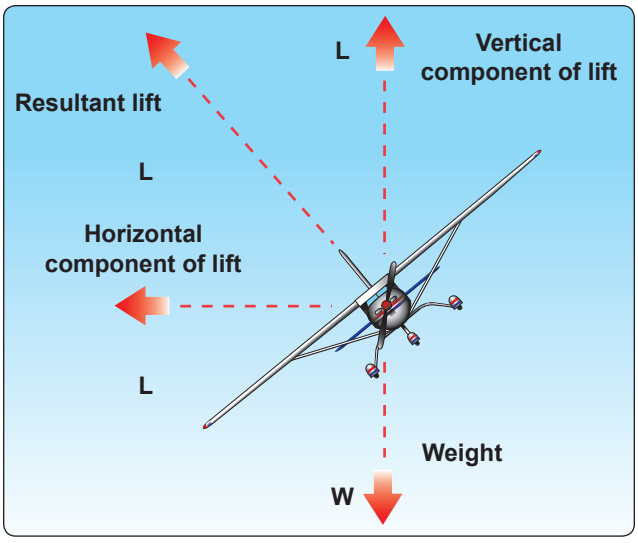

Figure 4-14. *Forces in a turn.*

If allowed to slow several knots, the airplane could enter the region of reversed command. At this point, the airplane could develop an unsafe sink rate and continue to lose speed unless the pilot takes a prompt corrective action. Proper pitch and power coordination is critical in this region due to speed instability and the tendency of increased divergence from the desired speed.

Large Airplanes

Pilots of larger airplanes with higher stall speeds may find the speed they maintain on the instrument approach is near 1.3 V_{SO}, putting them near point C *[Figure 4-11]* the entire time the airplane is on the final approach segment. In this case, precise speed control is necessary throughout the approach. It may be necessary to temporarily select excessive, or deficient thrust in relation to the target thrust setting in order to quickly correct for airspeed deviations.

For example, a pilot is on an instrument approach at 1.3 V_{SO}, a speed near L/D_{MAX}, and knows that a certain power setting maintains that speed. The airplane slows several knots below the desired speed because of a slight reduction in the power setting. The pilot increases the power slightly, and the airplane begins to accelerate, but at a slow rate. Because the airplane is still in the "flat part" of the drag curve, this slight increase in power will not cause a rapid return to the desired speed. The pilot may need to increase the power higher than normally needed to maintain the new speed, allow the airplane to accelerate, then reduce the power to the setting that maintains the desired speed.

Climbs

The ability for an aircraft to climb depends upon an excess power or thrust over what it takes to maintain equilibrium. Excess power is the available power over and above that required to maintain horizontal flight at a given speed. Although the terms power and thrust are sometimes used interchangeably (erroneously implying they are synonymous), distinguishing between the two is important when considering climb performance. Work is the product of a force moving through a distance and is usually independent of time. Power implies work rate or units of work per unit of time, and as such is a function of the speed at which the force is developed. Thrust, also a function of work, means the force which imparts a change in the velocity of a mass.

During takeoff, the aircraft does not stall even though it may be in a climb near the stall speed. The reason is that excess power (used to produce thrust) is used during this flight regime. Therefore, it is important if an engine fails after takeoff, to compensate the loss of thrust with pitch and airspeed.

For a given weight of the aircraft, the angle of climb depends on the difference between thrust and drag, or the excess thrust. When the excess thrust is zero, the inclination of the flightpath is zero, and the aircraft is in steady, level flight. When thrust is greater than drag, the excess thrust allows a climb angle depending on the amount of excess thrust. When thrust is less than drag, the deficiency of thrust induces an angle of descent.

Acceleration in Cruise Flight

Aircraft accelerate in level flight because of an excess of power over what is required to maintain a steady speed. This is the same excess power used to climb. Upon reaching the desired altitude with pitch being lowered to maintain that altitude, the excess power now accelerates the aircraft to its cruise speed. However, reducing power too soon after level off results in a longer period of time to accelerate.

Turns

Like any moving object, an aircraft requires a sideward force to make it turn. In a normal turn, this force is supplied by banking the aircraft in order to exert lift inward, as well as upward. The force of lift is separated into two components at right angles to each other. *[Figure 4-14]* The upward acting lift together with the opposing weight becomes the vertical lift component. The horizontally acting lift and its opposing centrifugal force are the horizontal lift component, or centripetal force. This horizontal lift component is the sideward force that causes an aircraft to turn. The equal and opposite reaction to this sideward force is centrifugal force, which is merely an apparent force as a result of inertia.