Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Simulations of Pulse Detonation Engines with MHD Thrust Augmentation[1] CHRISTOPHER ZEINEH, TIMOTHY ROTH, LORD COLE, ANN KARAGOZIAN, UCLA, JEAN-LUC CAMBIER, Air Force Research Laboratory — Pulse detonation rocket engines (PDREs) have received significant attention in recent years due to their potentially superior performance over constant-pressure engines. Yet unsteady chamber pressures cause the PDRE flow to be either over-expanded or under-expanded for the majority of the cycle, with substantial performance loss in atmospheric flight applications. The present computational studies examine the potential benefits of using magneto-hydrodynamic (MHD) thrust augmentation by extracting energy via a generator in the PDRE nozzle and applying it to a separate, secondary stream. In the present studies, which involve both transient quasi-1D and 2D numerical simulations, the energy extracted from the nozzle flow is directly applied to a by-pass air stream through an MHD accelerator. The air stream is first shocked by the under-expanded nozzle flow and raised to high temperature, allowing thermal ionization. The specific conditions for thrust augmentation are examined. Alternative configurations utilizing a magnetic piston in the PDRE chamber are also explored. Results show potential performance gains but with significant challenges, depending on the operating and flight conditions.

[1]Supported by AFOSR Grants FA9550-07-1-0156 and FA9550-07-1-0368

Ann Karagozian
UCLA Department of Mechanical and Aerospace Engineering

Date submitted: 31 Jul 2008 Electronic form version 1.4