Helmsman

1

Compass

1 A ***Compass*** is a navigational instrument for finding directions on the Earth. It consists of a magnetized pointer free to align itself accurately with Earth's magnetic field, which is of great assistance in navigation. The face of the compass generally highlights the cardinal points of north, south, east and west. A compass can be used in conjunction with a marine chronometer to calculate longitude and a sextant to calculate latitude, providing a very accurate navigation capability. This device greatly improved maritime trade by making travel safer and more efficient.

There are other, more accurate, devices for determining north (known in such cases as true north, as opposed to magnetic north), which do not depend on the earth's magnetic field for operation. A gyrocompass (ships) can be used to find true north, while being unaffected by stray magnetic fields, nearby electrical power circuits or nearby large masses of ferrous metals.

1.1 ***Lubber line*** is a fixed-line displayed on a compass binnacle or radar plan position indicator display pointing towards the front of the ship and corresponding to the craft's centreline.

1.2 C***compass card*** is a compass in the form of a card that rotates so that 0 degrees or North points to magnetic north (see figure 1)

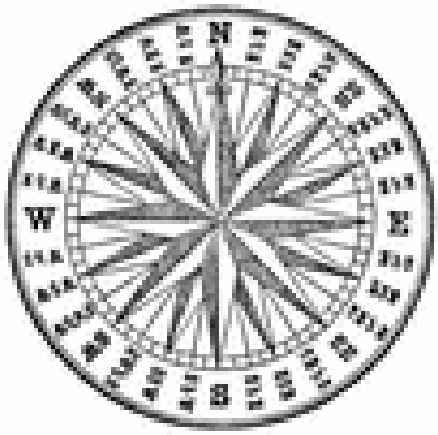


Fig -1

1.3 ***Compass Rose*** is a figure displaying the orientation of the cardinal directions, north, south, east and west on a map or nautical chart. It is also the term for the graduated markings found on the traditional magnetic compass.

The contemporary compass rose appears as two rings, one smaller and set inside the other. The outside ring denotes true cardinal directions while the smaller inside ring denotes magnetic cardinal directions. True north refers to the geographical location of the north pole while magnetic north refers to the direction towards which the north pole of a magnetic object (as found in a compass) will point. (see figure2)

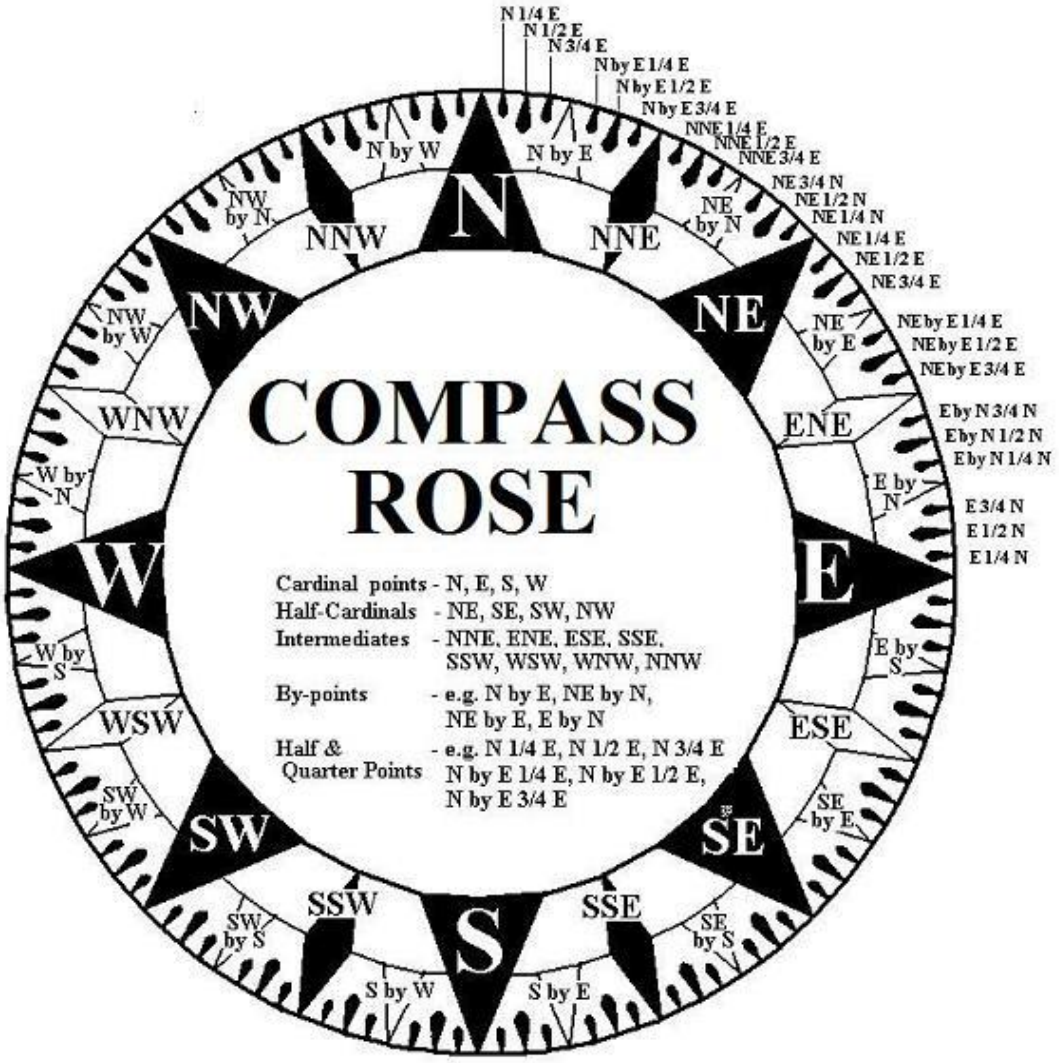


Fig -2

A 32 point compass has as its points in the directions:

NORTH
North northeast
North east
East northeast

EAST
East southeast
Southeast
South southeast

SOUTH
South southwest
South west
West southwest

WEST
West northwest
North west
North northwest (then back to North)

Reciting this list is known as ***boxing the compass***. It was considered to be one of the basic skills of an apprentice sailor to be able to recite these directions.

The smaller points such as that between North and NNE were known only in association with their larger neighboring point. For instance:

The point between North and NNE was N by E.
The point between NNE and Northeast was NE by N.
The point between Northeast and ENE was NE by E.
The point between ENE and E was E by N.

1.4 ***Liquid (Magnetic) Compass*** (See Figure-3)features a liquid filled header, fine graduations, large easy to turn dial, magnifying glass and

lanyard. In the liquid filled compass, which is the most stable type of mariner's compass, the bowl is filled with a liquid, usually a mixture of alcohol and water. The liquid helps to support the graduated card, which pivots about its center and floats in the liquid, thereby reducing pivot friction and lessening the vibrations of the card caused by the motion of the vessel. Because of these advantages the liquid compass is used more often than the dry compass.

Fig-3

Liquid compass is one of most popular compasses, especially a favorite among the hunters for years. It is also used for navigation and has been a vital tool for navigators at sea for centuries. The compass allows ships to steer a selected course and by taking bearings of visible objects with a compass, the navigator is also able to fix a ship's position on a chart. Liquid compasses, because of its greater steadiness, are used in most ships, especially small boats and life craft.

1.5 ***Gyro Compass*** is a compass that finds true north by using an (electrically powered) fast-spinning wheel and friction forces in order to exploit the rotation of the Earth. Gyrocompasses are widely used on ships. They have two main advantages over magnetic compasses:

- they find true north, i.e., the direction of Earth's rotational axis, as opposed to magnetic north,
- They are not affected by ferrous metal in a ship's hull. (No compass is affected by nonferrous metal, although a magnetic compass will be affected by copper wires with current running through them.)

1.6 ***Binnacle*** is a case or box on the deck of a ship,generallymounted in front of the helmsman, in which navigational instruments are placed for easy and quick reference as well as to protect the delicate instruments. A binnacle may be subdivided into sections and its contents typically include one or more compasses and a oil lamp or other light source. Other devices such as a sand timer for estimating speed may have been stored in the binnacle as well.

Fig-4

The construction of many early binnacles used nails (mid 1700s), which were later discovered to cause magnetic deviations in compass readings. As the development of the compass and understanding of magnetism progressed greater attention was given to binnacle construction to avoid compass disturbances caused by iron.

1.7 ***Azimuth Ring*** is a ring formed by the top side of the Azimuth housing's outer edge. The Azimuth ring contains rule markings. These marking represent a scale of measure.

Fig-5

The units of measure can be "degree", "mil", "quarter quadrant" or a combination of these units. For navigation purposes the most common scale used is 0 to 360 degrees. (See figure-5)

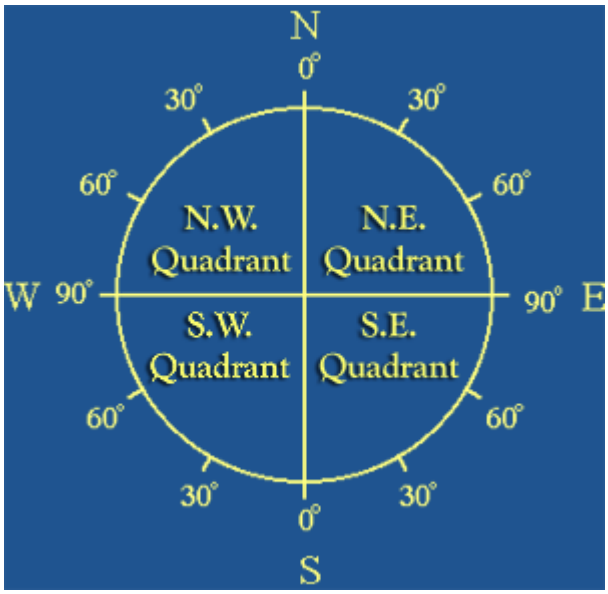
1.8 ***Cardinal Point*** One of the four principal directions on a compass: north, south, east, or west.
The four main points of direction on a compass; North, 360 degrees; EAST, 90 Degrees; SOUTH, 180 degrees; WEST, 270 degrees.

1.9 ***Compass Bearing*** A bearing is a measurement of direction between two points. Bearings are generally given in one of two formats, an ***azimuth bearing*** or a ***quadrant bearing***.

- An azimuth bearing uses all 360° of a compass to indicate direction. The compass is numbered clockwise with north as 0°, east 90°, south 180°, and west 270°. So a bearing of 42° would be northeast and a bearing of 200° would be southwest, and so on.

- For quadrant bearings the compass is divided into four sections, each containing 90°. The two quadrants in the northern half of the compass are numbered from 0° to 90° away from north (clockwise in the east, counterclockwise in the west). In the southern half of the compass, the two quadrants are numbered away from south Clockwise in the east, clockwise in the west).

Quadrant Bearings



Quadrant bearings are given in the format of N 40°E (northeast), S 26°W (southwest), etc. Whenever you measure a quadrant bearing, it should always be recorded with north or south listed first, followed by the number of degrees away from north or south, and the direction (east or west) away from north or south. In other words, you would never give a quadrant bearing as E 40°N or W 24°S.

1.10 ***Relative Bearing*** of an object is the angle formed by the heading of the vessel and a straight line drawn from the observer on the vessel to the object.

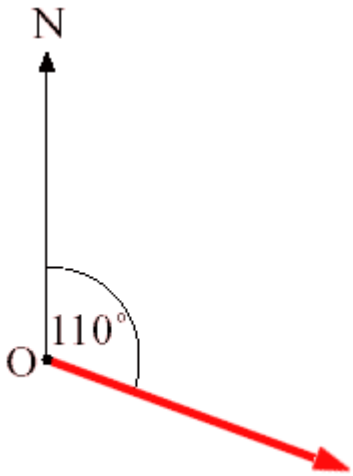
The relative bearing is measured with a pelorus.

The measurement of relative bearings of other vessels and objects in movement is useful to the navigator in avoiding the danger of collision.

Example: The navigator on a ship observes a lighthouse when its relative bearing is 45º and again when it is 90º. he now knows that the distance from the ship to the lighthouse is equal to the distance trvelled by the vessel between both observations.

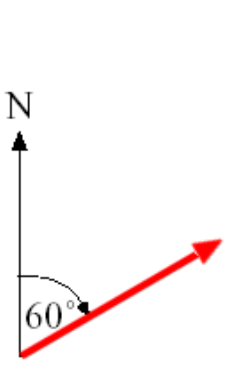
Some Examples

Look at the diagram below:

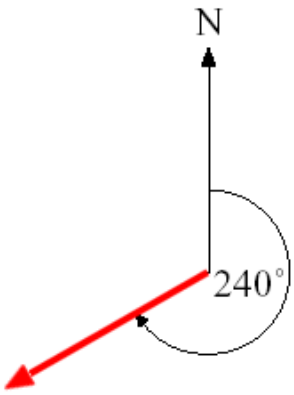


If you walk from O in the direction shown by the red arrow, you are walking on a bearing of 110 °.

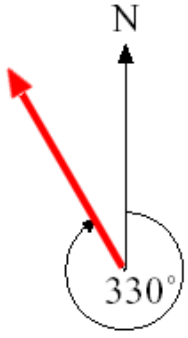
REMEMBER: Bearings are always measured clockwise from North and are given as 3 digits.



Bearing 060 °



Bearing 240 °



Bearing 330 °

Note that the first two bearings above are in directly opposite directions to each other. They have different bearings, but they are exactly 180° apart as they are in opposite directions.
A line in the opposite direction to the third bearing above would have a bearing of 150° because 330° - 180° = 150°.
These bearings in the opposite direction are called *back bearings* or *reciprocal bearings*.

2

Steering

Steering control of the ship will comprise manual steering and supplemented by an automatic pilot (autopilot) or other track control system.

In areas of high traffic density, in conditions of restricted visibility and in all other potentially hazardous situations a helmsman should be available on the bridge, ready at all times to take over steering control immediately.

When steering the ship under autopilot, it is highly dangerous to allow a situation to develop to a point where the OOW is without assistance and has to break the continuity of the look-out in order to take emergency action and engage manual steering.

Changing between automatic and manual steering should always be made in good time under the supervision of the OOw.

Manual steering should be tested after prolonged use of the autopilot
Use of override controls

The helmsman needs to be familiar with the operation of the steering control systems on the bridge, as well as the method of control at the emergency steering position.

The courses the helmsman steers must be ordered by the conning officer. The helmsman should have the ship on course before he or she surrenders the wheel to his or her relief.

The words port and starboard are used when giving orders to the helmsman. When an order necessitates a change of rudder angle to right or left, the direction of change is always stated, such as “Port steer one eight zero”. The helmsman always repeats all orders back to the conning officer, as they were given (word for word). Standard orders to the helmsman and their corresponding meanings is described in chapter 3 .1.

2.1 **Manual Steering** is a mode of steering required when the vessel enters or departs from a port, or navigates in narrow channels or congested areas and in restricted visibility.

Steering Mode

- Follow up -The required rudder angle is selected on the mechanical rudder position indicator at the follow-up hand wheel or tiller. The servo mechanism of the steering gear is operated by one amplifier (1 amplifier per pump or valve according to IMO or SOLAS) and the rudder is moved until it reaches the required angle. The actual rudder position is transmitted by the feedback unit. (See figure 6)

Fig-6

- Non Follow up -To command a rudder, electrical movement contacts are made by moving the NFU tiller. The rudder position is changed as long as the contact is held. The steering gear is controlled according to IMO or SOLAS (1 contact set per pump or valve). During the steering process, the actual rudder angle should be checked on the rudder position indicator.

- Emergency steering – Mode of steering required when all steering control on the bridge has failed to operate, steering is done operating the emergency mode from the steering flat.

2.2 Automatic Steering

The steering gear is switched over to the automatic position when ordered by the Master or the officer of the watch and when the vessel starts its ocean transit.

In areas of high traffic density, in conditions of restricted visibility and in all other hazardous navigational situations where the auto pilot is used, it shall be possible to establish human control of the ships steering. In situations as stated earlier, it shall be possible for the officer of the watch to have available without delay the services of a

qualified helmsmen who shall be ready at all times to take over the steering control.

The change over to auto pilot from manual steering and vice versa shall be made by or under the supervision of a responsible officer.

The manual steering must be tested after prolonged use of the auto pilot and before entering areas where navigation demands special attention. When navigating in narrow channel or confined waters or entering or leaving ports, both steering gear must be used simultaneously.

2.3 Steering Gear Test and Drills

12 Hours prior proceeding to sea, ships steering gear should be checked & tested by the ships staff. The test procedure shall include the following where applicable.

- The main steering gear
- The auxiliary steering gear
- The remote steering gear control system
- The steering location on the navigating bridge
- The emergency power supply
- The rudder angle indicators in relation to the actual position of the rudder
- The remote steering gear control system failure alarms
- Steering gear power unit failure alarms

<u>The checks & test shall include</u>

- Full rudder movement in accordance with solas regulations
- Visual inspection of steering gear and its connecting links
- Operations of the means of communication between the navigating bridge and the steering gear compartment

2.4 Reminders for Helmsman

- The helmsman must make extra effort to familiarize himself with the operations of the steering gear system particularly the changing over from manual to automatic or vice versa & emergency steering.
- If the helm order is inaudible, ask the Master, pilot or oow to repeat the order or command
- Never use large rudder angles for small course changes.
- To maintain high level of concentration when on wheel, especially in congested waters.
- Regularly monitor the rudder angle indicator for proper functioning.
- After course alteration compare courses of gyro & magnetic compass.
- When steaming at slow speed it is not unusual for helm to respond slowly, in such case report to Master, pilot or OOw immediately.
- If you observe anything abnormal with steering, report to the Master, pilot or OOw immediately.

2.5 Resistance while steering (Wind & Tide)

When a ship is in calm water with out any turning rate, resistance comes from frictional resistance due to wave & air, when a ship has a turning rate resistance consists of above stated reasons as well from transverse and longitudinal velocity resistance.

Reasons for developing Rate of Turns.

- Wind
- Tide
- Transverse thrust caused due to propeller movement

To minimize the above stated effect, helm has to be used to counteract the forces affecting the vessel.

3

ON – Board Communication Phrases

3.1 Operative Ship handling - Standard wheel orders

All wheel orders given should be repeated by the helmsman and the officer of the watch should ensure that they are carried out correctly and immediately. All wheel orders should be held until countermanded. The helmsman should report immediately if the vessel does not answer the wheel. When there is concern that the helmsman is inattentive s/he should be questioned:

"What is your course?"

And s/he should respond:

"My course ... degrees."

No	ORDER	MEANING
1	Midships	Rudder to be held in the fore and aft position.

2	Port five	5º of port rudder to be held.
3	Port ten	10º of port rudder to be held.
4	Port fifteen	15º of port rudder to be held.
5	Port twenty	20º of port rudder to be held.
6	Port twenty-five	25º of port rudder to be held.
7	Hard -a-port	Rudder to be held fully over to port.
8	Starboard five	5º of starboard rudder to be held.
9	Starboard ten	10º of starboard rudder to be held.
10	Starboard fifteen	15º of starboard rudder to be held.
11	Starboard twenty	20º of starboard rudder to be held.
12	Starboard twenty-five	25º of starboard rudder to be held.
13	Hard-a- starboard	Rudder to be held fully over to starboard.
14	Ease to five	Reduce amount of rudder to 5º and hold.
15	Ease to ten	Reduce mount of rudder to 10º and hold
16	Ease to fifteen	Reduce amount of rudder to 15ºand hold.
No	**ORDER**	**MEANING**
17	Ease to twenty	Reduce amount of rudder to 20º and hold.
18	Steady	Reduce swing as rapidly as possible.
19	Steady as she goes	steer a steady course on the compass Heading indicated at the time of the order. The helmsman is to repeat the order and call out the compass heading on receiving the order. When the ship is steady on that heading, the helmsman is to call out: “Steady on …"
20	Keep buoy/ mark/ beacon/ ... on port side.	buoy/mark/beacon to be kept on the port side of the bow
21	Keep buoy/ mark/ beacon/ ... on starboard side.	buoy/mark/beacon to be kept on the starboard side of the bow
22	Report if she does not answer wheel.	report if the ship does not respond to the helm order

23	Finished with wheel.	hand steering not required anymore

When the officer of the watch requires a course to be steered by compass, the direction in which s/he wants the wheel turned should be stated followed by each numeral being said separately, including zero, for example:

No	ORDER	COURSE TO BE STEERED
1	"Port, steer one eight two"	182º
2	"Starboard, steer zero eight two"	082º
3	"Port, steer three zero five"	305º

On receipt of an order to steer, for example, 182º, the helmsman should repeat it and bring the vessel round steadily to the course ordered. **When the vessel is steady on the course ordered, the Helmsman is to call out:**

"Steady on one eight two".

The person giving the order should acknowledge the helmsman's reply.

If it is desired to steer on a selected mark the helmsman should be ordered to:

"Steer on ... buoy/ ... mark/ ... beacon".

The person giving the order should acknowledge the helmsman's reply.

3.2 Hand over of Lookout Responsibilities

3.2.1 Briefing on Position, movement

Position

. 1 Present position latitude ..., longitude ... .
. 2 Present position bearing ... degrees, distance ...nautical miles.
. 3 Present position buoy ... *(charted name)*.
. 4 Present position between ... and... .

. 5 Present position way point/ reporting point....
. 6 Present position....
. 7 Next way point/ reporting point/....
. 8 ETA at ... ... UTC/local time.
.9 Passing buoy ... *(charted name)* on port side/ starboard side.
.9.1 Passed buoy ... *(charted name)* on port side/starboard side.
.10 Approaching buoy ... *(charted name)* on port side/ starboard side.
.10.1 Buoy ...*(charted name)* ... nautical miles ahead.
.11 Entering area ... .
.11.1 Entered area ... .
.12 Leaving area ... .
.12.1 Left area ... .

3.2.2 Briefing on Movements

Movements

. 1 True course ... degrees.
. 2 Gyro compass course ... degrees.
. 2.1 Magnetic compass course ... degrees.
. 3 Gyro compass error ... degrees plus/minus.
. 3.1 Magnetic compass error ... degrees east/west.
. 4 Speed over ground ... .
. 4.1 Speed through water ... .
. 5 Set and drift ... degrees, ... knots.
. 6 Making ... degrees leeway.
. 7 Course board written up.
. 8 Next chart within .... hours.

3.2.3 Briefing on Traffic situation

Briefing on traffic situation in the area

. 1 Vessel overtaking on port side/starboard side.
. 2 Vessel on opposite course.

. 3 Vessel passing on port side/starboard side.
. 4 Vessel crossing from port side.
. 4.1 Vessel will give way.
. 4.2 Vessel has given way.
. 4.3 Vessel has not given way yet.
. 4.4 Vessel standing on.
. 5 Vessel crossing from starboard side.
. 5.1 We have altered course to give way.
. 5.2 Vessel will pass ... nautical miles ahead.
. 5.3 Vessel will pass ... nautical miles astern.
. 6 Vessel ahead/astern on same course.
. 7 Bearing to vessel in ... degrees constant.
. 8 Heavy traffic in area.
. 9 Fishing boats in area.
. 10 No dangerous targets on radar.
. 10.1 Attention. Dangerous targets on radar.

4

Wind

4.1 Determining Wind Speed

For reporting purposes, Quartermasters must be able to compute the direction and velocity of the true wind. The following discussion contains instructions for observing the wind speed and direction and computing true wind data (speed, direction, gusts, and shifts).

The movement of the ship affects the wind speed observed by both the ship's anemometers and hand-held anemometer. Relative wind is measured from the direction and speed from which the wind appears to be blowing. Relative wind seldom coincides with true wind because the direction and speed of the relative wind are affected by the ship's movement. For example, if your ship is heading north at 10 knots and true wind is blowing from the south at 10 knots, there appears to be no wind at all. In another example, your ship is heading north and the wind appears to be blowing in on the port bow, but the true wind is actually coming from the port quarter. In our discussion of the different types of wind, refer to the following explanations:

1. True wind (TW) is the velocity and direction from which the true wind is blowing.

2. Relative wind (RW) is the velocity and relative direction from which the wind is blowing in relation to ship's heading (SH).
3. Apparent wind (AW) is the velocity and true direction from which the relative wind is blowing. For example, if your ship is heading 090° and the relative wind is blowing in on your starboard bow (045°) at 15 knots, the apparent wind is from 135°T at 15 knots.

The formula for apparent wind is: AW=RW+SH.

Wind speed (including gusts and squalls) is observed, computed, and reported in nautical miles per hour (knots) to the nearest whole knot. Since the true wind must be computed, the chance of committing an error is increased. The wind data reported is used as criteria for wind, storm, and high seas warnings. Care must be taken whenever computing true wind. Wind data can be observed using the following methods listed in order of preference:

1. Installed anemometer
2. Hand-held anemometer
3. Visual estimation

4.2 Determining True Wind

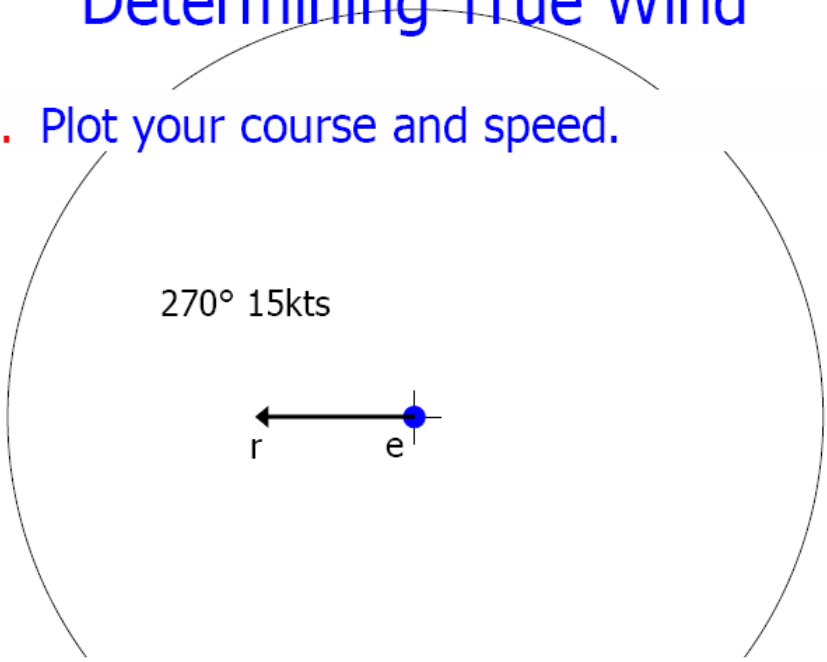
Information you NEED to know:

- Your course and speed (er vector)
- Apparent wind direction and speed (Wr vector)

Procedure for plotting

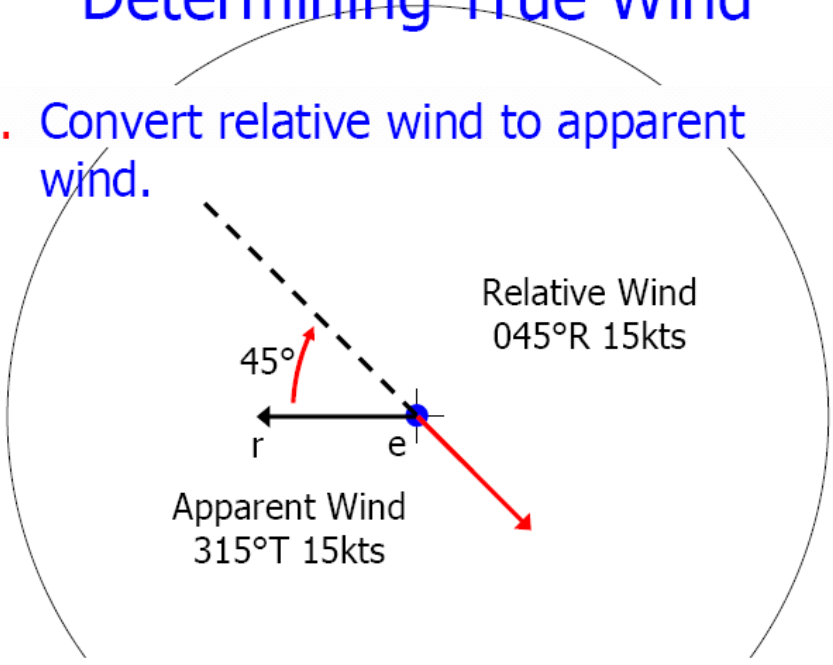
Determining True Wind

1. Plot your course and speed.



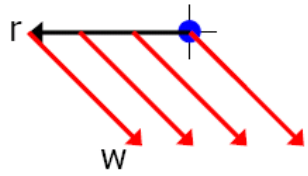
Determining True Wind

2. Convert relative wind to apparent wind.



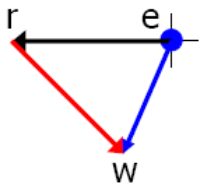
Determining True Wind

3. Move apparent wind vector to end of er vector.



Determining True Wind

4. Draw the ew vector from the center to the end of the rw vector.



True Wind going to 202°T 11.5kts

True Wind 022°T 11.5kts

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