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| **Activity 1.2.5 Aerodynamic Forces** |

Introduction

Aircraft take flight through their ability to generate lift. As fluid flows over an airfoil, lift and drag are generated, which can be calculated using the lift equation.

Equipment

* PC with Internet connection
* Pencil
* Calculator
* Notes from Aerodynamic Forces presentation

Procedure

1. A Boeing 777-200LR loaded to 92% of its maximum take-off weight takes off from Dubai International Airport (24.4 m elevation) during an average day in July (34.5 OC) with a standard pressure day (101.3 kPa). Assume that the take off speed is 376 kmph. What is the minimum coefficient of lift needed at the point where the aircraft just lifts off the ground? A 777-200 has a maximum take-off weight is 347,452 kg and its wing area is 427.8 m2.

**W=3135823**

**V=104.444**

**P=1.142**

**Cl=1.170**

1. If the same aircraft has a coefficient of lift of 1.24. How much lift is available for climbing off the runway?

-0.07

1. The same aircraft lands in Hong Kong (5.8 m elevation) after a long flight (over 5,950 km) that used 82,900 liters (21,900 gallons of fuel). Assume an an average day in July (32.8 OC) with a standard pressure day (101.3 kPa). What is the minimum speed that the aircraft can land? Assume the same 1.24 coefficient of lift and that that the jet fuel burned weighs 0.803 kg/l (6.7 lb/gal).

**L=2482784.843 p=1.154**

**CL=1.24 vm=?**

**A=427.8**

**CL=(2L)/(Apv2)**

**1.24=2(2482784.843) / 427.8\*1.154(v^2)**

**727.277 v2= 4965569.686**

**Vm= 90.064 m/s or 324.230 kmph 324**

1. How much drag will that same aircraft produce on landing in Hong Kong? Use the landing speed calculated in the previous question and assume that the coefficient of drag is 0.087.

Cd= 0.087 A= 427.8

P= 1.154 Vm= 90.064 m/s

D=?

Cd= D / (A\*p\*v2)

0.087= D/ [427.8\*1.154(90.064 ^2)]

174196.052 N= D

**Conclusion**

1. Describe how the coefficient of lift could be changed to lower the landing speed in the example.

One increases the coefficient of lift at low speeds by deploying flaps, which increases the coefficient of lift and also creating more drag, slowing down the speed of the plane

1. What factors could have changed the aircraft drag in this calculations?

The aircrafts induced drag or parasite drag

1. Explain any surprises you discovered about the magnitude of the figures used in the question.

I didn’t discover anything