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# TECHNOLOGY ASSESSMENT AND OPTIONS FOR A VERY HIGH PERFORMANCE NEP POWER SYSTEM

**Abstract**

Earlier analysis of proposed low enriched uranium 184WUO2 fueled Nuclear Thermal Rocket core modified for electric power generation showed significant promise toward achieving an objective of 1 kg/kWe power density. There were several very high risk factors that later assessments may have helped to meliorate. Specifically, the very high temperature operating cycle posed severe constraints on the reactor's moderator. At that time, beryllium was selected, although the temperature margin between melt and the gas inlet temperature to cool the moderator resulted in a reduced efficiency system, e.g. the recuperator needed to be less effective to constrain the reactor inlet temperature. Employing a separate water moderator loop actual serves two functions, it allows the shield, reflector and moderator to be formed from a common working fluid; in the NTR application, this allows the water to be pre-chilled by the hydrogen propellant. For NEP applications, a separate radiator will be necessary. However, part of that weight is offset by the reduced reactor size, mass and shield mass. The use of a water moderator will be more fully investigated. The potential use of a common reactor core for nuclear thermal propulsion, nuclear electric propulsion and surface nuclear power could be quite a cost-saving venture.

The proposed system employed a combined Brayton/Rankine cycle system. That cycle approach will be once again re-evaluated based on new information. Furthermore, alternative cycle approaches may be investigated to improve specific mass. While high efficiencies are important, the use of a combined cycle resulted in a rather large radiator, which at a reactor power of 30 MW would be large in any case. The radiator itself was proposed to employ graphene thermal panels, as graphene has one of the highest thermal conductivities recorded. Graphene, however has little out-of-plane thermal conductance, resulting in a challenging panel design. In the former paper, an areal mass of .7 kg/m2 was proposed, based only on the author's successful work in developing a panel that achieved 2 kg/m2 areal density using KS-1300S carbon fiber. This year's work will perform a preliminary analysis of the proposed graphene radiator so assess its feasibility. If the radiator can be shown to be feasible, this suggests potential for a highly advanced nuclear power system at the multi-megawatt level employing a common NTP-NEP core configuration.