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## NUCLEAR POWER AND PROPULSION INTERNATIONAL GAP ASSESSMENT

**Abstract**

Space exploration within our Solar System requires a robust, clean, and high-performance energy source. Traditional systems, reliant on chemical propellants, batteries, or solar arrays, face limitations in power and energy density. This paper delves into the potential of nuclear technology as a solution, presenting a summary of a report by the International Space Exploration Coordination Group (ISECG) that assessed gaps in nuclear power and propulsion technology. The assessment categorizes space nuclear technologies based on power levels, encompassing radioisotope power systems (RPS), fission reactors, and nuclear propulsion. Initiated in 2020, the ISECG Technology Working Group (TWG) formed a dedicated gap assessment team involving representatives from 13 international space agencies and non-space organizations. The team aimed to identify new capabilities, understand the global state of the art, pinpoint gaps, and facilitate partnerships. Agencies, depending on their resources, focus on different aspects of nuclear technology, ranging from conceptualization to the development of space nuclear systems for harsh space environments. Challenges and opportunities in space nuclear technology highlight safety and security concerns. Further, the absence of consistent international nuclear safety standards and a regulatory framework for Nuclear Power and Propulsion (NPP) systems in space is recognized as a challenge. Identified technological and programmatic gaps in the development of space nuclear technology are discussed, emphasizing the current shortage of radioisotope and reactor fuel supply for space applications. Key findings and recommendations stress leveraging unique capabilities among member agencies, recognizing substantial mission demand for nuclear systems, and addressing technical and geopolitical challenges through international collaboration. The absence of an internationally governing regulatory framework for space nuclear systems and the importance of nuclear launch safety highlight areas for cross-agency cooperation. The paper concludes by emphasizing the large potential of space nuclear systems to leverage advances in terrestrial nuclear technologies while addressing climate change and providing socio-economic benefits.