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TABLE OF CONTENTS

1 - The Company and its activities.....	Page 3
Ø Defense propulsion	
Ø Space propulsion	
Ø Aeronautical propulsion – civil and military	
Ø Thermostructural composite materials	
Ø Partnerships	
2 - Top quality personnel	Page 4
Ø Training	
Ø Mobility	
Ø Safety and the environment	
Ø Action V	
3 - Thermostructural composites - outstanding materials	Page 5
Ø Sepcarb [®]	
Ø Sepcarbinox [®]	
Ø Cerasep [®]	
4 - Products.....	Page 6
Ø Strategic and tactical propulsion, development and production of the Solid Rocket Motors for the M51 ballistic missile	
Ø Space propulsion, prime contractor for Solid Rocket Motors	
Ø Aeronautical propulsion, development of nozzles and afterbodies for civil and military engines	

1 – The Company and its activities

Snecma Propulsion Solide, a subsidiary of the SAFRAN Group, is a top European manufacturer of the Solid Rocket Motors used to power ballistic missiles and space launchers.

In the field of Thermostructural Composite Materials, Snecma Propulsion Solide is the SAFRAN Group's Center of Technical and Industrial Excellence – recognition of its work developing and manufacturing composite materials for very high temperature applications. These materials are a valuable asset for the Group and a major contributor to growth for the company. Snecma Propulsion Solide is also recognized as a skills center in aeronautical nozzles for the SAFRAN Group.

Snecma Propulsion Solide performs its four main activities on its 105-hectares Le Haillan plant, just outside Bordeaux in southwest France:

Defense Propulsion

- § Design, development and production of propulsion systems for strategic and tactical ballistic missiles, thrust vector control systems for tactical missile and interceptors.
- § Key projects: M45, M51, Mistral

Space Propulsion

- § Prime contractor for the solid rocket motors powering the Ariane 5 and VEGA launchers, jointly with AVIO. Design, development and production of the nozzles for these motors.
- § Key projects: solid rocket motors for the Ariane 5 and VEGA launchers. Extendible exit cone for the VINCI motor. An extendible nozzle RL10-B2 of Pratt & Whitney cryogenic engine.

Aeronautical Propulsion

Design and production of parts and subassemblies for civil and military aeronautical propulsion. Assembly of nozzles for the M88 engine, development and production of nozzles for regional aircraft engines.

- § Assembly of nozzles, projects of future nozzles.
- § Key projects: Cold flaps and afterbody assemblies for the M88 engine, Pratt & Whitney F100 engine powers flaps.

Thermostructural Composite Materials

- § Design and production of parts for military and space propulsion, military aeronautics, dimensionally-stable structures, tooling and equipment for space and industrial applications.
- § Key projects: combustion chambers, carbon-carbon ring on the high-resolution instrument fitted to the Pleiades satellite, insulation of nacelles on aircraft engines.

Partnerships

Aerojet, Aircelle, Arianespace, Astrium-ST, ATK, Avio, CEA, CNES, DGA, DPAC, ELV, ESA, Europropulsion, General Electric, MBDA, Messier-Bugatti, NAMMO, NASA, Pratt & Whitney, Snecma, Turbomeca.

These various activities generated sales for 2006 of 214 million euro.

2 – Top quality personnel

To ensure that it continues to play a leading role in Europe in solid rocket propulsion, Snecma Propulsion Solide invests readily in its 1,250 specialists in solid rocket propulsion and thermostructural composite materials.

Training

The skills and values of Snecma Propulsion Solide personnel are focused on improvement and innovation. The company spends the equivalent of 4% of its wage bill on training. The product of this investment is high-tech teams skilled in satisfying customers and in providing a high quality service. Product excellence also demands that the partners and subcontractors that Snecma Propulsion Solide chooses to work with also operate at the highest technological and economic level.

Mobility

Snecma Propulsion Solide also encourages mobility within the company. This is a cornerstone of its human resource management policy. Mobility is an essential element of every employee's development. It encourages the exchange of experience and career development, and fosters dynamism and creativity, and in these respects reflects the company's core values.

Safety and the environment

The protection of individuals and property, preserving the environment and a tight control of risk are issues that are constantly addressed by Snecma Propulsion Solide. Renewed November 2006, the ISO14001 certification of Le Haillan plant confirms the company's commitment to the continuous improvement of environmental protection measures.

Action V

Action V is a progress-related procedure of the SAFRAN Group which is making Snecma Propulsion Solide better able to face the challenges of tomorrow. Several generations of projects have followed one another in succession, each building on the accomplishments of the previous ones.

Since 2001 global organisation of production has been profoundly transformed by different successive projects (UPA, MRP2, 3P, AQCORDE). A new stage began in 2006: "Perf" projects in the major sectors have enabled the achievements of these projects to be converted into "operational performance", and our undertakings to be met.

3 – Thermostructural composites - outstanding materials

All the products developed and manufactured by Snecma Propulsion Solide require high levels of expertise due to the technological and industrial complexity of their production. The result is a range of products for defense, space and aeronautical applications.

Thermostructural composites –outstanding materials

Since 1970, Snecma Propulsion Solide has developed the skills and expertise needed in this very specific field to apply these materials to the manufacture of rocket motors and brakes for aircraft. The production of nozzle components for the solid rocket motors that power the Ariane 5 launchers and strategic missiles is the core work conducted within the thermostructural composite materials unit.

The outstanding properties of the materials and the skills developed means that their applications can now be extended to military and civil aircraft engines such as the Airbus family.

We are continuing to develop the extendible exit cone for the Vinci motor, liquid rocket motor of the future Ariane 5 ECB launcher.

The various composite materials each have specific properties that offer key competitive advantages in numerous applications.

- **SEPCARB[®]** : a family of composite materials made from carbon fibers in a carbon matrix. Their exceptional mechanical strength and stability at high temperatures mean that they can be used to make nozzles for rocket motors. Their tribological properties mean that they can also be used in friction applications. More than 60% of civil aircraft carrying 100 or more people are fitted with carbon brakes; a market in which Messier-Bugatti, SAFRAN Group, is a world leader.

Due to their dimensional stability, **SEPCARB^R** materials can also be used in numerous other applications in space, particularly in the field of high-resolution optical instrumentation, and in industry generally.

- **SEPCARBINOX[®]** : a family of composite materials made from carbon fibers and a ceramic matrix that offer low density combined with very good resistance to thermo-mechanical fatigue. They are particularly good at resisting prolonged exposure to oxidizing environments, and consequently are suited for use as: hot components for aircraft engines, thermal insulation systems and structural elements for atmospheric reentry vehicles or the reusable space vehicles of the future. A new generation of **SEPCARBINOX[®]**, comprising a self-healing matrix, and intended for aeronautical applications has been designed to offer a significant increase in their service life in operation.

- **CERASEP[®]** : composite materials made from ceramic fibers and a ceramic matrix that provide resistance to very high temperatures over very long periods. The properties of these materials are particularly valuable for the hottest aircraft engine components (combustion chambers, turbine shrouds, distributors and afterburner systems).

4 – Products

Strategic and tactical propulsion

Strategic and tactical propulsion, development and production of the Solid rocket motors for the M51 ballistic missile

The series production of the M51 missile started in 2005. The first flight test of the M51 ballistic missile ran smoothly on 9 November 2006 from the missile launch and test center (CELM-DGA). Snecma Propulsion Solide's skills and expertise in new technologies, such as the flow control of hot gases, opens up avenues of development for a high-performance terminal stage fitted to future interceptors. Work is on-going with MBDA, Astrium-ST and DGA to define a demonstrator that satisfies the needs for high endo and exo-atmospheric interception.

Tactical propulsion, continuation of the series production of rocket motors for missiles

Snecma Propulsion Solide continues its series production of the propulsion system for SATCP's Mistral missile.

Space propulsion, prime contractor for Solid Rocket Motors (SRM)

The Solid Rocket Motors (SRM) that power the Ariane launcher only operate for the first 2 minutes of flight, but in that time must provide sufficient thrust (90% of the rocket's total thrust) to release the rocket from the dense lower layers of the atmosphere. Ariane 5 can now place satellites of up to 10 metric tons into geostationary transfer orbits.

Snecma Propulsion Solide holds overall responsibility for the nozzle and formed a joint venture with Avio (resulting in the formation of the Europropulsion company) to develop and produce Solid Rocket Motors (SRM).

Snecma Propulsion Solide develops and manufactures the nozzle for the P80 solid rocket motor that will be fitted to the first stage of the VEGA light lift launcher. The first bench test, on 30 November 2006 at the Kourou space center, was a complete success. Snecma Propulsion Solide is also involved in the research and development of new nozzles with a view to their application on future launchers, and notably on behalf of the French space agency (CNES).

Aeronautical propulsion, development of nozzles and afterbodies for civil and military engines

As an expert in the field of military aeronautical nozzles, Snecma Propulsion Solide produces military engine nozzles and the mixed flow nozzle for the SaM 146 jet for SUKHOI's Russian regional aircraft.