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ISOTOPE

238

Pu

Plutonium

Plutonium-238

Powering Space Exploration

Feature of the Month

Plutonium-238

Plutonium-238 (Pu-238) is a vital power source used for deep space missions. This isotope is distinct because it emits steady heat due to its natural radioactive decay.

Half life of

87.7 years

30+

U.S. space vehicles have been powered by Pu-238

Used in space exploration for

60+ years

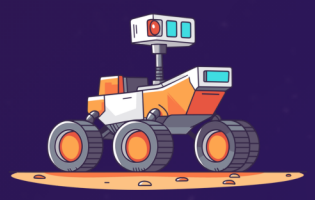
How is it produced?

1. Neptunium-237 (Np-237) is fabricated into targets and irradiated.
2. Once irradiated, Np-238 quickly decays to Pu-238.
3. Targets are processed to separate the Pu-238 from any remaining Np-238.
4. Pu-238 is converted into plutonium-dioxide ceramic pellets.
5. The pellets are inserted into a radioisotope thermoelectric generator (nuclear battery).

Plutonium-238

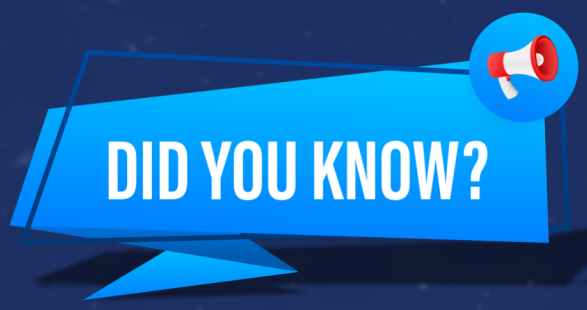
Why is Pu-238 ideal for deep space missions?

Since the early 1960s, space missions have used Pu-238 for their Radioisotope Power Systems (RPS).



Pu-238 RPSs have powered missions like the scientific experiments conducted on the Moon by Apollo astronauts, the Curiosity Mars rover, and the Voyager 1 and Voyager 2 spacecraft. Some RPS have powered missions for **35+ years and counting.**

Pu-238 is anticipated to play a significant role in upcoming space missions, including NASA's Dragonfly quadcopter mission to reach Saturn's Moon, Titan, which is expected to launch in July 2028.



Beyond its role in space exploration, Pu-238 has also been utilized as a battery source in cardiac pacemakers. Due to its long half-life, the Pu-238 pacemaker reduced the need for battery replacement surgeries by supplying a power source that can last decades.

Plutonium Powered Pacemaker (1974) Source: Museum of Radiation & Radioactivity

Plutonium-238

Canada Exploring Pu-238 Capabilities

In 2024, the Canadian Nuclear Isotope Council collaborated with Nuclear Promise X (NPX) to conduct a feasibility study for the Canadian Space Agency.

The objective of this study was to assess the economically viability of Pu-238 production in Canada using existing facilities to support deep space exploration missions.

This study explored how nuclear and research reactors in Canada could be used to irradiate Np-237 into Pu-238 and all costs associated with production, shipment, and extraction of the energy source.

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NPX

Source: Government of Canda - International Space Station news - 2020

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