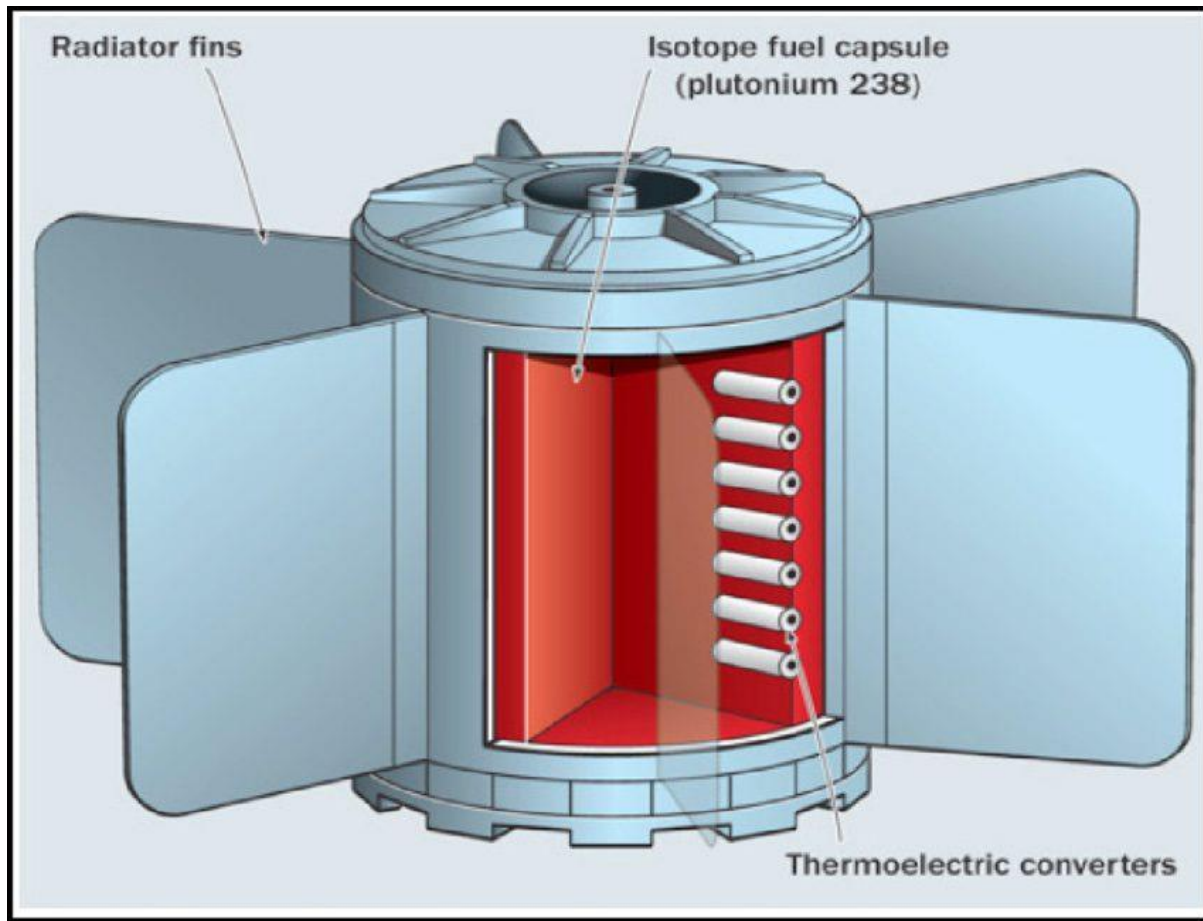


## ISRO & BARC To Develop Nuclear-Powered Rocket Engines

July 31, 2023

July 29, 2023: Bengaluru: **Indian Space Research Organization (ISRO)**, is currently engaged in a collaborative effort with the **Bhabha Atomic Research Centre (BARC)** to develop an advanced nuclear-powered propulsion system for inter-planetary missions.



While chemical engines, commonly employed in satellite thrusters, serve their purpose effectively, they have limitations when it comes to deep space exploration, particularly interplanetary missions. The challenges lie in their restricted fuel capacity and inability to rely on solar power due to the vast distances that hinder sunlight from reaching solar panels.

To overcome these hurdles, the development of nuclear-powered engines has become imperative. Reliable sources indicate that ISRO and BARC are working together to create **Radio Thermoelectric Generators (RTGs)**. It is essential to note that the nuclear engines under development are not akin to nuclear fission reactors used for electricity generation.

Instead, the RTGs employ radioactive materials, such as Plutonium-238 or Strontium-90, which emit heat during the process of decay.

The engine, under development, consists of two key components—the **Radioisotope Heater Unit (RHU)**, responsible for generating heat, and the RTG, which converts the generated heat into electricity.

RHU employs radioactive materials, such as Plutonium-238 or Strontium-90, which emit heat during the process of decay. The heat produced is transferred to a ‘thermocouple,’ a substance that generates an electric potential when subjected to a temperature gradient. To illustrate this simply, envision a rod—when one end is hot and the other end is cooler, a voltage is generated across the rod (known as the **Seebeck Effect**). This voltage can be utilized to charge batteries, providing the necessary propulsion for a satellite. ISRO’s objective is to develop a 5W RTG, according to sources.

“RTGs offer the advantage of independence from solar proximity and planetary alignment. This characteristic significantly reduces limitations such as the reliance on specific ‘launch windows’ that scientists must adhere to,” explains **Nitansha Bansal**, in an article published by the **Observer Research Foundation (ORF)**.  
By--Dr K N Mistry

NASA is also launching a mission to send humans to Mars using nuclear-powered rocket engines. This could enable faster and longer space missions. NASA announced that it is partnering with the US Department of Defense to launch a nuclear-powered rocket engine into space as early as 2027. Lockheed Martin received the contract, which sets a goal of flying a nuclear-powered rocket engine by 2027. It could be used for NASA’s Mars and moon missions.

The proposed Nuclear-powered rocket engines is likely to use a nuclear reactor to superheat a liquid propellant, such as hydrogen, and eject it at high speed to generate thrust. They are more powerful and efficient than chemical rocket engines which use fuel and oxidizer in a chemical reaction. A nuclear rocket engine has a nozzle that narrows sharply before expanding and a regenerative cooling system that flows cold hydrogen through tubes surrounding the nozzle. This technology could enable faster and longer space missions, such as to Mars.

The two missions by NASA and ISRO are following two different trajectories. If both projects are successful, NASA and ISRO may be able to use each other’s technology, where required.