## Answer on Question #49291, Physics, Other

Consider an airliner having a mass of $5 \times 10^4$ kg and a total wing area of $1.05 \times 10^2$ $m^2$. If the airliner is flying at a velocity of 225m/s and we assume this is also the velocity for the air moving on the underside of the wing, what is the velocity of the air above the wing for the airliner to remain at a fixed altitude. Assume the air has a density of 1.25kg/$m^3$.

**Solution:**

Imagine streamlines with uniform air conditions in front of the plane and that the streamlines divide and pass above and below the wing.

From Bernoulli's Equation

$$In\ front\ of\ plane = above\ wing + below\ wing$$

$$P_0 + \rho g y + \frac{1}{2}\rho v_0^2 = P_1 + \rho g y + \frac{1}{2}\rho v_1^2 = P_2 + \rho g y + \frac{1}{2}\rho v_2^2$$

The net upward force is

$$F = mg = (P_2 - P_1) * Area$$

Thus,

$$P_2 - P_1 = \frac{mg}{A} = \frac{5 * 10^4 * 9.8}{1.05 * 10^2} = 4666.7 \text{ Pa}$$

From first equation

$$P_2 - P_1 = \frac{1}{2}\rho v_1^2 - \frac{1}{2}\rho v_2^2$$

$$\frac{1}{2}\rho v_1^2 = \frac{1}{2}\rho v_2^2 + (P_2 - P_1) = 0.5 * 1.25 * 225^2 + 4666.7 = 36307.325 \text{ Pa}$$

Thus,

$$v_1 = \sqrt{2 * \frac{36307.325}{1.25}} = 241 \text{ m/s}$$

**Answer:** $241 \frac{\text{m}}{\text{s}}$.