

# PRESS KIT

## 47th Paris Air Show

Paris – Le Bourget  
(June 18 – 24, 2007)

### SAFRAN Group

Stand B 17 - Hall 2A - Chalet B 57  
Aerospace Propulsion: stand B17  
Aircraft equipment: stands D13 – D14 – F13  
Defense Security: outside stand C1

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**[www.lebourget2007.com](http://www.lebourget2007.com)**  
(SAFRAN news at the Paris Air Show)

**[www.safran-group.com](http://www.safran-group.com)** (corporate website)

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# SAFRAN CORPORATE PROFILE

**SAFRAN** is an international high-tech group, organized in four business branches: Aerospace Propulsion, Aircraft Equipment, Defense Security and Communications.

The Group has 61,400 employees in more than 30 countries, and sales **exceeding 11 billion euros in 2006**.

Comprising a number of companies with prestigious brand names, SAFRAN, working alone or in partnership, holds world or European leadership positions in its markets.

The SAFRAN Group operates worldwide, through design, production and service companies, as well as representative offices. Because of this global presence, we establish and maintain industrial and commercial relations with the world's leading prime contractors and operators, and give our customers responsive services and local support no matter where they are.

# SAFRAN CORPORATE PROFILE

## Business branches and main companies

### ▶ AEROSPACE PROPULSION

- Snecma
- Snecma Services
- Turbomeca
- Microturbo
- Snecma Propulsion Solide
- Techspace Aero

### ▶ AIRCRAFT EQUIPMENT

- Aircelle
- Hispano-Suiza
- Messier-Dowty
- Messier-Bugatti
- Messier Services
- Labinal
- Teuchos
- Technofan
- Sofrance

### ▶ DEFENSE SECURITY \*

- Sagem Défense Sécurité
- Sagem Orga
- Sagem Monetel
- Sagem Morpho
- Sagem Avionics
- Vectronix

### ▶ COMMUNICATIONS

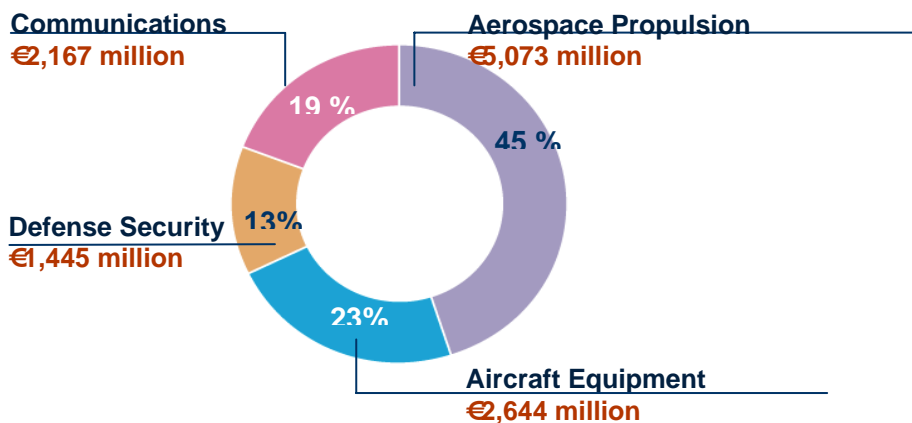
- Sagem Communication
- Sagem Interstar
- Photar Sagem

\* organization at June 15th – new organization takes effect July1, 2007

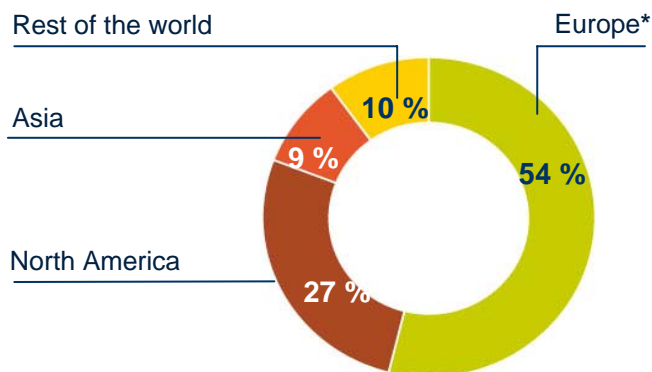
## KEY FIGURES

- ▶ **Sales:** **11,329 million euros**
- ▶ **Operating income:** **465 million euros**
- ▶ **Net income – Group share:** **177 million euros**  
*Adjusted pro-forma data*

### ▶ 2006 sales by branch



### ▶ 2006 sales by region



\* most exported by prime contractor customers

- ▶ **Workforce at March 31, 2007**  
**61,400 employees**, including more than **21,600 outside France**.

## ***Aerospace Propulsion branch***

### ***Sales: €5,073 million***

#### **MAIN COMPANIES IN THE AEROSPACE PROPULSION BRANCH**

##### **Snecma**

Snecma is one of the world's leading makers of aircraft and rocket engines, with a wide range of propulsion systems. These include commercial aircraft engines renowned for their performance, reliability, economical operation and environmental friendliness, including the best-selling CFM56, plus world-class military engines. Snecma develops and produces rocket propulsion systems and equipment for launchers, satellites and space vehicles.

- **Civil Aviation**

CFM56 engines through CFM International, an equally-owned subsidiary with General Electric.

SaM146 engine through PowerJet, an equally-owned subsidiary with NPO Saturn.

Large commercial engines (CF6, GE90, GP7200), in partnership with General Electric.

Silvercrest, a new generation of business jet engines.

- **Military aviation**

M88 (Rafale), M53 (Mirage 2000), Larzac® (Alpha Jet, MiG-AT, HJT36) and, through the European consortium Europrop International (EPI), the TP400-D6 (A400M).

- **Space propulsion**

HM7B, Vulcain® 2, Vinci® cryogenic engines (Ariane 5); PPS® 1350 plasma thruster.

**Snecma Services** is the branch's MRO specialist for commercial and military aircraft engines. It offers a full range of engine support services to airlines, operators and armed forces around the world, for engines built by Snecma or in which it has a significant share. Snecma Services also provides aftermarket support on behalf of CFM International. Its scope of services includes: on-wing and off-wing MRO, parts repair, engineering support (fleet management and remote diagnostics), support for engine installation, LRU replacement and repair, and engineering services including consulting, training, leasing and tools.

**Snecma Propulsion Solide** designs and produces solid rocket motors for Ariane 5 and Vega (via Europropulsion, an equal joint venture of SAFRAN and Avio), M45 and M51 ballistic missiles (via G2P, owned 75% by SPS and 25% by SNPE Matériaux Energétiques) and tactical missiles. It is also specialized in the design and production of thermostructural composites for the aerospace and manufacturing industries.

**Turbomeca** is the world leader in the design, development and manufacture of turbine engines for helicopters, made by industry leaders such as Eurocopter, Sikorsky, Agusta, Denel, Kamov and HAL. It has also earned recognition for jet engines powering training and support aircraft (Adour, built with Rolls-Royce). Since the company was founded, more than 50,000 Turbomeca engines have been produced around the world. Today, these engines – Arrius, Arriel, Makila, TM-333, Ardiden, RTM322 (with Rolls-Royce), MTR390 (within the MTR consortium) – power helicopters for 2,000 customers in 150 countries. Turbomeca operates worldwide through 14 facilities and two major subsidiaries.

**CGTM** (Compagnie Générale des Turbo Machines), a Turbomeca subsidiary, specializes in integration design studies for helicopter systems, and handles modifications and equipment installations, including flight testing and certification. It also designs and markets optional equipment for helicopters.

**Microturbo** is the leading European maker of jet engines for missiles and target drones. Most new-generation airplanes and helicopters built in Europe are fitted with Microturbo auxiliary power units (APU). This Turbomeca subsidiary also produces starting systems for aircraft.

## ***Aerospace Propulsion branch (continued)***

### ***Sales: €5,073 million***

#### **Techspace Aero**

Belgian company Techspace Aero designs, develops and produces components and subassemblies for aircraft and rocket engines. It has considerably strengthened its design capabilities, making it a major partner to the world's leading engine manufacturers. Techspace Aero's scope of business extends from military engine maintenance, to the design and construction of high-tech test systems, under the Cenco International brand. The company is jointly owned by SAFRAN (51%), the Walloon region of Belgium (28.4%), Pratt & Whitney (19%) and the Société Fédérale d'Investissement (1.6%).

## ***Aircraft Equipment branch***

### ***Sales: €2,644 million***

#### **MAIN COMPANIES IN THE AIRCRAFT EQUIPMENT BRANCH**

**Aircelle** designs, produces and markets nacelles for commercial aero-engines, and provides MRO services for its customers and users of its products. It is the No. 1 European manufacturer of aero-engine nacelles, and a major player worldwide. Aircelle is the only nacelle manufacturer in the world to offer a complete product line, with nacelles for engines ranging from business aircraft to the latest A380 super-jumbo.

**Hispano-Suiza** is a world leader in mechanical power transmissions and electronic control units for engines powering mainline commercial jets (over 100 seats). It also offers extensive expertise in engineering and technical coordination for engine control systems. A pioneer in power electronics designed for severe operating environments, Hispano-Suiza is developing the technologies and systems needed for tomorrow's "more electric" aircraft.

**Messier-Dowty** is the world's leading maker of landing gear, spanning design, development, manufacture and support. These landing gear now equip over 19,500 civil and military aircraft, and chalk up more than 35,000 landings a day. The company is a supplier to 33 aircraft manufacturers, and works with 2,000 operators of commercial, military and business aircraft, as well as helicopters. Messier-Dowty has plants in France, the U.K., the United States, Canada, Singapore and China.

**Messier-Bugatti** is a world leader in advanced braking systems. More than 2,800 commercial jets deployed by nearly 300 airlines use its wheels and carbon brakes, along with about 20 air forces. With operations in France, the United States and Asia, Messier-Bugatti provides 24/7 service worldwide. A systems engineering and integration company, Messier-Bugatti also delivers innovation and excellence in braking control systems, steering systems, landing systems and monitoring systems. More than 4,000 aircraft worldwide use these products. A partner to Airbus for over 20 years, and to Boeing for the last ten years, Messier-Bugatti is also a supplier to Dassault, ATR and other manufacturers.

**Messier Services**, the joint subsidiary of Messier-Bugatti and Messier-Dowty, provides maintenance, repair and overhaul (MRO) services for all landing, braking and hydraulic systems produced by its parent companies and other manufacturers.

**Labinal** is a world leader in the design, production and installation of wiring systems, engineering services and associated technologies for the aerospace and defense industries. It has built up extensive expertise over the years through work for the world's major aircraft manufacturers.

**Teuchos** is a consulting and engineering services company, working for the aerospace, defense and automobile industries. It offers a wide range of expertise covering the entire system development cycle, from technical specifications and preliminary projects, to development and operational support. In particular, Teuchos has carried out studies for the Airbus A380 and A400M, Dassault Falcon 7X and Ariane 5. Its customers include not only fellow companies in the SAFRAN Group, but also major players in the transport industry such as Michelin, Renault, PSA, Airbus, Eurocopter and Astrium. Teuchos recruits about 350 new engineers from around the world every year.

## **Defense Security branch**

### **Sales: €1,445 million**

#### **MAIN COMPANIES IN THE DEFENSE SECURITY BRANCH** (organization at June 15 – new organization takes effect July 1, 2007)

The Defense Security branch covers three main areas:

- navigation and aeronautical systems;
- optronics and air-land systems (technological programs and simulation, sights, etc.);
- security (government solutions, terminals and secure transactions).

The branch comprises Sagem Défense Sécurité and its subsidiaries.

**Sagem Défense Sécurité** develops and markets key technologies in electronics, micromechanics, optics, and information processing and transmission.

The company is a world-renowned specialist in gyroscopic solutions, ranging from a small vibrating gyroscope for light vehicles and weapons to the "star in a bottle" quality gyroscope enabling precision navigation for nuclear submarines.

This solid technology core enables Sagem Défense Sécurité to cover a very wide range of applications for all types of vehicles (land, ships, airplanes, helicopters, drones, missiles and guided weapons) and to make the transition from equipment supplier to systems integrator. It covers all aspects of avionics, especially for aircraft modernization programs.

This system expertise extends to information and communication systems such as those providing mission planning for military aircraft (Rafale and Mirage fighters, combat helicopters), onboard information systems for civil and military aircraft (A380, A400M) and airbase management-planning systems.

The optronics department offers products used in a wide range of applications: air-land defense (civil defense, helicopters and "network-centric warfare"), naval (surface ships, submarines, aircraft carriers, mainly for tracking and defense), land defense (all civil and military vehicles, particularly for surveillance), aviation (optronics equipment for military aircraft and missile seekers), space (mirror systems for very large telescopes).

Sagem Défense Sécurité is the leading European supplier of tactical unmanned aerial vehicles (UAV), with its Sperwer system now deployed by the armed forces of the Netherlands, Sweden, France, Greece and Canada. Sperwer tactical UAVs have been deployed on a daily basis in Afghanistan since March 2006 by Dutch and Canadian forces.

In the security sector, Sagem Défense Sécurité is the world leader in biometrics. The company started with digital fingerprint technology, and is now developing a range of multibiometrics solutions, including facial and iris recognition systems. About 60 countries have chosen biometric and multibiometric systems by Sagem Défense Sécurité.

Building on these technologies, Sagem Défense Sécurité has expanded its scope of business to include information and communications security solutions: production of non-falsifiable ID and health documents; the fight against delinquency (secure payments, transactions and games); developing infrastructures with public key identification/encryption (PKI); physical access control (buildings, airports, borders), logical access control (data, communications, etc.) and, more generally, homeland security.

## ***Defense Security branch (continued)***

### ***Sales: €1,445 million***

**Sagem Monetel** is the Sagem Défense Sécurité subsidiary specialized in electronic payment solutions. Its products feature cutting-edge technologies such as GSM, GPRS, biometrics and secure transmission. With over 20 years of experience in secure transaction terminals, Sagem Monetel has built up a solid reputation for reliability and quality. Sagem Monetel is also a major supplier of smartcard terminals (chip-capable), with over one million sold worldwide.

**Sagem Orga** was created in 2005 to combine the smartcard expertise of Sagem Défense Sécurité and the German company Orga Kartensysteme GmbH. It is now the world's fourth largest smartcard company. Based in Paderborn, Germany, Sagem Orga has production and R&D facilities in Germany, Russia and Brazil, along with subsidiaries in the United States, United Arab Emirates, United Kingdom, Singapore, Portugal, South Africa and Romania, and a joint venture in India. It employs about 1,600 people, more than half outside Germany.

**Sagem Morpho, Inc.** develops, integrates and manufactures biometric identification systems, which incorporate multibiometric technologies including fingerprint, iris and facial recognition. Sagem Morpho Inc. is the world leader in this field, with solutions for a number of applications: law enforcement, healthcare, airport security, national security, population management, etc. Its systems are currently used by a number of government agencies, including the FBI and the New York Police Department in the United States. Dedicated consumer systems are in operation in New York, Texas and Arizona.

**Sagem Avionics, Inc.** covers both civil and military avionics. With operations in Texas and Washington State, it handles marketing, sales and support for Sagem's aviation product line, as well as the development and production of cockpit display systems and satellite communications systems.

Sagem Avionics also carries out helicopter retrofits. It has earned FAA certification for a number of different helicopters, including the Bell 407 and 427, Eurocopter AS350, EC120, EC130, EC145 and AS355, plus STC (supplemental type certificate) for the Air-Crane Erickson S-64 helicopter.

Sagem Avionics Ind. is a full-fledged member of the U.S. Army's UH-72A Lakota helicopter program, since it makes the complete autopilot system, as well as flight control actuators.

**Vectronix AG** is a Swiss defense optronics company. It designs, develops and produces observation, positioning and rangefinding equipment and systems for five main applications: night vision, rangefinding, target observation and acquisition, military topography and positioning-orientation. These products integrate cutting-edge technologies such as digital electronics.

## **Communications branch**

### **Sales: €2,167 million**

#### **MAIN COMPANIES IN THE COMMUNICATIONS BRANCH**

The Communications branch groups all activities related to telecommunications: mobile phones, printing terminals, digital TV set-top boxes, broadband access and telecom equipment. It also provides fiber optics and electric meters. The branch comprises the company Sagem Communication and its subsidiaries.

#### **Sagem Communication**

Sagem Communication has two core businesses: mobile communications and broadband communications.

For the former, the company designs, develops and produces mobile phones, accessories, etc.

Sagem Communication offers a range of mobile phones featuring GSM, EDGE and 3G UMTS technologies, along with new communications services (mobile TV, GSM + WiFi, contactless payment and ticket solutions, etc.). It has formed industrial and technological partnerships based on its mobile platforms, and also offers mobile phones in partnership with today's trendiest and most luxurious brands.

In the broadband sector, Sagem Communication designs, develops and produces a complete range of products that meet demand in the high-growth markets of broadband, video and printing: multifunction fax machines for consumers and professionals, photo printers, digital TV set-top boxes (satellite, cable, ADSL), digital terrestrial television (DTTV) receivers, DECT wireless phones, ADSL modems, WiFi routers, meters, corporate networks, infrastructure and broadband Internet access. Its proven capability for innovation has driven breakthroughs in highly competitive markets.

Sagem Communication deploys a dense European sales and marketing network called the National Sales Organization (NSO), to strengthen the distribution of Sagem brand products by major European retailers.

# MAJOR AEROSPACE PROGRAMS

## *SAFRAN and the Airbus A380*

Ten group companies deploy their technological expertise on the Airbus super-jumbo jet

**Snecma:** Working for the Engine Alliance (an equal joint venture of General Electric and Pratt & Whitney), Snecma is in charge of the design, development and production of most of the 9-stage high-pressure compressor on the GP7200 (10% of the engine program).

**Techspace Aero** designs, develops and manufactures the low-pressure compressor and forward bearing supports for the GP7200 (7.5% of the engine program). It also manufactures the fan disk.

**Cenco International** (test cell engineering), a subsidiary of Techspace Aero, provides equipment and services for the GP7200 test cells at General Electric and Pratt & Whitney (engine cowls, variable nozzles, engine mount, adapters and modernization of the GE Aero Engine Service Wales test cell).

**Aircelle** designs, develops and supplies, on an exclusive basis, the two types of nacelles (with and without thrust reverser) for the two engines on offer, the GP7200 and the Rolls-Royce Trent 900. It has to meet three main technology challenges: materials, electrical systems, and demanding weight and acoustic specifications.

**Hispano-Suiza** developed and produces, in partnership with Honeywell, the first electrical thrust reverser actuation system (ETRAS) for commercial aircraft, which equips the GP7200 and Trent 900 nacelles made by Aircelle for the A380. Hispano-Suiza designed the electrical system architecture, as well as the electrical and power electronics components.

**Messier-Dowty** designs, produces, tests and supports the nose landing gear. The design of this forward-retracting gear involved new technologies, namely the use of 350-bar (5,000 psi) hydraulic pressure, never before used on a large jetliner, as well as the high velocity oxygen fuel (HVOF) surface treatment procedure, instead of chrome-plating.

**Technofan** produces the brake cooling system, the avionics bay ventilation systems and cabin ventilation equipment.

**Labinal** makes about 80% of the electrical wiring on the plane, and offers two noteworthy innovations: the use of aluminum cables, and innovative mechanical and electromagnetic cable protection. It develops and produces electrical wiring for the wings, the entire fuselage, including the fin, as well as the specific wiring required for flight testing.

**Sofrance** provides filtration systems for the hydraulic circuits (main, braking and flight control) and avionics (electronics cooling), as well as engine lubrication and fuel filtration. It is the lead filtration company on the A380.

**Messier-Bugatti** supplies five systems on the A380:

- Full-brake-by-wire braking system for 20 wheels, including a backup circuit using decentralized hydraulic generation for considerable overall weight savings.
- Steering system for the nose wheels and central bogies to give the aircraft maximum maneuverability.

# MAJOR AEROSPACE PROGRAMS

## ***SAFRAN and the Airbus A380 (continued)***

- Tire pressure, brake temperature and landing gear monitoring systems (TPMS NG, BTMS and OPMS).
- Mini-pumps for the electrohydraulic actuators (EHA) on the secondary flight controls.
- Components for the distribution and filtration system on the hydraulic circuits, capable of standing up to high pressure (5,000 psi).

### **Sagem Défense Sécurité** supplies:

- Onboard information system, the secure Network Server System (NSS). Connected to the aircraft's avionics, it collects extensive data, including flight parameters. The NSS also supports specialized applications, such as online documentation, maintenance information, etc.
- Secondary fly-by-wire flight control system, large environment accelerometer unit (LEAU).
- Various flight control components and sensors: backup yaw damper sensors, backup control module (BCM), backup power supply (BPS).

### **Snecma Services**

- This engine MRO specialist provides aftersales support for the GP7200 (installation, tools, documents, logistics, etc.), and product support engineering (PSE) for most of the core.
- Aftersales support for the high-pressure compressor module (technical support, tools, documents, logistics, etc.).
- Maintenance of high-pressure compressor modules and component repair.
- Since mid-2006 it has provided support services for flight tests of the GP7200-powered A380, plus installation support at Airbus.

All of these activities are carried out in conjunction with GEES and the Engine Alliance.

## MAJOR AEROSPACE PROGRAMS

### *SAFRAN and the Boeing 787 Dreamliner*

**Messier-Dowty** is responsible for the design, development, testing, production and assembly of the main and nose landing gear systems.

**Messier-Bugatti** supplies the two nose wheels and eight main wheels, along with eight electric brakes and control units (EBAC). These control units are developed in conjunction with Sagem Défense Sécurité. The 787 Dreamliner is the first commercial aircraft fitted with electric brakes, a major worldwide technology breakthrough.

**Sagem Défense Sécurité** provides the electrical brake actuator controller (EBAC) for the electric brake developed by Messier-Bugatti.

**Labinal**, as a partner to Boeing, designs the entire electrical installation for the 787, including wiring and integration panels, using collaborative working tools set up by Boeing and Dassault Systèmes. Labinal is responsible for production of all wiring and integration panels, and has already delivered all products for the first aircraft, in compliance with Boeing requirements.

**Techspace Aero** works in partnership with General Electric on the GENx engine. It is responsible for the design, development and production of the guide vanes for the low-pressure compressor, assembly of the low-pressure compressor, and production of the fan disk.

**Cenco International** supplies the cowls for the GENx development tests

**Aircelle** makes the braces (side stays) for the main landing gear, on behalf of Messier-Dowty.

**Fadec International**, an equal joint venture of Hispano-Suiza and BAE Systems, was selected by General Electric Aircraft Engines (GEAE) to design, produce and support the full authority digital engine control (FADEC) for the GENx.

# MAJOR AEROSPACE PROGRAMS

## *SAFRAN and the Sukhoi Superjet 100*

**Snecma** is developing the SaM146 engine in partnership with NPO Saturn through their joint venture PowerJet, in charge of all aspects of the engine program: design, production, marketing and support. In April 2003 the engine was selected by Sukhoi Civil Aircraft Company to power the different versions of the new Superjet 100 regional jet. Developing 14,000 to 17,500 pounds of thrust, the SaM146 propulsion system is purpose-designed for regional aircraft. It has all the advantages needed for a competitive entry in this market, where customers are particularly demanding in terms of cost of ownership, dispatch reliability and environmental standards. The latest, proven technologies are incorporated on this engine, to guarantee cost-effective commercial operation for airlines.

**Snecma Services** is in charge of setting up customer support operations (tools, technical documents, training), along with maintenance, repair and overhaul (MRO) services for the SaM146. These operations will be carried out on behalf of PowerJet, in conjunction with NPO Saturn.

- Because of its vast experience on the CFM56, Snecma Services advised aircraft manufacturer Sukhoi in setting up its customer support center, customer website, spares distribution and customer interface.

- On April 2, 2007, the Snecma Services training center offered its first course providing a general overview of the SaM146 engine.

**Hispano-Suiza** is prime contractor for the complete engine control system, and is the contracting authority for 46 components and subassemblies on the SaM146, including the design and production of a dozen of these items.

**Aircelle** is responsible for the complete nacelle, including the butterfly-type thrust reverser.

**Techspace Aero** designs and manufactures the engine's lubrication system.

**Cenco International** designed and manufactured the open air test cell for the SaM146 in Rybinsk, Russia.

**Messier-Dowty** is in charge of coordination, design and manufacture of the integrated landing system for the Superjet 100.

**Sagem Défense Sécurité**, in conjunction with Hispano-Suiza, developed and integrates the overspeed protection function on the SaM146 FADEC.

**Technofan** supplies all fans on the Superjet 100.

**Microturbo** supplies the 337-02 starter for the plane's SaM146 engines.

**Snecma Propulsion Solide** designs and manufactures the mixed flow nozzle (MFN) for the SaM146 engine.

# MAJOR AEROSPACE PROGRAMS

## *SAFRAN and the Dassault Aviation Rafale*

Dassault Aviation's Rafale is a modern multirole fighter with low radar signature and capable of a wide range of all-weather, day/night missions. Made in both naval and air force versions, it can operate from aircraft carriers, as well as on short runways.

**Snecma** makes the M88-2 engine which powers all versions of the Rafale; the first production engine was delivered in 1996. The M88-2 is well suited to both low-altitude penetration missions and high-altitude interception missions. To date, Snecma has delivered over 150 M88-2 engines to the French armed forces, and they have logged more than 38,000 flight-hours in service. The modular design of the M88-2 means maximum dispatch reliability and maintainability.

**Snecma Services** provides support services for the M88 on behalf of Snecma (including writing the e-documents for overhauls and developing new repair solutions), along with the maintenance of certain modules and parts repair.

Through Ceramic Coating Center, its joint venture with MTU, Snecma Services also produces the latest-generation thermal coatings for the hot section parts.

Life cycle support for French military aircraft engines is shared with the French air force's own AIA repair and maintenance shops.

**Hispano-Suiza** provides the complete control and power transmission system for the Snecma M88-2. In addition, working for Dassault Aviation, it provides the accessory gearbox and flex driveshaft for the Rafale.

The company also developed or specified a number of other systems and components:

- Electrical: FADEC, harness, actuators, speed transducers.
- Mechanical: engine accessory gearbox, flex driveshaft and aircraft-mounted accessory drive.
- Hydromechanical: main and afterburner fuel pumps, fuel metering units, lubrication units, injectors, actuators.

An upgraded version of the FADEC control unit, the M88 Type 3, was developed to meet requirements for enhanced safety and lower operating costs.

**Snecma Propulsion Solide** handles assembly of the afterburner module on the M88-2 nozzle, and also produces the secondary flaps using ceramic matrix composites – an area of expertise at the company.

**Messier-Dowty** supplies the landing gear for the Rafale M carrier-borne version – the most advanced landing system of this kind. Compared with the air force Rafale B and C air force versions also provided by Messier-Dowty, the main and nose gear on the naval version have been strengthened to withstand the demanding conditions of carrier-borne operations.

**Messier-Bugatti** supplies:

- wheels and brakes
- brake-by-wire braking control system
- nosewheel steering system
- landing gear extension/retraction system
- hydraulic generation system (5,000 psi/350 bar)
- brake temperature monitoring system (BTMS).

## MAJOR AEROSPACE PROGRAMS

### ***SAFRAN and the Dassault Aviation Rafale (continued)***

**Labinal** makes all electrical wiring for the Rafale, and is also in charge of installation of wiring harnesses on the assembly lines.

**Sagem Défense Sécurité** provides:

- inertial navigation system, hybrid GPS unit
- OSF infrared frontal imaging system
- Samir missile warning detector, part of the integrated Spectra self-defense system
- Gerfaut helmet-mounted display
- gyros for the fly-by-wire controls
- mission planning system
- AASM modular air-to-ground weapon system
- infrared seeker for the Mica air-to-air missile
- arming units.

**Aircelle** designs and produces composite engine parts for Snecma.

**Sofrance** produces filters for the main hydraulic circuit, the fuel circuit, and also air filters for the avionics suite.

**Technofan** supplies components for the air conditioning system.

## MAJOR AEROSPACE PROGRAMS

### *SAFRAN and the Airbus A400M*

**Snecma** is one of the major partners in the TP400-D6 engine program through the Europrop International (EPI) consortium, grouping the four leading European aero-engine manufacturers: Industria de Turbo Propulsores, MTU Aero Engines, Rolls-Royce and Snecma. Snecma is in charge of the combustor and the high-pressure turbine, installation on the aircraft, the control system and accessory gearbox (via Hispano-Suiza), and the lubrication system (via Techspace Aero).

**Snecma Services** is developing support resources for the Snecma-designed modules on the TP400-D6 (including overhaul documents and development of parts repair solutions, user training media, etc.) Through Ceramic Coating Center, its joint venture with MTU, it makes latest-generation thermal coatings for parts in the hot section. Snecma Services is also gearing up to take an active role in engine MRO as soon as the plane enters service.

**Techspace Aero** has a 4% share of the TP400 engine. It is responsible for lubrication equipment, production of the combustor housing and the high-pressure turbine disk, as well as part of the development engine assembly and testing.

**Hispano-Suiza**, in partnership with MTU Aero Engines, carried out the design studies for the engine control system, drew up specifications for its equipment, and integrated this equipment on the system test rig.

**Sofrance** is responsible for the filters on the engine's fuel and lubrication lines.

**Microturbo** provides the engine starter.

**Cenco International** is adapting a test cell for development tests of the TP400-D6.

**Messier Dowty** is responsible for the design, development, production, integration and support of the A400M's integrated landing gear system. It developed new technical solutions to meet the specific needs of this aircraft.

**Messier-Bugatti** was selected as supplier of carbon brakes and as systems integrator on the A400M. In addition to wheels and carbon brakes, Messier-Bugatti supplies the "SLK" system, for the steering, landing gear extension/retraction and the innovative aircraft kneeling/hiking functions. The kneeling function is controlled by the EBMA, or electrical backup mechanical hydraulic actuator, developed with Sagem Défense Sécurité.

**Sagem Défense Sécurité** supplies the inertial navigation system and hybrid GPS unit, the data acquisition and processing system, and the landing gear door actuator subassemblies on behalf of Messier-Dowty.

**Labinal** was selected to develop, engineer, manufacture, test and deliver electrical wiring harnesses, as well as NON-ARINC cabinets and flight test harnesses for the A400M nose. Airbus also chose Labinal to provide flight test installation assistance services in Toulouse and Seville.

**Technofan** provides cabin ventilation equipment.

# MAJOR AEROSPACE PROGRAMS

## *SAFRAN and the NH Industries NH90*

The NH90 is the first helicopter to feature fly-by-wire controls.

**Turbomeca** supplies the two RTM322 engines (through RRTM, an equally-owned company with Rolls-Royce).

**Cenco International** modernized the production RTM322 test cells for Rolls-Royce Deutschland and Patria of Finland.

**Technofan** provides the remote accessories gearbox (RAGB), as well as all fans for avionics and air conditioning.

**Sofrance** supplies the filters for the gearbox lubrication system and engine and avionics air filters.

**Sagem Défense Sécurité** supplies:

- Navigation system: inertial navigation unit, hybrid GPS, air data unit, Doppler sensor
- Flight control system, for stabilization and guidance
- Avionics assembly for FBW controls
- Multispectral optonics pod.

**Aircelle**, through its subsidiary SLCA, designed and produces the engine cowls.

**Messier-Bugatti** provides the uplock actuator, giving the helicopter deck landing capability during naval missions.

**Labinal** developed and produces the avionics bays as well as electrical wiring for the cockpit and cabin, on behalf of Eurocopter and Agusta.

## MAJOR AEROSPACE PROGRAMS

### ***SAFRAN and Ariane 5***

**Snecma** is propulsion leader on Europe's Ariane 5 launcher. It coordinates 40 partners in 12 European Space Agency (ESA) countries to produce the HM7B and Vulcain® 2 cryogenic engines. It is also in charge of development of the Vinci® upper-stage engine.

**Snecma Propulsion Solide** is in charge of the design, development and production of the MPS solid rocket motors, through Europropulsion. Snecma Propulsion Solide also makes the nozzles for the MPS motors and is developing new nozzle versions. In addition, it provides the pressure sensors for the cryogenic systems on the Vulcain® and HM7, as well as the starters and igniters for these engines.

**Techspace Aero** designed and manufactures the cryogenic valves for the Vulcain® 2 and Vinci® engines, and the hot gas valves for the Vulcain® 2.

**Labinal** has overall subcontractor responsibility for the high-tech cables used on the Ariane 5 cryogenic main stage.

# RESEARCH, DEVELOPMENT AND ADVANCED TECHNOLOGIES

## *Selected programs*

SAFRAN invests heavily in research & technology. It spends some 1.4 billion euros on R&D, of which 60% is self-financed. In addition to the research & technology activities by group companies, SAFRAN participates in a number of joint research programs.

### 1- INTERNATIONAL RESEARCH PROGRAMS

#### **SAFE**

A European Commission program within the scope of the 6th PCRD framework R&D program, SAFE is examining aircraft security in the future European environment. It was launched to meet the need for greater civil aviation security, in light of hijacking and other terrorist attacks. The project focuses on a wide range of threat detection systems, along with the development of corresponding measures to counter physical or electronic threats. One of the keys to this project is the integrated information system, based on a secure communications link. Five sub-projects have been defined to meet the general goals:

- Detection of onboard threats: an integrated threat detection system based on a number of information sensors is installed on the aircraft. A prototype will be built and tested.
- Assessment of the threat and response generation system: a decision-aid tool that will give pilots real onboard crisis management support.
- Recovery of aircraft control by automated systems, with or without human intervention.
- Secure aircraft and ground-aircraft communications.
- Assessment of the economic impact and compliance with national laws.

**Partners:** over thirty partners, including Airbus, BAE, Thales, EADS, nine smaller businesses, and several research labs and universities.

**Term:** February 2004 to December 2007

**Sagem Défense Sécurité 's role:** project coordination and head of 4th sub-project.

#### **TATEM**

A European Commission program for the 6th PCRD, focused on aircraft MRO. The main aim of this project is to improve the efficiency of maintenance, repair and overhaul (MRO) operations, which account for 20% of airlines' operating expenses. For instance, unscheduled maintenance can lead to costly flight delays and cancellations, if the problem cannot be resolved in time.

The Tatem integrated project team aims to validate technologies and techniques that would make maintenance operations more effective, and especially to change unscheduled maintenance into scheduled maintenance.

It is focusing on the following areas:

- Onboard sensors to group data from different aircraft systems (avionics, flight control, engines, structures, landing gear, hydraulics, fuel, etc.).
- Maintenance-free avionics.
- Signal processing (for example, fuzzy logic, neural networks, etc.) to transform raw data into pertinent information on system health.
- Diagnostic methods to identify and locate failures and malfunctions, thus reducing the cases of undetected failures.
- Prediction methods, to support preventive maintenance.
- Decision aids for maintenance crews, including process-oriented information and advice.
- Man-machine interface technologies suited to the needs of maintenance teams.

**Partners:** over 30, including Airbus, EADS, Alenia and Eurocopter.

**Term:** March 2004 to March 2008

**Sagem Défense Sécurité's role:** coordinator of the sub-project "Data management".

### **PIBRAC**

A European Commission program (second call for bids, 6th PCRD) focusing on reducing braking system costs. In particular, the project aims to show how the promising technology of piezo-electric motors could be applied to braking actuators to reduce weight, power consumption and maintenance costs.

The Pibrac program is taking two approaches, studying a rotary configuration in the medium term, and a linear configuration in the long term. The research work should culminate in a technology demonstrator, based on the rotary configuration.

The program will conclude with a technical-economic assessment of these new products.

**Partners:** ten, including Airbus, BAM, Messier-Bugatti and Noliac, plus other small businesses and universities.

**Term:** January 2005 to January 2008.

**Sagem Défense Sécurité's role:** project coordination.

### **European defense R&T: SENSE and AVOID, UAV SIMULATION TEST BED**

In 2005, the European Defense Agency launched an initiative designed to accelerate the development of UAVs for use by armed forces. Sagem Défense Sécurité is a full-fledged partners in two projects: the first, "Sense and Avoid", is designed to support the integration of UAVs in air traffic; the second focuses on the creation of a UAV system simulation testbed to facilitate the evaluation of new sensors and systems.

**Partners:** Sagem Défense Sécurité, TNO, Onera, ESPELSA, BAE

**Term:** 2006-2008

**Sagem Défense Sécurité's role:** coordination of the Sense and Avoid project, partner in the UAV Simulation Test Bed project.

### **LEAP56**

The LEAP56 program is designed to lay the groundwork for future generations of CFM56 turbofans, by tackling all major aspects of aircraft engines. Primary objectives are to improve fuel consumption, efficiency, environmental-friendliness, maintenance costs and reliability. This research is validated by engine demonstrations under actual conditions. The initial TECH56 program kicked off in 1999 and finished in 2004, in particular resulting in the Tech Insertion improvement kit which was recently certified. A follow-on program, LEAP56 has even more ambitious objectives, especially in terms of reducing specific fuel consumption, cost of ownership and environmental impact. It was launched in 2005 and will run until 2009.

**Partners:** Snecma and General Electric Aircraft Engines (GEAE)

**Term:** 2005 to 2009

**Snecma's role:** development of a new-generation fan; evaluation then demonstration in conjunction with General Electric of an engine concept based on a counter-rotating fan and turbine.

### **SILENCE (R)**

A European Union program, organized within the scope of the second call for bids for the 5th PCRD, concerning aircraft noise. Its objective is the large-scale experimental validation of noise reduction technologies concerning the engine, nacelle and aircraft:

- Engine: aeroacoustic design, active technologies
- Nacelle: aeroacoustic design, innovative acoustic treatment, active noise control
- Aircraft: primarily wing and landing gear noise (aeroacoustic design, fairings, innovative acoustic treatment, active noise control).

The program will also evaluate the acoustic performance of future-generation engines, such as those studied within the scope of the EEFAE program (including the CLEAN program).

**Partners:** Over 50 companies (including Airbus Industrie, Rolls-Royce and MTU Aero Engines), research centers and universities. Participating group companies are Snecma, Messier-Dowty and Aircelle.

**Term:** 2001 to 2007

**Snecma's role:** program coordination, and development of key technologies.

### VITAL

Another European Commission program, part of the second call for bids in the 6th PCRD. Vital evaluates technologies for low-pressure modules on future very-high-bypass engines, to reduce fuel consumption and noise in line with objectives set by ACARE. In particular, it is studying new fan architectures, including a stator-less fan with two counter-rotating stages, as well as shaft and structure technologies, and low-pressure turbines. The CIAME research center of Russia has joined Snecma in design and testing of fan models, marking the first significant collaboration by a Russian research center in European aeronautical programs.

**Partners:** Snecma, Techspace Aero, Rolls-Royce, MTU, ITP, Rolls-Royce Deutschland, Avio, Airbus.

**Term:** 2005 to 2008

### SAFRAN's role:

- **Snecma:** program coordinator, development of technologies for counter-rotating fan, aircraft installation.
- **Techspace Aero:** booster module.

### NEWAC

A European Commission program, part of the third call for bids for the 6th PCRD. NEWAC is designed to evaluate and demonstrate certain core engine technologies that will help reduce emissions of greenhouse gases and polluting species, in line with ACARE objectives. The program will be studying: intercooler and active cooling energy recovery cycles, and advanced combustor and compressor technologies.

Snecma is developing innovative compressor technologies such as special housing treatments, boundary layer suction and blowing, active clearance control, etc.

**Main partners:** Snecma, Rolls-Royce, MTU, Rolls-Royce Deutschland, Avio.

**Term:** 2006 to 2009

**Snecma's role:** responsible for work on compressors.

### POA/POWER OPTIMIZED AIRCRAFT – MOET/MORE ELECTRIC AIRCRAFT

POA is also a European Commission program, and one of the nine technology platforms in the 5th PCRD, focusing on the development of "more electric" aircraft. It aims to replace hydraulic power sources by electrical power on an Airbus A330 class aircraft, optimize energy management and validate innovative architectures. POA finishes in 2007, and will be followed by MOET (6th PCRD), dedicated to ruggedized designs of electrical networks, culminating in proposals for standards.

**Partners:** 43 laboratories and companies, including seven from the SAFRAN group.

**Term:** 2002 to 2007.

**SAFRAN's role in POA:** each of the seven group companies is working on a key part of the program:

- **Hispano-Suiza:** responsible for test aspects of the project, in charge of the aircraft test rig (engine plus a half-A330), and design and production of a distributed system (all-electric control), including FADEC and fuel system.
- **Aircelle:** electric thrust reverser control.
- **Labinal:** optimization of electrical distribution and power management.
- **Messier-Dowty:** feasibility study and integration of all-electric landing gear.
- **Snecma:** integration of electrical devices in a turbofan engine.
- **Technofan:** ventilation systems.
- **Techspace Aero:** engine lubrication system with electric pumps.

#### **SAFRAN's role in MOET**

- **Hispano-Suiza:** in charge of electronic power controllers.
- **Labinal:** works with Airbus on network engineering.

#### **TPTECH/TPX – FUTURE TURBOPUMP**

Technology demonstration programs financed by French space agency CNES, designed to lay the groundwork for a hydrogen turbopump on a future-generation rocket engine. The TPTECH technology demonstrator resulted in conclusive initial tests on a component test bench. It will therefore shortly be followed by demonstration tests of TPX, a Vulcain-scale turbopump featuring a simplified architecture and lower-cost components (open impellers, fluid bearings, blisk type turbine rotor, etc.). The technologies validated in this program will also be a critical part of the hydrogen turbopumps on tomorrow's reusable rocket engines.

**Partners:** Snecma, Volvo Aero Corporation, IHI (Japan).

**Term:** 2001 to 2007

#### **FLPP - Future Launcher Preparatory Program**

Snecma is leading European partners in this ESA program to foster the technology developments needed for propulsion systems on reusable launchers. The main areas of research are: staged combustion using LOX-LH2 and LOX-CH4 propellants, turbopumps and monitoring.

**Partners:** Snecma, Techspace Aero, DLR

**Term:** first phase from 2005 to 2007.

#### **P80**

The P80 is a demonstrator program for a new-generation solid rocket motor with 80 metric tons of solid propellant. It is being built by a European team, with ESA as program manager. The P80 program is designed to qualify technologies offering excellent cost reduction potential for use in future launchers or derivatives of Ariane 5. Snecma Propulsion Solide is developing the nozzle, and SAFRAN is involved in overall design and testing through Europropulsion, its joint venture with Avio. The first of two ground firing tests was carried out successfully at the Guiana Space Center in Kourou, French Guiana, at the end of 2006. The Vega small launcher will be the first application.

**Partners:** Europropulsion (50/50 SAFRAN-Avio joint venture), Avio, Snecma Propulsion Solide

**Term:** 2003 to 2007

## 2- JOINT PROGRAMS IN FRANCE

SAFRAN is currently involved in over 100 R&T programs with 60 French labs at the CNRS (national scientific research agency), CEA (atomic energy commission), ONERA (aerospace research agency), etc. Some of the major joint initiatives are listed below.

### INCA

SAFRAN faces three major imperatives in developing next-generation combustion systems: failsafe operation, minimal environmental impact (reduction of NOx, CO2, soot, etc.), and competitive costs. To meet these challenges, SAFRAN, Onera and CNRS have launched major research programs to foster continuous improvement and also identify innovative, even “disruptive” technologies. For even more effective collaboration, they have pooled their skills within the INCA Advanced Combustion Initiative. Its goal is to leverage French combustion expertise, and ensure that SAFRAN is a top-tier player in all related technologies.

**Partners:** Snecma Propulsion Solide, Snecma, Turbomeca, over 30 CNRS and Onera labs; support from the French defense procurement agency DGA, civil aviation program directorate DPAC, space agency CNES and the Ministry of Research.

**Term:** started in 2002, renewed for 2007-11

### MAIA

The Advanced Mechanical Engineering Methods initiative (MAIA) aims to support the design of lighter, higher-performance, lower-cost, less polluting and high-reliability components for aeronautical systems developed by the group. The founding partners in this initiative are French research agencies Onera (aerospace) and CNRS (science); MAIA brings together over 100 engineers and scientists from eight group companies, along with the public laboratories. They will be working on developments in robust computation, vibrations, transient dynamics, modeling of composite materials, lifespans of structures and contact mechanics.

**Partners:** Hispano-Suiza, Aircelle, Messier-Bugatti, Messier-Dowty, Snecma Propulsion Solide, Snecma, Techspace Aero, Turbomeca, three Onera departments, 22 CNRS laboratories, 2 CEA (French atomic energy commission) laboratories, three Belgian labs, an American lab, and support from defense procurement agency DGA, civil aviation program directorate DGAP, French space agency CNES and the Ministry of Research.

**Term:** 2003 to 2008.

### IROQUA

Following in the footsteps of previous initiatives, CNRS, ONERA, Airbus, Dassault Aviation, Eurocopter and SAFRAN have launched a similar initiative, IROQUA, this time to reduce aircraft noise.

The Advisory Council for Aeronautics Research in Europe (ACARE) has set noise reduction targets for 2020, including a decrease of 10 decibels in noise around airports, or a ten-fold decrease in sound power – which means cutting perceived noise in half. This objective is all the more ambitious, since previous scientific and technical studies have already reduced noise by about 20 decibels since the 1980s. Researchers will focus on two approaches: the first is to reduce noise at the source wherever possible, by working on the shape and configuration of airframes, engines, equipment and materials. For example, they will be studying nozzles, turbine speeds and combustion rates that foster noise reduction. This facet is the focus of the IROQUA program.

The second approach concerns low-noise flight procedures and paths. People are not disturbed to the same degree if aircraft are flying overhead once an hour or once every ten minutes, not to mention during the day or at night. The perceptions of neighboring populations will be taken into account to orchestrate aircraft movements around airports.

This research will help contain noise around airports, as recommended by ACARE. In this case, noise is considered to be a disturbance when it exceeds a level of about 65 decibels, or the noise a car makes at 130 kilometers/hour.

Five projects were launched in 2006 with the support of the Aerospace Research Foundation.

**Partners:** CNRS, ONERA, Airbus, Dassault Aviation, Eurocopter, and within SAFRAN, Snecma, Snecma Propulsion Solide, Aircelle, Messier-Dowty, Turbomeca.

**Term:** 2005 to 2010

## **AEROSPACE RESEARCH FOUNDATION**

SAFRAN is a founding member of the Aerospace Research Foundation, along with EADS, Thales and Latécoère. On April 1, 2005, the foundation received the French government's seal of approval. Its aim is to define, promote and finance, for a period of at least six years, joint aerospace research programs, especially those involving a public-private partnership. These programs will address the fundamental challenges of sustainable development, security, safety and environmental protection.

Since the outset, the Foundation has issued four calls for bids, and financed about 15 projects on the following subjects:

- Silent aircraft
- Wireless technologies for data transfer and energy management
- Autonomous aerospace systems
- Materials.

## **CENTERS OF COMPETITIVENESS**

SAFRAN is heavily involved in several centers of competitiveness established in French regions concerning aerospace in general and onboard systems in particular. Snecma Propulsion Solide in Aquitaine, and Labinal and Technofan in Midi-Pyrénées are major participants in the Aerospace Valley initiative, while Sagem Défense Sécurité, Hispano-Suiza and Snecma are involved in a number of areas of research coordinated by System@tic in the greater Paris area. Aircelle is involved in the MOVEO program in Normandy. Furthermore, SAFRAN has taken the leadership in the candidacy of ASTech-Paris Region to receive an aerospace center of competitiveness label, complementing the one in southwest France.

## **3 - SAFRAN'S IN-HOUSE PROGRAMS**

Here are just a few of the many R&T programs now being conducted within the SAFRAN group.

### **ECO, reduced cost-of-ownership combat aircraft engine demonstrator (Snecma)**

Based on the Rafale's M88 engine, ECO is a demonstration program that aims to reduce cost of ownership by extending time between inspections, while also expanding the performance envelope to increase the engine's versatility and keep pace with evolving mission requirements. The improvements designed to ensure world-class performance focus on the HP and LP compressors, HP turbine, afterburner, nozzle and control system. The program is supported by French defense procurement agency DGA. Tests kicked off in 2004 and were successful. They will continue until 2008, including the demonstration of a new generation of high-pressure turbine blades, dubbed Theo.

### **EGISTHE, general design studies on highly economical turbomachinery (Snecma, Turbomeca, Snecma Propulsion Solide, Microturbo)**

The EGISTHE program, supported by French defense procurement agency DGA, aims to develop state-of-the-art technologies and tools in the following areas:

- Decreasing total cost of ownership for engines: development, acquisition and support costs.
- Improving operational performance: specific fuel consumption, power-to-weight ratio, integration, etc.
- Increasing the survivability of aircraft and missiles: reduced signatures, improved engine reliability, etc.

For military aircraft engines, EGISTHE will provide a technology base to foster improvements in engines under development or already in service. It will also pave the way for tomorrow's demonstrators and engines.

On missile engines, the aim is to increase range by reducing fuel burn, using a twin-spool turbofan layout.

French aerospace research center Onera is a major partner in this program.

### **CERAMIC MATRIX COMPOSITE COMPONENTS FOR AIRCRAFT ENGINES (Snecma, Aircelle, Snecma Propulsion Solide)**

Reducing engine weight is a critical factor in helping reduce aircraft noise and pollution. Ceramic matrix composites can play a major role in this endeavor, since they combine light weight with excellent temperature resistance.

However, innovative solutions are still needed if these composites are to offer the required service life of thousands of hours, plus acceptable cost. Research is now under way at Snecma, and at the LCTA joint laboratory (CNRS-University of Bordeaux-CEA-SAFRAN). It has already achieved significant results, including decisive demonstrations of nozzles on French and American military engine.

A CMC mixer was successfully tested on a CFM56-5C in 2006. This year, work is focusing on an acoustically treated nozzle plug designed to reduce combustion noise without incurring a weight penalty.

### **TITANIUM MATRIX COMPOSITE PARTS (Snecma, Turbomeca, Messier-Dowty)** **Rotating parts for aircraft engines**

The Epicur program, funded by the DGA, involves the development of an integrally bladed disk, or blisk, made of a composite material with a titanium matrix and silicon-carbide (SiC) fibers. Considered a disruptive technology, this material will cut weight in half. The innovative, low-cost production process (high-speed coating) allows a variety of matrices to be used, unlike conventional coating processes. The concept has been tested for mechanical strength. A full-scale prototype is now being built within the scope of the Epicur 2 program.

### **Titanium matrix composites for landing gear (Snecma and Messier-Dowty)**

Building on Snecma's extensive expertise in titanium matrix composites, Messier-Dowty has launched a program to adapt this technology to landing gear. Research is focusing on performance, especially a significant lightening of the parts concerned, and reducing the production costs for this technology.

### **ORGANIC MATRIX COMPOSITES (Aircelle, Snecma, Messier-Dowty)**

These three companies are involved in a program that reflects the Industry Ministry's dynamic commitment to enhancing the competitiveness of the French composites industry. Aircelle, as the Group's center of expertise in this area, will be in charge of a project to develop RTM (resin transfer molding) composite parts for nacelles, engines and landing gear. It is also a partner in the Défi Composite, or Composite Challenge, a program proposed to the French agency for industrial innovation.

### **GRH (Sagem Défense Sécurité)**

Hemispheric resonator gyros (GRH in French) provide a real “disruptive” technological advance for inertial systems. This type of technology offers not only a wide range of performance, but also reduced size and cost, to make these units appropriate for many different applications.

In this type of gyro, a hemispheric resonator is fixed along its axis, and is excited and controlled by a capacitative effect, initially provided by two concentric hemispheres. This structure enables controlling the deformation of the resonator according to the air gap, but production and assembly is meticulous and costly.

R&D work has resulted in a number of patents filed over the last ten years. The patents mainly concern the architecture of the inertial sensor, especially the replacement of the conventional spherical air gap by a flat gap which is less costly to produce, along with signal processing electronics and manufacturing processes.

Tests have validated this research, and results match expectations. Production of a high-performance inertial reference system was recently launched, and will be used for tactical missions on a variety of platforms.

### **Image processing for defense and security applications (Sagem Défense Sécurité)**

Image processing is a core discipline for Sagem Défense Sécurité’s optronics and biometrics businesses. It involves a variety of functions: image stabilization, tracking via visible and infrared imagery, multispectral image fusion, detection, recognition and identification of targets on fixed or moving images, in visible and IR wavelengths, recognition of digital fingerprints, irises and faces, etc.

Sagem Défense Sécurité has participated in a number of advanced research projects for French defense procurement agency DGA, concerning or including target identification and classification functions, in land or air environments.

The company has been carrying out contract or independent research for a dozen years, calling on collaboration with major research organizations such as Inria and CNRS, as well as universities.

Sagem Défense Sécurité is a member of the ISIS research group, and is participating in the Techno-Vision program launched by the ministries of research and defense through the Robin project.