

# Reaching the Outer Planets with Nuclear Electric Propulsion: Trades, Sensitivities, and the case for a Neptune System Explorer

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**Abstract.** Over the last year, a large effort that involved several NASA agencies and DOE was initiated to evaluate the mission benefits and understand the sensitivities of Nuclear Electric Propulsion (NEP). This paper first describes the sensitivities of the mission design parameter space (i.e. the trades between propulsion system characteristics, power level, system efficiencies, and flight times). It then illustrates the findings for a conceptual Neptune System Explorer mission. A point design for this mission is presented, using a 100-kWe Power and Propulsion Module (designed in parallel by a NASA MSFC lead effort) along with a representative science payload. This mission features a Fly-by Nereid, a capture and 10-month stay around Triton, a transfer to an elliptical polar orbit around Neptune and science in this orbit for 12 months, and finally a transfer into a low equatorial circular orbit to study Neptune's rings. The system features a very high downlink data rate from Neptune (several 10s of Mbps), and a full complement of science instruments. Variations in power levels around the design point are investigated. This analysis shows where the technologies should be headed to fully take advantage of the NEP capabilities.