The real function of today's magnetic compass is one of redundancy. All but replaced by the directional gyro (DG), the compass has been relegated to the role of backup, occasionally being used to reset the DG to proper magnetic orientation. Unfortunately, compass knowledge has almost become obsolete too.

One of the most neglected of all aircraft instruments, it provides the heading of the fore and aft axis of the aircraft relative to magnetic north. This should not be confused with either course or track. Course is a line drawn between two points, while track is the actual movement of the aircraft with relationship to the ground.

Pilots hope their actual ground track will be the same as the course they plotted during preflight, but in reality the effect of wind usually makes that difficult. From a planning point of view, magnetic course plus or minus computed wind correction angle equals magnetic heading. But planning to use a compass and actually using it are two very different things. The effect of existing errors is so significant that a thorough understanding of them all is necessary to make the compass a reliable piece of equipment.

Earth as a Giant Magnet

The earth is a large magnet. It has poles and a flux field, but it is a bit deceiving in that the true geographic north and south poles (those at the top and bottom of the globe) are not the magnetic poles, as can been seen in Figure 2-18. Magnetic north, located in Canada, changes position ever so slightly every year. That is one reason why maps and aeronautical charts are laid out according to unshakable true north. The flux field around the earth is nothing more than a giant version of a small magnet. Flux lines come vertically (an angle of 90 degrees) out of the south pole, bend around until they run parallel to the average earth's surface at the equator, then curve back and vertically reenter the earth at the north pole. At points in between individual poles and the equator, flux emerges and enters the earth at angles of less than 90 degrees. The imaginary angle between the flux and the earth's horizontal plane is called the *dip angle*.

Imagine yourself standing thousands of feet up in the air with no magnetic objects within miles. Then suspend a long, rectangular magnet by a thread located right at the balance point. The first thing you would notice is that it aligns with the earth's flux field, pointing toward the magnetic north pole. The next thing you would probably notice is that, with a single exception, one end of the magnet is pointing downward, as if out of balance. In the northern hemisphere it would be the north-seeking end, which is incidentally the south pole of the magnet (remember, opposites attract). In the southern hemisphere, the south-seeking pole would be dipped. Only at the equator would the magnet appear to be balanced, parallel to the earth's surface.

The greater the dip angle, the more severe the problem with compass accuracy. Taken to the extreme, as when directly over the north pole, the compass needle wants to point straight down into the ground. It would obviously be difficult to navigate with the needle pointing straight down, so knowing the direction of the lines of flux alone is insufficient, you need to know the direction of the flux lines relative to a horizontal plane. That defines the direction relative to magnetic north.