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PEPE: A LOW COST, RELIABLE, REUSABLE, USER- AND ENVIRONMENT- FRIEND PROPULSION SYSTEM

Abstract

BD SENSORS is a Czech SME operating, through its Space division CSRC, in Space business since more than 25 years for design, development and MAIT of Space electronics. More recently BDS together with its strategic research partner OteSpace invested in developing a new concept of Propulsion. BDS is presently developing the PEPE engine family to offer to the space transportation community an attractive propulsion system for their vehicles and provide significant competitive advantage. PEPE (Peroxide Electric Propulsion Element) family is designed to achieve significant improvements in the following engine characteristics: Reliability, Reusability, Versatility, User friendliness (operation, maintenance), Cost, Environmental Impact. The PEPE family is based on the following concepts: Bi-liquid engine, storable eco- and user-friendly propellants. Selected oxidizer is stabilized hydrogen peroxide, while for fuel some options are still under consideration. Electric pumps, simple, reliable, versatile. The electric-pump fed cycle has been selected, as it combines the virtues of the pressure-fed and the turbopump-fed cycles and reduces most of their flaws. Hypergolic ignition, reliable, repeated restart ability. After ignition the engine could switch to a non-hypergolic fuel in order to guarantee enhanced safety and performance. Regeneratively cooled chamber and nozzle in order to guarantee reusability. Injector with variable wet area in order to guarantee throttling ability. PEPE concept has some limitations with respect to more traditional propulsion systems. In particular, two limitations have been identified: Lower ISP than NTO/MMH or LOX concepts Longer ignition sequence than NTO/MMH. The activities are in progress. One 1kN Breadboard Model has been developed and tested. Test results were in general positive, but presented some problems, that have been analyzed and hopefully solved. The parts related to a prototype, implementing the "lesson learned", shall be ready for integration and test by the end of February 2022. In parallel, activities related to a second unit of the PEPE family are in progress. This second unit will have 10kN thrust. It will be characterized by Pressure-fed cycle and it will run with hypergolic fuel only, in order to avoid fuel switch. This will imply slightly lower ISP but faster ignition sequence and reduced complexity. Thrust chamber injector design are ongoing, as well as design of an upgraded test stand, designed to eventually manage engines up to 15-20kN thrust level. The paper will present more detailed description of the 1kN design and testing campaign, as well as the status of 10kN thruster development.