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HIPER: A EUROPEAN PROGRAMME TO DEVELOP HIGH POWER ELECTRIC PROPULSION TECHNOLOGIES FOR FUTURE SPACE EXPLORATION.

Abstract

High Power Electric Propulsion (HPEP) could play a key role in Space Exploration venture by enabling more affordable and sustainable space-to-space missions. The high thrust efficiency and lifetime of HPEP technologies shall enable mass savings, launch flexibility and long interplanetary journeys with no gravity assist constraints. This in turn open the way to transferring large payloads through the solar system in a much more affordable way than in the past.

HiPER is a 3-year collaborative project, substantially funded by the European Union and aimed at laying the technical and programmatic foundations for the development of HPEP technologies able to satisfy Space Exploration needs. HiPER involves 20 partners from 6 European Countries under the coordination of Alta. The project's goal is clearly ambitious, since it not only addresses enabling technologies' road-mapping, but it also considers their fall-out impact on foreseeable future European and worldwide social, economical, and political scenarios. In particular, three different HPEP concepts (and related solar electric and nuclear power generators) have received particular attention and are considered as the candidates with the highest application potential: Hall Effect Thrusters (HET), Gridded Ion Engines (GIE) and Magneto-Plasma-Dynamic Thrusters (MPDT).

During the first year, HiPER activities were devoted to select mission scenarios which could benefit from the increase of the operational power level of HPEP systems. Based on the assumption of Solar Electric and Nuclear Electric high power generation, simulations of transfer trajectories were performed. The Nuclear Electric Power (NEP) generation draft technical roadmap was also produced in which the achievable performance and design characteristics of a nuclear fission reactor for power generation consistent with the candidate mission requirements were identified. The second year was mainly focused on the technological work packages studied in the programme. Based on realistic improvements in power generation and HPEP for the next decade, design and development activities of the three EP concepts were initiated. Moreover, the definition of a novel design concept for solar concentrators with inflatable structure was also initiated.

At present, manufacturing, assembly and testing activities of a 20 kW HET, two 100 kW-class MPDTs, a long lifetime cathode for a 25 kW-class GIE and a prototype of solar concentrator are in progress.

Proposed scenarios for HPEP applications, the development status and test results of innovative technologies for future space exploration identified in the HiPER program will be presented in this paper.