NUCLEAR POWER IN SPACE

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ABSTRACT

The development of space nuclear power and propulsion in the United States started in 1955 with the initiation of the ROVER project. The first step in the ROVER program was the KIWI project that included the development and testing of 8 non-flyable ultrahigh temperature nuclear test reactors during 1955-1964. The KIWI project was precursor to the PHOEBUS carbon-based fuel reactor project that resulted in ground testing of three high power reactors during 1965-1968 with the last reactor operated at 4,100 MW. During the same time period a parallel program was pursued to develop a nuclear thermal rocket based on cermet fuel technology. The third component of the ROVER program was the Nuclear Engine for Rocket Vehicle Applications (NERVA) that was initiated in 1961 with the primary goal of designing the first generation of nuclear rocket engine based on the KIWI project experience. The fourth component of the ROVER program was the Reactor In-Flight Test (RIFT) project that was intended to design, fabricate, and flight test a NERVA powered upper stage engine for the Saturn-class lunch vehicle. During the ROVER program era, the Unites States ventured in a comprehensive space nuclear program that included design and testing of several compact reactors and space suitable power conversion systems, and the development of a few light weight heat rejection systems. Contrary to its sister ROVER program, the space nuclear power program resulted in the first ever deployment and in-space operation of the nuclear powered SNAP-10A in 1965.

The USSR space nuclear program started in early 70's and resulted in deployment of two 6 kWe TOPAZ reactors into space and ground testing of the prototype of a relatively small nuclear rocket engine in 1984. The US ambition for the development and deployment of space nuclear powered systems was resurrected in mid 1980's and intermittently continued to date with the initiation of several research programs that included the SP-100, Space Exploration Initiative, the Jupiter Icy Moons Orbiter (JIMO), the project PROMETHUS, and the Moon and Mars surface power project.

A brief history, future prospect, and some technology challenges of space nuclear power and propulsion will be discussed.