9.95 A light aircraft with a wing area of 200 ft² and a weight of 2000 lb has a lift coefficient of 0.40 and a drag coefficient of 0.05. Determine the power required to maintain level flight.

For equilibrium $\mathcal{L} = W = 2000\,lb = C_L \frac{1}{2}\rho U^2 A$

or

$2000\,lb = (0.40)\frac{1}{2}(0.00238\,\frac{slugs}{ft^3})U^2(200\,ft^2)$

Hence,

$U = 145\,\frac{ft}{s}$

Also, $\mathcal{P} = power = \mathcal{D}U$, where

$\mathcal{D} = C_D \frac{1}{2}\rho U^2 A = (0.05)\frac{1}{2}(0.00238\,\frac{slugs}{ft^3})(145\,\frac{ft}{s})^2(200\,ft^2) = 250\,lb$

Note: This value of $\mathcal{D}$ could be obtained from

$\frac{W}{\mathcal{D}} = \frac{\mathcal{L}}{\mathcal{D}} = \frac{C_L}{C_D} = \frac{0.40}{0.05} = 8$, or $\mathcal{D} = \frac{W}{8} = \frac{2000\,lb}{8} = 250\,lb$

Thus,

$\mathcal{P} = 250\,lb(145\,\frac{ft}{s}) = 3.63 \times 10^4\,\frac{ft \cdot lb}{s}\left(\frac{1\,hp}{550\,\frac{ft \cdot lb}{s}}\right) = \underline{\underline{65.9\,hp}}$