		o			o				
PEZET SAS		o			o				
PMD VALLON		o			o				
PORTELLI PRODUCTIONS		o					o		
PROFORM		o			o				
SAVOIE RECTIFICATION		o			o				
SEEB AUTOMATION		o			o				
SERINOX		o			o				
SERRE INDUSTRIE MECANIQUE		o			o				
SETFORGE LA CLAYETTE Société Nouvelle		o			o				
SIMEP		o				o			
SMOC INDUSTRIES		o			o				
SN AUVERGNE AERONAUTIQUE		o		o	o			o	
SPECIAL BRIDES SERVICE (SBS)		o		o	o				
SUCHIER		o			o		o		
SUDELEC		o				o			
SUPERMETAL		o			o				
TECHCI RHONE-ALPES		o				o			
TOLYREX		o			o				
WE ARE Group		o			o				
WICHARD		o			o				
40-30			o						
ACNIS INTERNATIONAL			o	o	o				
AD SOFTWARE			o						
ADDEV MATERIALS (DIMEX)			o	o				o	
AÉROPORTS DE LYON			o						
AUVERGNE QUALITE			o		o	o			
AVIATION STRUCTURE ASSISTANCE			o		o		o	o	
BANC NATIONAL D'EPREUVE			o						
BINC INDUSTRIES SAS			o					o	
BOUYGUES E&S Maintenance Industrielle			o						
CIPAM			o						
COMPOSITES DISTRIBUTION			o	o			o		
CT CORETECHNOLOGIE			o						
DEVILLE RECTIFICATION			o	o	o				
DIMOTRANS GROUP			o						
EMITECH			o		o	o			
HOP ! REGIONAL			o						
INFODREAM			o						
INTERFACE TECHNOLOGIES			o	o	o				
LMBA			o		o				
MARLIER SA			o						
MODERTECH INDUSTRIES			o					o	
PRAXAIR SURFACE TECHNOLOGIES			o	o	o			o	
SIAE / AIA Clermont-Ferrand - AIA Ambérieu			o					o	
SOPAVIB			o		o				
SOUDAGE TECHNIQUE D'Auvergne			o		o				
TECHNO LOGISTIQUE			o						
TECKNOWMETRIX			o						
THERMI-LYON			o		o			o	
TMD			o	o				o	
ZEP AVIATION			o						
ZYLIA TECH			o						
ADFI CFAI DU DAUPHINE			o	o	o				
CAMPUS DES METIERS ET DES QUALIFICATIONS AERONAUTIQUES			o						
AUVERGNE-RHONE-ALPES									
CETIM Délégation Régionale	o				o	o			
ECOLE SUPERIEURE D'INGENIEURS EN SYSTEMES INDUSTRIELS AVANCES RA									
FONDATION LA MACHE-ECOLE LA MACHE			o			o			
I M A A (Instruction Maintenance Aéronautique et Automobile) - MFR			o		o				
INSA DE LYON									
INSAVALOR	o		o						
INSTITUT CARNOT INGENIERIE @ LYON									
IPC - INNOVATION PLASTURGIE COMPOSITES	o			o			o		
LYCEE ROGER CLAUSTRÉS	o		o	o	o	o	o		
ONERA - CENTRE DE MODANE AVRIEUX									
SIGMA CLERMONT	o		o						
AUVERGNE-RHONE-ALPES ENTREPRISES	o		o						
CCI DE REGION AUVERGNE-RHONE-ALPES			o						
DIRECCTE AUVERGNE-RHONE-ALPES			o						
REGION AUVERGNE-RHONE-ALPES									

	TOOLING	TESTS AND CONTROL	INDUSTRIAL PROCESS (MACHINES)	MRO	GROUND SUPPORT EQUIPMENT	TRAINING	RESEARCH	LOGISTICS	COMPUTER SERVICES	OTHER SERVICES	ISO 14001	ISO 9001	EN/AS/ JISQ 9100	NADCAP	PART 21	PART 145	ISO 17025	WEBSITE
												o	o					www.neonickel.com
		o									o	o	o					www.novaressort.fr
												o	o					www.pezet-sas.com
	o	o										o						www.pmdvallon.com
												o	o					www.portelli-productions.com
												o	o	o				www.proform.fr
												o	o					www.savoie-rectification.com
	o		o									o	o					www.groupeeseeb.com
			o									o	o					www.serinox.fr
												o	o					www.g-serre.fr
											o	o	o	o				www.farinia.info
												o	o					www.simep-roussin.fr
												o						www.smoc-industries.fr/
												o	o	o	o	o		www.auvergneaero.com
		o	o								o	o						www.sbs.forge.com
												o	o					www.suchier.com
												o						www.sudelec42.com
												o	o					www.supermetal.fr
												o	o	o				www.techci.fr
												o						www.tolyrex.com
												o	o					www.comefor.com
		o		o		o					o	o	o					www.industrie.wichard.com
											o	o						www.40-30.fr
												o	o					www.acnis-titanium.com
				o					o	o		o	o					www.adsoftware.fr
										o	o	o						www.addevmaterials.com
		o								o		o						www.lyonaeroports.com
				o						o		o						www.europequalite.eu
		o														o		www.asa.eu.com
												o					o	www.banc-epreuve.fr
			o							o	o	o	o					www.binc.biz
				o					o	o		o						www.bouygues-es.com
					o							o	o					www.cipam.com
		o							o			o	o					www.composites-distribution.com
												o	o					www.coretechnologie.com
				o				o				o						www.deville-rectif.com
		o										o						www.dimontrans.com
				o		o		o				o	o		o	o	o	www.emitech.fr
		o				o			o			o						www.hop.com
												o						www.infodream.fr
						o						o						www.interface-technologies.com
		o											o					www.gedix.fr
							o					o	o			o		www.marliersa.com
											o	o	o					www.modertech-industries.com
				o								o	o	o	o	o		www.praxairsurfacetechologies.com
		o									o		o			o	o	
			o			o											o	www.sopemea.fr
				o						o		o			o	o		www.sta-form.com
											o	o						www.technologistique.fr
	o											o						www.tkm.fr
												o	o	o				www.groupe-thermi-lyon.com
		o										o	o					www.galvanoplast.com
				o						o		o						www.zep-industries.fr
		o				o			o			o						www.zylitech.com
		o										o						www.formation-industries-isere.fr
																		www.campus-aeronautique.com
		o										o	o	o				www.cetim.fr
												o						www.esisar.grenoble-inp.fr
												o						www.ecolelamache.org
	o																	www.mfr-ima.fr
																		www.insa-lyon.fr
												o						www.insavalor.fr
										o								www.ingenierie-at-lyon.org
												o					o	www.ct-ipc.com
				o								o						www.lycee-roger-claustres.fr
		o								o		o						www.onera.fr
										o		o						www.sigma-clermont.fr
										o								www.auvergne-business.fr
										o								www.auvergne-rhone-alpes.cci.fr
										o								www.rhone-alpes.travail.gouv.fr
										o								www.auvergnerrhonealpes.fr



Company	Website	Local Telephone
2matech	<a href="http://www.2matech.com">www.2matech.com</a>	(+33) 4 73 28 64 00
Acnis International	<a href="http://www.acnis-titanium.com/fr/">http://www.acnis-titanium.com/fr/</a>	(+33) 4 72 14 55 00
Air Liquide Advanced Technologies	<a href="http://www.airliquideadvancedtechnologie.com">www.airliquideadvancedtechnologie.com</a>	(+33) 4 76 43 59 28
Amphenol Socapex	<a href="http://www.amphenol-socapex.com">www.amphenol-socapex.com</a>	(+33) 4 75 44 88 99
Auvergne-Rhône-Alpes Aerospace Cluster	<a href="http://www.aerospace-cluster.fr">www.aerospace-cluster.fr</a>	(+33) 4 72 11 43 63
Auvergne-Rhône-Alpes Enterprises Agency	<a href="http://www.auvergnerhonealpes-entreprises.fr/">http://www.auvergnerhonealpes-entreprises.fr/</a>	(+33) 4 72 75 47 90
Avnir Engineering	<a href="http://www.avnir.fr">www.avnir.fr</a>	(+33) 6 24 48 00 90
BINC Industries France	<a href="http://www.mmptechnology.com">www.mmptechnology.com</a>	(+33) 4 72 79 39 40
Campus Aeronautics Auvergne-Rhône-Alpes	<a href="http://www.cafoc-auvergne2.net">www.cafoc-auvergne2.net</a>	(+33) 4 73 19 21 00
Centum Adeneo	<a href="http://www.adetelgroup.com">www.adetelgroup.com</a>	(+33) 4 72 18 08 42
Compose Group	<a href="http://www.compose-group.com">www.compose-group.com</a>	(+33) 4 74 73 85 74
Constellium	<a href="http://www.constellium.com">www.constellium.com</a>	(+33) 4 73 55 50 50
Cristal Innov	<a href="http://www.cristalinnov.fr">www.cristalinnov.fr</a>	(+33) 6 19 23 40 56
Crouzet Automatismes	<a href="http://www.crouzet.com">www.crouzet.com</a>	(+33) 4 75 80 21 01
CSUG	<a href="http://www.csug.fr/">www.csug.fr/</a>	csug-contact@univ-grenoble-alpes.fr
Desgranges Outils Coupants	<a href="http://www.nexam.aero">www.nexam.aero</a>	(+33) 4 77 02 14 64
DBC	<a href="http://www.dbc.fr">www.dbc.fr</a>	(+33) 4 50 34 58 04
Duqueine	<a href="http://www.duqueine.fr">www.duqueine.fr</a>	(+33) 4 78 98 39 93
Eldec France	<a href="http://www.craneae.com/AboutUs/ELDEC.aspx">\www.craneae.com/AboutUs/ELDEC.aspx</a>	(+33) 4 72 81 42 05
Emitech	<a href="http://www.emitech.fr">www.emitech.fr</a>	(+33) 4 78 40 66 55
Esisar	<a href="http://www.esisar.grenoble-inp.fr">www.esisar.grenoble-inp.fr</a>	(+33) 4 75 75 94 00
GGB	<a href="http://www.ggbearing.com">www.ggbearing.com</a>	(+33) 1 41 40 07 12
GO2CAM International	<a href="http://www.go2cam.net">www.go2cam.net</a>	(+33) 4 72 27 06 64
Groupe Roux Jourfier	<a href="http://www.group-rj.com">www.group-rj.com</a>	(+33) 4 73 83 22 59
Inoprod	<a href="http://www.inoprod.com">www.inoprod.com</a>	(+33) 4 73 27 20 89
Institut Carnot	<a href="http://www.ingenierie-at-lyon.org/en/">http://www.ingenierie-at-lyon.org/en/</a>	(+33) 4 72 29 15 69
Jet Cut	<a href="http://www.jetcut.fr">www.jetcut.fr</a>	(+33) 4 71 66 01 95
Kalistrut Aerospace	<a href="http://www.kalistrut-aerospace.com/">www.kalistrut-aerospace.com/</a>	(+33) 4 75 03 41 28
Lathuille Hudry	<a href="http://www.lathuille.fr">www.lathuille.fr</a>	(+33) 4 50 18 24 85
MDP Maxon Motor France	<a href="http://aerospace.maxonmotor.fr">aerospace.maxonmotor.fr</a>	(+33) 4 72 01 83 98
Mecapole	<a href="http://www.mecapole.fr">www.mecapole.fr</a>	(+33) 4 78 92 88 73
Meggitt-Sesnorex	<a href="http://www.sensorex.fr">www.sensorex.fr</a>	(+33) 4 50 95 43 55
MGB	<a href="http://www.mgb.fr">www.mgb.fr</a>	(+33) 4 50 98 26 67
Michelin Aircraft Tyres	<a href="http://www.michelin.com">www.michelin.com</a>	(+33) 4 73 32 76 40
Proform SAS	<a href="http://www.proform.fr">www.proform.fr</a>	(+33) 4 72 67 13 00
Safran Landing Systems	<a href="http://www.safranmbd.com">www.safranmbd.com</a>	(+33) 4 72 81 63 48
Secaero	<a href="http://www.sacaero.com">www.sacaero.com</a>	(+33) 4 75 85 29 92
SIC Marking	<a href="http://www.sic-marking.com">www.sic-marking.com</a>	(+33) 4 72 54 80 00
Sintex NF Group	<a href="http://sintex-np.com">http://sintex-np.com</a>	(+33) 4 78 40 11 52
SKF Aerospace France	<a href="http://www.sleti.fr">www.sleti.fr</a>	(+33) 4 28 08 00 14
Smoc Industries	<a href="http://www.smoc-industries.fr/">http://www.smoc-industries.fr/</a>	(+33) 4 76 07 01 47
SN Auvergne Aeronautique	<a href="http://www.auvergneaero.com">www.auvergneaero.com</a>	(+33) 4 73 60 41 41
Techni-Modul Engineering	<a href="http://www.techni-modul-engineering.eu">www.techni-modul-engineering.eu</a>	(+33) 4 73 54 53 48
Teledyne E2V Semiconductors	<a href="http://www.teledyne-e2v.com">www.teledyne-e2v.com</a>	(+33) 4 76 58 32 02
Thales	<a href="http://www.thalesgroup.com">www.thalesgroup.com</a>	(+33) 4 75 79 87 40
Timet Savoie	<a href="http://www.timet.com">www.timet.com</a>	(+33) 4 79 89 73 00
Tresse Industries	<a href="https://www.tresse.com/">https://www.tresse.com/</a>	(+33) 4 73 82 45 75
Zodiac Aerotechnics	<a href="http://www.zodiacaerospace.com">www.zodiacaerospace.com</a>	(+33) 4 77 90 71 00

## Local Address

220 rue Léon Blum, 69100 VILLEURBANNE
220 rue Léon Blum, 69100 VILLEURBANNE
2 rue de Clémencières, Les Engenières, BP 15, 38360 SASSENAGE
948 Promenade de l'Arve, BP 29, 74311 THYEZ
32 quai Perrache, 69002 LYON
30 Quai Perrache, Immeuble Empreinte, 69002 LYON
15 boulevard Vivier Merle, 69003 LYON
10 rue du Champ Dolin, 69800 SAINT PRIEST
Rue Maryse Bastié, 63510 AULNAT
4 chemin du Ruisseau, 69134 ECULLY
8 bis avenue de la Gare, BP 79, 01116 OYONNAX
Rue Yves Lamourdedieu, ZI des Listes, CS 40042, 63500 ISSOIRE
Parc d'Activités Alpespace, 354 voie Magellan, 73800 SAINTE HÉLÈNE DU LAC
2 rue du Docteur Abel, BP 59, 26902 VALENCE
120 Rue de la Piscine, 38400 SAINT-MARTIN-D'HÈRES
36-38 rue Jean Martouret, BP 12, 42161 ANDREZIEUX BOUTHEON
151 rue de la Marinière, 74950 SCIONZIER
442 avenue Lavoisier, 01600 MASSIEUX
10 Rue de Lombardie, 69800 SAINT-PRIEST
7 rue Georges Méliès, 69680 CHASSIEU
Esisar, 50 rue Barthélémy de Laffemas BP 54, 26902 VALENCE
65 chemin de la Prairie, BP 2074, 74009 ANNECY
120 avenue Jean Jaurès, 69007 LYON
Rue de Serbie, 63000 CLERMONT-FERRAND
46 Rue de Sarliève, Centre d'Affaires du Zénith, 63800 COURNON-D'Auvergne
66 Boulevard Niels Bohr, 69100 VILLEURBANNE
ZA de Lavée, 43200 YSSINGEAUX
1 avenue Marc Seguin, CS 14189, 26240 SAINT VALLIER
ZAC des Léchères, Rue des Noisetiers, BP 69, 74314 MARNAZ
21 Porte du Grand Lyon, Neyron, 01707 MIRIBEL
95 cours Lafayette, 69006 LYON
196 rue Louis Rustin, Parc d'Affaires International, BP 63108, 74166 ARCHAMPS
Rue du Bary, BP 16, 74460 MARNAZ
Place des Carmes-Déchaux, 63040 CLERMONT FERRAND
4 - 8 route du Caillou, BP 12 - Zone des Sables, 69630 CHAPONOST
7, AV du Bel Air, 69100 VILLEURBANNE
Aéroport de Valence-Chabeuil, 26 120 CHABEUIL
ZAC de la Braille, 13 rue de Limonest, BP 73, 69380 LISSIEU
10, Rue Jean Rostand, 69740 GENAS
22 rue Brillat Savarin, Rovaltain - Parc du 45ème Parallèle, BP 16235, 26300 CHATEAUNEUF-SUR-ISERE
ZI Route de Saint Quentin, 38210 TULLINS
1 rue Touria Chaoui, 63510 AULNAT
ZA de Pérache, 63114 COUDES
Avenue de Rochepleine, BP 123, 38120 SAINT EGREVE
25 rue Jules Védrières, 26000 VALENCE
62, AV Paul Girod, 73400 UGINE
Rue Marc Seguin, Zone Industrielle, 63600 AMBERT
Boulevard Sagnat, BP 3, 42230 ROCHE LA MOLIERE





GLOBAL BUSINESS REPORTS