

AAE 519 Prof. Schneider, Fall 2011

Problem Set 2

Handed Out: Friday, 2 Sept.

Due: Friday, 16 Sept.

Using the Newtonian hypersonic approximation for the pressure, determine the lift and drag on a cone frusta at arbitrary angle of attack and zero yaw. Do so by first deriving the following equations in Clark and Trimmer, *Equations and charts for the evaluation of the hypersonic aerodynamic characteristics of lifting configurations by the Newtonian theory*, AEDC-TDR-64-25, March 1965: Normal force, equations (133) and (135). Refer to the various steps in Clark and Trimmer (e.g. eqn. 128), but derive everything from the Newtonian law and the geometry. You may omit the derivation of the axial force equation, it is similar to the normal force equation. Do *not* assume any of the formulas in Clark and Trimmer are correct, derive whatever you need from scratch.

Describe how the lift and drag can be obtained, given the formulas for the normal and axial forces. You need not write out the full formulas for lift and drag, you can just write them in terms of the axial and normal forces.

Plot the lift/drag ratio vs. angle of attack, for various values of the geometrical parameters. Discuss.