

DEFENSE. With the development of the new M51 ballistic missile, France's nuclear deterrence force bolsters its credibility. Snecma Propulsion Solide supplies the solid rocket motors for this new strategic missile.

M51, THE KEY TO FRENCH DETERRENCE

France's nuclear deterrent force plays a key role in the country's national defense. In 2006, former president Jacques Chirac said, "Deterrence must maintain its essential credibility in a changing geographic environment. (...) With its intercontinental range, the M51 will allow us to counter any threats that arise in this uncertain world, no matter where they come from."

For his first official visit to the armed forces, France's new president Nicolas Sarkozy chose the highly symbolic site of Ile Longue (western France), where the navy's nuclear-powered ballistic missile submarines are based. During his speech he reiterated his commitment to allocating "the resources needed to guarantee French security under any circumstances."

The original M5 program (subsequently renamed M51) was launched in 1992 to replace the ballistic missiles now deployed on France's nuclear submarines. The M51 is a three-stage missile powered by solid rocket motors. Weighing 56 metric tons (123,200 lb), it carries up to six nuclear warheads and features inertial guidance.

Propulsion system qualification on track

"We've nearly completed qualification of the propulsion system," says Gérard Frut, managing director of programs at Snecma Propulsion Solide, a Safran Group company. He is also a director of G2P, a consortium formed by Snecma Propulsion Solide and SNPE Matériaux Energétiques (supplier of the solid propellants) to oversee

solid rocket motor production. With a 75% share of G2P, Snecma Propulsion Solide is the propulsion prime contractor, in charge of manufacturing all inert components in the rocket motors (structure, thermal lining, igniter and nozzle), as well as final assembly. "The M51 program accounts for 50 to 60 percent of business volume at SPS," continues Frut, "so it's extremely important for our company. We have a production contract that runs to 2015, and we're already making preparations for the future."

According to Laurent Sellier, director of sea-launched strategic ballistic missiles (MSBS) at French defense procurement agency DGA, "During development of the M51, there were extensive discussions between teams from Snecma Propulsion Solide, SNPE Matériaux Energétiques and the DGA concerning rocket motor development and testing, as well as program management. The co-contracting agreement between overall prime contractor EADS Astrium and propulsion prime contractor G2P proved to be very effective, and enabled us to overcome the problems inherent in any program of this size. We should keep this in mind for any future developments."

The missile passed a major milestone in its qualification program with a successful first test launch on November 9, 2006. This was confirmed with an equally successful second launch on June 21, 2007. Several more qualification launches are scheduled in the coming years, leading to service entry of the M51 on the new-generation nuclear submarine Le Terrible in 2010. ■

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A WIDE VARIETY OF APPLICATIONS FOR THERMOSTRUCTURAL COMPOSITES

The ongoing search for higher-performance ballistic missile technologies led Snecma Propulsion Solide to develop very light carbon-carbon and ceramic matrix composite materials, which retain their mechanical properties even at ultra-high temperatures. These materials were subsequently used in brakes and engine exhaust systems on both civil and military aircraft, developed and produced by other Safran companies, reflecting the synergies within the Group and its dual technology cross-fertilization.

HI-REL INERTIAL NAVIGATION

The M51 is fitted with an inertial navigation system developed by Sagem Défense Sécurité, based on purpose-designed accelerometers and laser gyros. With this system, the M51 enjoys complete independence in terms of navigation and flight control. This highly integrated system has to be extremely reliable, since size and weight restrictions mean it cannot provide a very high degree of redundancy. Mission success and therefore the credibility of French deterrence depend on this reliability, as well as navigation accuracy and the ability of the navigation system to resist external threats.