cetim.fr

cetim infos

Going for the future

N° 246 JUNE 2019 - ISSN 0399-0001
EXTRACT

The MRO challenge

© Safran

Aeronautics: meeting the MRO Challenge

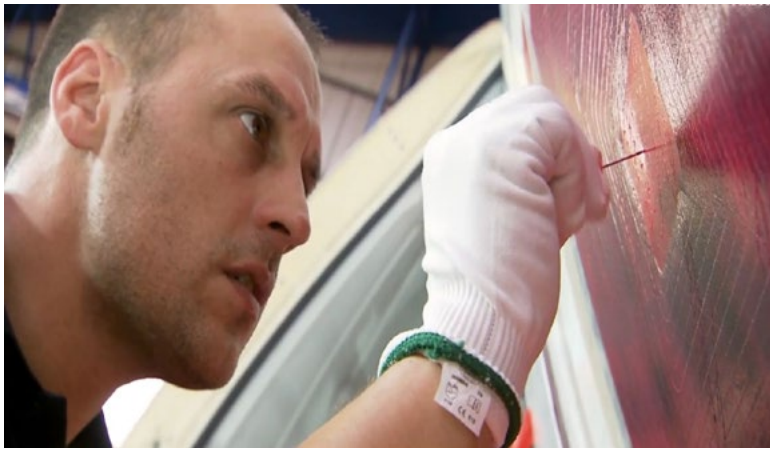
Air traffic volumes are constantly increasing, which means that ensuring the availability of operational aircrafts is a key priority. This factor is considered from the design phase, and throughout production, with a focus on sturdiness and quality, right up to aircraft maintenance and even during the flight thanks to connected technologies. The aim is to optimise maintenance to reduce downtime and maximise flight time.

State of the art

Maintenance, the cornerstone of effectiveness

In a world where air traffic is constantly increasing, a short production lead time is not enough. The aeronautical sector must also ensure that operational aircrafts spend as little time as possible on the ground. Servicing and maintenance resources must be upgraded to meet this requirement, as well as design and production processes. Digital technologies must be widespread.

In today's world, aeroplanes are simply another means of transport. In 2018, according to the International Civil Aviation Organization (ICAO), over 4.3 billion people (up 6.1% from the previous year) travelled on one of the 38 million passenger flights recorded that year, i.e. excluding cargo-only flights! Aviation experts are expecting more steep increases in the coming years, particularly driven by growth in China and India. According to the forecasts of the International Air Transport Association (IATA), air traffic figures will double over the next 15 years.



© Airbus

Composite parts are increasingly used on new aircraft, even for structural components. Suitable repair tools must be available.

Keeping aircrafts... in the air

The giants of the sector such as Airbus and Boeing, smaller operators such as Embraer and Bombardier, and new arrivals such as the Chinese manufacturer, Comac, or the Japanese firms, Honda and Mitsubishi Regional Jet, have been working twice as hard to produce around 2,000 aircrafts per year for many years now. And yet, it's not enough! Despite everything, lead times are indicated in years and, as highlighted by Matthieu Lemasson, associate for aeronautical, defence and spatial sectors for PricewaterhouseCooper (PWC) France, *"the number of aircrafts currently operating is well below actual requirements"*. The current figure of slightly over 27,000 is expected to reach 45,000 over the next 20 years. In the meantime, how can airlines transport as many passengers as possible, without enough aircraft? The answer is: by making sure that aircrafts spend as much time as possible... in the air. Airlines reduce stopover time for this purpose. The PWC expert explained that *"Airlines aim to optimise servicing and maintenance operations in every possible way, while guaranteeing passenger safety"*.

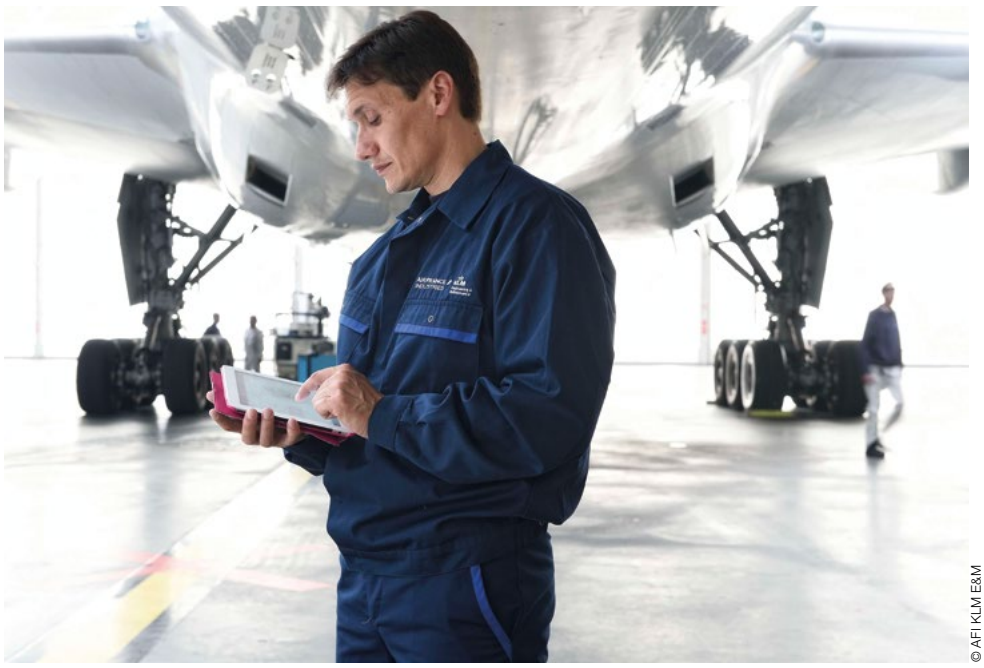
Optimising maintenance

According to Maintenance, Repair and Overhaul (MRO) firms, technology is the key optimising aircraft operations.

>>>

Airbus invests in MRO

Airlines and dedicated service providers are not the only ones involved in aircraft maintenance. Airbus itself is investing substantially in this sector, specifically to meet the current boom in the Asia-Pacific region. For this reason, the European manufacturer recently took over the MRO specialist, Sepang Aircraft Engineering (SAE), in Malaysia, adding 500 employees and 50,000 m² of fully-equipped hangar space to the Airbus Customer Services team resources dedicated to aircraft servicing and maintenance.



© AFI KLM E&M

MRO staff (Air France Industries KLM E&M in this photo) use tablets during stopovers to speed up testing. The tablets can provide all the information they need, right next to the aircraft.

Regular inspections are carried out on all aircraft throughout their lives, including daily and weekly checking, more in-depth inspections several times annually and finally, overhauls, where every little detail is checked and upgraded. Any new idea which could shorten the time required for these operations is welcome. To give just one example at Air France Industrie KLM Engineering & Maintenance, James Kornberg, Innovation Director, explained *"Our stopover inspection teams use connected tablets, able to access technical data and aircraft history, scan a part code to obtain a precise reference or contact a remote expert"* *(read the article on page 7)*. Composites are increasingly used for aircraft parts, including for structural components. According to Laurent Bildstein, CEO of Awak Technics (Crit group) *"We invested in* "composite checkers", *which are ultrasound-based non-destructive testing systems specifically designed for composite materials"*. If his staff are informed of potential damage to a part, they can detect the slightest defect right on the aircraft, on the tarmac. He is also considering the use of drones to check appearance. Laurent Bildstein acknowledges that *"Drones could be useful, for example, to check damage caused by lighting to an A380 stabiliser, which is otherwise difficult to access without specific equipment. However, safety issues must be solved before drones can be used at an airport"*. Current tests are generally conducted inside a closed hangar for this reason. Additive manufacturing is another technology with strong potential. *"We use these technologies to produce cabin fittings, as well as some engine parts"* announced James Kornberg. And with good reason, if parts can be generally produced on-demand, one at a time, such a policy would lead to reduced spare part stocks, particularly for parts with excessive delivery times... However, part certification problems and low profitability levels for components currently manufactured in large series are still obstacles to the use of 3D printing.

Reviewing the design phase to cut times

Maintenance could also be optimised by planning ahead, well before the operating phase. At Kopter, a *"Customer Support"* team has been integrated into the design team and the young Swiss helicopter manufacturer is making every attempt to make it easier to access information and launch operations when its SH09 leaves the assembly lines (see insert). Once again, additive manufacturing is promising, particularly when replacing assemblies with mono-block parts. However, aircraft manufacturers are taking things a step further by sharing resources, just like in the automotive sector. As explained by Matthieu Lemasson *"Production platforms are now dominant. Airbus has dropped from 15 to 7. In the future, 2 or 3 modular platforms*

Connect airplanes and factories

Equipment maintenance is also essential at factories, particularly for *"critical"* machines. *"Operators carry out preventive maintenance operations based on key process parameters and data obtained from machine sensors"*, explained Cyrille Camus, head of Business development & Corporate Account Management Aerospace at Siemens France. New projects tend to focus on predictive maintenance. Just like with the aircraft, real-time data is analysed in order to predict failures and malfunctions and schedule operations when they are required. According to Cyrille Camus *"The next stage will involve reconciling this process data with component operating data, particularly for product upgrades or to optimise certain quality control procedures for parts in use"*.

will be used to standar dise and share resources, etc." Such an approach will have a direct impact on maintenance and the associated logistics.

Making aircrafts communicate

Manufacturers, operators and MRO firms are also betting on the benefits of digital systems. Since the 1980's, data has been transmitted in-flight, including aircraft status data, via Acars (Aircraft Communication Addressing and Reporting System). The volume of data collected has increased substantially over the last five years or so.

As explained by Vincent Caulet, in charge of the aerospace market at Cetim *"A large amount of data is continuously recorded during the flight, and off-loaded during stopovers"*.

Engine manufacturers, such as Rolls Royce or Safran can provide A-to-Z packages including data recording (thrust, fuel consumption, approach speed, brake monitoring, etc.) during the flight, automatic transfer to a server, and the analysis of the data obtained in view of reaching optimised decisions as rapidly as possible. Safran has already analysed over 20 million flight hours using its Casiopee system. MRO experts are also turning to advanced digital functions.

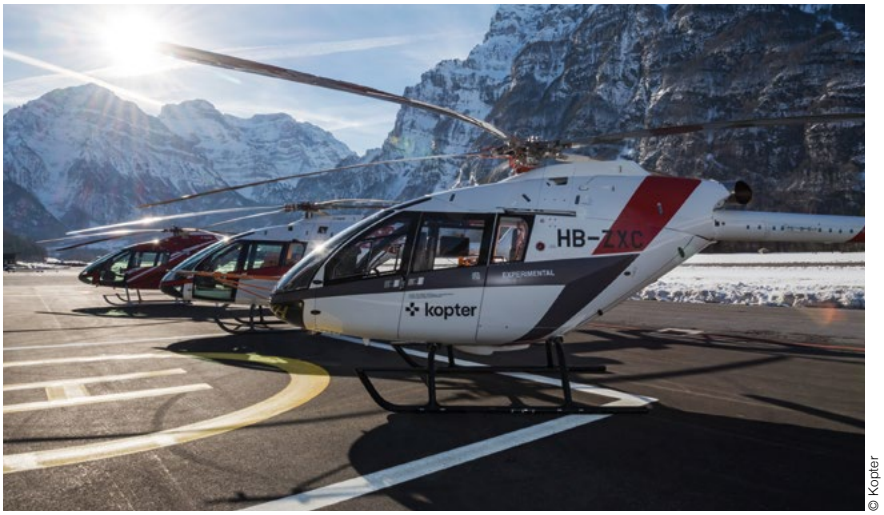
At Air France KLM Engineering & Maintenance, a similar system known as Prognos processes data (terabytes of data are stored during each flight!) and plans ahead for any likely failures.

A real-time world

The predictive maintenance and data analysis trend is spreading well beyond the aviation sector. With the arrival of *"reusable launch pads, we must develop predictive maintenance solutions for our rockets. This is a radical development."* claims Hervé Gilibert, Chief technical officer & quality for ArianeGroup (see article on page 6).

The next stage is to share in-flight data in real-time. 100% secure and solid systems are required for this purpose. Matthieu Lemasson is betting on the Blockchain in this respect. As he explained *"With this approach, we can issue validations and authorisations automatically. If an engine manufacturer informs an airline that a part needs replacing on one of its aircraft, the entire series of actions required will be automatically started to ensure that the part and the necessary teams are in the right place at the right time, in a secure manner, and with no need for human input, including invoicing"*. Thanks to this system, aircraft maintenance logs are updated in real time. He continued *"This is a real market requirement. 50% of fleets are currently leased, and leasers must be able to prove the condition of their aircraft to customers at any time"*.

The ultimate aim of operators in the sector is to connect operational aircraft with their virtual twins, which will fly in parallel in digital skies. Matthieu Lemasson clarified that *"Digital mock-ups from PLM software publishers such as Dassault Systems have partially solved this problem, however we still need to find workarounds for a plethora of obstacles before this aim is achieved."* ■ **JSS**



© Kopter

The Swiss knife of the helicopter industry

Kopter is opting for a multi-functional aircraft which is easy to use with its first ever single-engine model, the SH09. Three SH09 prototypes have already flown (see photo). The young Swiss manufacturer is also offering easy maintenance. To start with, according to Lionel Lussan, supplier manager on the Customer Support team *"the aircraft is totally designed for maximum operating time. Maintenance operations have been reduced and are planned for, thanks to reliability and fatigue analyses, and numerical calculations correlated with physical tests, among other factors"*. Above all, he continued *"Our approach to maintenance matches the expectations of our customers, who do not want to see red or orange alarms appearing during flight, requiring the immediate replacement of a part or maintenance involving helicopter downtime. Customers prefer to be informed, ahead of time, so they can plan for these operations and fit them into the operating schedule of their helicopter. We are working on the connectivity of the different helicopter components, processing the data collected and data use by Kopter and its customers for this purpose."*

Perspectives

A world of innovation

Commercial aviation, civil security, aerospace, etc. are all sectors involving air and space operations which require maintenance to be optimised as a priority feature. We spoke to four contributors to hear their opinions on the limitations involved and planned innovations.

"Meeting the challenge of re-usable launch pads"

Hervé Gilibert, Chief technical officer & quality, ArianeGroup

© D-Eskenazi-ArianeGroup

"We are currently launching 10 rockets annually, so the question has not come up just yet, but according to assumed growth on the space launch market, we can expect this figure to double, or more, over the next decade.
Using re-usable structures will certainly become economically appropriate at this point. We will need to change our approach to design and focus on sturdiness. We are currently working on this adaptation with the future rocket engine, Prometheus, due to replace the Vulcain.
The second challenge facing us is to guarantee the reliability of a "used" product. We must check the re-usable modules, retrofit them if necessary, and certify their ability to fly within a short period. Just like in the aeronautical sector, we will adopt predictive maintenance procedures based on in-flight measurement databases and artificial intelligence, to detect any weak points for our equipment. We can already access data, as we currently track around 500 parameters during each flight, however Ariane 5 can only boast 103 launches. This is next to nothing compared with the millions of flight hours recorded by commercial aircraft! We are never going to hold Big Data, and will have to manage with "Few Data", and learn quickly.
In particular, we are talking to academic researchers focusing on how the brains of young children learn for this purpose, as ultimately children require very little information in order to understand their environment."

"Composite repairs are becoming a complex business"

Roland Chemama, CEO, GMI Aero

© GMI-AERO

"GMI Aero has focused on the technologies used to repair composite parts for many years. We supply the devices required to detect defects, prepare surfaces and apply patches to the damaged parts, while maintaining strict temperatures. Temperatures can reach 140°C or even 180°C, and must be maintained within +/- 5°C!
Composites are currently in widespread use. On this basis, we must be able to repair critical and complex parts, at any thickness, with or without reinforcements, over surface areas of up to one square metre.... directly on the aircraft as the components cannot be removed! Suitable heating systems with precise control functions are required.
We are contributing our technologies to a Clean Sky 2 programme project in this respect, in cooperation with Airbus. GMI can offer technology derived from Clean Sky research to reduce repair times, by producing a heated mat at the site, with the right geometry for the damaged area.
The challenge of Structural Health Monitoring (SHM) also awaits us in the future. We are working on "smart patches" covered with magnetostrictive wires, with ATR. Changes can be detected by comparing the magnetic profile of the patch with its initial condition, and an ultrasound system can then be used to obtain more details if necessary.
These issues are gradually gaining in importance. In fact, they will take centre stage at the European Aeronautics Science Network seminar held from 18 - 20 June, at the same time as the Paris air show 2019."


© AFI-KLM E&M

"A continuous innovation programme"

James Kornberg, Director Innovation, Air France Industries KLM Engineering & Maintenance

"Air France Industries KLM & E&M (14,000 employees) monitors 2,000 planes, from both our fleets and those of third-party customers, making us the 2nd general MRO firm worldwide. Our teams maintain the entire aircraft, from the structure to the equipment, not forgetting the engines.
Innovation is required at all levels. To give just one example, checkers at stopovers are now equipped with "Toolpads", which are tablets connected to a central system, providing access to technical data, the aircraft history and the precise product reference for the plane cabin or allowing staff to contact a remote expert. We have allocated 2,300 tablets to our teams and will continue to extend the programme to engines, ensuring our technicians can access digital solutions at the aircraft or in workshops. We have also developed an in-house predictive maintenance system: Prognos. This system downloads the data obtained on the aircraft, engines, auxiliary systems, etc. at each stopover and transmits the data to our central server. This Big Data is analysed and used to predict any possible failure over the next two or three weeks, and therefore to schedule the necessary maintenance. We use 3D printing technologies to repair some parts.
Our MRO Lab developed all of these innovations. The lab includes around a hundred individuals, who assess and implement all sorts of solutions to boost the efficiency of our teams, sometimes with the assistance of external partners. Most contributors have field experience. In fact, our teams come up with around 4,000 new ideas each year as part of our internal innovation programme. Around 75% of these ideas are implemented."

Reinforced maintenance for Canadair aircrafts


© DR

Franck Weber, Engineering manager at the Nîmes site (France), Sabena Technics

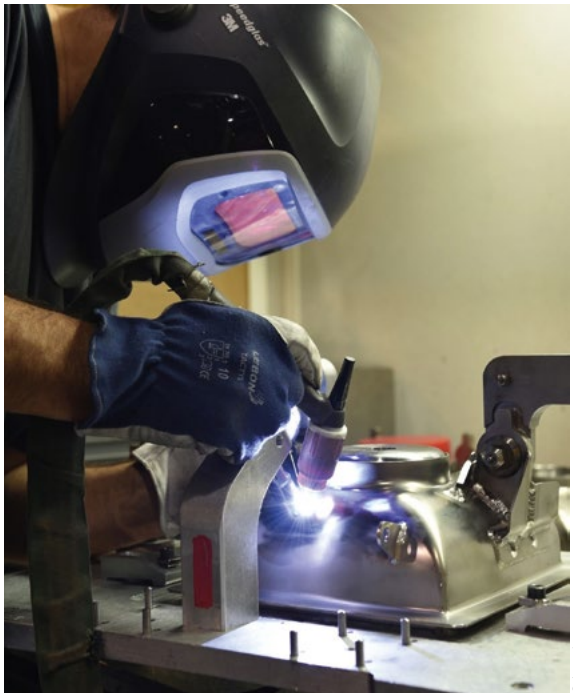
"Sabena Technics is an international MRO expert with 15 sites worldwide, 2,700 employees and 490 million euros in annual turnover. We mainly maintain civil security aircraft at the Nîmes site: 25 aircrafts, including 12 Canadair CL 415 by Bombardier. These aircrafts must be available whenever possible. During the summer, during the day, they must be able to take off at any time. Maintenance requirements must, therefore, be light at this time of the year, and any operations must be completed at night. Heavy duty maintenance operations are scheduled during the winter.
These Canadair aircrafts carry sea water. Their landing gear and underbellies suffer from extensive corrosion, despite coats of primer and paint designed to treat and protect them, and some corroded parts are not visible under the naked eye. In worst-case conditions, landing gear can become incompatible with flight in less than one year! Our aim is to ensure the best possible protection for these parts. The aircrafts are systematically rinsed when they return to the base, and overhauls during the winter are particularly detailed, but this is not enough! We are currently testing several solutions to take our action further: coating exposed parts with a water-repellent corrosion inhibitor, spraying plastic materials, etc. The most complicated aspect is finding effective products certified by regulated bodies. In-depth studies are required for all new solutions. The process can take time... but the results are worth it if we manage to use these aircraft for a few extra years."

Policy

Lauak targets solidity

The Lauak group has incorporated extra fields of expertise to expand and optimise its services, aiming to meet the requirements of the main operators in the aeronautical sector. The group has launched a modernisation policy for its production lines, while reinforcing its quality process.

There can be no doubt that augmented reality will soon be part of the day-to-day routine for Lauak operators, although widespread use is still limited due to high costs. Such systems will indicate which tasks must be carried out in the form of 3D animations, boosting precision. Augmented reality is one of the new technologies adopted by the group as part of its modernisation policy, aiming to ensure that its products are ever more reliable.



© Lauak

Lauak trains welders and adjusters in-house in cooperation with UIMM to ensure permanent advanced levels of expertise

Steady harmonious growth

Since the group was created by Jean-Marc Charritton in 1975 under the Eskulanak name, it has recorded steady harmonious growth. The SME specialised in boilers has progressively adopted other trades such as welding, pipes, surface treatment, machining and assembly to become the Lauak group, one of the leading French sub-contractors for primary parts, sub-assemblies and assemblies for the aeronautical industry.

In the early years of the 21st century, the group started growing at a faster pace. According to Mikel Charritton, group co-director, *"We had to reach a critical size to help consolidate the supply chain. On this basis, we acquired the expertise we needed by buying out various companies specialised in machining, composites, aircraft engines, hot forming and Bombardier's metal pipes division."*

The Lauak group generates 200 million euros in turnover and employs 1,652 members of personnel spread over ten production sites, plus its international operations (the group has subsidiaries in Portugal, Canada and Mexico), establishing its position as a key partner for aircraft manufacturers (Airbus, Dassault Aviation, Bombardier, Embraer), leading airframe specialists (Stelia Aerospace, Daher, Latécoère, etc.) and the main equipment producers (Liebherr Aerospace, Safran).

Increased volumes and more reliable final products

Operational growth represents 20% for most production sites. The group is organising its activities, modifying its structure, using external expertise and recruiting qualified personnel: metal workers, welders, machiners, etc. All of these trades are competitive and Lauak is struggling to recruit, just like all industrial operators in the sector. The company therefore decided to train selected members of personnel in the form of operational training courses in cooperation with UIMM (French metalworkers' union), and with the support of some of the most experienced tutors.

According to Mikel Charritton *"Business providers have three key requirements: risk hedging; operational performance, we must be able*

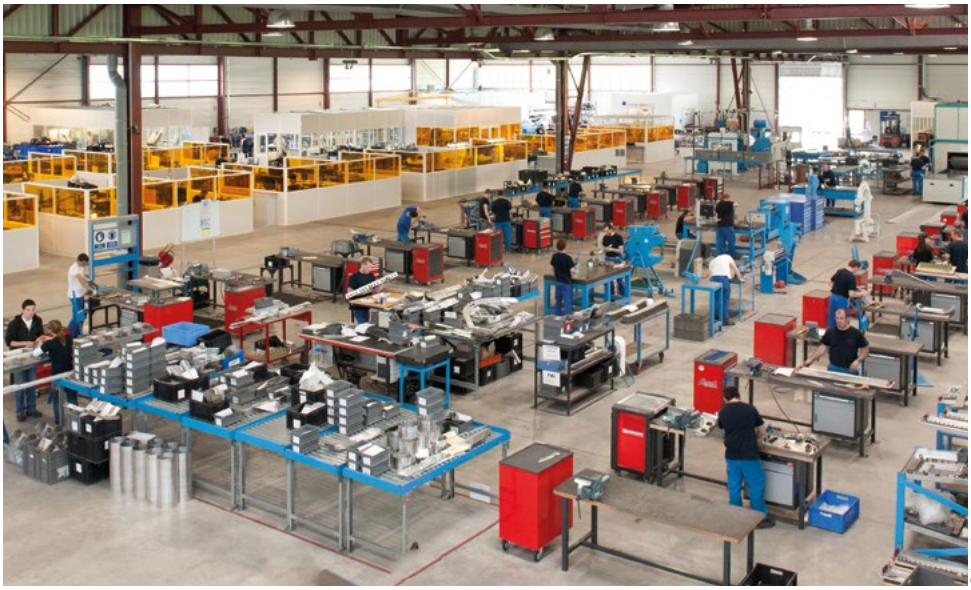
to produce to the necessary quality within the set lead times - late penalties apply; and a solid quality system and processes."
Increasing volumes of air traffic means greater output, but we must also ensure that operational aircraft spend as much time as possible in the air, rather than on the ground. In the eyes of sub-contractors such as Lauak, the aim is not simply to increase production output, but to deliver more reliable products.
Mikel Charritton acknowledges that *"Our customers apply extensive IPCA (Industrial Process Control Assessment) processes, they aim to ensure that we control quality and plan ahead over the coming two or three ye ars for any changes, constantly adapting our production systems."*
In order to satisfy these processes and reassure its customers, the group has rewritten its organisation by expanding its support services. Quality plans, test tools, internal audits, etc. the production process is moving towards more solid guarantees. Lauak has also selected well-positioned suppliers in terms of competitiveness with a solid quality assurance plan. Lauak has increased the scope of its monitoring and provides support for boosting performance, *"just like our customers do with us"* highlighted Mikel Charritton.


© Lauak

> **"Business providers expect us to ensure that we control quality and plan ahead over the coming two or three years for any changes, constantly adapting our production systems."**
>
> **Mikel Charritton, Lauak co-director**

Improving the entire ecosystem

As the second part of its strategy for ensuring reliable production processes, the group is adopting automated and digital systems for its operations, while attempting to boost its productivity.
As indicated by Mikel Charritton, *"We are currently defining a digital transformation strategy, in view of subsequently selecting which tools we intend to deploy"*. The group has already selected an information system, which will be installed throughout the group, and one of its Portuguese plants, which will become the group's showcase site 4.0. The Internet of Things has now appeared and will meet requirements in terms of ensuring the traceability of production orders thanks to the deployment of 14,000 smart sensors. Pending the widespread use of augmented reality, operators are provided with tablets and instructions. The test plans will be converted to an electronic format. Processes will be standardised in parallel to the digital transformation. The idea is to determine what works best at the sites and define a roadmap, and subsequently ask all plants to align their best practices, improving the entire ecosystem. Lauak is supported by the solid values of its teams, established over the years, to ensure all of their members contribute to the new era: ethics to maintain integrity, humility to reconsider positions and move forward, commitment to keep your word and flexibility to combine actions with reactions.
Mikel Charritton concluded by stating that *"A quality system is alive, with constant energy and drive. During periods with strong growth, we will certainly need to recruit new members, and produce more parts, but we must also continue to make our processes ever more solid."* ■ **AL**


© Lauak

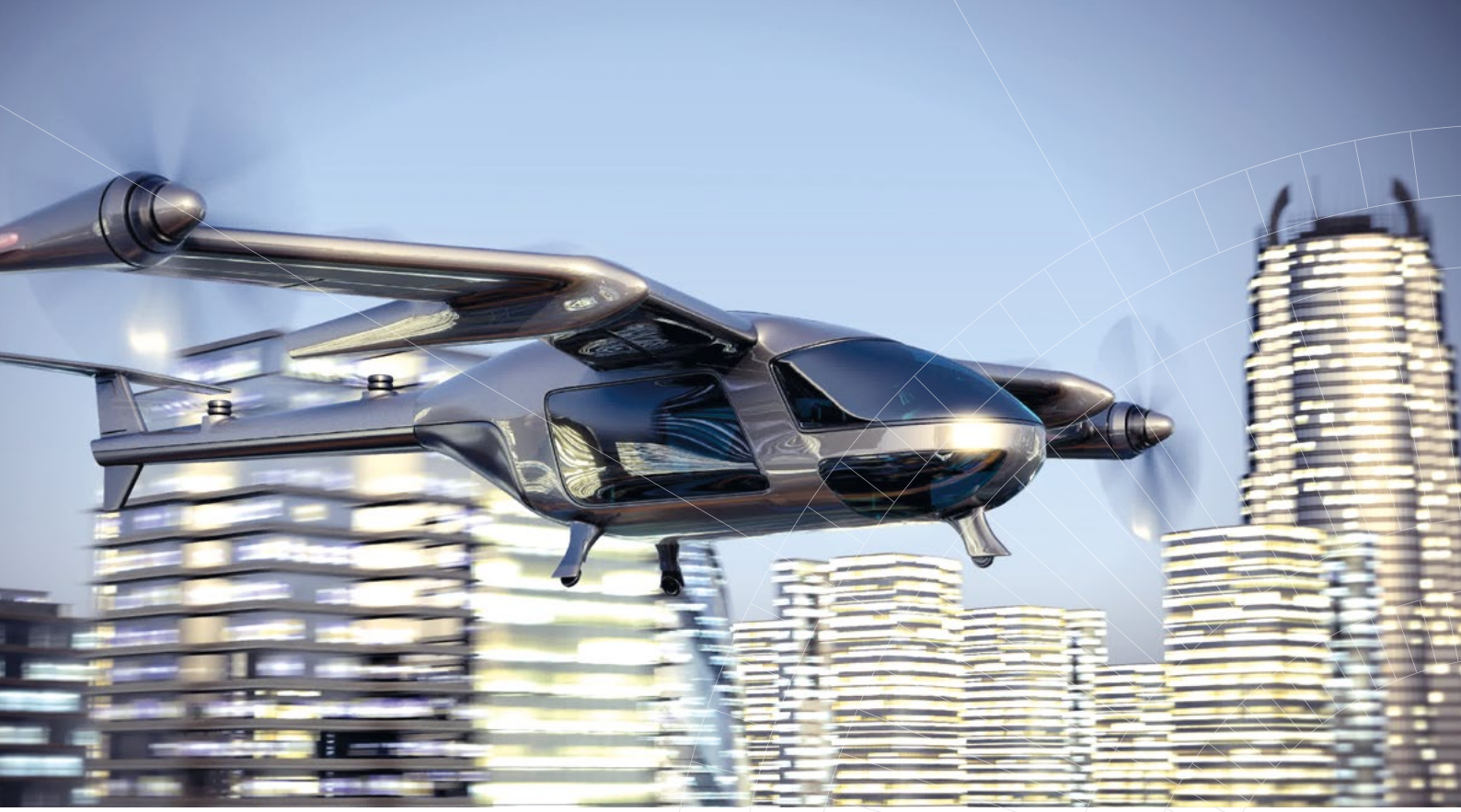
Lauak has consistently expanded since its incorporation in 1975, gradually offering more comprehensive services. The company currently employs 1,650 individuals at ten production sites (Hasparren, Basque country, shown in the photo).

cetiminfos

CETIM, 52 avenue Félix-Louat - CS 80067 - 60304 Senlis Cedex - France
sqr@cetim.fr - cetim.fr

Publishing director:
Daniel Richet
Editor in chief:
Christophe Garnier
Associate chief editor:
Akim Djouadi
Deputy chief editor:
Jean-Sébastien Scandella

Special issue written by:
Alain Lamour, Jean-Sébastien Scandella
Layout:
Clémentine Rocolle
Cover picture:
© Jag-cz



Get on board the aerospace engineering of the future

Successfully boost your production across the whole sector, increase your profitability, reduce emissions, improve passengers' comfort…

Cetim can help you with as many challenges as you face thanks to its broad range of multidisciplinary skills and access to the best practices and technologies of the industry 4.0!

- Comprehensive range of R&D services
- Eco-friendly and innovative design
- Smart testing and simulation
- Analysis and implementation of change management in the shop floor
- Industrialization of new technologies
- Digitalization of services and processes across the entire value chain
- Optimization of the MRO
- Training to develop skills

Discover our solutions on cetim-engineering.com

CONTACT
Vincent CAULET
Tel.: +33 / 970 821 680
sqr@cetim.fr

Centre technique des industries mécaniques
52, avenue Félix-Louat, 60300 Senlis - France +33 / 970 821 680 - sqr@cetim.fr

cetim.fr
cetim-engineering.com