would be to provide the endurance thrust with some engine(s) shut down and the remaining engine(s) operating at a more efficient power output. This technique would cause a minimum loss of endurance if at low altitude. The feasibility of such a procedure is dependent on many operational factors.

In all cases, the airplane should be in the cleanest possible external configuration because the specific endurance is directly proportional to the (L/D).

MANEUVERING PERFORMANCE

When the airplane is in turning flight, the airplane is not in static equilibrium for there must be developed the unbalance of force to produce the acceleration of the turn. During a steady coordinated turn, the lift is inclined to produce a horizontal component of force to equal the centrifugal force of the turn. In addition, the steady turn is achieved by producing a vertical component of lift which is equal to the weight of the airplane. Figure 2.28 illustrates the forces which act on the airplane in a steady, coordinated turn.

For the case of the steady, coordinated turn, the vertical component of lift must equal the weight of the aircraft so that there will be no acceleration in the vertical direction. This requirement leads to the following relationship:

$$n=\frac{L}{W}$$

$$n=\frac{1}{\cos\phi}$$

$$n=\sec\phi$$

where

n = load factor or "G"
L = lift, lbs.
W = weight, lbs.
ϕ = bank angle, degrees (phi)

From this relationship it is apparent that the steady, coordinated turn requires specific values of load factor, n, at various angles of bank, ϕ. For example, a bank angle of 60° requires a load factor of 2.0 ($\cos 60°=0.5$ or $\sec 60°=2.0$) to provide the steady, coordinated turn. If the airplane were at a 60° bank and lift were not provided to produce the exact load factor of 2.0, the aircraft would be accelerating in the vertical direction as well as the horizontal direction and the turn would not be steady. Also, any sideforce on the aircraft due to sideslip, etc., would place the resultant aerodynamic force out of the plane of symmetry perpendicular to the lateral axis and the turn would not be coordinated.

As a consequence of the increase lift required to produce the steady turn in a bank, the induced drag is increased above that incurred by steady, wing level, lift-equal-weight flight. In a sense, the increased lift required in a steady turn will increase the total drag or power required in the same manner as increased gross weight in level flight. The curves of figure 2.28 illustrate the general effect of turning flight on the total thrust and power required. Of course, the change in thrust required at any given speed is due to the change in induced drag and the magnitude of change depends on the value of induced drag in level flight and the angle of bank in turning flight. Since the induced drag generally varies as the square of C_L, the following data provide an illustration of the effect of various degrees of bank:

Bank angle, ϕ	Load factor, n	Percent increase in induced drag from level flight
0°	1.000	0 (of course)
15°	1.036	7.2
30°	1.154	33.3
45°	1.414	100.0
60°	2.000	300.0

Since the induced drag predominates at low speeds, steep turns at low speeds can produce significant increases in thrust or power required to maintain altitude. Thus, steep turns must be avoided after takeoff, during approach, and especially during a critical power situation from failure or malfunction of a powerplant. The greatly increased induced drag is just as