Rev 2

Prioritized Technology: RPS Orbital and Surface Power
Dynamic RPS

Technical Goal

- A 2016 study conducted with the mission community identified impediments to using the MMRTG to support science missions and needs of the Next RTG.
  - The two major concerns of the community include the higher MMRTG degradation rate and the power of the MMRTG.
  - The MMRTG provides approximately 110 Watts, which maybe too low of a power point to best benefit PSD missions.
  - Integration of multiple hundred watt units is possible but increases the mass, increases integration complexity, increased overall mission cost, and increases the use of Pu-238.
- PSD is funding DOE to reestablish domestic plutonium production capabilities. Currently these capabilities will be targeted to provide 1.5 kg of PuO2 per year on average with a surge capability between 2-2.5 kg per year. This rate of production was sized considering dynamic system and an assumed PSD RPS utilization rate. Improved fuel efficiency of RPS is desired to enable a wider variety or more frequent utilization by missions.
- The next step on our roadmap after eMMRTG is to provide a dynamic RPS that has ~ 4 times better fuel efficiency than the SOA..

Mission Applications

- A higher power system, in the range of 400 – 500 Watts is more desirable to the future PSD missions for flyby and orbit. This is consistent with the results from the 2014 Nuclear Power Assessment Study conducted by the RPS program.
- A dynamic RPS would have the intrinsic capability to support both orbital and surface power missions.

Technical Status - SOA

- The current SOA for RPS is the MMRTG (6% efficiency), which was designed to multi-mission requirements
- MMRTG Engineering Unit successfully tested to the multi-mission levels
- MMRTG F1 was proto-flight tested to the MSL requirements

	Parameter	MMRTG	eMMRTG	Next Gen	DRPS
Performance	P_0 - BOL (We) [1]	110	148	590.2	200-500
	Efficiency - $P_0/Q*100$ (%)	6.00%	8.00%	10-14%	25.00%
	Specific Power - P_0/m (We/Kg)	2.44	3.29	9.3	TBD
	Q - BOL (Wth) [4, 5]	2000	2000	4000	500-2000
	Average annual power degradation, r (%/yr)	4.8	2.5 [3]	1.9 [3]	1.0
	P_{BOM} - $P=P_0*e^{-rt}$ [2] (We) [6]	110	NA	557.5	#VALUE!
	Fueled storage life, t (years)	3	3	3	3
	Design Life, t (yrs)	17	17	17	20
	Planetary Atmospheres (Y/N)	Y	Y	N	Y

Definitions

Beginning of Life (BOL) is defined as time of fueling
Beginning of Mission (BOM) is defined as Launch, and can be as long as 3 years after BOL
End of Design Life (EODL) is 17 years after BOL

Heat Source

Step-2 GPHS, estimated at 244-256 W_t at BOL will be used for this study

Development Cost and Schedule