SAFRAN magazine
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THE SAFRAN GROUP MAGAZINE

SPECIAL REPORT

SUPERJET 100, SUKHOI'S LATEST

Powered by the French-Russian SaM146

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web
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22 markets

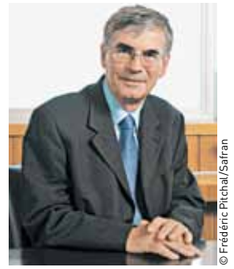
Safran is the world's leading provider of helicopter engine MRO services, through subsidiary Turbomeca's international support network.

NETWORK BENEFITS

editorial

From engines to biometrics

JEAN-PAUL HERTEMAN
CHIEF EXECUTIVE OFFICER, SAFRAN GROUP



© Frédéric Pitchal/Safran

At this year's Paris Air Show, better known here as "Le Bourget", the Safran group will be showcasing our latest innovations in electrical, electronic and optronic systems, as well as composite materials. Tomorrow's aircraft will be lighter and more electric, making them quieter and less fuel hungry. Our contributions to these developments, and to sustainable growth in general, are a top priority in all three of our core businesses, aerospace, defense and security.

We bolstered our security business in 2008 by acquiring Sdu-Identification, followed by Motorola's biometrics operations and more recently Homeland Protection, a General Electric subsidiary. This transaction also strengthens our long-standing partnership with the American company, while firmly consolidating our world leadership in the security market.

> "Aerospace and security have a number of points in common"

In fact, aerospace and security have a number of points in common: entry barriers are high, both technically and financially, and there are few global players. Both of these sectors have also proven resilient, because of their associated spare parts and service businesses.

Furthermore, and perhaps most importantly, they involve key technologies at key moments. An aircraft taking off, or immigration control at an airport, demand state-of-the-art technologies and absolute confidence. And that's Safran's profession.

FIRST FLIGHT OF TURBOMECA-POWERED DHRUV

© DR

On January 12, 2009, the Dhruv helicopter built by Hindustan Aeronautics Limited (HAL) of India, powered by two Turbomeca (Safran group) Ardiden 1H1 engines, made a successful first flight in Bangalore, southern India. Developed in conjunction with HAL as part of an industrial partnership contract, the engine is designed to meet the most demanding mission requirements for operation in hot, high and cold environments. The first test flight checked the engine's aero-mechanical performance. Subsequent flights confirmed its performance when operating at high altitudes, at the Leh air base in northern India. The engine, also called Shakti ("power" in Hindi), develops 1,032 kW of power (about 1,380 hp) and has chalked up 350 orders to date.

MORE
www.safran-group.com, in the Media section

LEAP-X, IN LINE WITH ACARE OBJECTIVES

Snecma's Leap-X engine, expected to hit the market towards 2016, is designed to meet increasingly demanding requirements, especially environmental, since it will help reduce aircraft emissions by 16%. This is one of the objectives set by the Advisory Council for Aeronautics Research in Europe, or Acare. Launched by the European Commission eight years ago, this council has some 40 members representing all stakeholders in European aviation: EU governments and the Commission, industry, research organizations, airlines, airports, etc. Acare's main mission is to draw up a Strategic Research Agenda (SRA), that will be approved and followed by all players in European aviation, and then to monitor its application.

MORE
www.acare4europe.org

SAFRAN SCIENTIFIC COUNCIL: FIRST MEETING

The first meeting of the Safran Scientific Council was held on April 9. Comprising eight world-renowned scientists, this council was created to oversee the excellence of Safran's scientific partnerships, contribute to its strategy of technological differentiation, and help enhance the Group's expertise.

It is chaired by Georges Charpak, winner of the 1992 Nobel Prize in Physics, and also comprises Mathias Fink, French physicist, who holds the technological innovation chair at the Collège de France; Daniel Eylon, specialist in materials engineering and a professor at the University of Dayton, Ohio; Alain Aspect, French physicist, research director at the French national scientific research agency CNRS and professor at the Ecole Polytechnique; Jean-François Baumard, deputy scientific director in the CNRS Chemistry department; Albert Benveniste, mathematician-engineer; and Jean-Louis Chaboche, French research-engineer with aerospace research agency Onera. The Scientific Council meets three times a year.

Participative innovation

Safran handed out its Innovation Awards during a ceremony on May 9, attended by Dominique Bussereau (photo), French Secretary of State for Transportation. For nearly a dozen years, Safran has encouraged its employees' creativity through a participative innovation initiative, covering subjects such as sustainable development, patented innovation, Lean-Sigma, etc. During this ceremony Safran also inaugurated its Scientific Council, chaired by Nobel prizewinner Georges Charpak.

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GLASS COCKPIT FOR THE SIKORSKY S-61

In early 2009, the Federal Aviation Administration (FAA) of the United States certified the five digital displays made by Sagem Avionics Inc. (Safran group) for the new glass cockpit in the Sikorsky S-61 helicopter. First launched nearly 50 years ago, the S-61 is especially well known in the Sea King version, specialized in maritime missions. These new-generation displays will rejuvenate the 600 S-61s now in service worldwide.

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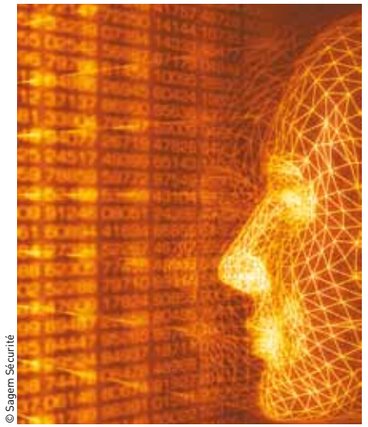

© Sagem Sécurité

BIOMETRICS CONFERENCE FOR USERS WORLDWIDE

In early April, Sagem Sécurité (Safran group) brought together its customers in Paris for "Image", a conference it has organized every two years since 1992. This year's event was attended by 119 customers and security agencies from 63 countries, who were able to exchange information on the biometric systems they operate.
For Sagem Sécurité, it is an ideal opportunity to showcase its latest technologies.

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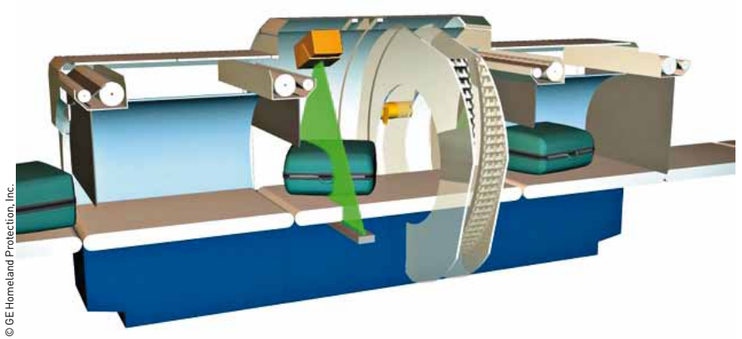
Safran acquires GE Homeland Protection



© GE Homeland Protection, Inc.

In April 2009, Safran acquired an 81% stake in GE Homeland Protection, a subsidiary of General Electric. GE Homeland Protection specializes in tomography-based systems for detection of hazardous or illicit substances in checked baggage. It has the world's largest installed base, with approximately 1,600 machines in service. GE Homeland Protection offers a range of equipment and services to both civil and military government customers, to protect airports, ports, borders and high-value sites. Customers include several U.S. government departments (justice, defense, homeland security), airports in Paris, New Delhi, Israel, etc.

General Electric retains a 19% stake in Homeland Protection, thereby further strengthening its links with Safran (the two groups already have joint ventures in aircraft engines and nacelles). This latest acquisition significantly bolsters Safran's third core business, security, which should eventually generate 20% of the Group's revenues.

SOLAR-POWERED RADARS IN THE GULF

In March, the Abu Dhabi police took delivery of automated speed control radars using solar power. Designed by Sagem Sécurité (Safran group), they will be deployed along the highway from Abu Dhabi to Saudi Arabia. These radar units are fully autonomous, operate day and night, and help improve road safety while saving energy.

DELIVERY OF 1,000TH A330/A340 LANDING GEAR

Early this year Messier-Dowty (Safran group) delivered its 1,000th landing gear for the A330/A340 family. Messier-Dowty's landing gear were selected by Airbus in 1988 and entered service in 1993. Today, they are fitted on 950 aircraft deployed by 90 airlines. Airbus' order book now stands at over 400 aircraft still to be delivered.

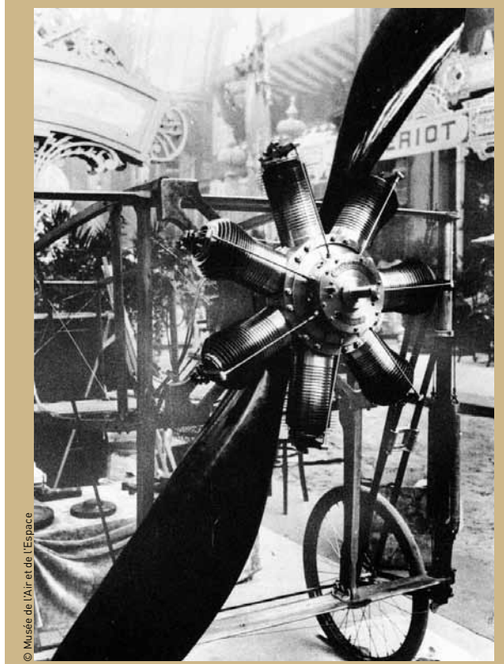
SAFRAN AT THE PARIS AIR SHOW

As a major player in the global aerospace, defense and security industry, Safran will boast an extensive presence at the 48th Paris Air Show-Le Bourget, from June 15 to 21, 2009.
Most of the airplanes and helicopters on display include a number of Safran systems and equipment. For example on the A380, the Group supplies the engine nacelles, wiring, braking systems, nose landing gear and more. In addition to these aircraft, Safran will be showcasing its own products on two main stands: one dedicated to aerospace, to display its civil and military airplane and helicopter engines, rocket engines, landing gear etc.; the other stand is dedicated to defense, and will feature a real Mirage F1, as well as the Sperwer drone system (including the drone itself and its catapult launcher).

The Group's revamped website provides full coverage of Safran's presence at this year's Paris Air Show:
www.safran-group.com

© Jannouncing days open to the public/ GIFAS

The wings of history



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First air show a success

The first international air show – also called the Aeronautical Salon, Flight Show or Aero Exhibition – was held under the majestic glass roof of the Grand Palais in Paris on December 24, 1908. Over the six days of the show, some 720,000 visitors came to see, at last, those magnificent flying machines that had been making the front page in all the newspapers. No less than 15 aeroplanes were on display – including three Blériot models, a Wright and the Voisin-Farman – as well as helicopters and airships. Airplane and engine manufacturers were in the spotlight, under very impressive signs. The Gnome Omega engine presented at the show by the Seguin brothers was still something of a curiosity. But it would shortly be lauded throughout Europe. The 7-cylinder Gnome rotary engine quickly enjoyed unprecedented market success, eventually leading to the creation of Snecma, now part of the Safran group.

MORE
www.museesafran.com (French Only)

BIOMETRICS. Recognizing people by looking at their faces is something we do every day. But facial recognition is also the principle behind a biometric technology that meets emerging security requirements.

FACIAL RECOGNITION: PORTRAIT OF A PROMISING TECHNOLOGY

© Jupiter Images/Sagem Sécurité/Citizen Pres

Out of all biometric technologies, facial recognition is undoubtedly the most easily accepted by the general public. It the most widely used and most natural: nobody minds seeing their photo on an ID card, transportation pass or healthcare system card. With the ongoing progress in biometric technologies, this type of identification is also becoming automated. The technology is based on a comparison of a person's face with his or her photo stored in the system's memory, to make sure that it's really the same person.

After several years of design work, the facial comparison engine developed by Sagem Sécurité (Safran group) hit 100% accuracy on one of the tests used by the National Institute of Standards and Technology (NIST) in the United States.

Multiple applications

Facial recognition is used today for three main applications. First, to issue identity cards, most often in association with another biometric identifier, such as fingerprints. This is the case in Guatemala, where Safran was selected at the end of 2008 to supply a complete biometric ID card system. "Facial recognition is used when the quality of fingerprints is insufficient," notes Claude Bauzou, product manager at Sagem Sécurité.

The second major use is border control, in which the photo on a biometric passport (which includes a digital photo) is compared with the face of the passport holder. Australia is a real pioneer in this field, and has already fitted its main airports with the SmartGate system developed by Sagem Sécurité, capable of automatically performing this operation in a couple of seconds. Since being installed, Australia's SmartGate systems have already checked more than 150,000 passengers.

The third, and far less common application is for the police. In this case, it is used to help identify people having committed criminal acts, based on shots from a surveillance camera for instance.

Growing use

Although comfortable and well accepted by the public, facial recognition system do not yet offer the ability to distinguish people as well as fingerprints or the iris. Furthermore, a new beard, sunglasses, a broad smile and other factors can disturb the identification process. However, error rates are still fairly low, and the technology continues to progress.

For instance, Safran coordinated a European research project, 3D Face, which aimed to develop a 3D facial recognition system. "The advantage of 3D is that it captures faces even on the move, without having to ask subjects to stand still and look at the camera," explains Jean-Christophe Fondeur, head of R&T at Sagem Sécurité. The prototype systems based on this research work are now being tested at airports in Berlin (Germany) and Salzburg (Austria). Initial results are excellent.

These advances herald new uses for facial recognition. For example, authorities are considering the use of facial recognition systems that check passports at borders to also help identify internationally wanted persons whose faces are already on record. Another possible application is monitoring people released on probation. Likewise, secure access to public buildings could be made much easier and more user-friendly thanks to this technology, which guarantees security without all the usual restrictions.

FINGERPRINT AND IRIS RECOGNITION

In the world of biometric recognition systems, fingerprints are still the most widely used characteristic. Not only do they combine precision, comfort and low cost, but fingerprints don't change over time. However, in certain countries they are saddled with a negative "police state" image. Iris recognition, although well behind in popularity, about on a par with facial recognition, is actually more accurate than fingerprints. The main drawback it that it requires people to place their eye in front of a reader, which is not always very pleasant. But, once again, technology is improving. Safran is at the cutting edge of both of these technologies, and continues to develop innovative and highly capable solutions.

PROPULSION. Innovative yet simple, the SaM146 perfectly meets the requirements of the regional aviation market. Here we take a closer look at this engine that delivers excellent performance for the Superjet 100.

POWERPLANT FOR THE 21ST CENTURY

The SaM146 marks the first time Safran is managing the development of a complete propulsion system, including the engine itself, plus the nacelle and thrust reverser. The engine is under the responsibility of a joint venture called PowerJet, created by Safran company Snecma and the Russian engine manufacturer NPO Saturn. The worksplit is clear, with the Russian partner in charge of the low-pressure section, assembly and final testing, and the French partner in charge of the engine core (high-pressure section), control system, accessories and integration. Each partner is responsible for the design and development of the equipment under its responsibility. As the systems integrator, Snecma is coordinating the program, in association with NPO Saturn.

"Engine development went very quickly," recalls program manager Robert Vivier. "The first ground test was on July 9, 2006, and the engine reached nominal power. We carried out the first flight test using a flying testbed on December 6, 2007, and six months later the Superjet 100 made its first flight, powered by two SaM146s."

Performance and simplicity

The SaM146 is technically sophisticated and yet simple, to ensure that its maintenance costs are significantly lower than competing engines. For example, the core developed by Snecma largely draws on the company's experience with the M88, the engine powering the Rafale fighter, as well as extensive work on its DEM21 core demonstrator program.

"We have met our performance and specific fuel consumption targets," says Robert Vivier, "and the engine satisfies all environmental standards with room to spare." Based on the SaM146's performance, the Superjet 100 should carve out an excellent position in the highly competitive market for regional jets. Building on this initial success, the engine may well be chosen to power other new commercial airplanes. ■

SaM146 engine under the wing of the Ilyushin IL-76 flying testbed, in August 2007.

PHILIPPE PERRIN,
AIRBUS TEST PILOT

FLIGHT-DECK FEEDBACK

Philippe Perrin, a former fighter pilot and astronaut, is a test pilot at Airbus. He was also alternate test pilot for Snecma on the SaM146 program, and kept a close eye on the development of the new engine. Perrin co-piloted the Ilyushin IL-76 flying testbed for the maiden flight of the new engine. "The SaM146 was a fascinating adventure, based on a very tight-knit collaboration between French and Russian teams. During the test flights, I was struck by how we all spoke the same language: of technicians from two countries with a great tradition in aeronautics. During some 45 hours of testing on the IL-76, we were able to completely open the flight envelope and explore the engine's handling qualities. In the end, we delivered a safe, responsive engine, which played a key role in the successful first flight of the Superjet 100."

Messier-Dowty designs and produces the complete landing gear system for the Superjet 100.

EQUIPMENT. In addition to the propulsion system, Safran provides other systems and equipment on the Superjet 100, starting with the landing gear and nacelles.

SAFRAN, MAJOR EQUIPMENT SUPPLIER ON THE SUPERJET 100

The Sukhoi Superjet 100 is a major program for Messier-Dowty, a Safran group company. This landing gear specialist has mainly worked on business aircraft and large commercial jetliners until now, but with the Superjet 100 it bolsters its position in the regional aviation market. "We were selected by Sukhoi in 2003," recalls Carole Petit-Marty, program manager at Messier-Dowty. "When Sukhoi opted for a main gear with dual struts in 2005 we had to accelerate the pace of development."

Design work was a concurrent effort by Messier-Dowty's Canadian plant in Toronto, for the main landing gear, and the French plant in Vélizy, for the nose gear. Another plant, at Bidos in southwest France, will manufacture

© Sukhoi

Aircelle makes a complete nacelle system, including the thrust reversers, air inlets, nozzle, fan cowls, etc.

the shock struts and carry out final assembly of the nose landing gear.

The Superjet 100 is also the first regional jet to be fitted with fly-by-wire flight controls. This feature actually affects the landing gear, since it interfaces with about 50 other aircraft systems. As Carole Petit-Marty points out, "The control unit for landing functions is under the responsibility of Safran Electronics."

Because of the fast-paced development of the aircraft, a preproduction version of the landing gear was used on the Superjet 100 during its maiden flight on May 19, 2008. "We're still working on development of the production-standard landing gear, optimized in terms of the weight budget, which will be certified at the same time at the airplane," adds Petit-Marty.

Qualification tests started back in November 2008 and fatigue tests will continue until 2014. "Most tests will be carried out in Toronto, except the fatigue tests for the main gear, conducted by the SibNIA research institute in Novosibirsk," notes Petit-Marty. "Static and fatigue tests require the use of a wing section rigidity simulator. Loads are applied to this wing section during simulations of takeoffs, landing and taxiing. Russian certification authorities have also requested 'multi-drop' endurance tests, including a demonstration of sustained shock attenuation, and this is a first at Messier-Dowty."

Total responsibility

Fellow Group company and nacelle specialist Aircelle, selected by PowerJet at the end of 2003, is also logging a number of firsts.

"For this program we're taking care of everything within the scope of a nacelle manufacturer," explains Serge David, Superjet program manager at Aircelle. "In other words, our responsibilities include not only the thrust reversers, air inlet, nozzle and fan cowls, but also the engine suspension system and what we call the Engine Build Up, or EBU, meaning all the wiring harnesses and ducts providing the interface between the aircraft and the engine."

The design of the suspension system, which connects the engine to the pylon, is a first for Aircelle. "This is the first time we've designed these parts, which means we had to start working with the engine-maker very early in the process," says David.

Aircelle is also in charge of final integration of the nacelle, a task known as podding. "The podding was performed by an Aircelle team based near the assembly line in Komsomolsk-on-Amur," says David. "We'll be delivering complete propulsion assemblies, so that the aircraft manufacturer just has to attach them under the wings."

The nacelle itself boasts aerodynamic and acoustic performance on a par with the latest Boeing and Airbus jetliners, a first for a regional jet in this class. "We're applying advanced technologies," adds David, "such as a single-piece acoustic panel for the air inlet. Large acoustic panels are also used for the fan cowls, nozzle and thrust reversers." Aircelle has made wide use of composite materials to reduce overall weight, including on the nozzle.

Entering production

Sukhoi plans to deliver the first production Superjet 100 at the end of the year. Which means that Messier-Dowty, Aircelle and other Safran companies are stepping up the pace to meet this tight deadline. Messier-Dowty has already delivered the first landing gear shipset, and expects to deliver a few more by the end of the year. Aircelle is moving forward at the same rate, and will complete manufacture and podding of nacelles for all test aircraft by the beginning of the summer. Its plants will then make the transition to production-standard equipment. ■

SAFRAN'S CONTRIBUTION TO THE SUPERJET 100

ENGINE

SNECMA (VIA POWERJET)
- **SaM146 propulsion system**

ENGINE EQUIPMENT

TECHSPACE AERO
- **Lubrication systems**

MICROTURBO
- **Air starter**

HISPANO-SUIZA
- **Electrical equipment**
- **Hydromechanical equipment**
- **FADEC (via Fadec International)**
- **Engine control system components**

TECHNOFAN
- **Fans**

SAGEM
- **Engine overspeed controller**

AIRCELLE
- **Thrust reversers**
- **Nacelles**

SOFRANCE
- **Engine injector upstream filter**
- **Main fuel filter**

SNECMA PROPULSION SOLIDE
- **Mixed flow nozzle (MFN)**

OTHER EQUIPMENT

MESSIER-DOWTY
- **Landing gear**