Solution to Problem 292A

At takeoff:

$$W = \frac{1}{2}\rho V^2 A C_L$$
$$V = \left(\frac{2W}{\rho A C_L}\right)^{\frac{1}{2}}$$
$$= \left(\frac{2(3\times 10^6\ kg\ m/s^2)}{(1.2\ kg/m^3)(550\ m^2)(1.6)}\right)^{\frac{1}{2}}$$
$$= 75.38\ m/s$$

Neglecting drag, $Thrust(T) = Mass(M) \times Acceleration(a)$,then:

$$a = \frac{T}{M}$$
$$= \frac{4(2\times 10^5\ kg\ m/s^2)}{3\times 10^6\ kg\ m/s^2} \times g$$
$$= 2.61\ m/s^2$$

Then, takeoff distance is:

$$L = \frac{V^2}{2a} = 1086\ m$$

Drag(D) at takeoff is the lift divided by 22, where the lift is equal to the weight(G). So $D = G/22 = 136364\ kg\ m/s^2$. So the net thrust is:

$$T_{net} = (8\times 10^5 - 1.36\times 10^5)\ kg\ m/s^2 = 6.64\times 10^5\ kg\ m/s^2$$

So, the acceleration is:

$$a\frac{T_{net}}{T} = 2.17\ m/s^2$$