

Aircraft Instruments

From a practical point of view, a compass in good condition is accurate only in straight-and-level, unaccelerated flight. Any other time it is plagued by any of several dynamic errors, the most obvious of which is oscillation—the erratic movement of the compass card as a result of turbulence or rough handling. Whether induced by the environment or the pilot, when the airplane bounces and shakes, the compass will behave unreliably. When flying on instruments, for many reasons, smoothness is the all-important word. Except for those flying over the equator where the earth's magnetic field is horizontal, some errors are, practically speaking, ever-present.

Turning error, which is dominant when flying either north or south, affects the compass because in a turn the compass card banks with the aircraft. In the northern hemisphere, on a northerly heading, turning to the east, for instance, the card banks to the right. Remember that the farther north the aircraft is, the further the compass magnet dips down at its north-seeking (front) end. When the centrifugal force of the bank is added to the dip, the card swings toward the west (remember, west is on the right side of the card). As the turn proceeds toward the east, this error causes the compass heading to lag way behind the actual aircraft heading. If the pilot rolls the aircraft out of the turn when the compass reads east, the aircraft will be way past the target heading. Therefore it is necessary to anticipate this and roll out early.

On the other hand, if the aircraft is on a southerly heading, the error produces a greater heading change than actually occurs (compass leads actual heading change) and the pilot must allow for the extra heading change before rolling out. For those of you with sympathies that lie south of the Mason-Dixon line, there is a little crutch to remind you of these errors that will warm your hearts: the south leads, while the north lags.

Because of the inherent difficulties this error can produce while flying solely by reference to instruments, we use the D.G. as our primary direction instrument. However, D.G.s have been known to fail, and the compass can be your sole heading instrument. In such a case it is imperative to be proficient at timed turns using a combination of a rate-of-turn indicator and the magnetic compass. As a rule of thumb, the pilot should allow for a rollout to the desired heading proportional to the latitude where the flight is taking place. For instance, when turning from south to north at approximately 30 degrees north latitude, let's say a left turn, start rollout 30 degrees prior to north PLUS another 5 degrees to allow time to roll the wings level. This means you should begin your rollout at a compass indication of 035 degrees. When turning from north to south, let's say a right turn, you must fly past south, in this case, by 30 degrees MINUS the 5-degree rollout lead or 205 degrees. So the trick is, depending on which way you are turning, to add or subtract the latitude and allow an additional 5 degrees to stop the turn. If all this makes you think perhaps it is best to try to plan all your trips so you only fly on headings of east and west, read on.

Acceleration/deceleration error occurs on headings of east and west. By now you are well aware that the north-seeking end of the compass is already dipped down slightly when the aircraft is in the northern hemisphere. When the aircraft accelerates on an east or west heading, the aft end of the compass card tilts upward, causing the card to rotate toward north (again, remember that the north indication is actually on the south side of the card). Therefore it appears that the aircraft is turning toward the north when in fact it