

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Joint Session on Advanced and Nuclear Power and Propulsion Systems (10-C3.5)

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ANALYSIS OF SMALL MODULAR NUCLEAR REACTOR CONSTRUCTION ON THE MOON

**Abstract**

Lunar exploration is currently underway and power generation is an important aspect of a lunar settlement development. Several power generation concepts have been proposed which mainly include solar or nuclear sources. This paper points out the advantages of small modular nuclear reactor systems and focuses on the Lunar in-situ resources that can be utilized for the construction of a nuclear reactors on the Moon. It has been found that the Moon is rich in many useful elements and materials which can be utilized for construction as well as propellant and nuclear fuel extraction and processing. Many metal oxides have been detected from the Apollo Lunar samples. These include SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, CaO, FeO and others and can be extracted, processed, and manufactured into construction parts to later be used as building materials. Another important structural material is concrete which can be produced on the Moon from the lunar soil. Large amounts of SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, and CaO have been found can be used to produce cementitious material while aggregates can be obtained by physically crushing the lunar rocks and soil. On the other hand, the discovery of nuclear elements such as Uranium-238 and Thorium-232 on the near side of the Moon is very promising since it means that there is a potential for nuclear fuel production. Another important resource on the Moon is water which can be processed to obtain propellants such as hydrogen and oxygen. The extraction and processing of all in-situ resources into usable materials and propellants will require energy which can potentially be supplied by nuclear power. Therefore, it is important to take into consideration the availability of Lunar resources and analyze the potential of processing and using them for assembling small modular nuclear reactors. This can be achieved when the infrastructure is in place to extract and process all the aforementioned materials. The end goal of this research is to determine whether it will be more advantageous to create a lunar infrastructure for small modular nuclear reactor production or continue supplying the required materials from Earth. Therefore, it is important to first draw parallels between the materials used in the current small modular nuclear reactor designs and the materials that can be extracted and processed on the Moon.