SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)
Future Space Transportation Systems Technologies (5)

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CONTINUOUS TWIN SCREW TECHNOLOGY FOR THE MANUFACTURE OF LARGE SOLID PROPELLANT GRAINS OF NEXT GENERATION LAUNCHER

Abstract

Europe is soon to operate from French Guiana a family of launchers, composed of Ariane 5, Soyuz, and Vega. This family is fitted to current European institutional and commercial needs from small to heavy payloads. This family of launch rockets should be replaced by 2025. While it is too early to set out in detail the technology building blocks for future launchers, and considering the lead-time required to develop a new launcher – between 10 and 15 years - CNES teamed industrials in a program devoted to prepare future solid propulsion technologies needed for Next Generation Launcher (NGL). Technological breakthroughs are critical to ensure increased cost attractiveness production of motors. Initial process studies already performed on the casting of a 180 tons solid rocket motor, a promising first stage candidate for Ariane 6 NGL, with only two 1800G vertical mixer show limits of the existing manufacture facilities in Kourou. Moreover, vertical mixers in use are in operation since the end of the 80's, requiring also addressing items such as maintenance of these mixers that would need to be used for manufacture of grains until well beyond 2040. Continuous mixing process for solid propellant is one of technological breakthroughs that would allow casting very large solid rocket motors not only to comply with cost reduction goals but also to contribute to largely reduce hazards in production, thus allowing increased production rates. Taking advantage of current existing pilot facilities installed at SNPE Matériaux Energétiques (SME) plant near Bordeaux, it was possible to define the additional technologies that would be required for the production of large solid propellant motors. To reach the maturity level needed to start a full scale development in 2015, a first study phase is now performed at SME in the frame of CNES RT studies. Program of activity includes manufacturing a 1/15 mock-up of Ariane 5 to be test fired in the middle of 2010 with the same propellant than the Ariane 5 launcher but produced with a twin screw process. A first test of Ariane 5 propellant mixed using this pilot unit was recently performed leading to very promising results that will be presented. In the second phase, other larger scale demonstrations are mapped to consolidate scaling effects from pilot to industrial application to grow TRLs. They will provide experimental data to scale up to the large industrial capacity required for large mass production needed for NGL.