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Identification of Archived Design Information for Small Class Nuclear Rockets

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The new Vision for Space Exploration initiative issued by President Bush requires technology development in several disciplines to place humans on the Moon and Mars within the next twenty years. One major technology development to achieve these goals could be nuclear thermal rockets (NTR). Several NTRs were developed and tested by the Los Alamos Scientific Laboratory in collaboration with NASA and private industry from 1956 through 1972 in the Rover and NERVA programs. The technology reached TRL-6 by the current NASA definition. Recovery of the NTR technology could significantly reduce the cost of building a Lunar Base or of sending humans to Mars. Any recovery of NTR technology would be greatly facilitated by identifying and consolidating all designs, drawings, and blueprints generated during the NTR programs. More specifically, accumulation of the component designs for the Pewee I reactor could greatly facilitate recovery of the NTR technology base. We have completed an effort to identify the information still present on the Pewee and to identify the requirements to construct electronic CAD/CAM files of parts used in an NTR. Completion of this project will be used in formulating a technology roadmap for the recovery of NTR technology.

Nomenclature

Isp	=	specific impulse, s
NTR	=	Nuclear Thermal Rocket
VSE	=	Vision for Space Exploration
IMLEO	=	Initial Mass in Low Earth Orbit
LASL	=	Los Alamos Scientific Laboratory
NERVA	=	Nuclear Engine for Rocket Vehicle Applications

I. Introduction

In 2004, President Bush announced his Vision for Space Exploration (VSE) as a new direction for NASA. The stated goals of the VSE are for NASA to “set its sights on a return to the Moon and then human missions to Mars and to worlds beyond." Although chemical propulsion has already proven sufficient to put humans on the Moon, nuclear propulsion may be required to safely take humans to Mars and back – more specifically, nuclear thermal propulsion. The nuclear thermal rocket (NTR) will provide high thrust, high Isp, and high thermal efficiency in a compact system. The NTR will enable missions under 18 months round trip. In effect, use of the NTR will reduce the total radiation dose to the crew because of reduced exposure to the Galactic Cosmic Ray background in space.

In order to have a NTR available in the 2025 time frame that has proven reliability and operational margins, several space flights must occur prior to that time. Because of the improved performance of the NTR, significantly reduced IMLEO can be realized for development of the VSE Lunar Base. Thus, substantial cost savings can be realized by developing the NTR early in the VSE program, using the NTR for cargo missions to the Moon, establishing reliability and performance margins, and then using the NTR to enable the Mars mission.