UNIFIED ENGINEERING Fall 2003

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Problem U1. (Range Equation)

a) Assuming steady-level flight and no fuel reserves, estimate the range of a B-777 using the information given in the lecture notes (and/or on Boeing's web page). How well does this compare to the estimates Boeing publishes on their web page?

b) Now assuming that L/D, propulsion system efficiency and final weight are unchanged, estimate the range of a B-777 if the same volume of liquid hydrogen were to be used instead of Jet-A.

c) Derive an equation for the range of a battery-powered aircraft in steady-level flight. Express the range in terms of L/D, propulsion system efficiency, battery mass and heating value, and aircraft weight. Estimate the range of a B-777 if the fuel was taken out and replaced with its equivalent weight in batteries.

"FUEL"	Heating Value (MJ/kg)	Density (kg/m^3)
Jet-A	42.8	800
Liquid Hydrogen	120	70
Batteries	2.5	8000