

Technology Roadmaps for Space Exploration (09)
Technology Development Concepts (2)

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GAS CORE REACTOR AS TECHNOLOGICAL BREAKTHROUGH FOR LONG RANGE SPACE
MISSIONS**Abstract**

In the technological feasibility for the long range missions in the deep space exploration, nuclear propulsion is proven to be the feasible method. Gas core reactors design are opening up possibilities to the deep space exploration missions such as mission to various planets in the solar system and also to the Installer distances. This paper describes various challenges in the design of gas core reactor systems and methods to reduce the total radiation from the mission. To increase the scope of the mission we have to create very efficient reactor system. To create safe reactor designs, we have to control neutron spectrum within the limits without creating loss to the total energy density inside the reactor core. The refined designs consist of reflector, which will also act as an external moderator in place on all sides of the cavity. Specific approach on the cavity design in our approach is to have multiple cavities to increase neutron moderation and to help neutrons to thermalize by their own. In the long range missions, the reactor will be exposed to higher temperatures in the presence of higher limits of pressure. In case of UF₆ in order to control chemical reactions with reactor core and to the coolant, we have to maintain absolute amount of pressure so that reaction will be stabilized. Another aspect of reactor design is proliferation resistance, since gas density will be a function of both pressure and temperature. In reality this is not the case, since the reflector is cooled and the fuel near to the reflector wall will have lower temperature than the core. In order to maintain the greater amounts of heat flux inside the reactor core creating relative amounts of turbulence in the coolant flow, so that it will allow reactor system to expose to grater energy density. Also we need to consider actinides and fission products inventory in the system design. In line of the above problems, this paper will talk about the various efficiencies in the gas core reactor design approach and radiation control and reactor fission kinetics. In addition, this paper will demonstrate that using nuclear reactors is within the realm of today's technology and hence they can be used for long range missions as long as the budget is present.