

# AEE 427: Aircraft Performance and Dynamics

## Homework 1

Due at the beginning class Wednesday, 16 September

**If a problem requires a figure or there is another stated need for Matlab, then the homework will receive a grade of zero if that portion of that problem is not included.**

1. Plot the density standard atmosphere in Matlab using English units. You may use the values of  $T$ ,  $\rho$ , and  $p$  at sea level, the lapse rates (be careful about units!), the altitudes at which the temperature profiles change, and the relevant equations (read: don't use the tables in the back of the book). Include at least 51 data points within each atmospheric level, and plot using symbols and a line. Attach both the figure and the m-file with equations.
2. An aircraft starts at sea level, flying 250 kts, and rises vertically through the atmosphere on a standard day, not changing its true forward speed. This particular aircraft has a position error of -7 kts. Using Matlab, calculate and plot the velocity that would be shown on a standard aircraft indicator as a function of altitude, up to 50,000 ft. Use at least 100 points, and use both symbols and line in your figure.
3. A Fairchild Republic A-10 with the following characteristics is in level unaccelerated flight at standard sea level:  
 $C_{D,0} = 0.032$   
 $AR = 6.5$   
Max  $T_{sl} = 9060$  lb (each of 2 engines)  
 $S = 506\text{ft}^2$   
 $e = 0.88$   
 $W = 22,800$  lb  
 $C_{L,max} = 2.1$   
 $\Delta V_p = +7$  knots

- (a) Plot the drag polar for the A-10 at this flight condition.
- (b) The current METAR at the Syracuse airport (taken the morning of 9 Sept) is: KSYR 091454Z 23011KT 10SM SCT100 BKN200 31/18 A2983 RMK AO2 SLP095 BKN V SCT T03060183 58005  
Find the stall velocity of this aircraft at 400 ft (the altitude of KSYR). What speed would the aircraft's airspeed indicator indicate?