Dynamic Radioisotope Power Systems Development and Potential First Mission Utilization

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Dynamic power conversion offers the potential to produce Radioisotope Power Systems (RPS) that generate higher power outputs and utilize the Pu-238 radioisotope more efficiently. Additionally, dynamic power conversion offers the potential of producing generators with minimal degradation resulting in more power at the end of the mission, when the power is needed. Dynamic power conversion technologies being considered for space applications include the Stirling, Ericsson, Brayton, and Rankine thermodynamic cycle machines. Machines can be built based on these cycles while eliminating wear mechanisms of the moving components, enabling long design life necessary for space missions. Developing robust and reliable dynamic conversion technology has been challenging yet is essential. To that end, the Radioisotope Power System Program maintains a strategic investment in dynamic power conversion technology. The result of this investment will be in the maturation of multiple conversion technologies that could be used in a dynamic space-based power system. With maturation of these dynamic conversion technologies, the RPS Program is investigating and evaluating possible first-use mission scenarios for a Dynamic RPS (DRPS). A mission with a shorter timeline yet having science return is preferable. When the first RPS were developed in the 1960s, the mission timelines were short, from months to a few years. A lunar mission has a relatively short timeline yet a DRPS may provide significant mission science benefits that would make DRPS advantageous and suitable for an inaugural flight leading to subsequent planetary missions. This presentation will address the work being performed and potential lunar applications for lunar missions that might utilize a DRPS.