

Degrees Compasses and Heading Indicators - Ground Lesson

Attention

Turn to 'two six zero'.

Objective

To understand the use of a compass and heading indicator.

Schedule

Ground instruction – 10 minutes

Reference Material

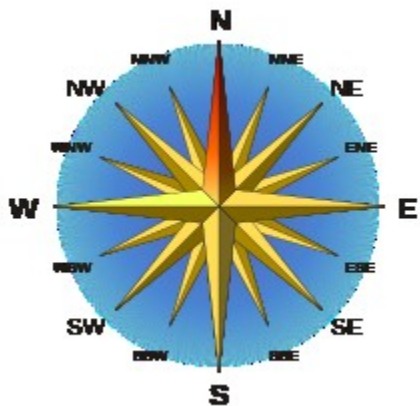
<http://www.compassdude.com/compass-units.php>
<http://www.compassdude.com/compass-reading.php>
https://en.wikipedia.org/wiki/Compass_rose
https://en.wikipedia.org/wiki/Points_of_the_compass
https://en.wikipedia.org/wiki/Compass#Magnetic_compass_2
<https://setcompass.com/TypesofNorth.htm>

Material

Different Compass Units of Measure

There are a few different ways a compass is divided into units. Depending on the use for the compass, different units of measure may be more useful: Points and Degrees

Points



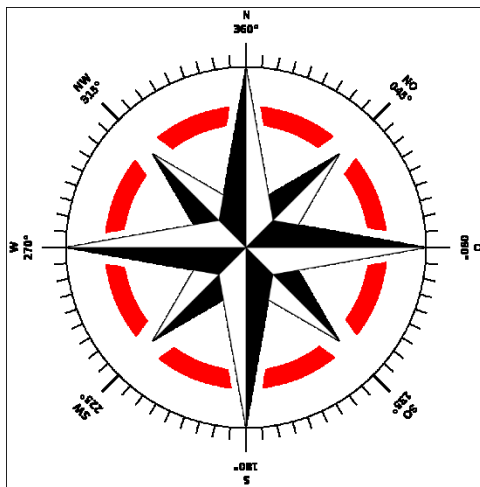
There are four cardinal points on a compass - North, South, East, and West. When reading a compass, and telling other people directions, you need to wipe "right" and "left" out of your vocabulary. Right and Left are relative directions and differ depending on your location and direction, but the cardinal points are constant.

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The direction halfway between North and East is an intercardinal point and is called NorthEast. The other three intercardinal points are SouthEast, SouthWest, and NorthWest.

Finally, there are secondary intercardinal points halfway between each cardinal point and intercardinal point. These are North-NorthEast, East-NorthEast, East-SouthEast, South-SouthEast, and so on. With these directions, you can give someone a fairly good idea of what direction they need to go. We could add additional points, continuing to break each section in half over and over, but telling someone to go East-EastEastNorthEast-EastNorthEast would not be fun.

Degrees



A compass divided into 360 degrees is the most common unit of measurement. Each degree is divided into 60 minutes, each minute into 60 seconds. A handheld compass is not able to measure down to a minute, let alone a second, but those units are used for precise locations using latitude and longitude.

North is at 0 degrees (and 360 degrees), East is 90 degrees, South is 180 degrees, and West is 270 degrees.

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Magnetic Compass



You will find a magnetic compass on top of the dashboard of the aircraft or mounted at the top of the front window. You would think that the more expensive instruments in the dash would be more accurate but usually you adjust other instruments based on this.

The magnetic compass is the most familiar compass type. It functions as a pointer to "magnetic north", the magnetic meridian, because the magnetized needle at its heart aligns itself with the horizontal component of the Earth's magnetic field. The magnetic field exerts a torque on the needle, pulling the North end or pole of the needle approximately toward the Earth's North magnetic pole, and pulling the other toward the Earth's South magnetic pole.

In navigation, directions on maps are usually expressed with reference to geographical or true north, the direction toward the Geographical North Pole, the rotation axis of the Earth. Depending on where the compass is located on the surface of the Earth the angle between true north and magnetic north, called magnetic declination can vary widely with geographic location. The local magnetic declination is given on most maps, to allow the map to be oriented with a compass parallel to true north. The location of the Earth's magnetic poles slowly change with time, which is referred to as geomagnetic secular variation.

Types of North

True North = Each day the Earth rotates about its axis once. The ends of the axes are the True North and South poles. True North on a map is the direction of a line of longitude which converges on the North Pole. Think of a globe that spins.

Magnetic North = A compass needle points to the magnetic north pole. The magnetic north pole is currently located in the Baffin Island region of Canada, and from the UK, is west of true north. The horizontal angular difference between True North and Magnetic North is called magnetic variation/declination.

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Grid North = The grid lines on Ordnance Survey maps divide the UK into one kilometer squares, east of an imaginary zero point in the Atlantic Ocean, west of Cornwall. The grid lines point to a Grid North, varying slightly from True North. The difference between grid north and true north is very small and for most navigation purposes can almost always be ignored.

Heading Indicator



The heading indicator is a flight instrument used in an aircraft to inform the pilot of the aircraft's heading. It is sometimes referred to by its older names, the directional gyro or DG, and also direction indicator or DI.

They can't fit 180, 210, etc so you will just see S, 21, etc.

The primary means of establishing the heading in most small aircraft is the magnetic compass, which, however, suffers from several types of errors, including that created by the "dip" or downward slope of the Earth's magnetic field. To remedy this, the pilot will typically maneuver the airplane with reference to the heading indicator, as the gyroscopic heading indicator is unaffected by dip and acceleration errors. The pilot will periodically reset the heading indicator to the heading shown on the magnetic compass.

The heading indicator works using a gyroscope, tied by an erection mechanism to the aircraft horizontal, i. e. the plane defined by the longitudinal and the lateral axis of the aircraft. The gyroscope is spun either electrically, or using filtered air from a vacuum pump (sometimes a pressure pump in high altitude aircraft) driven from the aircraft's engine. Because the Earth rotates (15° per hour), and because of small accumulated errors caused by friction and imperfect balancing of the gyro, the heading indicator will drift over time, and must be reset from the compass periodically. Normal procedure is to realign the direction indicator once each ten to fifteen minutes during routine in-flight checks. Failure to do this is a common source of navigation errors among new pilots.