

No. 9

SEPTEMBER 2021

one

TEAM - BUSINESS - FUTURE



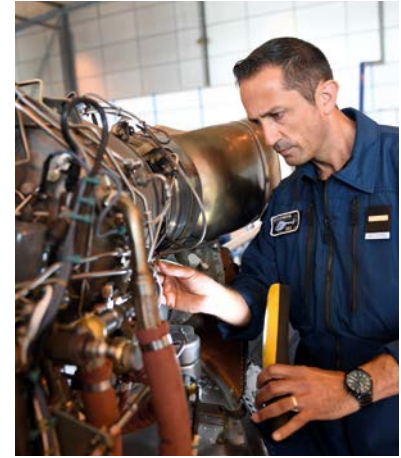
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Left to right: A Safran Data Systems technician works on the Orion1300 antenna at Arcachon in southwest France. The LEAP-1B-powered Boeing 737 MAX once again takes to the sky! Servicing an Arriel 2D turboshaft engine from Safran Helicopter Engines, powerplant of the H125.



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Design and production: TERRE DE SIENNE

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DEAR COLLEAGUES,

Safran has made a very firm commitment this year to achieve carbon neutrality by 2050. This target reflects our resolve to play an active role in this global movement, based on the Paris Climate Agreement, to address the climate emergency.

The environment is now Safran's top strategic priority, not only in terms of reducing the CO₂ emissions of our products and operations, but also by improving the energy efficiency of our products — as demonstrated by the Revolutionary Innovation for Sustainable Engines (RISE) technology program launched in June with GE Aviation to prepare the next generation of airplane engines.

But our responsibilities as a company go even further, to include fostering diversity, providing access to learning, acting ethically and supporting research. Our new corporate social responsibility (CSR) strategy, "Engage for the future", formally sets out our commitments and objectives in all these areas, and more. Built around tangible and measurable objectives and commitments, this strategy will enable us to strengthen our positive impact on society. As its name implies, "Engage for the future" embodies the drive for us all to work together to achieve this. Furthermore, our new strategy was developed in collaboration with our stakeholders, the aim being to further bolster our ties by enhancing our image

as a responsible corporate citizen, not just among our employees but also among recent graduates and the general public to help counter the current "flight shame" trend.

We have already launched a number of tangible initiatives — some described in the following pages — and I can only encourage all of you to ask yourselves how you can make a real contribution to this essential dynamic, which will allow us to meet the challenges facing us today, and in the years to come.

OLIVIER ANDRIÈS
Chief Executive Officer of Safran



SAFRAN
Je me souviens...

SAFRAN
I remember...

ONE
TEAM



100TH ANNIVERSARY!

Safran Electrical & Power (formerly Labinal) is celebrating its 100th anniversary this year. To mark the occasion, staff, partners and customers have been asked to share their favorite memories and help build a “family tree” of the company in its current configuration. An exciting project? A major innovation? A notable event? A memorable anecdote? An unforgettable colleague? If you want to contribute, go to www.100years.safran-electrical-power.com and send in your testimonials, starting with “I recall when...”. They will then be shared on Safran’s social media. After all, a whole century of achievements couldn’t have been done without you!

SAFRAN DAYS BACK ON THE AGENDA

In early June, Safran teams in Beijing, Suzhou and Guiyang were able to get together for the first global Safran Day event since the outbreak of the Covid-19 crisis. Safran Days are designed to help employees network, embrace the One Safran mindset and benefit from strategic insights on the Group through presentations by Executive Committee members. This long-awaited return edition got underway with video speeches by Olivier Andriès, Safran CEO, and Alexandre Ziegler, Safran Senior Executive Vice President, International and Public Relations.

WORK CLOTHES FOR EVERYONE

In spring 2021, the Safran Helicopter Engines facility in Bordes collected 164 kg of used work clothes as part of a joint initiative between the Safran Foundation for Employment and the Cravate Solidaire charity organization. Dedicated to getting people back

into the workforce, Cravate Solidaire organizes donations of work clothes and provides coaching for job seekers. Staff at Bordes have been donating their used work gear for several years to contribute to these efforts, which have proved a great success.

ZERO DEFECTS – MISSION ACCOMPLISHED!

In 2020, staff at Safran Transmission Systems were set the goal of improving the Rolls-Royce Trent 7000 engine case. So, despite the distance that separates them – not to mention the ongoing Covid crisis – the French and Polish teams from Aero Gearbox International (AGI, the joint venture between Safran Transmission Systems and Rolls-Royce) put their heads together to completely revamp the manufacturing process, improve the design and eliminate all non-value-added operations. Thanks to this tight teamwork, they have eliminated waivers and the case now takes 30% less time to make. Kudos to everyone who helped rise to this ambitious challenge!

INTERNAL MOBILITY SHIFTS INTO HIGH GEAR

The mobility support policy introduced by Safran as part of the Group-wide “Business Transformation” agreement in July 2020 is yielding results, bringing significant benefits to employees and Safran alike.



BAPTISTE LEMARCIS
Fitter, seconded to
Safran Power Units

“I came from Safran Helicopter Engines, where I was a fitter on the Arriel production line in Tarnos. When business dropped off, I was seconded to the Safran Power Units turbojet assembly line in October 2020. Everyone made me feel very welcome. I was given training to adjust to my new job and now I’m fully up to speed. It’s a really positive experience, allowing two Safran entities with a lot in common to help each other out and at the same time enabling employees to get to know each other better.” ■



PATRICK AMADO
Inspector at the Safran Aircraft Engines facility in Saint-Quentin-en-Yvelines

"I'd planned to take up a mobility opportunity when the 737 MAX crisis began, but it was cancelled due to the outbreak of Covid-19. However, as organizational requirements changed, I was able to transfer to the Saint-Quentin-en-Yvelines facility in a new role as inspector. I wanted to experience something new, even though I'd done a fairly similar job before. I was given 18 months' training to learn the basics of repairs. It's quite different to the world of production because we deal directly with airlines. This is a big change for me and what I find the most stimulating. In my opinion, setting yourself a new challenge to expand your skills can be really rewarding!" ■

The entire aviation industry has been severely hit by the impact of the Covid-19 crisis on air travel since March 2020. Because we are involved in a diverse range of segments, our companies' business volumes have been affected to varying degrees.

Safran responded swiftly to the situation, signing a Business Transformation agreement in July 2020 that was applied in France. One of the main thrusts of the agreement is stepping up support for staff mobility to allow us to effectively match skills to requirements. Delphine Berilloux, Executive Vice President, Talents and Skills, explains: "Thanks to the combined efforts of everyone involved, a comprehensive system was put in place to support all types of mobility within the Group and among our subsidiaries, encompassing internal and external

transfers, assignments, entrepreneurship – either setting up in business or taking over a business – sabbatical leave, and skills transfer schemes."

ENCOURAGE STAFF MOVEMENT

One year later, more than 1,400 employees have completed a mobility or transfer thanks to the measures introduced by Safran and its companies. These have included webinars (online meetings) to present the businesses and opportunities available and to help employees draft their applications. When Covid-related restrictions permitted it, face-to-face job speed dating events were also held with people looking to change jobs. Violaine Rebiffé, HR business partner at Safran Electronics & Defense's engineering department, and organizer of a job speed dating event, explains what's involved: "People

› from other Safran companies aren't necessarily familiar with what we do. These events allow us to present the diversity of our products and the high-tech nature of the jobs involved, in the hope of encouraging people to join us. This approach will bring short-, medium- and long-term benefits." At the same time, mobility kits have been put together providing sample CVs, learning programs available from Safran University, job interview tutorials, etc., for employees, managers and human resources teams.

SUPPORT FOR MOBILITY

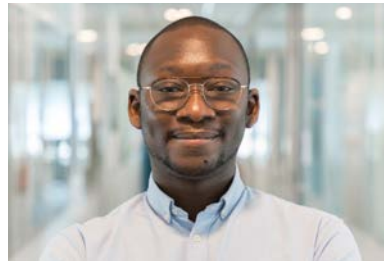
To deal with the unprecedented situation, some Safran companies have introduced targeted support measures. Safran Helicopter Engines, for example, launched the "Trajectoire compétences" (skills pathway) initiative to help employees build their mobility plans using a set of career management tools and with follow-up support from local HR managers. At Safran Electronics & Defense, the Tempo project allowed the company to pinpoint and then match mobility and secondment opportunities to employees forced to work part time. These efforts paid off, with more mobilities completed not just among the company's different sites but also with its subsidiaries and within the Group.

CHANGE JOBS... OR COMPANIES

Thanks to these initiatives, a number of employees have been able to change companies to take up a role either in the same field or in a related area, within the scope of a mobility arrangement or a temporary assignment. But Safran's mobility support policy has also encouraged more radical changes, with some people moving into a completely new line of work. Two specific pathways have been developed by HR for jobs where we face a skills shortage and which offer good prospects: embedded software development and electronic component programming.

Others will be set up in the coming months. "The embedded software pathway is the result of close collaboration with Safran Electronics & Defense," remarks Florence Gourmanel, head of human resources at Safran Engineering Services. "Employees at our company who've been particularly affected by the decline in workload were given priority. This is a good example of how collaboration can help address the Group's needs in sectors where skills are scarce."

Encouraged by these positive outcomes, the teams behind the initiatives are eager to pursue their efforts. "The challenge now is to sustain the momentum throughout 2021," says Delphine Berilloux. "We aim to go even further by making it easier for employees to retrain in jobs that are expected to grow, like embedded software, health, safety and environment, RAMS and data management." ■



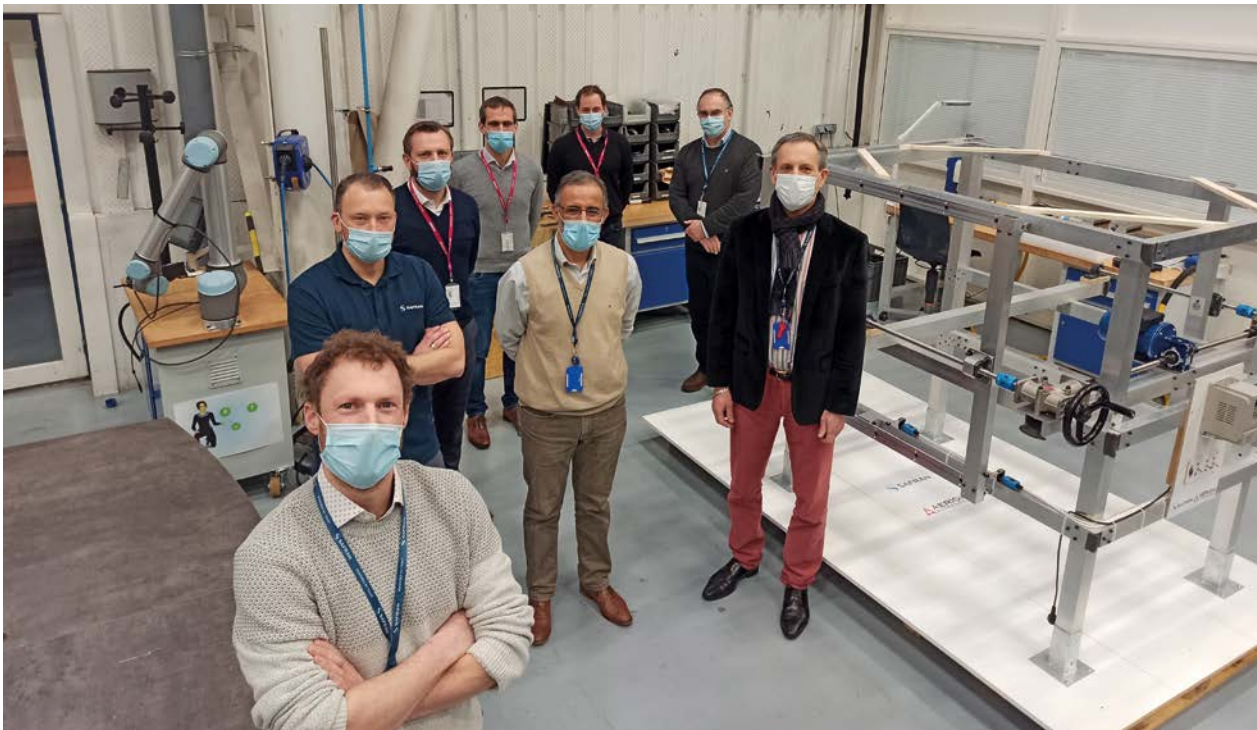
PAPA DIOP

Former entrepreneur now retraining in embedded software, Safran Electronics & Defense

"When my project at the Safran Tech incubator was discontinued at the end of 2020, I was given the chance to return to my previous job as process simulation engineer. But my intrapreneurship experience had given me a taste for change and adventure! So when I heard about the embedded software retraining program from my Careers and Mobility officer and local HR manager, I jumped at the opportunity. After attending the presentation webinar in January 2021, I decided to apply. Today, I've nearly finished retraining and am already part of a team at Safran Electronics & Defense. What's more, I'm making a real contribution to the major project I've been assigned to thanks to my newly acquired skills!" ■

AROUND THE WORLD OF SAFRAN

Introducing people from Safran companies, for a quick look at their career paths, their areas of expertise and their rich and exciting vision of Safran.



Safran Nacelles goes startup!

How can supersonic transport be compatible with the environmental challenge? Safran Nacelles is meeting the challenge by developing disruptive technologies for next-generation business jets.

Among the avenues being explored is an air inlet that can be oriented according to the plane's speed. This is such an innovative concept that it must be tested and proven at the earliest stage possible so as to offer aircraft manufacturers an optimal solution and reduced development time. A big challenge, but one that a team from the engineering department rose to impressively, developing a full-scale prototype electrical actuation system in record time.

The demonstrator was designed and manufactured in under a month and at very low cost, using commercial off-the-shelf (COTS) parts and in-house assembly resources. It's already been used to validate a number of technology choices.

The project team's setup and approach were crucial to this ultra-fast, concrete achievement. They applied the agile methodologies used by startups, which put the emphasis on out-of-the-box thinking and frugal innovation – a winning combination!

“I’ve held this position since 2020. In that time, my teams around the world have shown unfailing commitment and solidarity, ensuring we come through the crisis by maintaining our strong ties with customers and notching up some great new contracts.”



Simon Gavillet

Vice President, Sales and Marketing of the Wheels & Brakes department, Safran Landing Systems

—

“My role is to develop sales of wheels and brakes among aircraft manufacturers and airlines through a differentiating sales strategy and efficient contract management. “I’ve held this position since 2020. In that time, my teams around the world have shown unfailing commitment and solidarity, ensuring we come through the crisis by maintaining our strong ties with customers and notching up some great new contracts, notably on the Boeing 777X for Singapore Airlines. In addition, the crisis has accelerated our digital transformation, reflected in improved performance. Innovations include a new customer relationship management, or CRM, tool introduced across Safran, together with a robot to automate certain billing tasks.” ■

Stéphanie Caers

Facility Manager, London (Canada),
Safran Electrical Components

“I started out in London in 1990 as head of Operations. I’m now Facility Manager, having held a variety of positions. We’re recognized as a flexible provider of complete services for the transportation of fluids and electrical components. Over the years, I’ve built close relations with my teams, our customers, and our suppliers, which has helped grow the business. I believe the success of the company is intrinsically linked to job satisfaction. So I always aim to provide a caring workplace that people are happy to come to every day. Our focus at the moment is dealing with the ongoing pandemic while also safeguarding the future of our company and its people.” ■

“I believe the success of the company is intrinsically linked to job satisfaction. So I always aim to provide a caring workplace that people are happy to come to every day.”

Pauline Hallouin

Head of Quality for Competency Centers,
Safran Helicopter Engines

“After ten years as a design office engineer, I moved to Quality and have since been made head of the department. Basically, I wanted to see first-hand what impact my work had. Another reason for wanting to work in Quality is that it entails more comprehensive, diversified jobs: each new problem is different, involving discussions with people across a broad spectrum of fields, both within the company and at suppliers. I believe you should go where your interests lie and always be open to new opportunities that allow you to expand your career plans, even if it means moving into a different sector. People shouldn’t be afraid to change jobs!” ■

“People shouldn’t be afraid to change jobs. You should go where your interests lie and always be open to new opportunities.”



LOW CARBON: EMPLOYEE-DRIVEN CHANGE

Safran has revised the goals of its low carbon project and set a more ambitious target of a 30% reduction in CO₂ emissions by 2025, versus 2018. As well as developing low-carbon products, this also implies reducing the carbon footprint of all our activities. Here are some of the initiatives underway.



CYRIL ELMOUSTAINE

Operations Manager, Gennevilliers (France),
Safran Aircraft Engines

“At the end of 2020, we had to replace the cooling units that produce ice water for specific machines and workshops; these units had been in service since 1980 and had become obsolete. We came up with the idea of designing a system to reuse the

heat generated by the cooling units. As they cool the water, the new, more efficient units generate residual heat which can reach up to 80°C, so we connected them to the facility’s central heating system. As a result, we’ve been able to reuse 2,500 MW since December 2020, cutting CO₂ emissions by 540 metric tons. What’s more, our annual heating gas consumption has been cut about 10%, already generating savings of €15,000 in just a few months! This solution, which combines emission reductions with energy savings, can be deployed anywhere that requires permanent cooling, whether at a foundry or another industrial facility.” ■

PIERRE-SAMUEL GALL

Low carbon project leader, Colombes (France),
Safran Transmission Systems

“Safran Transmission Systems launched the Green Makers Challenge at its sites in France and Poland in October-November 2020. It was a stimulating initiative and, like a lot of my co-workers, I submitted ideas. In total, more than 150 ideas for reducing our carbon footprint were gathered from staff. The best ideas chosen by the selection committee included initiatives to decarbonize our production facilities, reduce our electricity consumption, curb suppliers’ transport-related CO₂ emissions, and improve the performance of our buildings. Other ideas aim to encourage staff to opt for green transport modes in their daily commutes and adopting more eco-friendly practices. All of these initiatives have been integrated into the main “Reduce our carbon footprint” project launched in 2021, which I’m now in charge of.” ■





BRYAN TAYLOR

HSE manager, Gloucester (UK),
Safran Landing Systems

“I’ve been developing initiatives to reduce our facility’s carbon footprint since I began working here as HSE manager in 2018. I oversee efforts and ensure that our facilities comply with HSE policy. One of our top priorities is producing renewable energy onsite. We’ve installed solar panels, an electric power generator that runs on biofuel and an energy storage system. An audit carried out in the first quarter of 2021 showed that these solutions have cut our CO₂ emissions from gas and electricity consumption by 42% in just three years! What’s more, we achieved energy self-sufficiency for eight hours over a five-day test period, the equivalent of one day of activity. This is really promising and shows the way forward to reduce carbon emissions at all Safran sites in the United Kingdom.” ■



LOW CARBON AND CLIMATE CHANGE: TAKE THE MOOC!

To find out about the environmental initiatives pursued across the Group and learn how you can reduce your own carbon footprint in your everyday work, take the Low Carbon and Climate Change MOOC on Safran’s 360Learning platform.

RAPHAËL RENOUVIN

Low carbon and climate change project leader, Casablanca (Morocco),
Safran Nacelles

“We get a lot of sunshine here in Casablanca, so harnessing solar power was an obvious solution to reduce CO₂ emissions by Safran Nacelles. Our aim is to cut emissions by 1,750 metric tons a year, which amounts to 20% of the company’s overall target. As part of the project, photovoltaic roofing panels will be installed on a building currently under construction and over parking lots by the end of 2021. With an installed capacity of 1.3 MW, this will be the largest solar plant deployed anywhere in the Group. It will cover 15% to 20% of the site’s annual energy needs, which also means lower bills.” ■



DIGITALIZATION

**ÉMILIE
DELACOURTE****Central Chief Information Officer**

Émilie Delacourte was named Central Chief Information Officer on March 1, 2021, a position reflecting one of the main challenges facing our Group, namely building an effective IT and digital strategy.

**Could you briefly describe the new organization?**

Émilie Delacourte: The Digital Transformation and Information Systems department is built on three pillars: our teams in charge of the digital transformation, Safran Analytics staff and the Central Information Systems department. It's tasked with quickly rolling out an agile, consistent and unified digital architecture for the Group in four strategic 4.0 areas: engineering, manufacturing, services and workplace... not to mention data 4.0, which cuts across all four.

How can Safran's digital transformation improve our operational excellence?

E.D.: First, by using collaborative communications and other tools, which make information sharing faster and smoother. For instance, several teams can now work on a project at the same time, based on the same facts. But the digital transformation actually encompasses a much vaster scale. The development of advanced analytical tools, and even artificial intelligence, will have a major impact on manufacturing, the supply chain and quality. For example, Safran is developing data processing tools enabling the instantaneous detection of defects by imagery. Furthermore, since the digital transformation will improve quality, costs and on-time delivery, it will also benefit our customers. At the same time, using a Group-wide model, we're developing

tools for our support teams to simplify and accelerate customer services, including data exchanges.

What lies ahead for information systems - will change be evolutionary or revolutionary?

E.D.: A little bit of both... We can't just wipe out our current architectures, like our ERP systems. But there will be a real break in the solutions developed to connect all these systems and to fully unleash the performance potential of our systems and their data.

The integration of digital technology also makes us more dependent. Isn't the cybersecurity risk too great?

E.D.: Cybersecurity is an absolute priority. Back in March we launched a cybersecurity plan for Group infrastructures, with two main objectives: attenuate the risks of system paralysis and guarantee data protection.

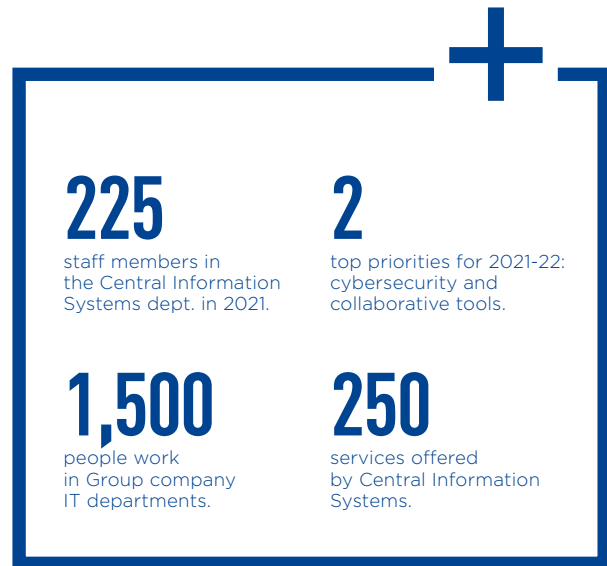
“The digital transformation is vast: the development of advanced analytical tools, and even artificial intelligence, will have a major impact on manufacturing, the supply chain and quality.”

You've held a number of positions in Safran companies since 1999. How would you summarize your wide-ranging experience?

E.D.: Although I originally graduated with a general engineering degree from Mines de Paris, I've always worked in IT. In fact, it's that constant role that made my experiences so diverse! I've worked in many different sectors and dealt with problems of all kinds, shifting between management, project management, special assignments, etc., I've developed a dual macro/micro vision of our Group. Furthermore, and this is critical, I've always been able to strike a good work-life balance, and I've always had the feeling that management listened to me, especially when I wanted to make a significant career move. It's worth reiterating that Safran only judges people according to the excellence of their work. And this is of course a rule I apply myself: my team reflects gender equality, but above all it comprises very talented people!

So you're familiar not only with the Group's digital challenges, but also those facing several companies. What major deadlines has the Central Information Systems department set?

E.D.: Based on the policy defined by the Executive Committee for our department, our next steps for this year and the first half of next year are implementing the cybersecurity plan and rolling out collaborative tools based on Office 365. At the same time, we're supporting some longer-term projects: HR management systems, customer relationship management (CRM) systems, and three SAP projects for Safran Cabin, Safran Aircraft Engines and Safran Electronics & Defense. Last but not least, we'll be helping our counterparts at Group companies meet the objectives in their own 2021 roadmaps. ■



SAFRAN TECH

SABRINA AYAT

**Electrical machinery research engineer,
Safran Tech**

Working in the Electrical and Electronic Systems Research Group at Safran Tech, Sabrina Ayat designs tests and integrates key technologies for tomorrow's aircraft. We joined her for a typically busy day.

My doctoral student is at the office today, giving us a chance to review his progress. He studies electromagnetism, while I'm working on thermal aspects. These two disciplines are interdependent, of course: we keep each other up to date so I can guide his research.

My day starts with numerical modeling, studying the performance and cooling of an electrical machine and conducting sensitivity studies. This type of work is generally part of a funded project with several partners.

8:30 am



10:00 am



I'm testing the cooling system in our lab so I can check my computer models and learn whether the system will be effective.



11:00 am



2:00 pm



FACTS & FIGURES

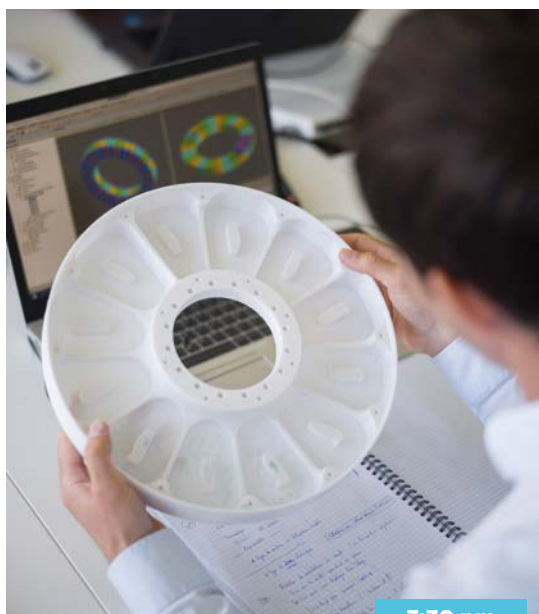
2035: when the electrical machines now under study will be incorporated in aircraft.

<100 K (-173°C): the operating temperature of superconducting materials.

One of the most important parts of my job is filing for patents, a process that protects our intellectual property and also spotlights our ability to innovate.



5:00 pm



3:30 pm

Above, I conduct technology intelligence to track trends and keep a step ahead of our competitors. This includes reading patents and scientific papers, as well as identifying promising startups in our fields.

Left: A team meeting, during which we review progress on our innovative projects.

SAFRAN DATA SYSTEMS, AN INSTRUMENTAL ROLE IN AIR & SPACE

Specialized in flight test instrumentation and telemetry, Safran Data Systems applies its expertise to high value-added niche markets. The company is consolidating its leadership by leveraging its ability to innovate and anticipate in these fast-moving markets.

Part of Safran Electronics & Defense, Safran Data Systems operates in very different markets from the Group's other businesses. Now 700 people strong, it traces its roots to the telemetry and instrumentation markets – in other words, acquiring data on a moving vehicle and transmitting it to a ground station.

LEADERSHIP GROUNDED IN EXPERTISE

The associated technologies are traditionally called on to acquire and store data during test flights of fixed and rotary-wing aircraft, missiles and

drones, as well the latest flying taxis and other new mobility modes. In fact, Safran Data Systems addresses an entire market segment dedicated to the testing of moving vehicles in the broad sense of the term, for both civil and military applications. Another core business segment is the production of ground stations for satellite data transmission and reception. The company provides a complete slate of design and production services for products including antennas, modems and high-speed receivers.

This focus on niche markets is a defining characteristic of Safran Data

Systems. As CEO Jean-Marie Bétermier explains, “The company’s footprint stops when a plane starts to fly; we’re only involved in test programs, not production. That means we’re not dependent on aircraft sales volumes, so we’ve been less affected by the current crisis. However, we operate in limited markets, which demand constant performance improvements. The solution is to invest heavily and continuously, so we can meet increasingly demanding expectations. Our quality has to be flawless, since we operate in small markets where word of mouth really resonates.”

The “fab” team meets at its Arcachon facility in southwest France.



“Our products are designed to be bought by as many customers as possible. What allows us to stand out, fortunately, is that every aviation or space program potentially needs us.”

JEAN-MARIE BÉTERMIER,
Chief Executive Officer of Safran Data Systems

CANDIDATES WANTED!

Safran Data Systems has very ambitious recruitment goals for 2021, with more than 100 job openings in project management and support functions. If you're tempted by these exciting jobs with a future, go to e-talent to apply.

Two Safran Data System technicians mount the horn on an antenna used for flight testing.



FROM NASA TO ROCKET LAB

Because of the limited size of its markets, Safran Data Systems applies a clear and focused sales strategy: sell standard products and solutions to everybody, anywhere. "We don't sell projects, but rather products that are designed to be bought by as many customers as possible," notes Jean-Marie Bétermier. "What allows us to stand out, fortunately, is that every aviation or space program potentially needs us. And we work with aerospace customers worldwide, including space agencies and launcher manufacturers, as well as aircraft and engine-makers and aeronautical test centers. Safran Data Systems' client roster includes majors such as Airbus, Boeing, ESA, NASA and ArianeGroup, as well as new players such as Rocket Lab, Virgin Orbit and Relativity.

The company is capitalizing on its agility, and above all on a major innovation effort, with some 15% of annual sales being reinvested in R&D. Furthermore, its talented R&D teams, capable of quickly bringing products to market, work closely with an extensive sales & marketing force, enabling Safran Data Systems to keep its fingers on the pulse of a changing market.

SPACE GOES WILD WEST

The company's staff invests a lot of time and energy in tracking market intelligence. For example, Safran Data Systems' ground systems business is capitalizing on the emergence of new players, with more than one hundred entities today that say they want to build their own launch vehicles, most privately funded.

"The space market has turned into a sort of Wild West," explains Bétermier, "and everybody wants to span the sky with huge satellite constellations such as Starlink from SpaceX or Kuiper from Amazon. All these projects will lead to a huge number of new orbiting objects which have to communicate with the ground, thus creating new opportunities for our business."

In the telemetry segment, the trend towards decarbonized aviation should also generate new growth opportunities as innovative new concepts emerge, requiring even more testing. In short, a challenging, but very promising future lies ahead for Safran Data Systems. ■



ONE BUSINESS



A NEW SALVO OF RAFALE EXPORT SALES

Rafale export sales have taken off again this year, starting in January when Greece placed an order for 18 of these Dassault Aviation fighters, making it the first export customer in Europe. In early May, Egypt announced the acquisition of 30 additional aircraft. Egypt was the first export customer, ordering 24 Rafales in 2015. Then in late May, Croatia announced an order for 12 Rafales. A total of 156 Rafales have been sold in export markets to date, more than the number deployed by French armed forces. And in late April, Safran Aircraft Engines celebrated the delivery of the 600th M88 engine for the Rafale.

HELICOPTERS GO GREEN

On June 7 in Munich, an ADAC Luftrettung Airbus H145 helicopter flew for the first time using sustainable aviation fuel (SAF). The twin Arriel 2E engines from Safran Helicopter Engines used a biofuel from TotalEnergies, made from used cooking oil. This was a milestone on the road to decarbonized helicopter flight. ADAC Luftrettung and Safran Helicopter Engines kicked off operational tests this summer, with the goal of gradually increasing the proportion of SAF used by helicopter engines to 100%.

SAFRAN THE BIG WINNER IN CRYSTAL CABIN AWARDS

The Crystal Cabin Awards ceremony was held virtually in the spring of 2021. Usually held during the Aircraft Interiors trade show in Hamburg, these are the only international awards dedicated to aircraft cabins. The big winners were Safran Cabin, with its Sophy connected trolley in the

Cabin Systems category, Safran Passenger Innovations, with the RAVE screen in the In-Flight Entertainment and Connectivity category, and Safran Seats, with its Modulair' concept in the Passenger Comfort Hardware category.

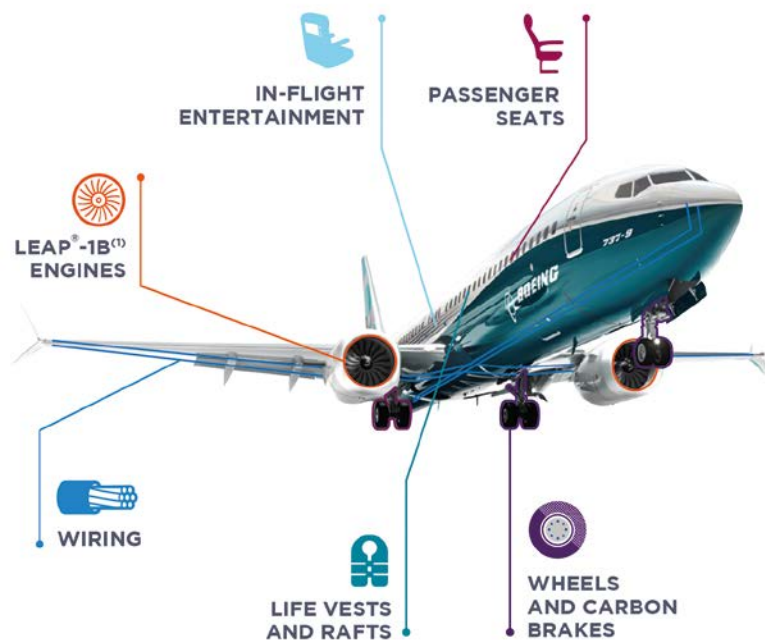
60,000+ SEATS FOR EMIRATES' A380 FLEET

Safran Seats teams in Gainesville, Texas and Issoudoun, France have celebrated the delivery of the last seats for an Emirates Airlines Airbus A380. Since Emirates started taking delivery of the superjumbo-jet in 2008, Safran has delivered 53,248 economy class seats and 9,078 business class seats for the Dubai-based carrier's flagship.

A NEW START FOR THE 737 MAX

After two difficult years, the 737 MAX is back! Boeing restarted deliveries in 2021, more than half of the airplanes grounded since March 2019 have now resumed revenue service and new orders have been recorded. All of this is excellent news for Safran, Boeing's long-standing partner on the 737 family.

Safran's contributions to the 737 MAX. For the complete list, go to the "Safran Onboard" section on Insite.



November 2020: 18 months after the 737 MAX was grounded following accidents to Lion Air and Ethiopian Airlines planes, partners in this major program finally began to see the light at the end of the tunnel. Based on software updates and changes in pilot training procedures, the Federal Aviation Administration (FAA) of the United States removed flight restrictions on the MAX. This first mark of confidence from the American aviation authority was followed by approvals from counterparts in Brazil, Canada and Europe. Boeing could start delivering the 451 airplanes it had stored, and some 387 airplanes parked by operators worldwide could gradually resume service.

GE Aviation and Safran Aircraft Engines, partners in engine supplier CFM International, had already been working for months to prepare for the return to service of the LEAP-1B, exclusive powerplant of the 737 MAX.

OTHER SYSTEMS AND EQUIPMENT



© Boeing

⁽¹⁾ LEAP[®] is the successor to the CFM56[®] engine from CFM International, the 50/50 joint company between Safran Aircraft Engines and GE.

⁽²⁾ Through FADEC Alliance, the 50/50 joint venture between FADEC International and GE.



Wiring, passenger seats, wheels and carbon brakes, cockpit control panels, low-pressure compressor, oxygen distribution systems, galleys... No fewer than ten Safran companies supply equipment for the Boeing 737 MAX.

Throughout the time the plane was grounded, CFM's customer support staff teamed up with airlines to apply engine safeguard procedures, thus facilitating resumption of operations.

737: MORE THAN HALF OF LEAP ORDERS

"CFM teams had three main objectives," points out Raphael Cohana, LEAP-1B program manager at Safran Aircraft Engines. "Work with Boeing to deliver the stored aircraft, aid airlines as they returned the planes to service, and provide seamless support. All of our actions helped restore the 737 MAX's credibility, not to mention that the credibility of Boeing, CFM and Safran was also at stake." The return to service of this iconic twinjet is of course a top priority for Safran, Boeing's partner on the 737 for 40 years. The sales success of succeeding generations of the 737, first powered by the CFM56, now by the LEAP, underpins the success of the

CFM partnership and therefore of Safran's aircraft propulsion business. Today, out of some 15,000 orders for LEAP engines, more than half are for the 1B version.

SOUTHWEST REITERATES TRUST

The first carriers to return the MAX to commercial service were GOL Linhas Aereas and American Airlines, in December 2020. However this momentum was halted for a few weeks in March-April 2021 after a potential electrical problem was discovered on the aircraft. But now nothing seems to be able to stop the MAX: in May, Southwest Airlines, a legacy partner of CFM, expressed its trust by placing an order with Boeing for 100 more aircraft. Another major CFM/737 operator, Ryanair, finally took delivery of its first 737 MAX models in mid-June. By mid-June, the MAX had passed the mark of 100,000 flight-hours since returning to service.

LEAP-1B: ALL SYSTEMS GO!

"Everybody is very satisfied with the MAX's return to service," notes Jean-Paul Alary, CEO of Safran Aircraft Engines. "More than 250 of these planes are now flying regularly, to the great satisfaction of all passengers. The LEAP-1B is performing as expected, and our teams are doing a remarkable job to make sure that the return to service is successful." ■

SAFRAN'S WEIGHTY AMBITIONS IN THE AIR CARGO MARKET

With the opening of a brand new plant in Bangkok in early 2021, the Safran Cabin Cargo & Catering division confirms its ambition of becoming a major player in the fast-growing, innovation-centered air cargo market.

“Covid-19 was a severe blow for passenger air traffic, but the impact on cargo was much more limited,” notes Pascal Piveteau, Safran Cabin Executive Vice President, Cargo & Catering division. He’s describing the market situation for a business segment recently added by Safran, the design and manufacture of cargo containers and pallets. This is already a key activity, as shown by the recent opening of a new plant in Bangkok, Thailand, in January 2021. “Bangkok is one of our two legacy production centers in Asia, along with Lamphun (northern Thailand), which makes trolleys and inserts for in-flight catering,” explains Klaus Hofmann, Vice President and

General Manager of the Cargo & Catering division. “Until now, we had three separate facilities, including a warehouse, which were all becoming obsolete. By grouping our operations under a single roof, we reduced production cycles and simplified our supply chain. In addition, the new building allowed us to considerably improve environmental protection and occupational health and safety.”

DIVERSE DEMAND

The whole project came together very quickly. It got a green light in April 2020, and the plant was up and running by December. The new plant is designed to address the diverse needs

of the division’s clientele, including airlines, integrators (air freight companies) and pooling companies looking for solutions to maximize cargo capacity on the lower deck (passenger flights) or the main deck (cargo flights). Safran Cabin is already a world leading supplier for passenger cabins, while it only entered the latter segment five years ago, but has already chalked up some impressive wins. “Our customers’ top priorities are on-time delivery, durability, and ease of assembly and maintenance,” explains Jasper Van Gelder, the division’s Sales Manager. “Our Netherlands-based engineering department develops a constant stream of new products, such as foldable



“The pandemic grounded a number of passenger flights, but it also spurred a boom in online sales, and consequently in air freight business.”

PASCAL PIVETEAU,
Executive Vice President,
Cargo & Catering division, Safran Cabin

Cargo pallet. The newly improved design of the pallet angles facilitates maintenance, repair and strength.



SAFRAN CABIN IN BANGKOK

Before: 3 facilities (incl. 1 warehouse), 15,000 square meters.

After: 1 facility, 11,400 square meters (2021), 9,850 square meters (2022). Production capacity up 33%, more eco-efficient shipping & receiving, to save 325 metric tons/year of CO₂.

New Safran Cabin production site in Bangkok, dedicated to the production of pallets and containers.



containers to make return trips more cost-effective. We also address specific requirements, such as the fire-resistant container technology we developed in 2020 that lets us safely carry lithium-ion batteries. We're also working on passive refrigeration solutions to maintain low temperatures inside the containers, which may stay grounded for long periods, and we've noticed growing interest in integrated tracking technologies."

LOOKING FORWARD

Although a world leader in this highly competitive market, Safran is striving to accelerate its development. Pascal Piveteau explains how this growth will depend on diversification: "A lot of airlines would like to have flexible cabin layouts, allowing them to adjust passenger/cargo capacity as needed.

However, this raises several issues, both technical (weight distribution is critical on airplanes) and operational: flexibility is only an advantage if you can change the layout quickly, without grounding planes for too long. At the same time, we've seen another underlying trend: with the drop in passenger traffic, the cargo business on passenger flights has decreased as well, and planes are flying less often. Our arrival in the dedicated air cargo sector five years ago allowed us to capitalize on this unexpected situation. While the pandemic grounded a number of passenger flights, it also spurred a boom in online sales, and consequently in air freight business."

Safran Cabin has already taken advantage of this trend, signing several new contracts in 2020-2021. "The context is rather favorable," says Pascal Piveteau.

"Furthermore, thanks to our engineering department's responsiveness and innovative solutions, coupled with our production versatility, we can address our customers' needs and anticipate their evolving requirements. It's a constant challenge, but we're up to the task." ■

A SEAT WITH A LONG-RANGE VIEW

At the 2019 Paris Air Show, Airbus announced the launch of the A321 XLR – the extra long-range version of its iconic single-aisle twinjet. This extension of the traditional single-aisle market was an excellent opportunity for Safran Seats, and Airbus chose the company's Vue ("View") business class seats, purpose-designed for long-range single-aisle jets.



A business class cabin with Vue seats, largely on a par with widebody business class cabin standards.



CHALLENGE SAPIENS: A RICH SOURCE OF INNOVATION

The aim of Safran Seats' Challenge Sapiens is for staff to propose an innovative solution on a given topic. The competing teams come from different job fields – engineering, design, R&D, engineering, sales & marketing – and are often international. In addition to the winner of the 2019 contest, which led to the new Vue seat, two concepts from the 2018 Challenge were showcased at the AIX Hamburg interiors show, and subsequently sold to airlines.

While the Airbus A321 XLR isn't the first long-range single-aisle jet, this new version is reenergizing a market that reached its previous apogee with the Boeing 757, out of production since 2005. The A321 XLR offers an optimized tradeoff between range and passenger capacity, a winning equation that has spurred airlines to place over 450 orders already. In particular, these long-range single-aisles enable airlines to test new destinations and open "longer, thinner" routes.

According to Jean-Christophe Gaudeau, Executive Vice President for Marketing at Safran Seats, "With the emergence of these new airplanes, passengers want the same comfort as on a wide-body jet. The seats available today can't fulfill this need because of their size and/or weight, which means a new generation of seats had to be developed – and that's where Safran Seats came in!"

IN-HOUSE CONTEST WINNER!

In 2018, Safran Seats kicked off an annual in-house innovation contest, dubbed Challenge Sapiens, inspired by methods in the auto industry. The challenge for 2019 was to work on a type of seat dedicated to long-range single-aisle jets. Teams had to offer seat concepts featuring a lie-flat bed and direct access to the aisle, while meeting seating density objectives. They had to come up with innovative solutions in terms of layout, comfort and the passenger experience. About fifty projects were submitted, and the four finalists proceeded to the construction of wood mockups.

"Vue won the 2019 contest because of its unrivaled passenger experience," explains Quentin Munier, Executive Vice President, Strategy and Innovation at Safran Seats. "It ensures the same experience for each passenger, facing the window and back to the aisle, the ideal combination of space and privacy."

THE ABCs OF VUE

The Vue seat is based on ABC, a modular seat platform that shares its armrest and tray mechanisms with other first and business class seats, like Versa and Unity. Offering unprecedented comfort, this seat can also incorporate options such as a door or headset-free in-flight entertainment to enhance passengers' freedom of movement.

Since the Challenge Sapiens winner was announced in 2019, development teams have worked without letup to mature the project. The announced specs won over aircraft manufacturers, and a European airline acknowledged the seat as the lightest in its class. All of these efforts culminated in 2021 with signatures of the first two contracts: one for the A321 XLR and the another for a long-range version of the Boeing 737 MAX.

This success clearly reflects the productive innovation initiative at Safran Seats, coupled with a good understanding of the market and the advantages of the company's industrial transformation. The first Vue seats should hit the market by 2023. ■

NARANG REFUELING POD FOR THE RAFALE

The Rafale upgraded to the F3-R standard entered service in March 2021, fitted with Narang in-flight refueling pods from Safran Aerosystems. Here's a closer look at this dedicated system.



Above: A Rafale in “tanker” configuration with the Narang refueling pod.

Left: At the Roche-le-Molière plant in central France, two Safran Aerosystems technicians work on a Narang pod.



MILESTONES

2014: Rafale F3-R standard launched.

2019-2022: Start of deliveries in France and abroad. A new 7-year contract from French defense procurement agency DGA for 16 more pods.

H1 2021: Narang deployed for five months on the Charles-de-Gaulle aircraft carrier.

March 8, 2021: Service entry of Rafale F3-R fighters with Narang pods.

In-flight refueling is a critical strategic capability for today's fighter missions, increasing both responsiveness and operational flexibility. Traditionally provided by large dedicated tanker aircraft, fighters like the Rafale can also provide this capability, thanks to the Narang refueling pod developed by Safran Aerosystems at its Roche-la-Molière and Plaisir facilities in France. Narang (*Nacelle de Ravitaillement en vol de Nouvelle Génération*), French for new-generation in-flight refueling pod, is in fact a modern take on the first-generation systems developed by the company over 30 years ago, for use on the carrier-borne Etendard and Super-Etendard fighters, then on the naval Rafale.

STRATEGIC CHALLENGES

The ability of the Rafale to refuel other aircraft in flight plays a critical role in France's ability to deploy its forces in distant theaters of operation. A Rafale

fitted with this nacelle and extra fuel tanks can refuel other aircraft so they can fly longer missions before having to land back on the carrier.

While the first type of refueling pod allowed the Rafale to deliver fuel at a rate of 530 liters/minute, the new-generation system developed by Safran Aerosystems raises this to 750 to 1,000 liters/minute. The main advantage is of course to decrease the time needed for refueling and the associated vulnerability when the two aircraft are flying only about ten meters from each other.

"The refueling pod is a highly complex system," notes Ludovic Coquille, head of the Narang program at Safran Aerosystems. "Its performance makes it critical during aircraft operations around the aircraft carrier, because of its additional fuel load."

The pod also adds new functions, including built-in tests and troubleshooting aids, to simplify maintenance.

CUSTOMERS IN FRANCE AND ABROAD

The French navy certified the Narang's operability on January 18, 2021, just two months before it entered service on the F3-R standard Rafale. Its first operational deployment was therefore during the Clemenceau mission performed by the Charles-de-Gaulle nuclear aircraft carrier during the first half of 2021.

To date, this pod has logged some 250 hours of operation. Over the last five months, the navy's Onboard Air group has carried out operations in the Eastern Mediterranean, the Persian Gulf and the Indian Ocean, supporting Operation Chammal in the fight against terrorism.

More Narang pods are slated for delivery in 2021 and 2022, not only for the French navy, but also for Rafale export customers. ■

AN A320NEO NACELLE LINE THAT REDEFINES INNOVATION

In May 2021, Safran Nacelles inaugurated a new production line in Le Havre for the aft cowl of its A320neo nacelle. A team effort involving the plant's employees, this ultra-modern line features the best Lean Manufacturing precepts, plus a number of innovations, all geared to operational excellence.

Workstation in the assembly line for the aft core cowl on the nacelle for the LEAP-1A-powered A320neo.



40%

of aft core cowls for A320neo nacelles will be produced on the new line at Le Havre.

X2

Safran Nacelles will double its ACC production capacity in 2022.



Left to right: **Ross McInnes**, Chairman of the Safran Board of Directors, **Olivier Andriès**, Chief Executive Officer of Safran, and **Vincent Caro**, Chief Executive Officer of Safran Nacelles.



SPOTLIGHT ON INNOVATION

A FEW OF THE SOLUTIONS FEATURED ON THE NEW ASSEMBLY LINE

› Tool preparation

To reduce costs induced by duplication of tools, each workstation has a cart that includes all the tools needed for assembly operations, already adjusted and calibrated.

› Varnish primer

Once the aft cowl has been made, a protective coat of varnish is applied to project it when integrating with the thrust reverser.

The aim is to reduce waivers due to scratches or impact damage.

› Optimized drilling

A drilling method called “one way assembly” allows drilling holes with the requisite quality without having to disassemble parts for deburring – resulting in considerable time savings and improved quality.

› Handling assist device

Each of the drills weighs 7 or 8 kg (15-18 lb).

To improve working conditions, these workstations are fitted with a handling assist device that reduces the physical effort needed for drilling and avoids any possible damage due to a handling accident.

“It’s a model for quality, productivity, safety and environmental performance,” proudly states Vincent Caro, CEO of Safran Nacelles. He’s talking about the assembly line for the aft core cowl (ACC) on the nacelle equipping the engines for the Airbus A320neo. This new line at the company’s plant in Gonfreville-l’Orcher, near Le Havre, was inaugurated in May by Vincent Caro, alongside Ross McInnes, Chairman of the Safran Board of Directors, and Olivier Andriès, Chief Executive Officer. The new line covers some 1,200 square meters (12,960 sq ft) and includes 14 workstations. Once assembled, the ACCs are sent to the A320neo thrust reverser assembly line just a few meters away for integration.

60+ INNOVATIONS

The new assembly line addresses a strategic challenge for the company, namely to bring 40% of ACC production back in-house, whereas it had previously been outsourced. This will give Airbus a second supply source, while also ensuring the dependability of the nacelle supply chain. And of course the new line had to meet the airframer’s demanding expectations.

Safran Nacelles therefore allied collective intelligence with technical innovation to come up with the new assembly line, the upshot of close collaboration between operators and production support teams. It features more than 60 innovative solutions designed to shorten production cycles – which have

been cut four-fold! – and improve both quality and workstation ergonomics.

“Our teamwork played a decisive role in meeting the targets for delivery times and competitiveness,” notes Ghislain Fauquet, head of the ACC production engineering drive. “We focused on improving the assembly process itself, but also all associated steps, down to the slightest detail on our workstations. The line also incorporates state-of-the-art technologies in terms of virtual reality modeling, allowing us to hit our cost and quality targets right from the first part made.”

Safran Nacelles plans to make more than 150 aft core cowls this year and then nearly double its production capacity in 2022. ■

FLEX 4.0: RETHINKING OUR FACTORIES

A small, but enthusiastic and determined team at Safran Electronics & Defense has developed the new standard in production lines. It's a subtle blend of harmonization, agility and modularity, all designed to meet the challenging industrial performance targets set by One Safran.

A BIT OF HARMONY IF YOU PLEASE!

The Flex 4.0 project was the response to a widespread observation in industry: for a given product assembly need, each plant tends to propose a different solution, depending on its habits and its culture. According to project owner Stéphane Thiebaut, Flex 4.0 was designed to “harmonize the approach based on the most effective One Safran production and engineering practices, to meet the standards stipulated by Safran’s reference system.”

The multidisciplinary project team brought together a dozen different job fields, from production operators and technicians to change leaders, along with IT and HSE experts, plus One Safran correspondents.

STANDARDIZED... BUT ALSO MODULAR AND SCALABLE

The Flex 4.0 team came up with a standard production line that could be deployed for the assembly and integration of any type of product. Designed to adapt to the specific characteristics of each plant, the line is highly modular. It draws on an array of methodological building blocks that encompass optimized solutions for each aspect of production: workstation ergonomics,

quality, tools, value chain, treatment of non-conformities, etc.

Charlotte Lefebvre, product manager at the Mantes plant, near Paris, is all in favor of this approach, as she explains: “One of the main advantages of Flex 4.0 is that it covers all facets of a production line with ready-to-use solutions, from optimizing flows by reducing displacements to making sure the line gets just the materials needed.” In other words, our plants are free to develop their own standardized line based on the building blocks offered by Flex. 4.0.

But the project’s ingenuity doesn’t stop there: it’s also scalable! You could say that Flex 4.0 is a living, breathing reference system: it’s improved continuously by a dozen authorities (Black Belts, technicians, etc.) tasked with informing the entire network when a promising improvement emerges at their own facility. Stéphane Thiebaut (see next page) is firmly convinced of its advantages: “The success of this project depends as much on the quality of the solutions offered as on the motivation of the people who will be deploying these solutions.”



A UNIVERSAL LINE

Flex 4.0 is designed so that any operator can immediately get up to speed on a production line, thanks to clear, logical and standardized information concerning the workstations: visual performance indicators, no FOD, etc.



A technician at Montluçon working at a potting station on the Flex 4.0-based production line.

SUSTAINED DEPLOYMENT

First tested on critical assembly lines at the Montluçon and Mantes-la-Ville plants, Flex 4.0 has already shown very promising results. In Montluçon, for example, production times have been reduced four-fold and the time needed for manual tasks cut 25%.

Flex 4.0 is now being rolled out at eight Safran Electronics & Defense facilities in France and Morocco, calling on four training sessions for nearly 150 employees. Each site now uses the recommendations and building blocks provided to adapt the reference system to their own One Safran improvement initiatives. Within three years, more than 60 Safran Electronics & Defense

production lines will have been adapted to Flex 4.0 to meet Safran standards. “Yes, it’s an ambitious project,” admits Stéphane Thiebaut, “but it harbors tremendous human and industrial potential!” ■



STÉPHANE THIEBAUT

Master Black Belt and Flex 4.0 project manager at Safran Electronics & Defense

“The strength of One Safran is being able to set a target and achieve operational excellence by using a simple and universal method based on Lean Six Sigma principles. Flex 4.0 shows the way to this target by providing a concrete and scalable structure. It’s based on a catalog of turnkey solutions to develop a line that meets One Safran requirements in order to improve employee performance and wellbeing. We’re very confident in Flex 4.0 being able to achieve the expected results at all facilities and company-wide, in order to accelerate production, really help our customers and better integrate new production employees.”

ARRANO, TOMORROW'S HELICOPTER ENGINE

Safran Helicopter Engines designed the new-generation Arrano turboshaft engine for future-generation single-engine helicopters in the 2 to 3-ton class and twin-engine models in the 4 to 6-ton class, like Airbus Helicopters' new H160. Combining high power and low fuel consumption, the Arrano improves rotorcraft range and payload, meaning it can be used for a wide spectrum of missions. Here's a closer look at its main features.



The accessory gearbox with its fuel control unit also includes an integrated oil reservoir and radiator. Located at the front of the engine, this unit allows easy access for quicker maintenance.

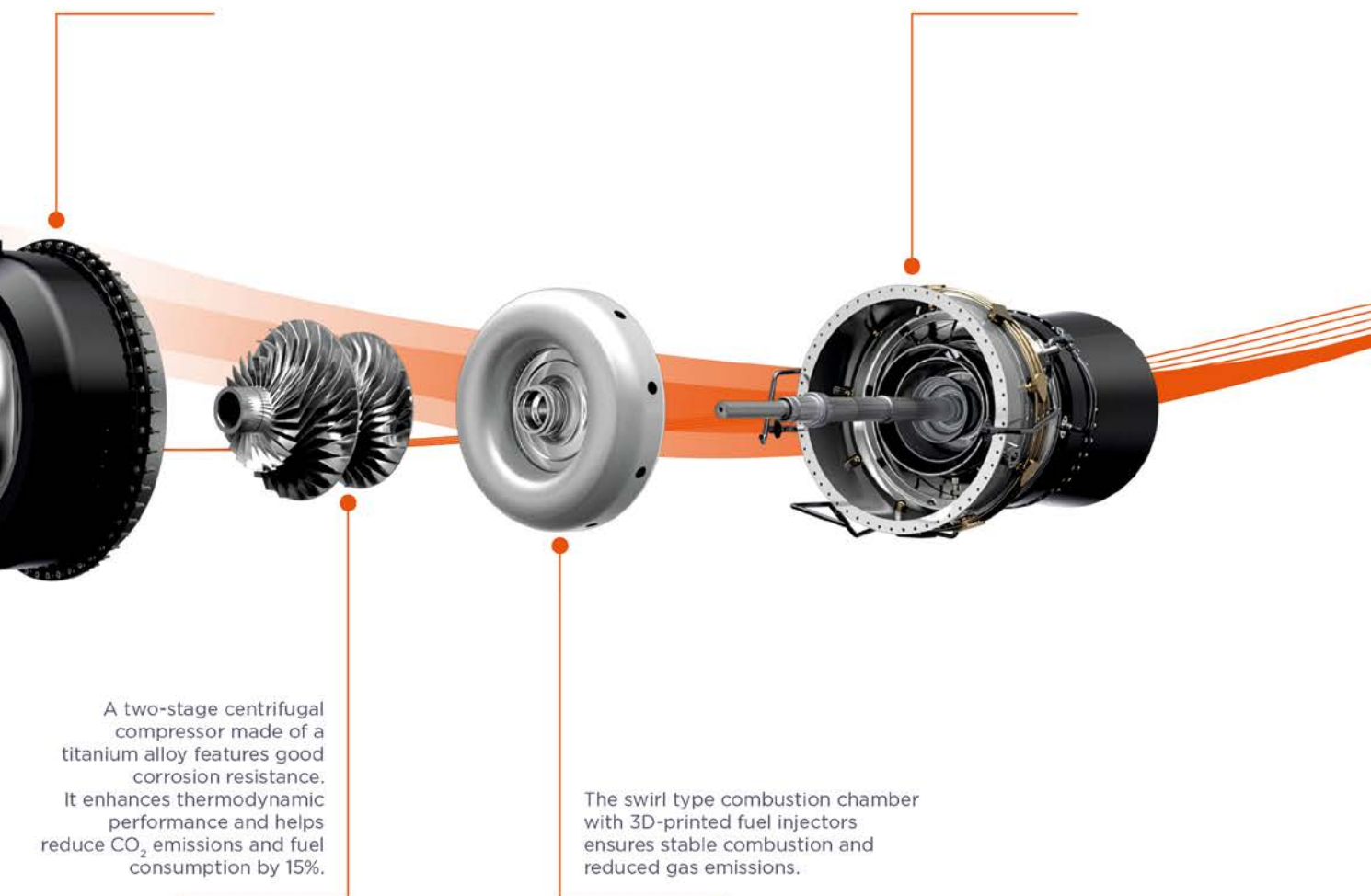
An air inlet optimized for flights in very cold conditions.

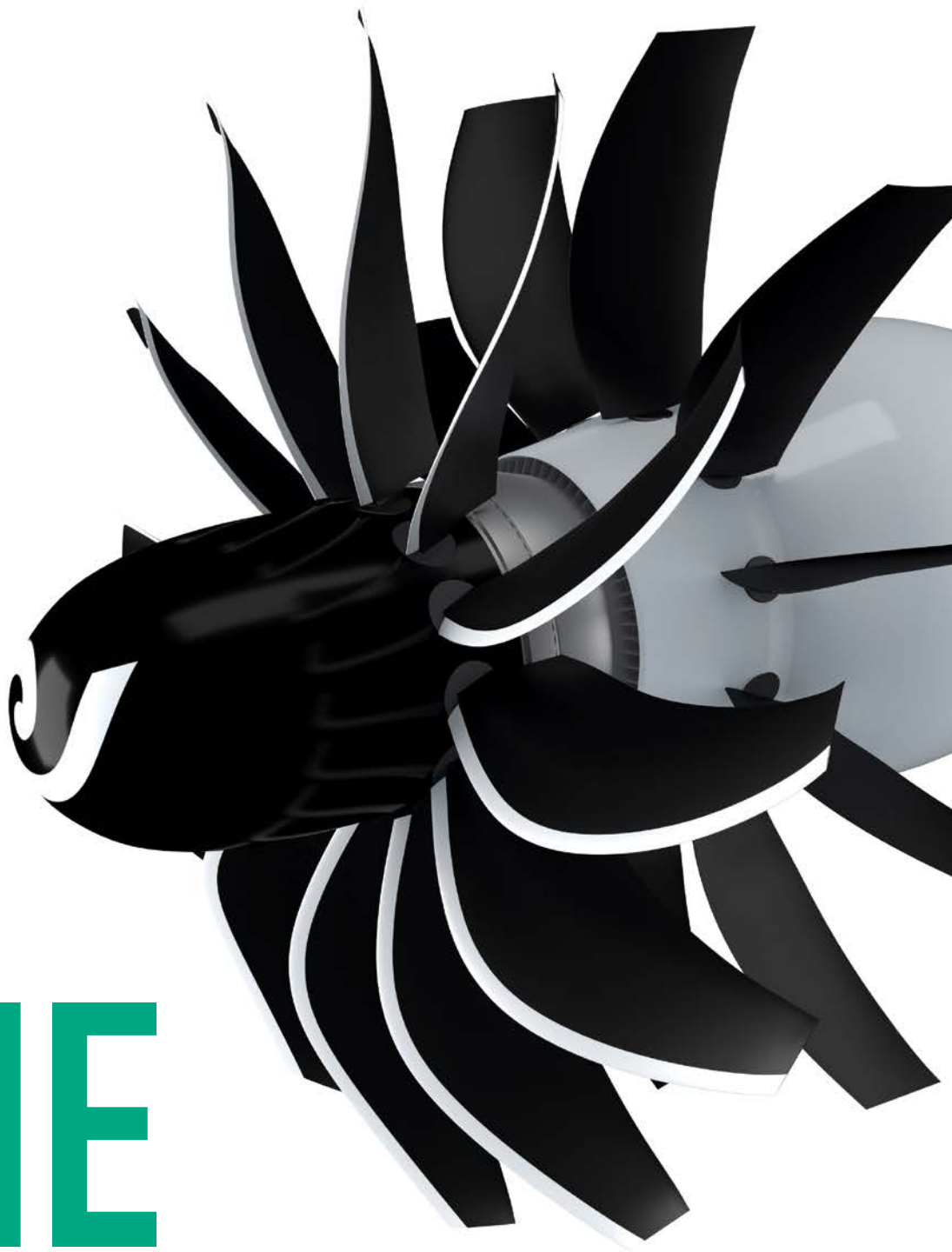
New technologies in a compact package

Arrano marks the first time that Safran Helicopter Engines has used additive manufacturing to make parts subject to high thermal stress. Teams also focused on reducing its environmental footprint, which means that the Arrano can operate on new sustainable aviation fuels (SAF) with no restrictions.

The compressor case is made of a light alloy to reduce engine weight.

The power turbine case, power shaft and exhaust assembly deliver high power with a reduced acoustic signature.





「ONE
FUTURE



RISE: AN AMBITIOUS PROGRAM

At an all-virtual event in June, Safran CEO Olivier Andriès and GE Aviation President & CEO John Slattery announced the launch of an ambitious technology development program called CFM RISE (Revolutionary Innovation for Sustainable Engines). RISE aims to reduce fuel consumption and CO₂ emissions by over 20% compared to current engines. The program will test and mature a range of innovative, disruptive technologies for aircraft engines that could enter service by the mid-2030s. These engines will be based on an unshrouded architecture and will run on fully sustainable fuels. Safran and GE Aviation also signed an agreement to extend their 50/50 partnership in CFM International to 2050.

ENGINEUS™ MOTORS FOR THE EFLYER

Partners since 2020 in the design of an electric propulsion system for the eFlyer 1 and 2, Safran Electrical & Power and Bye Aerospace have extended their cooperation to include the eFlyer 800. This eight-seat all-electric plane in the twin-turboprop class is designed to meet growing demand for higher-performance and more cost-efficient electric regional aircraft. The two companies are working on the complete electric propulsion system: two ENGINEUS™ electric motors, power distribution and a GENEUSGRID™ network protection system.

CERAMIC MATRIX NOZZLES

As part of the DIAPASON R&T project, which will provide planemakers with nozzles made of ceramic composites, the teams at Safran Nacelles, Safran Ceramics and Safran Tech have jointly designed an oxide/oxide ceramic matrix composite (CMC) nozzle

demonstrator. Safran Nacelles and Safran Ceramics have also obtained subsidies from the French civil aviation authority DGAC through 2023. The two companies plan to produce full-scale CMC nozzles and test them on an UltraFan demonstrator.

GREENER CARBON BRAKES

Eight inventors at Safran Ceramics and Safran Landing Systems have filed a patent to improve the performance and environmental impact of carbon brakes. The invention is based on two major improvements: elimination of the large plates supporting the disk stacks and introduction of a forced-flow process. By optimizing gas circulation, furnace capacity rates will be increased and production lead times reduced. The result will be 20% lower energy consumption for a given quantity of brake disks.

MRO: FOCUS ON A FLAGSHIP BUSINESS

Maintenance, repair and overhaul (MRO) is crucial to the business models of Safran companies and must help drive the post-Covid recovery and prepare their longer-term future. We look at the key challenges ahead.

MRO is a vitally important activity for all Safran companies. It provides key information about the in-service performance of the Group's products, while generating a substantial revenue stream and playing a critical role in customer relations.

IN-HOUSE KNOW-HOW

The importance of MRO to Safran's business activities can be measured in both economic and industrial terms. At Safran Landing Systems, for example, 1,400 people work in MRO, which accounted for 14% of revenues and 12% of profit in 2019. Its landing gear MRO services are delivered locally through a network spanning the globe. "We operate as closely as possible to our customers," says Bruno Chiarelli, Executive Vice President of the MRO division at Safran Landing Systems. "We have facilities in Mexico and Florida, serving North and South America, two major European sites in Molsheim and Dinard, France, another in Gloucester, United Kingdom, a legacy MRO station in Singapore and a newly created joint venture with China Eastern Airlines in Xi'an, which covers

Asia. These facilities form a multifaceted network serving all aircraft families and all continents. Due to the complexity of our products, we deploy all the necessary resources, skills and expertise in-house, so we make almost no use of outside providers."

POST-COVID CHALLENGES

Safran Landing Systems' MRO activities, based on preventive maintenance at scheduled intervals, irrespective of circumstances, have enabled the company to better weather the Covid crisis. But for most other Safran companies, workloads were impacted in 2020 and early 2021 by the slowdown in air travel. At Safran Electronics & Defense's workshop in Singapore, created in 2010 through a partnership with Singapore Airlines' engineering division and specializing in the maintenance of avionics equipment, business fell by 40% last year. "We're expecting a gradual recovery in the second half of 2021, which will of course depend on how the crisis plays out in the region," says Matthieu Péré, MRO General Manager for Safran Electronics & Defense Singapore. "While anticipating higher volumes after the

crisis, enabling it to grow its market share, the Singapore station is preparing for future projects, such as insourcing of the repair of new products on the Airbus A350 and Boeing 787 and 777X. The workshop, with its strong culture of innovation and continuous improvement, is focusing on areas such as automation and blockchain technology, in line with Safran's digitalization roadmap. The last key development challenge for the longer term is access to and use of flight data, especially with our Cassiopée services, in accordance with the development of Services 4.0 at Group level. Safran Electronics & Defense has set the standard within the Group for aircraft data management, >



CHINA, A DYNAMIC MARKET

—

Safran is strengthening its presence in the Chinese MRO market through partnerships with local players — a prerequisite for entry. Safran Landing Systems, for example, has become the first OEM in its segment with a maintenance capability in China, through a joint venture with China Eastern Airlines. Safran Aircraft Engines is now present in CFM56/LEAP maintenance through its partnership with Air China in SSAMC, based in Chengdu. And in 2022, Safran Nacelles will open its first China-based maintenance shop in Suzhou, on the Safran industrial campus.

› and especially in Singapore we intend to become a leading center of excellence in this area for the Asia-Pacific.”

LEAP RAMP-UP

Beyond its direct impact on business volumes, the health crisis has led to higher customer expectations: we need to do more, faster and cheaper, while extending the service life of our products. In an increasingly competitive environment, cost and industrial performance are becoming key success factors. This is the case for Safran Aircraft Engines, which handles shop visits for flagship products like the CFM56 and LEAP. With the LEAP, “we’re at the start of the engine’s service life with Quick Turn operations, designed to fix teething issues and minor faults through on-wing or shop interventions,” says Pierre Guillaume, Vice President, Commercial Engines MRO. “But we’re already structured to capture a significant share of the market for future LEAP shop visits and component repairs, while meeting the

challenge of cost control. Digitalization is at the heart of a range of projects to optimize our MRO operations and deliver the best and most appropriate type of service. For example, we only remove and overhaul engines when necessary. More broadly, we’re organizing to keep pace with a significant increase in production volumes. This involves raising the efficiency of our existing workshops and investing in new industrial capacity for the long haul. The challenge of hiring and training new people is equally important, even though this is a business anchored in employee passion and knowledge transfer.”

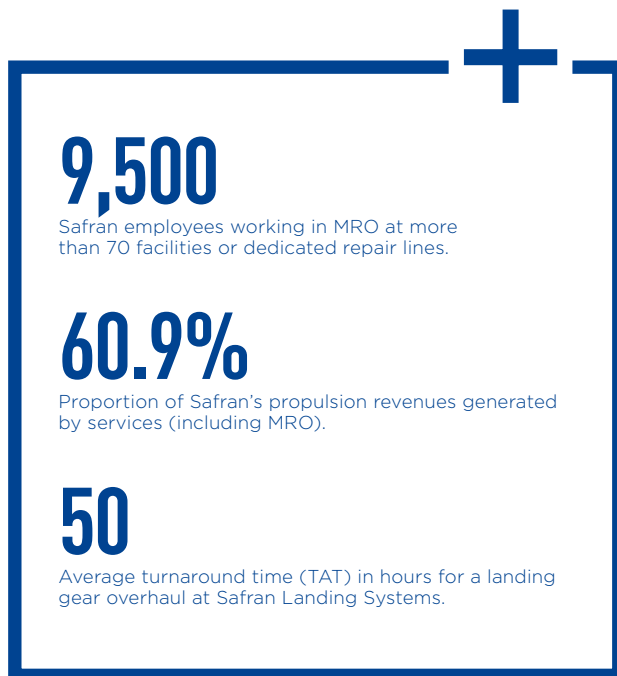
TOWARDS A “ONE MRO” APPROACH

While each Safran company manages its own operations and customers, they face many of the same challenges, especially in the post-Covid world. The first is to harmonize processes, standards and methods across the Group’s MRO divisions — a dynamic

that began with the One Safran initiative and the creation of job field committees in Services and MRO.

“The main post-Covid objective is to drive productivity gains and achieve maximum customer satisfaction. We also want to offer service packages that are more clearly recognizable from one company to another and that convey the ‘Safran Touch’,” says Olivier Savin, Vice President, Digital Transformation, Sales, Support & Services for Safran. “To do this, we need to accelerate the digitalization of our MRO businesses. It’s a key initiative that involves modernizing the basic building blocks of the information systems supporting our operational processes. It also calls for a whole host of innovative new digital solutions, inspired by the world of industry and delivering tangible benefits for our MRO operations. These include automation of diagnostics and greater use of virtual and augmented reality, cobots and robots, as well as more seamless digital continuity. Not to mention smarter use of data to streamline processes, improve operational performance and increase customer satisfaction and differentiation in an extremely competitive marketplace.”

There’s plenty to keep us busy on the MRO front! ■





EPOWER LIFE: SAFRAN ELECTRICAL & POWER'S NEW BRAND

Safran Electrical & Power is expanding its service offering with ePower Life — a brand that brings together all its repair, spare part and service expertise for wiring harnesses, generators, distribution equipment and electric motors.

LANDING LIFE: A NEW BUNDLED SOLUTION FROM SAFRAN LANDING SYSTEMS

The competitiveness of Safran companies in MRO markets also depends on value propositions that meet customer expectations. Safran Landing Systems, for example, is launching Landing Life, which groups a number of previously separate solutions. The result is greater clarity for customers and the possibility of choosing a service package tailored to their exact needs.

ePowerlife™

LandingLife™

SAFRAN ENGINEERING SERVICES DIGITALIZES HARNESS DESIGN

Digital Design, Manufacturing and Services (DDMS) is Airbus's large-scale digital transformation program. One component of DDMS is to eliminate the use of 2D diagrams for the design of wiring harnesses on the Airbus A320. Safran Engineering Services has met this challenge with flying colors, reducing production cycle times and costs while demonstrating its flair for innovation.

SUPPORTING THE DIGITAL TRANSFORMATION

Design, production, services — nothing is outside the scope of Airbus's comprehensive digital transformation and continuity program. With over 20 years' experience in electrical system design, Safran Engineering Services was the right partner to take charge of one aspect of the DDMS project: digitalization of wiring interconnection system diagrams for the A320. According to Yves Bley, Head of Engineering and Innovation at Safran Engineering Services, "We were ideally placed, with our years of knowledge of their tools and processes — from the oldest, used for the A320, to the most recent for the A350 and A380. We have a deep understanding of each aircraft's electrical systems. We're also experts in supporting the digital transformation for our customers."

Airbus launched the A320 program in the 1980s and needed to modernize its tools and processes to meet the latest A350 standards. "Back then, there were no digital models — everything was on paper or in 2D," says Pierre Murcia, project manager for the A320 at Safran Engineering Services. "Each A320 cabin is different. It has its own wiring interconnection system and related design

work. We modeled all the electrical harnesses in the new digital model, then compared it to the actual harnesses manufactured and installed."

A COMPLEX TASK

"It took us a year and a half to model the entire aircraft in 3D, with many iterations between the digital model and the physical model," continues Pierre Murcia. "It would serve as the baseline for all Airbus A320s built. We then adapt each diagram to the specific cabin. The challenge was also

to integrate the new digital tools and processes on the plane without impacting production rates." Over time, the project involved about 100 colleagues in Toulouse, Bangalore and Chihuahua.

But why create 3D diagrams for existing aircraft built from 2D models? "The purpose is to facilitate installation of electrical harnesses on the assembly line," explains Pierre Murcia. "The high quality of the digital model makes it easier to anticipate routing issues and inconsistencies between systems, which



A SINGLE-AISLE XLR FROM AIRBUS

—
Launched at the 2019 Paris Air Show, the Airbus A321 XLR (extra-long range) will be capable of 10-hour flights with 244 passengers. This single-aisle jet will fly long-haul routes that were previously only operated by widebody planes. Since 2019, more than 450 orders have been placed for the XLR, including 37 in 2020.



A team working on the digitalization of harness design at Safran Engineering Services.

can be impossible to detect with 2D diagrams. This allows us to reduce compliance issues, increase productivity and cut production costs and cycle times.”

INNOVATION IS THE WATCHWORD

Aware of the digital transformation needs of its customers, Safran Engineering Services is forging ahead with its research. The company’s teams working on electrical installation diagrams are currently identifying repetitive engineering tasks. It has also formed a partnership with French startup DessIA, which has developed a bot platform making it easier to automate these tasks. “Bots allow engineers to focus on higher value-added tasks,” says Florent Geneste, Director of Operations for France.

The next step? “Transition to automated design,” continues Florent, “and develop a single digital design solution for harness routing.” This will take account of each aircraft’s configuration and requirements, part specifications and modifications to automatically generate the optimal design. ■



VALENTIN SAFIR

President of Safran Engineering Services

“Safran Engineering Services is well known within Safran for all the work we do for Group companies, but our projects for outside customers are less well known, even though they represent half our workload. Airbus is a long-standing customer, and we’re involved in many projects for its Commercial Aircraft and Helicopters divisions, as well as Airbus Defense & Space. As demonstrated by our contribution to electrical installations on the A320, our strength lies in our ability to combine deep operational expertise with innovative solutions and to support our customers in their digital transformations.”

A DEVELOPMENT BOOST FOR TOMORROW'S COMPRESSORS

Safran Aero Boosters has partnered with the Belgian government to create BeCOVER, an aerodynamic testing center for turbomachinery in Liège. Offering technical capabilities unrivaled in Europe, it will test all types of compressors for engines powering new-generation civil and military aircraft.

The Belgian government and the Walloon region are teaming up with Safran Aero Boosters to invest in a very promising project, an exceptional test center for new-generation compressors. Based in Liège, Belgium, this facility will work for both Safran and major prime contractors. It will play an important role in the development of disruptive technologies and help the aviation industry meet its ambitious goals for the reduction of CO₂ emissions. "The long-term viability of our industry depends on the development of new technologies enabling us to meet our environmental objectives – and we're already gearing up to make that possible," says François Lepot, President and Chief Executive Officer of Safran Aero Boosters. "This new test center will considerably accelerate our research and technology drive."

THE ONLY TEST FACILITY OF ITS KIND IN EUROPE

Set to start operation in 2023, this new test facility will be an advanced laboratory for use by Safran, industry, universities and research centers. BeCOVER will span a wide range of low and high-pressure compressor applications. It features exceptional technical capabilities, especially a closed-circuit airstream so that turbomachinery

components can be tested under altitude or ground conditions, plus bypass flow testing, a multispeed gearbox, resistance to temperatures exceeding 600°C and the ability to remotely control tests jointly. Initially applied to aviation, these capabilities could subsequently be called on by other sectors, such as the energy industry. A five-meter test section installed for compressors could easily handle other applications as well.

INNOVATIVE SOLUTIONS TO SUSTAIN COMPETITIVENESS

The BeCOVER test facility will be built by Safran Test Cells, a subsidiary of Safran Aero Boosters that's a leader in the design and construction of test rigs. According to Jérôme Morhet, head of test installations, "This project will call on the latest techniques to optimize our use of resources. We're paying special attention to reducing noise and seamlessly integrating with the environment

"The long-term viability of our industry depends on the development of new technologies. This new test center will considerably accelerate our R&T efforts."

FRANÇOIS LEPOT,
President and Chief Executive Officer
of Safran Aero Boosters

by designing a semi-buried building. Furthermore, this test facility will showcase our abilities for future customers, and it's also a way of publicizing our innovations in test systems."





The only test facility of its kind in Europe, capable of testing disruptive innovations.

Several potential customers have already shown a keen interest in this type of test facility. Already on the agenda are tests of the low-pressure compressor for the RISE engine demonstrator planned by CFM partners Safran Aircraft Engines and GE, and discussions are under way to test a demonstrator of the high-pressure compressor for this program. ■



3 KEY OBJECTIVES

- › **Test compressors with low air inlet pressure** to better simulate conditions in flight.
- › **Provide a test rig adaptable to all engine configurations**, using a layout that handles multiple flowrates.
- › **Cover all current civil and military engine requirements**, thanks to an initial power rating of 20 MW.

DIGITAL METALLURGY, A DIFFERENT ALLOY DESIGN APPROACH

Safran Tech, the Group's Research & Technology Center, has conducted extensive research in recent years to help develop tomorrow's decarbonized and digitized aircraft. Meeting this goal depends on rethinking not only how an airplane works, but also its constituent components and production processes. Here we take a closer look at digital metallurgy, one of the eco-design solutions under consideration.

Today, the metallic alloys used in many Safran products are still developed using the old trial and error method. This entails developing and characterizing as many alloys as necessary, using traditional physical, chemical and mechanical methods, and then determining the best composition. But this method takes a lot of time, because analyzing these compositions is a very complex task, and metallurgists have to go through a number of iterations before coming up with the best solution.

In digital metallurgy, we use digital modeling and visualization tools to predict the operational performance of proposed metallic alloys. It involves the use of a datasheet in conjunction with thermodynamic evaluation tools.

IMPROVING PRODUCT RELIABILITY AND PERFORMANCE

Digital metallurgy is suited to the development of nickel or titanium-based alloys, and offers a host of advantages. For example, assuming we already have models capable of replacing experimental methods, we can estimate certain key properties for a hundred thousand alloys in just a few days - compared to the trial and error method, which would take at least a day for each

alloy. This type of eco-design method for future materials also reduces environmental impact, since it decreases the number of actual physical-chemical tests needed.

“This approach allows us to design-in operating and production requirements for these parts very early in the development process.”

OLIVIER DELCOURT,
Head of the Materials & Processes
research group, Safran Tech

Over the last three years, the digital metallurgy method has allowed Safran to design new alloys faster and more robustly, at less expense and better tailored to Group company requirements. Part of a complete product design cycle, it optimizes the design of new metallic alloys to ensure the development of products offering higher performance and reliability.

RIISING TO THE CHALLENGE

For this method to be effective, our design departments have to work very closely with acknowledged Experts in the field. Together, they examine the defined specifications to determine the key criteria expected of the material. The digital metallurgy method does the rest!

Olivier Delcourt, head of the Materials & Processes research group at Safran Tech, explains: “This approach, along with advanced modeling tools, results in materials offering a better tradeoff between the different stresses affecting operating parts, especially high temperatures and fatigue corrosion. It also allows us to design-in operating and production requirements for these parts very early in the development process.” ■

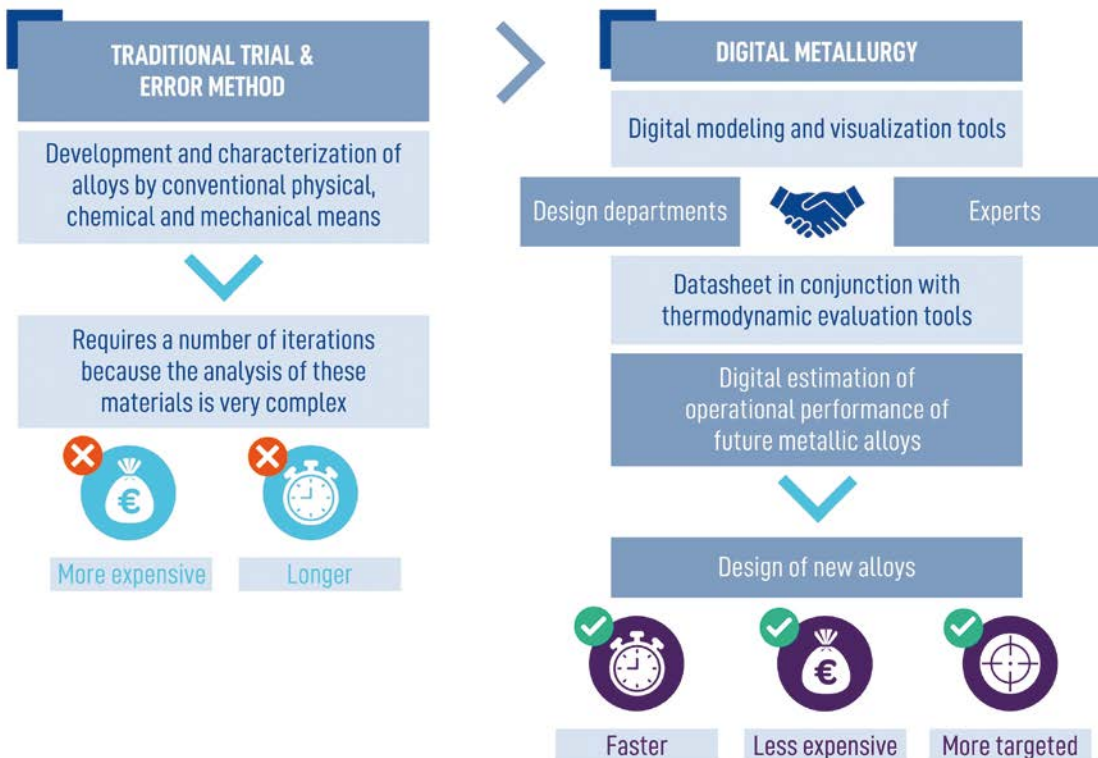


PRODUCT CANDIDATES

There are a number of possible applications, especially for parts made using additive manufacturing. This includes parts in engine hot sections, such as turbine blades and disks, but also landing gear and engine pylons. The engine parts are considered critical, because they are subject to very high temperatures, requiring equally resistant materials.

A number of tests have already been carried out in conjunction with Group companies, including Safran Aircraft Engines and Safran Helicopter Engines. As a result, since 2018, we have already filed for a dozen patents.

MATERIAL ANALYSIS



YOUR MAGAZINE ONE IS CHANGING!

It's going online, with more issues,
more variety and in more languages.
Coming this autumn!

