Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Plasma Sheath Modeling Using The Three Fluid Plasma Model
ROBERT LILLY, URI SHUMLAK, University of Washington, Aerospace and Energetics Research Program — There has been renewed interest in the use of plasma actuators for high speed flow control applications. In the plasma actuator, current is driven through the surrounding weakly ionized plasma to impart control moments on the hypersonic vehicle. Accurate modeling of plasma sheath physics is of particular importance for the plasmas found in high speed flight applications. This study employs the three-fluid (electrons, ions, neutrals) plasma model as it allows the capture of electron inertial effects without the unbounded whistler wave that accompanies Hall MHD, as well as energy and momentum transfer between the charged and neutral species. Previous investigations have typically assumed an electrostatic electric field. This work includes the full electrodynamics. Floating potential sheath formation is investigated initially. We then present a method of voltage control that allows for control of the sheath. The resulting boundary scheme, in conjunction with the use of the purely hyperbolic Maxwells equation set, will be reviewed and the results in 1D and 2D discussed. Finally the outlook for incorporating transport will be presented.

Robert Lilly
University of Washington, Aerospace and Energetics Research Program

Date submitted: 17 Jul 2010 Electronic form version 1.4