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THE PYLON: COMPACT LEU COMMERCIAL FISSION POWER THE MOON, MARS, AND SPACE

Abstract

Nuclear energy is a key technology for locations in space far from the sun or in places that face environmental challenges such as the long lunar night or the Martian dust storm. Yet, despite exceptional potential, nuclear energy is often omitted from further consideration due to technology development and policy considerations. However recent developments demonstrate that the technology development and policy challenges are surmountable and a near-term solution for nuclear energy in the Lunar environment is available.

Some terrestrial nuclear technology is well-suited for space environments. USNC is a commercial company that is developing a terrestrial gas-cooled micro-modular reactor (MMR) for off-grid and rugged locations on Earth. The MMR utilizes a novel refractory carbide nuclear fuel technology designed to optimize safety. For the same reasons why the technology excels in remote terrestrial regions, it also excels in the space environment.

USNC-Space is a commercial company spun out of USNC to commercialize the nuclear technology for the space environment. The Pylon is a low enriched uranium (LEU) fission reactor system utilizing the nuclear fuel technology of the MMR for electricity and process heat on the Moon, Mars, and deep space.

The Pylon is a 4500 kg 125-150 kWe radiatively-cooled system. Approximately 800 kW of waste heat at temperatures between 300-500 K is available for in-situ resource exploration and acquisition. In addition, up to 1150 K process heat is available. The Pylon design is such that it can be delivered to the Lunar Surface on a large CLPS class lander such as the Blue Moon. The temperature ranges are well-suited to utilize currently available directly-cycle Brayton energy conversion technology.

The Pylon fission power system can enable sustainable, power-abundant exploration, and lead to meaningful development on the Lunar surface, Mars and beyond.