

ORPHEE- Innovative propellants in hybrid propulsion technology and its applications in space transportation

REFERENTE: prof. Annamaria Russo Sorge, Dip. Ingegneria Aerospaziale

Nowadays, chemical propulsion is based on solid (launch applications like first stage booster) or liquid technologies (upper stage engines). Complementary, hybrid propulsion technology, as defined in ORPHEE (Operational Research Project on Hybrid Engine in Europe), appears as a new generation of advanced space transportation system. Engines based on this innovative propulsion concept provide advantages like thrust performance, throttling (thrust modulation), versatility (easy adaptation to various configurations), simplicity, safety, which significantly reduce the global engine cost. It will help to consolidate the long term sustainability and ensure a technology needed by the European propulsion space community to remain independent.

Hybrid propulsion principle is based on the injection of a liquid oxidizer into the engine combustion chamber where it reacts with a solid fuel to generate hot gases providing the thrust. Enlarge the burning surface is the current proposed solution to reach the needed performance level. It dramatically increases the solid grain volume and the engine weight, limiting the applications. The regression rate is a key parameter controlling the solid fuel grain design. Its increase is a very attractive solution to reduce the grain volume. The main objectives of ORPHEE are to increase versatility of space propulsion system, ensure significant increase performance of hybrid engine, improve solid fuel technological maturity from TRL 1 to 3 and gather European skills on hybrid propulsion and ensure European access to space. In near future, the availability of new hybrid engines will allow the access to new space transportation missions and to obtain significant costs reduction. It will consolidate the knowledge on this innovative technology, allowing the European space community to become non dependant. It may be considered as a competitive propulsion solution to be implemented in future space agencies roadmaps.

Coordinator

SNPE MATERIAUX ENERGETIQUES SA (France)

Other participants

ASTRIUM GMBH (Germany)

THYIA TEHNOLOGIJE D.O.O (Slovenia)

UNIVERSITATEA POLITEHNICA DIN BUCURESTI (Romania)

ASTRIUM S.A.S. (France)

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES (France)

DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (Germany)

AVIO S.P.A (Italy)

POLITECNICO DI MILANO (Italy)

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