As discussed in Chapter 6, engine pressure ratio (EPR) is the ratio between exhaust pressure (jet blast) and inlet (static) pressure on a turbo jet or turbo fan engine. An EPR gauge tells the pilot how much power the engines are generating. The higher the EPR, the higher the engine thrust. EPR is used to avoid over-boosting an engine and to set takeoff and go around power if needed. This information is important to know before taking off as it helps determine the performance of the aircraft.

In addition to the important factors of proper procedures, many other variables affect the takeoff performance of an aircraft. Any item that alters the takeoff speed or acceleration rate during the takeoff roll affects the takeoff distance.

For example, the effect of gross weight on takeoff distance is significant, and proper consideration of this item must be made in predicting the aircraft's takeoff distance. Increased gross weight can be considered to produce a threefold effect on takeoff performance:

1. Higher lift-off speed
2. Greater mass to accelerate
3. Increased retarding force (drag and ground friction)

If the gross weight increases, a greater speed is necessary to produce the greater lift necessary to get the aircraft airborne at the takeoff lift coefficient. As an example of the effect of a change in gross weight, a 21 percent increase in takeoff weight requires a 10 percent increase in lift-off speed to support the greater weight.

A change in gross weight changes the net accelerating force and changes the mass that is being accelerated. If the aircraft has a relatively high thrust-to-weight ratio, the change in the net accelerating force is slight and the principal effect on acceleration is due to the change in mass.

For example, a 10 percent increase in takeoff gross weight would cause:

- A 5 percent increase in takeoff velocity
- At least a 9 percent decrease in rate of acceleration
- At least a 21 percent increase in takeoff distance

With ISA conditions, increasing the takeoff weight of the average Cessna 182 from 2,400 pounds to 2,700 pounds (11 percent increase) results in an increased takeoff distance from 440 feet to 575 feet (23 percent increase).

For the aircraft with a high thrust-to-weight ratio, the increase in takeoff distance might be approximately 21 to 22 percent, but for the aircraft with a relatively low thrust-to-weight ratio, the increase in takeoff distance would be approximately 25 to 30 percent. Such a powerful effect requires proper consideration of gross weight in predicting takeoff distance.

The effect of wind on takeoff distance is large, and proper consideration must also be provided when predicting takeoff distance. The effect of a headwind is to allow the aircraft to reach the lift-off speed at a lower groundspeed, while the effect of a tailwind is to require the aircraft to achieve a greater groundspeed to attain the lift-off speed.

A headwind that is 10 percent of the takeoff airspeed reduces the takeoff distance approximately 19 percent. However, a tailwind that is 10 percent of the takeoff airspeed increases the takeoff distance approximately 21 percent. In the case where the headwind speed is 50 percent of the takeoff speed, the takeoff distance would be approximately 25 percent of the zero wind takeoff distance (75 percent reduction).

The effect of wind on landing distance is identical to its effect on takeoff distance. *Figure 11-19* illustrates the general effect of wind by the percent change in takeoff or landing distance as a function of the ratio of wind velocity to takeoff or landing speed.

The effect of proper takeoff speed is especially important when runway lengths and takeoff distances are critical. The takeoff speeds specified in the AFM/POH are generally the minimum safe speeds at which the aircraft can become airborne. Any attempt to take off below the recommended speed means that the aircraft could stall, be difficult to control, or have a very low initial ROC. In some cases, an

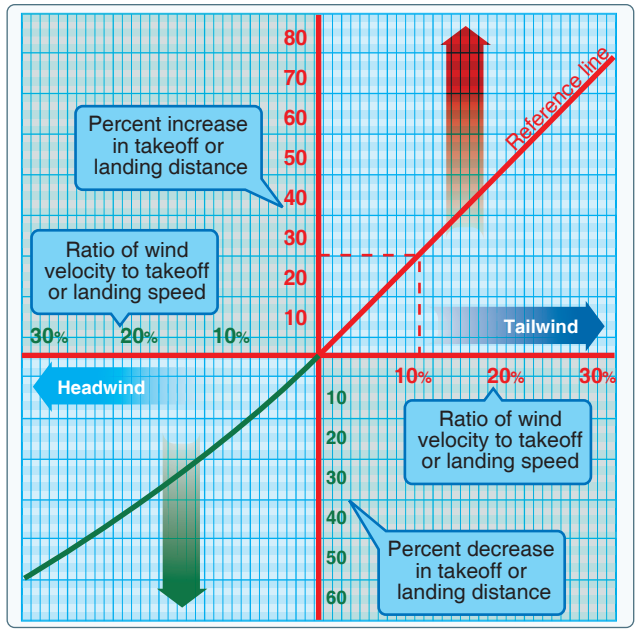

Figure 11-19. *Effect of wind on takeoff and landing.*