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Author: Mr. Rohan M Ganapathy
Hindusthan College of Engineering and Technology, India, rohan2692@yahoo.in

Mr. Mohammed Shazin Shoukath Ambalathil
Hindusthan College of Engineering and Technology, India, shazinchachi7@gmail.com
Mr. Anand Shanmugam
Hindusthan College of Engineering and Technology, India, anandshanmugam05@gmail.com

SOILD CORE FISSION THERMAL ROCKET AND ITS ADVANCEMENTS - A VITAL & POSSIBLE NUCLEAR TECHNOLOGY FOR THE EXPLORATION OF MARS AND THE PLANETS BEYOND

Abstract

In this paper, the physics and technology issues and performance potential of various direct thrust fission and fusion propulsion concepts are examined. Next to chemical propulsion the solid core fission thermal rocket (SCR) is the only other concept to be experimentally tested at the power (-1.5 - 5.0 GW) and thrust levels (-0.33 I.II MN) required for manned Mars missions. With a specific impulse of -850 s, the SCR can perform various near-Earth, cislunar and interplanetary missions with lower mass and cost requirements than its chemical counterpart. Beyond the SCR, a succession of advanced nuclear engines can be developed each having improved performance. The gas core fission thermal rocket, with a specific power and impulse of -50 kW/kg and 5000 s, offers the potential for quick courier trips to Mars (of -80 days) or longer duration exploration / cargo missions (lasting -280 days) with starting masses of -1000 metric tons. Convenient transportation to the outer Solar System will require the development of magnetic and inertial fusion rockets (IFRs). Possessing specific powers and impulses of -100 kW/kg and 200-300 kiloseconds, IFRs will usher in the era of the true Solar System class spaceship. Even Pluto will be accessible with roundtrip times of less than 2 years and starting masses of -1500 metric tons. This paper further addresses manned exploration to Mars and other planets with possible to construct nuclear propulsion technology.