which works fundamentally the same. Now that you understand how the compass works, it's time to consider operational compass errors.

Compass Errors

There are two types of compass errors: static and dynamic. Static errors are the result of deviation—compass accuracy degraded by local disturbances. The source of deviation can be anything in the cockpit that will have a magnetic effect such as motors, any magnetic objects installed in the aircraft, iron or steel structure, and actual magnets used in other equipment. There is also pilot-induced deviation, such as laying a metal clipboard or a stopwatch on the instrument panel. And, of course, any electric, current-carrying wire, especially one twisted in the shape of a loop—think of all those radio leads behind the instrument panel!

To minimize deviation, a compensator is located next to the north-seeking magnets. It consists of two sets of one or more small permanent magnets that can be adjusted to compensate for local disturbances. By turning the compensator screws, these small magnets are rotated and their flux fields interact predictably with the compass's magnets. One set is for north/south adjustment and a second for east/west. These should only be set by a mechanic, as the procedure is done for a specific compass and aircraft under specified conditions. The procedure is done entirely on the ground with the aircraft configured for normal flight—radios and electrical equipment on. Called "swinging the compass," it is accomplished in the following manner:

First the aircraft is taxied onto a compass rose. Many airports have them painted somewhere on a taxiway or ramp surface. The aircraft is faced toward magnetic north according to the compass rose. The mechanic adjusts the north/south compensator until the compass reads correctly. The aircraft is turned toward magnetic east, and the east/west compensator is adjusted until the compass reads correctly. Similarly, the aircraft is turned toward magnetic south, but this time the compensator is adjusted until the compass reads halfway from its current reading to where the compass would actually read south; you are now splitting the error difference between north (which was set accurately) and south. The aircraft is again turned, this time toward magnetic west, and the difference is split between west and east. Going back to north again, the process of "splitting the difference" is repeated for north, south, east, and west one more time. The result is the best compromise possible for the deviation that exists in the cockpit. Other methods of swinging a compass without a rose include using a handheld direction-finding instrument called a *pelorus* or a true, north-seeking gyro compass.

At best, compensators remove only part of the deviation, so after the compass has been swung it is important to document the error for the pilot. This is done by filling out a compass correction card. To do so, the aircraft is turned at 10-degree increments according to the compass rose. At each increment the actual magnetic compass heading is read and the difference (deviation) is listed on the correction card. For instance, when the aircraft is positioned on the compass rose at an actual magnetic heading of 10 degrees, if the compass reads higher than 10 degrees, say 12, the difference is displayed on the compass card as STEER 12. This indicates to the pilot that to fly a magnetic heading of 10 degrees, it is necessary to steer the aircraft to a compass heading of 12 degrees.