SAFRAN magazine
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THE SAFRAN GROUP MAGAZINE

SPECIAL REPORT

# TOWARDS GREENER SKIES

## Eco-responsibility is at the heart of Safran's corporate strategy

P. 24 C919 FOCUS: SAFRAN, A PARTNER ON CHINA'S NEW JETLINER / P. 39 SECURITY: ELECTIONS IN ALBANIA

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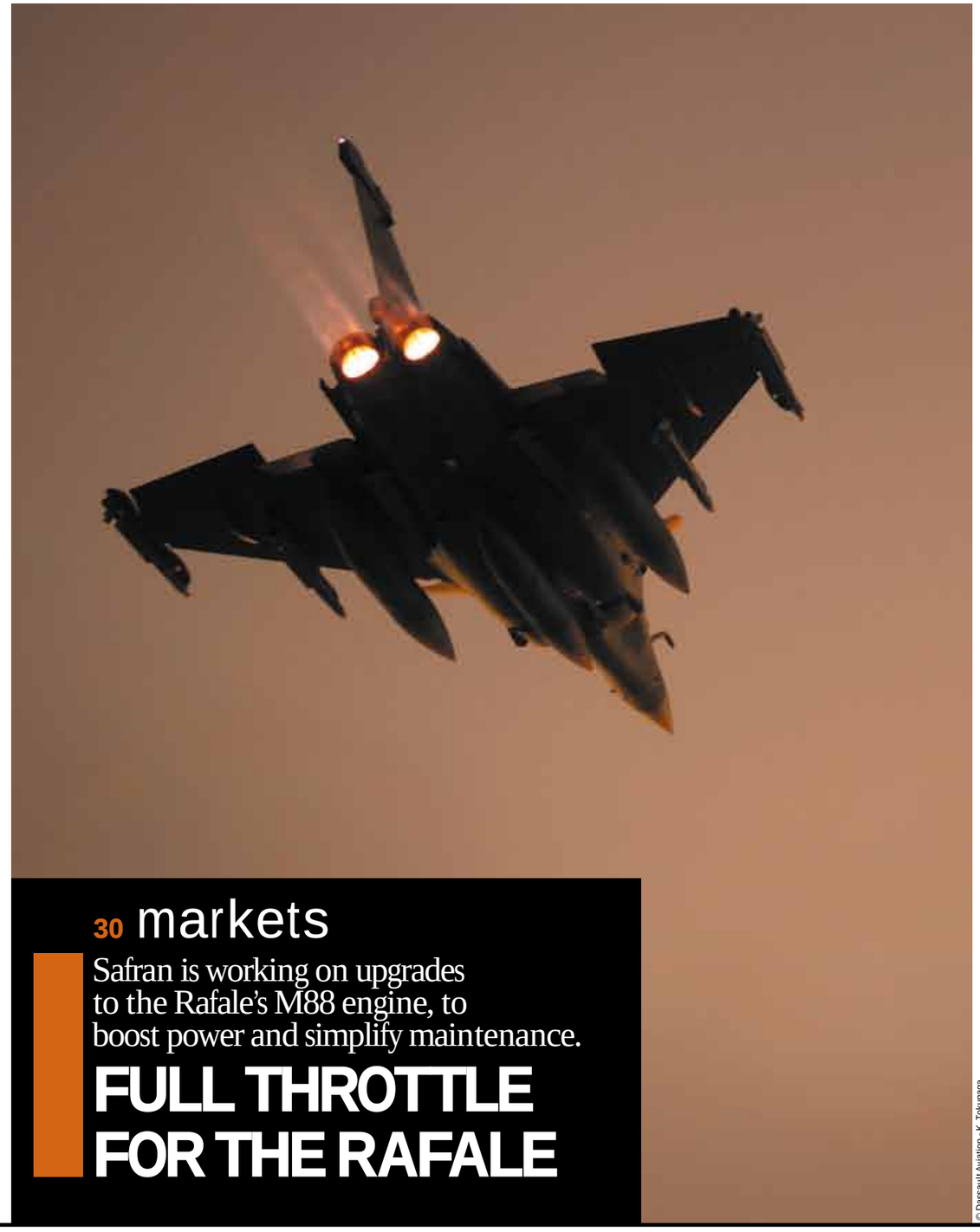

© Dassault Aviation - K. Tokunaga

**30 markets**
Safran is working on upgrades to the Rafale's M88 engine, to boost power and simplify maintenance.
**FULL THROTTLE FOR THE RAFALE**

editorial

# Shaping the future

© Stéphane de Bourgies/Abaca press

JEAN-PAUL HERTEMAN
**CHIEF EXECUTIVE OFFICER, SAFRAN GROUP**

Reflecting our long-term strategy, Safran continues to bolster our security businesses in different markets. We recently acquired 81% of General Electric's Homeland Protection division, making our Group the world leader in imaging systems used to detect dangerous or illicit substances in luggage.

We also recently celebrated the delivery of the 20,000th CFM56 engine, which mainly powers the Boeing 737 and Airbus A320 twinjets. This was a historic milestone, symbolizing the unprecedented success of this landmark turbofan engine. Created 35 years ago, the CFM partnership instigated a profound change in the course of civil aviation. Today, reflecting this adventurous mindset, our research efforts and investments are shaping industry over the next 30 years, not only in aerospace, but also in our other areas of expertise.

> "Shaping tomorrow's industry"

Just as we were going to press, Chinese aircraft-maker Comac selected Safran and General Electric, via their joint ventures CFM International and Nexcelle, to supply the complete propulsion system for the new C919 jetliner. This business win continues to validate our long-standing transatlantic collaboration. Its selection also gave the Leap-X a head start in the major engine competitions coming up in the next decade, particularly in the market for single-aisle commercial jets (over 100 seats) by leading Western manufacturers.

## V-22 GETS IN GEAR

© Boeing

After the main gear, the nose gear! In August, Messier-Dowty (Safran group) delivered its first nose landing gear for the Bell-Boeing V-22 Osprey, for which it already provides the main landing gear. Messier-Dowty currently is under contract to deliver nose gear for 141 aircraft. Safran is extremely proud of its role in this unique aircraft: the V-22 "tiltrotor" can land, take off and hover like a helicopter, but then tilts its rotors forward to fly like an airplane. Through this latest contract, Messier-Dowty strengthens its position as a landing gear supplier to Boeing Integrated Defense Systems.

## JEAN-PAUL HERTEMAN, THE NEW CHAIRMAN OF GIFAS

© Jean-François Damois/Creative Center/Safran

**In 2008 Gifas celebrated the aviation industry's 100th anniversary on the Champs-Elysées in Paris.**

Safran CEO Jean-Paul Herteman was elected chairman of Gifas (Groupement des Industries Françaises Aéronautiques et Spatiales), the French aerospace industry trade association, on July 9.
In accepting the appointment he reiterated his commitment to meeting the associated challenges: "Given the fierce economic crisis and an unfavorable euro-dollar exchange rate, my efforts will be fully focused on helping all of our members overcome these difficulties and prepare for the eventual recovery." Jean-Paul Herteman succeeds Charles Edelstenne, Chairman and CEO of Dassault Aviation, who held this position for four years. The Gifas chairman is elected from among the heads of the companies belonging to the association. Three Safran company heads have been chairman of Gifas over the last 30 years.

## SAFRAN AND GENERAL ELECTRIC ENGINE CHOSEN FOR CHINA'S NEW JETLINER

At the end of December 2009, Comac (Commercial Aircraft Corporation of China, Ltd.) chose the Leap-X engine offered by Safran and General Electric, via their joint company CFM International, for its new C919 jetliner. Comac opted for a complete propulsion system, including the engine itself plus the nacelle (the housing that protects the engine and allows it to be attached under the wing) and the thrust reversers (which help brake the aircraft on landing). The 150-seat C919 is slated to enter service in 2016. Safran is also a candidate on other equipment contracts for this aircraft. Its selection for the propulsion system already represents total potential sales of $15 billion over the next 30 years. "The selection of the Safran-GE alliance on the C919 is the culmination of our strategy based on partnerships and operations in China reaching back over 30 years," said Safran CEO Jean-Paul Herteman. "This latest success confirms Safran's excellent position in the commercial aviation market, especially in the single-aisle jet segment."

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## 20,000th CFM56, delivered!

On October 20, 2009, Safran and GE celebrated the delivery of the 20,000th CFM56, the world's best-seller. The ceremony was attended by the French Secretary of State for Transportation, Dominique Bussereau (photo), and the CEO of GE International, Ferdinando Beccalli-Falco. Safran CEO Jean-Paul Herteman addressed the guests, reminding them that the creation of CFM International in 1974 was inspired by the excellent relationship between Gerhard Neumann and René Ravaud, the respective heads of GE Aircraft Engines and Snecma at the time. "They were able to develop a breakthrough aircraft engine, the CFM56, that would eventually become the greatest success in the history of civil aviation."


© Rémy Poinot/Creative Center/Safran

## A SINGLE SIGHT FOR MULTIPLE TARGETS

During NATO's "Belcoast 09" trials in October 2009, designed to assess new defense and homeland protection technologies, Sagem's new multirole optronic sight, SAPS, made a very strong impression. Mounted on an all-terrain vehicle, it demonstrated its day/night, all-weather detection and identification capabilities with different threats: foot soldiers, snipers, light aircraft, drones, fast landing craft and vehicles. This data can then be shared between system operators and tactical command units, for situational analysis in near real time.

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SAFRAN

# FIRST FLIGHT OF BOEING 787 DREAMLINER A SUCCESS

© Vince Streano/Creative Center/Safran

On Tuesday, December 15 at 10:27 am, two big jet engines spooled up on the runway at Paine Field in Everett, Washington, not far from Seattle. A few seconds later, a large blue bird climbed into the gray sky: the Boeing 787 Dreamliner had just taken off for the first time. With some 840 orders already under its belt, Boeing's new long-range jet with the all-composite fuselage is already a striking success. Safran is playing a major role in this program, with contributions spanning the landing system, wiring, engine control units and engine. The 787 is slated to enter commercial service at the end of 2010.

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## SMARTGATE WINS INDUSTRY DESIGN AWARD

Customs agents at airports in Australia and New Zealand deploy a very innovative control system based on facial recognition, enabling adult passengers to save time during ID checks. Dubbed SmartGate and designed by Sagem Sécurité (Safran group), this system authenticates travelers' identities by comparing their face to a digital photo stored on a chip in their e-passport. This ergonomic, easy-to-use system has just received the Janus de l'Industrie prize, awarded by the French Design Institute since 1953.
The Janus award recognizes products that are designed to deliver real benefits to their users. The prize was awarded by Christian Estrosi, French Minister of Industry.

© Sagem Sécurité

# A400M airlifter in the skies of Spain

December 11 will go down in history as a landmark date in joint European defense efforts. The Airbus Military A400M airlifter, designed to carry both troops and equipment, made a successful first flight in the skies over Seville in southern Spain. Initiated primarily by Germany, France, Spain and the United Kingdom, the A400M program has had to meet a number of challenges. Its propulsion system, for instance, the only one of its kind in this class of aircraft, required extensive design work, including by Snecma (Safran group), responsible for about one-third of the total. Safran makes other major contributions to this aircraft, including the landing, wiring and navigation systems.

© Frédéric Lert

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# GUILLEMOT: WORLD CHAMPION!

15 days, 19 hours, 22 minutes and 10 seconds: that's how long it took for Marc Guillemot and Charles Caudrelier Benac to win the 2009 Transat Jacques Vabre aboard Safran, sailing from Le Havre in France to Puerto Limon in Costa Rica. Safran took over first place on the fifth day of the race and held it all the way to the finish line, despite the very trying weather conditions: storms with winds up to 50 knots at the midway point, and a becalmed zone near the end.
"We gave it all we had to win this race," admitted a tired but very happy Marc Guillemot. He was finally able to fly Safran's colors at the top of the podium, after finishing second in the 2007 Transat Jacques Vabre and third in the 2008-09 Vendée Globe. Based on these excellent results, the Safran skipper was crowned IMOCA world champion for 2009 in the Open 60 (sixty-foot monohull) class.

© Marcel Mochet/AFP/DPPI/Safran

## The wings of history

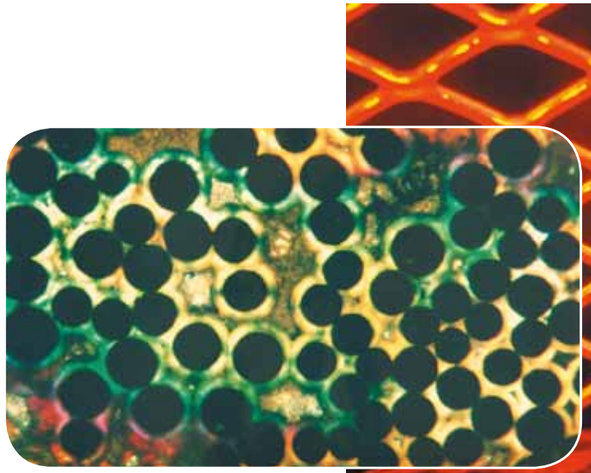
© Aérospatiale

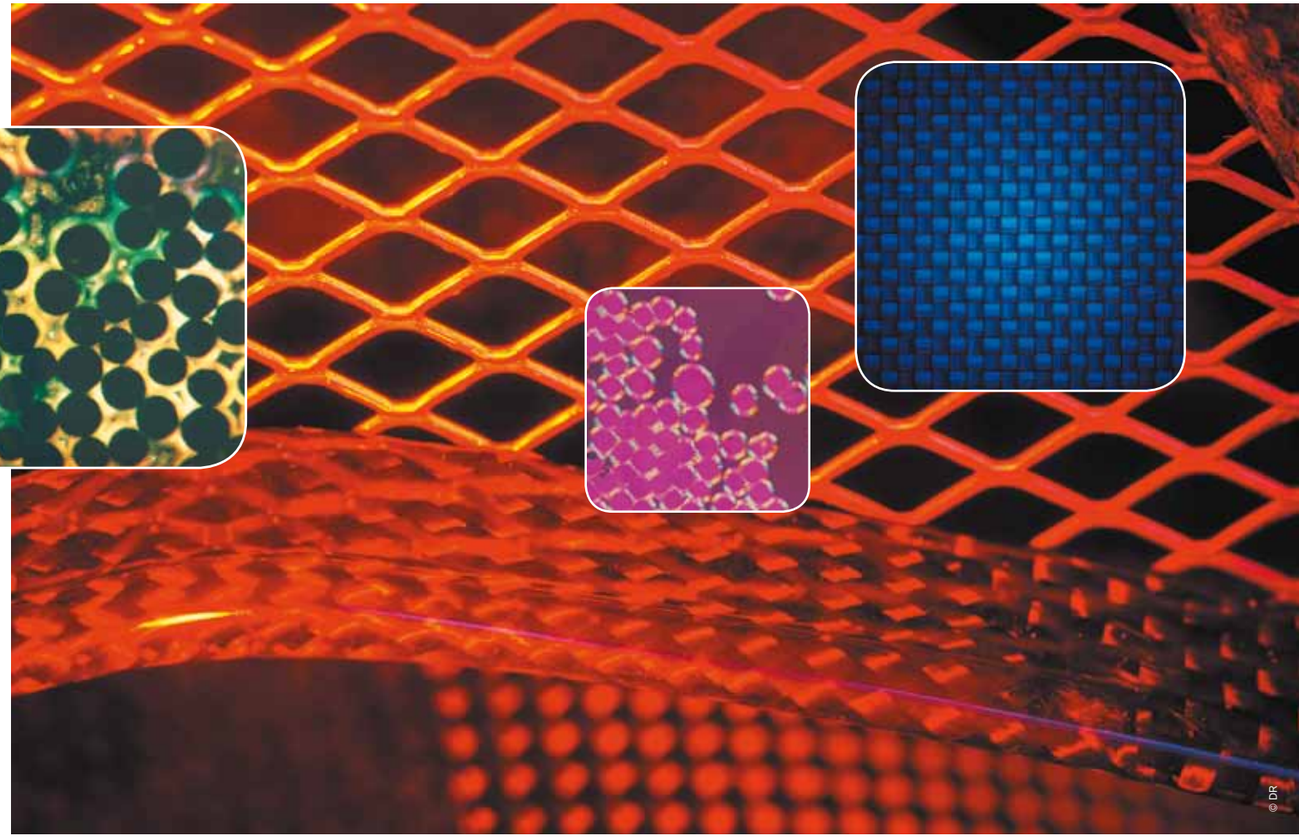
# Concorde, a commercial SST

Concorde took off for the first time 40 years ago. Taking the controls, André Turcat knew that he was making history. The new French-British aircraft was a supersonic transport, or SST, the first in the world. Within a few months, the Concorde had broken the sound barrier and reached its nominal cruise speed of Mach 2.02. Which meant that Paris was only three hours from New York. Propelling this streamlined bird were four Olympus 593 turbojet engines jointly developed by Snecma and Rolls-Royce, and generating over 150,000 pounds of thrust at takeoff. Today, we're still waiting for the oft-announced successor to the Concorde. Paris and New York have drawn further apart, as the flight once again takes about eight hours. But aviation has progressed in different directions. The A380 super-jumbo, for instance, carries over 500 passengers with unrivaled comfort and environmental awareness: it consumes less than 3 liters of jet fuel per 100 passenger-kilometers.

**RESEARCH.** Safran's researchers are studying the new materials that will go into tomorrow's aircraft engines. Stronger and lighter, these materials will help reduce fuel consumption and $CO_2$ emissions.

# MATERIALS TO SHAPE THE FUTURE





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"For engineers working on tomorrow's engines it's a real scientific and technological challenge to strike the right balance: the continued growth of air transport will depend on the development of airplanes that are lighter, stronger and environmentally-friendlier – but don't cost any more to buy and maintain!" explains Claude Quillien, the head of materials and processes at Safran. To meet this challenge, the Group has a permanent workforce of over 750 researchers and technicians. They team up with well-known research labs, such as the Ecole des Mines de Paris engineering school, French aerospace research center Onera and national scientific research agency CNRS, to develop new materials. Their task is to find solutions that will reduce structural weight, and replace certain parts made of titanium, nickel or steel-based alloys that are used on most engines today.

Since the early 1990s the focus has been on composite materials. Made of a "framework" of carbon fibers, strengthened by an organic matrix of resin, ceramic or metal, these materials considerably reduce engine weight. "On fan blades, composites can cut weight by up to 100 or 130 kilos, with an even greater induced impact on the aircraft itself," says Bruno Dambrine, composites and materials mechanics expert.

## VIEWPOINT

© Onera

SHIGEHISA NAKA,
**DIRECTOR OF THE METALLIC STRUCTURES AND MATERIALS DEPARTMENT, ONERA (FRENCH AEROSPACE RESEARCH AGENCY)**

### "It's a heck of a challenge!"

After joining Onera in 1978, Shigehisa Naka quickly focused on research concerning new alloys. Along with his team, he worked on the development of single-crystal solidification. Since then, this revolutionary process has given rise to nickel-based superalloys that are now used to make the turbine blades on Safran engines. In spite of all his experience, when faced with the current demands of aircraft manufacturers his immediate response is a cri du coeur, "It's a heck of a challenge!"

But he's not at all discouraged, in fact far from it. Firmly convinced that metallic alloys still harbor enormous potential, he is directing his teams to focus on three main areas for the future: an intermetallic alloy based on refractory metals such as niobium, which would increase the lifespan of parts subject to temperatures reaching 1,300°C; a higher performance version of his superalloy; and an intermetallic alloy such as titanium aluminide, far lighter than the nickel-based alloy used today.

## Boosting propulsion efficiency

Organic matrix composites based on polymer resins cannot stand up to temperatures exceeding 200°C, so they will be used on the "cold" parts of the engine, namely the fan blades and inlet section. Tests of these components are planned for 2010 and complete engines should be flying by 2014. These composite materials are widely used in nacelles, the structure that surrounds and protects the engine, and attaches it to the airplane via a pylon.

Ceramic matrix composites offer excellent temperature resistance – up to 1,100°C – and are therefore used on the hot parts of the engine, mainly in the nozzle and low-pressure turbine blades. They also offer excellent mechanical strength, based on a combination of silicon carbide fibers and a titanium matrix, making them the ideal material for the disks holding the blades, not to mention delivering significant weight savings.

## Alloys still in pole position

Even though composites seem especially promising, Safran is also working on metallic alloys, which continue to progress by leaps and bounds. For example, a niobium/silicon-based alloy is used to make "refractory" composites that stand up to a temperature of 1,300°C. By increasing the heat-resistance of the high-pressure turbine blades, this new material will enable temperatures in the combustor to be increased, for greater engine operating efficiency.

"For the moment this alloy is still susceptible to oxidation, since we don't have an appropriate coating, and nobody knows how to produce it at reasonable cost," notes Jean-Yves Guédou, an expert in metallic materials. The first engines equipped with turbine blades using this new alloy won't fly until 2018 at the earliest. This may seem a rather distant date, but in fact for engineers it's just around the corner. For engine-makers to deploy these new materials, they have to start revamping their design tools right now by integrating the specific characteristics of these materials, as well as identifying production methods that combine robustness and cost-effectiveness. Safran's engineers will have their hands full indeed as they try to rise to these latest challenges. ■

1

2

**1. 80-TON DROP-HAMMER**
The part is shaped by the power of this 80-ton drop-hammer.

**2. FROM FURNACE TO FORGE**
After being heated in the furnace, the rough disk is moved over to the 80-ton drop-hammer for forging.

**3. CIRCULAR ROLLING PRESS**
Heated to over 1,100°C, the ring is then gradually enlarged on this 565-ton circular rolling press to provide its final shape.

**4. 20-TON DROP-HAMMER**
The forge operator adjusts a heated ring that will be shaped by the 20-ton drop-hammer prior to machining.

**5. GRINDING**
After the forging operations, the parts go to the finishing shop for grinding to remove surface defects and burrs.

**6. FORGING**
A reactor blade that has just undergone precision forging is removed for cooling.

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4

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6

## A CENTURY OF METALLURGY

© Safran

In 1895 Louis Seguin set up shop in the Paris suburb of Gennevilliers with about 40 workers. That was the birthplace of the Omega rotary engine, the first successful product offered by the company Gnome, the ancestor of Snecma, a Safran group company. Over a century later, some 1,400 employees now work on the sophisticated parts that go into the Group's aircraft engines. From the CFM56 and SaM146 to the M88 and TP400, all of the Group's aero-engines start their lives in the forges and presses of this historic site. But materials and processes have of course evolved over the last 100 years. Today, Gennevilliers offers resources and technologies that are unique in Europe, including powder metallurgy, single-crystal structures, isothermal forging, high-speed machining and micro-drilling. Safran Magazine takes a closer look at these forge and foundry facilities that turn out some 95,000 high-tech parts a year.

Photos : Jean-François Damois/Creative Center/Safran