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A COMPARATIVE STUDY BETWEEN NUCLEAR PROPULSION SYSTEMS AND CONVENTIONAL SYSTEMS TO REACH JUPITER'S MOON EUROPA

Abstract

Over the years, with advance in technology, the mankind has begun to explore the galaxy deeply. The main purpose behind this exploration being the search of hospitable environment like earth and the search of life's existence outside Earth. Jupiter's moon Europa has most favourable conditions in terms of the life support as its atmosphere contains high amount of molecular oxygen and a confirm ionosphere created by charged particles from Jupiter's magnetosphere, providing solid evidence of a habitable atmosphere. Being the moon of Jupiter, Europa is at a considerably high distance from the Earth (628,300,000Km). As a result, with the existing technology of propulsion systems it will take huge amount of time to reach and back. Also the manned spacecraft will be needing enough resources during that amount of time, which has left us with the option to have more efficient propulsion system that can achieve very high speeds in order to reduce timespan of journey. The nuclear propulsion system is the most ideal choice for this problem because nuclear electric propulsion and nuclear thermal propulsion can generate huge amount of specific impulse (5000s-15000s) and has large power density as compared to conventional chemical propellant systems. The higher speed also reduces the risk of the effect of excess galactic cosmic radiation on the crew which is the prime concern in manned space mission. The paper deals with the comparative study of nuclear propulsion system over conventional chemical system for the long distance space travel from Earth to Europa. The advance nuclear systems such as the Gridded-Ion thrusters and the Magneto-Plasma dynamic thrusters have a capability of producing very high amount of specific impulse and it will increase substantially in the near future which will lead to fast, efficient and affordable interplanetary travel. It will be more useful in terms of health safety of future astronauts. One of the crucial challenges in implementing this technique in space propulsion is the structural integrity of spacecraft to sustain that much amount of speed. Also the design of the reactor needs to be optimized in order to implant the system into the spacecraft. But in the long run this propulsion technique may turn out to be the best system for deep space exploration and interstellar travel.