Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

A Monte Carlo Hall Thruster Electron Trajectory Model MICHAEL MCDONALD, ALEC GALLIMORE, University of Michigan, RICHARD HOFER, DAN GOEBEL, UNIVERSITY OF MICHIGAN TEAM, JET PROPULSION LABORATORY, CALIFORNIA INSTITUTE OF TECHNOLOGY TEAM — Predictive modeling of Hall thruster plasma properties and discharge channel erosion is hampered by poor understanding of electron transport across the thruster magnetic field, particularly in the near-field plasma plume between the cathode and thruster exit plane. An electron transport model has been developed to estimate the level of transport in the near-field plume of a 6-kW Hall thruster in the absence of turbulent transport mechanisms, considering only the ExB drift and collisions with neutrals, ions and exposed thruster surfaces. Instead of empirically determined electron mobility coefficients, the model integrates the electron equations of motion through experimentally measured electric and magnetic fields over timesteps proportional to the local electron Larmor frequency. A Monte Carlo treatment of neutral and ion collisions is employed, and approximately 10ˆ7 electrons are seeded to resolve the electron energy and angular emission distribution at the cathode. By comparison with observed cross-field electron current, this technique permits evaluation of the current deficit that must be attributed to turbulent or other anomalous transport processes. We find that classical transport occurs only at small levels, generally less than a percent of observed transport, and that what transport does occur from the cathode to thruster exit plane is more often attributable to thruster surface collisions than plume collisions.

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Date submitted: 11 Jun 2010 Electronic form version 1.4