Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Electrohydrodynamic modeling of an electrospray-based thruster in cone-jet mode MANISH JUGROOT, MARTIN FORGET, CECILE MALARDIER-JUGROOT, Royal Military College of Canada — Electrospray-based propulsion is an excellent candidate for small satellites due to its inherent small size and high specific impulse. The present study aims to gain an increased understanding of complex underlying physical processes namely transitions. Numerical modeling and simulations can offer insights into the flows within the electrospray and offer critical local information difficult to measure experimentally due to the small scales. A multi-component continuum-based model coupling fluid dynamics, charged species dynamics and electric field is developed. The simulations describe the charged fluid interface with emphasis on the Taylor cone formation and cone-jet transition under the effect of a electric field. The goal is to recapture this transition from a rounded liquid interface into a Taylor cone from an initial uniform distribution, without making assumptions on the behaviour, geometry or charge distribution of the system, and transition to droplet or cone-jet mode. The time evolution of the interface highlights the close interaction among space charge, coulombic forces and the surface tension, which appear as governing and competing processes in the transition. Several modes and regimes are examined and compared to experimental results. The results from the coupled formalism provide valuable insights on the physical phenomena and will be applied to tailoring a multi-beam colloid thruster.

Manish Jugroot
Royal Military College of Canada

Date submitted: 09 Nov 2012 Electronic form version 1.4