THRUST

Remember that thrust is a vector quantity (which has magnitude and direction). Any manoeuvre will require an imbalance of forces (or excess thrust). We can consider the net horizontal force as Thrust = F_H which can also be expressed as excess thrust F_E.

Since we need enough thrust to counteract the drag in level flight, we can consider the Net thrust (F_E) as Thrust minus Drag. The difference will give us the value of excess thrust required.

$$F_E = T - D$$

Since this force is based on Newton's second law of motion[2] which is the mass of an object multiplied by the acceleration, we can re-arrange the equation by substituting the excess thrust by using Newton's Second Law of Motion (mass x acceleration) in order to determine the acceleration of the aircraft:

$$F_E = T - D$$

$$m \cdot a = T - D$$

$$a = \frac{(T - D)}{m}$$

Therefore, the acceleration of an aircraft is equal to the excess thrust divided by the mass of the aircraft. The calculation of thrust enables us to determine the power curves (or drag curves) in aircraft performance charts. Remember that jet engines produce generate **thrust** (the reactive force), whereas propeller aircraft are connected via a shaft to engines that generate **power**. Engines are rated in either Horsepower (HP) or Thrust (LBS or KG).

Below are two examples of power curves for jet and propeller powered aircraft.

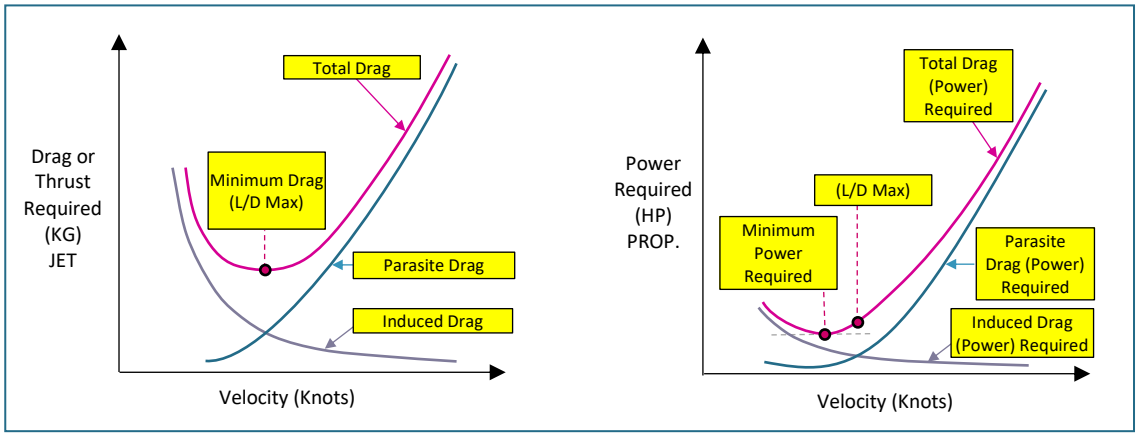

Figure 9 Jet and Propeller aircraft drag/power curves

Both these graphs represent the amount of thrust (power) needed to overcome the total drag in order to maintain a steady speed in level flight. Drag curves can provide an important reference for the pilot and most importantly, shows the limitations of the aircraft. Limitations are important in all aspects of aviation and flying and provide an envelope for safe operation of the aircraft.

[2] Newton's Second Law of Motion states that the rate of change of momentum of an object is directly proportional to the force applied, or in other words, force is the mass of the object multiplied by the acceleration (*F= m x a*).