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# SOLID ROCKET MOTORS FOR FUTURE EUROPEAN LAUNCHER

**Abstract**

Solid Rocket Motors (SRMs) are well suited to deliver very large thrust levels required for space launchers take-off. They proved their reliability on the whole Ariane launcher family with zero failure since 30 years now. The successful Vega maiden flight, beginning 2012, comforted this record.

For the coming decade the current European launchers panel - Ariane 5, Soyuz and Vega - will guarantee an independent access to space to European institutional satellites and offer reliable launch services to commercial satellites. Nevertheless even if some evolutions of A5 (like A5ME) or Vega could enlarge their mission capabilities, this panel suffers from an overall low level of synergies and long term sustainability of the Soyuz is questionable. A more homogeneous launcher family would lead to a globally less expensive and more sustainable complete launch system.

ESA (European Space Agency) and CNES (French Space Agency) are managing, with the support of industry, numerous studies to identify such new launcher family designs. One important scope is to define the required motors and engines necessary for these new launch systems in order to engage preliminary development activities if required, technology maturation being most of time very long for propulsion systems.

This paper presents an overview of large solid rocket motor possibilities for potential new generations of European launchers. It summarizes studies performed since a decade by Herakles (Merging of Safran Snecma Propulsion Solide and Safran SME, former SNPE Materiaux Energetiques) with the support of CNES and ESA. Several motor preliminary designs are presented to constitute launcher families covering from Soyuz up to A5ME GTO missions. All launcher families are retaining a cryogenic propellant upper stage using the under development Vinci engine. The different launcher 'cores' are more innovative and relies on solid propulsion with most of time a stack of two SRMs. Some launcher architectures are proposed with solid strap-on motors for versatility purpose.

One design driver for the very large first stage motor is to remain compatible with existing production facilities in French Guyana in order to avoid excessive investments. Two motor calibers are explored: either 3 m in line with current A5-MPS and Vega P80 examples or a new larger 3.7 m caliber for more powerful motors. For each projects, the general motor design, propulsive performances and technical challenges to achieve payload target are presented.