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Author: Dr. Vladimir Koshlakov
Keldych Research Centre, Russian Federation, kerc@elnet.msk.ru

Dr. Nikolay Arkhangelsky
Keldysh Research Center, Russian Federation, arkhangelsky@kerc.msk.ru
Dr. Andrey Karevskiy
Keldysh Research Center, Russian Federation, 101310-1@kerc.msk.ru
Dr. Ekaterina Kuvshinova
Keldysh Research Center, Russian Federation, kuvshinova@kerc.msk.ru
Mr. Evgeny Muzychenko
Keldysh Research Center, Russian Federation, muzychenko@kerc.msk.ru
Dr. Alexander Semenkin
Keldysh Research Center, Russian Federation, semenkin@kerc.msk.ru
Dr. Alexey Sinitsin
Keldysh Research Center, Russian Federation, sinitsin@kerc.msk.ru
Dr. Alexander Solodukhin
Keldysh Research Center, Russian Federation, solodukhin@kerc.msk.ru
Dr. Leonid Zakharenkov
Keldysh Research Center, Russian Federation, zakharenkov@kerc.msk.ru

APPLICATION OF NUCLEAR POWER AND PROPULSION SYSTEMS OF HIGH POWER LEVEL FOR SPACE TRANSPORTATION

Abstract

Realization of new research and exploration space missions requires a qualitative increase of spacecraft (SC) power and propulsion capabilities. Because of that high power space tug [1,2] based on nuclear power system (with power level up to hundreds of kW – MW) and electric propulsion system, is mainly considered as a new transport vehicle for near-Earth and deep space missions realization. Nuclear power systems are characterized by significantly greater compactness than solar panels, independence of the generated power from the distance to the Sun, light conditions, and increased radiation resistance. The use of electric propulsion (EP) thrusters for such tasks as inserting a spacecraft into orbit, keeping a spacecraft in orbit, interplanetary flights and missions in deep space provides significant savings in the used propellant mass in comparison with traditional chemical propellant thrusters due to the high specific impulse of EP thrusters. Projects aimed at development and application of space vehicles based on nuclear power propulsion system (PPS) of high power level have been conducted since the very beginning of space exploration Era. Interest to such projects [1] arises as human activity in space grows, for example: project Prometheus (NASA, USA), project Transport Power Module (Russia) and European-Russian projects DEMOCRITOS and MEGAHIT [2]. New projects of SC with nuclear PPS continue to appear due to the development of new designs and technological solutions for the main parts and subsystems of high power level nuclear PPS. One of the promising options is a nuclear power and propulsion consisting of a gas-cooled reactor, a closed Brayton cycle Power Conversion Unit (PCU) and an Electric Propulsion (EP) thrusters [1]. Efficiency of nuclear power and propulsion systems application for transport missions to Moon, to Mars and to Europa (Jupiter's satellite) is analyzed in comparison with conventional chemical propulsion systems. It is shown

that high power level power and propulsion systems can have significant advantage in comparison with conventional chemical propulsion, so their application is actual for realization of near-Earth and deep space transport missions.

References

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