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THE BENEFITS OF USING NUCLEAR ELECTRIC PROPULSION IN SPACE.

Abstract

Nuclear Electric Propulsion (NEP) can offer multiple advantages in regards to space exploration. Significant gains can be realised in flight time (by eliminating the need for gravity assists, even for deep space missions), on-board power availability (with a power level an order of magnitude higher of what is available today) and payload mass delivered to the selected target. To deliver a spacecraft in the 2030-2040 time frame, necessary ground and space demonstration missions will be required. The readiness of the system will be reached by testing of all key technologies on ground and in orbit on subsystem and system level. This includes the core, conversion, thermal management, power management and propulsion subsystems as well as the assembly of all subsystems in orbit by autonomous or remote control robotics.

The MEGAHIT project has produced an incremental development plan for the realisation of a NEP spacecraft in the 2030-2040 time frame. It has developed the high level requirements for a multi-use NEP spacecraft and investigated the preliminary mission architecture for two reference missions: an asteroid mission for planetary protection/exploration and a deep space exploration mission. By using the power source of a nuclear core, power in the range of 1MW will be achievable that can then utilised by the spacecraft for advanced electric propulsion, using clustered ion or hall thrusters. Furthermore, synergies that exist between the proposed spacecraft project development plans and on-going RD in the nuclear, advanced materials and aeronautics industry highlight the technological and societal benefits from such an endeavor. These synergies also include the potential risks associated with the project and the propose risk mitigation actions and regulations in order to reduce those risks. A spacecraft that is able to deliver

and operate a multi-ton payload to the outer planets or to an asteroid would provide a step change in current mission ability and provide real benefit. NEP is seen as a key enabling technology for such a spacecraft, providing additional mission options that are currently not practicable.