while a transport airplane usually feels heavy on the controls and responds to control pressures more slowly. These features can be designed into an airplane to facilitate the particular purpose the airplane is to fulfill by considering certain stability and maneuvering requirements. In the following discussion, it is intended to summarize the more important aspects of an airplane's stability; its maneuvering and controllability qualities; how they are analyzed; and their relationship to various flight conditions. In brief, the basic differences between stability, maneuverability, and controllability are as follows:

- **Stability**—The inherent quality of an airplane to correct for conditions that may disturb its equilibrium, and to return or to continue on the original flightpath. It is primarily an airplane design characteristic.

- **Maneuverability**—The quality of an airplane that permits it to be maneuvered easily and to withstand the stresses imposed by maneuvers. It is governed by the airplane's weight, inertia, size and location of flight controls, structural strength, and powerplant. It too is an airplane design characteristic.

- **Controllability**—The capability of an airplane to respond to the pilot's control, especially with regard to flightpath and attitude. It is the quality of the airplane's response to the pilot's control application when maneuvering the airplane, regardless of its stability characteristics.

BASIC CONCEPTS OF STABILITY

The flightpaths and attitudes in which an airplane can fly are limited only by the aerodynamic characteristics of the airplane, its propulsive system, and its structural strength. These limitations indicate the maximum performance and maneuverability of the airplane. If the airplane is to provide maximum utility, it must be safely controllable to the full extent of these limits without exceeding the pilot's strength or requiring exceptional flying ability. If an airplane is to fly straight and steady along any arbitrary flightpath, the forces acting on it must be in static equilibrium. The reaction of any body when its equilibrium is disturbed is referred to as stability. There are two types of stability; static and dynamic. Static will be discussed first, and in this discussion the following definitions will apply:

- **Equilibrium**—All opposing forces acting on the airplane are balanced; (i.e., steady, unaccelerated flight conditions).

- **Static Stability**—The initial tendency that the airplane displays after its equilibrium is disturbed.

- **Positive Static Stability**—The initial tendency of the airplane to return to the original state of equilibrium after being disturbed. [Figure 3-10]

- **Negative Static Stability**—The initial tendency of the airplane to continue away from the original state of equilibrium after being disturbed. [Figure 3-10]

- **Neutral Static Stability**—The initial tendency of the airplane to remain in a new condition after its equilibrium has been disturbed. [Figure 3-10]

STATIC STABILITY

Stability of an airplane in flight is slightly more complex than just explained, because the airplane is free to move in any direction and must be controllable in

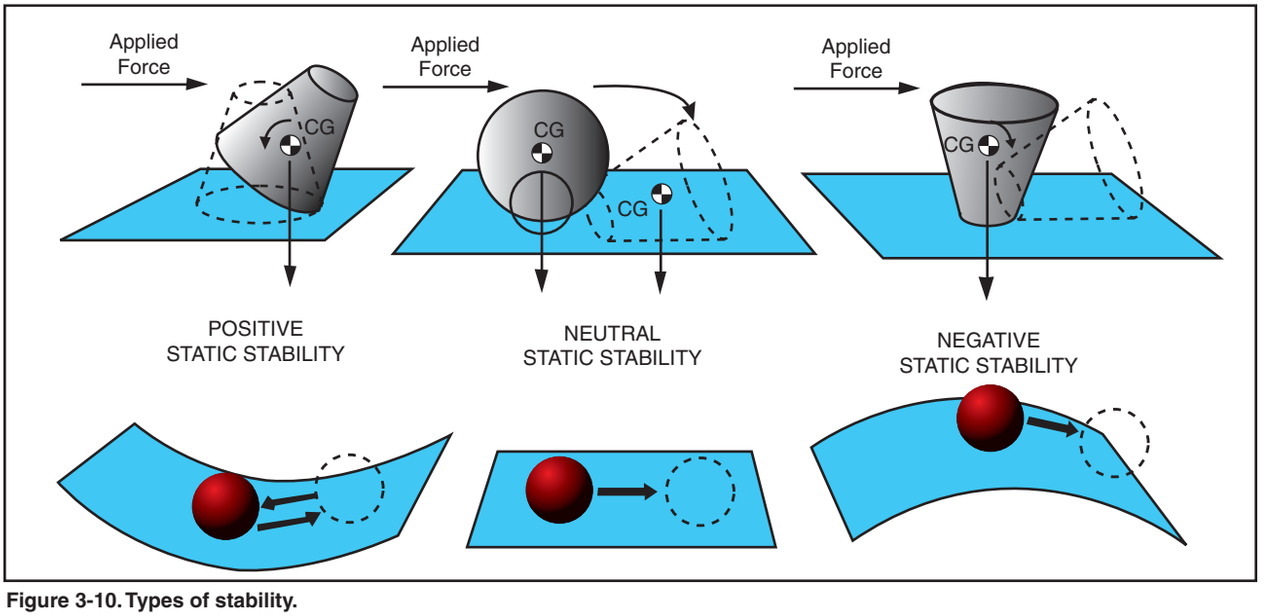

Figure 3-10. Types of stability.