AOE 3104 Problem Sheet 10

Due 23 April, 2003

Read Marchman, Chapter 7

Our class business jet has the following characteristics:

Gross Weight = 10,000 lbs	b = 40 ft	C_{Lmax} = 1.8 (normal flight)
S = 200 ft^2	$C_D = 0.02 + 0.05 (C_L)^2$	C_{Lmax} = 2.4 (with flaps)
2 engines with 1000 lb / engine	(up and away drag polar)	

During ground roll, the wing is 5 ft above the ground
The coefficient of friction on the paved runway is $\mu = 0.02$
The coefficient during braking is $\mu_b = 0.3$

51. Calculate the takeoff ground roll distance assuming no flaps are used for takeoff and that minimum takeoff distance conditions are used during the ground roll.

52. Calculate the landing ground roll distance for this aircraft assuming a full flap landing and that zero lift occurs during the ground roll, and that brakes are applied at touch-down (short field landing in which you retract the flaps and hit the brakes as soon as possible after touch-down).

53. It is determined that the runway is too short so that a Jet Assisted TakeOff (JATO) is to be used with a rocket giving an additional 2000 lbs thrust for 5 seconds.

a) Should the JATO be fired during the first 5 seconds of the takeoff roll or during the last 5 seconds of the takeoff roll (and why?).

b) What is the takeoff distance using the JATO in the most efficient way?

54. Calculate the distance for takeoff with a 40 ft/sec head-wind (not JATO)

55. How would the takeoff distance equation be modified if the runway were on a slope? Determine the takoff distance for the case where the runway is sloped upward 5 degrees in the direction of takeoff. What is the % increase over the normal takeoff distance?