Thus, induced power required will vary with lift, aspect ratio, altitude, etc., in the same manner as the induced drag. The only difference will be the variation with speed. If all other factors remain constant, the induced power required varies inversely with velocity while induced drag varies inversely with the square of the velocity.

$$\frac{Pr_{i_2}}{Pr_{i_1}}=\frac{V_1}{V_2}$$

where

Pr_{i_1} = induced power required corresponding to some original speed, V_1

Pr_{i_2} = induced power required corresponding to some different speed, V_2

For example, if an airplane in steady level flight is operated at twice as great a speed, the induced drag is one-fourth the original value but the induced power required is one-half the original value.

The parasite power required is a function of the parasite drag and velocity.

$$Pr_p=\frac{D_pV}{325}$$

where

Pr_p = parasite power required, h.p.
D_p = parasite drag, lbs.
V = true airspeed, knots

Thus, parasite power required will vary with altitude and equivalent parasite area (f) in the same manner as the parasite drag. However, the variation with speed will be different. If all other factors are constant, the parasite drag varies as the square of velocity but parasite power varies as the cube of velocity.

$$\frac{Pr_{P2}}{Pr_{P1}}=\left(\frac{V_2}{V_1}\right)^3$$

where

Pr_{P1} = parasite power required corresponding to some original speed, V_1

Pr_{P2} = parasite power required corresponding to some different speed, V_2

For example, if an airplane in steady flight is operated at twice as great a speed, the parasite drag is four times as great but the parasite power required is eight times the original value.

Figure 2.1 presents the thrust required and power required for a specific airplane configuration and altitude. The curves of figure 2.1 are applicable for the following airplane data:

gross weight, W=15,000 lbs.
span, b=40 ft.
equivalent parasite area, f=7.2 sq. ft.
airplane efficiency factor, e=.827
sea level altitude, σ=1.000
compressibility corrections neglected

The curve of drag or thrust required versus velocity shows the variation of induced, parasite, and total drag. Induced drag predominates at low speeds. When the airplane is operated at maximum lift-drag ratio, $(L/D)_{max}$, the total drag is at a minimum and the induced and parasite drags are equal. For the specific airplane of figure 2.1, $(L/D)_{max}$ and minimum total drag are obtained at a speed of 160 knots.

The curve of power required versus velocity shows the variation of induced, parasite, and total power required. As before, induced power required predominates at low speeds and parasite power required predominates at high speeds and the induced and parasite power are equal at $(L/D)_{max}$. However, the condition of $(L/D)_{max}$ defines only the point of minimum drag and does not define the point of minimum *power* required. Ordinarily, the point of minimum power required will occur at a speed which is 76 percent of the speed for minimum drag and, in the case of the airplane configuration of figure 2.1, the speed for minimum power required would be 122 knots. The total drag at the speed for minimum power required is 15 percent higher than the drag at $(L/D)_{max}$ but the minimum power required is 12 percent lower than the power required at $(L/D)_{max}$.