

# Tonight's Program

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## Introduction to Navigation

- Section 5:- The Magnetic Compass
- Section 1:- Navigation - TVMDC
- Exercise in “Conning”



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# Navigation

## Plotting a course & directing vessel SAFELY over water

- This can only be achieved by **KNOWING WHERE YOU ARE** are and being able to **ACURATELY** direct the heading of your vessel to the next point.
- The **COMPASS** enables you to do this.



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# Section 5 - The Magnetic Compass



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# What is a Compass?

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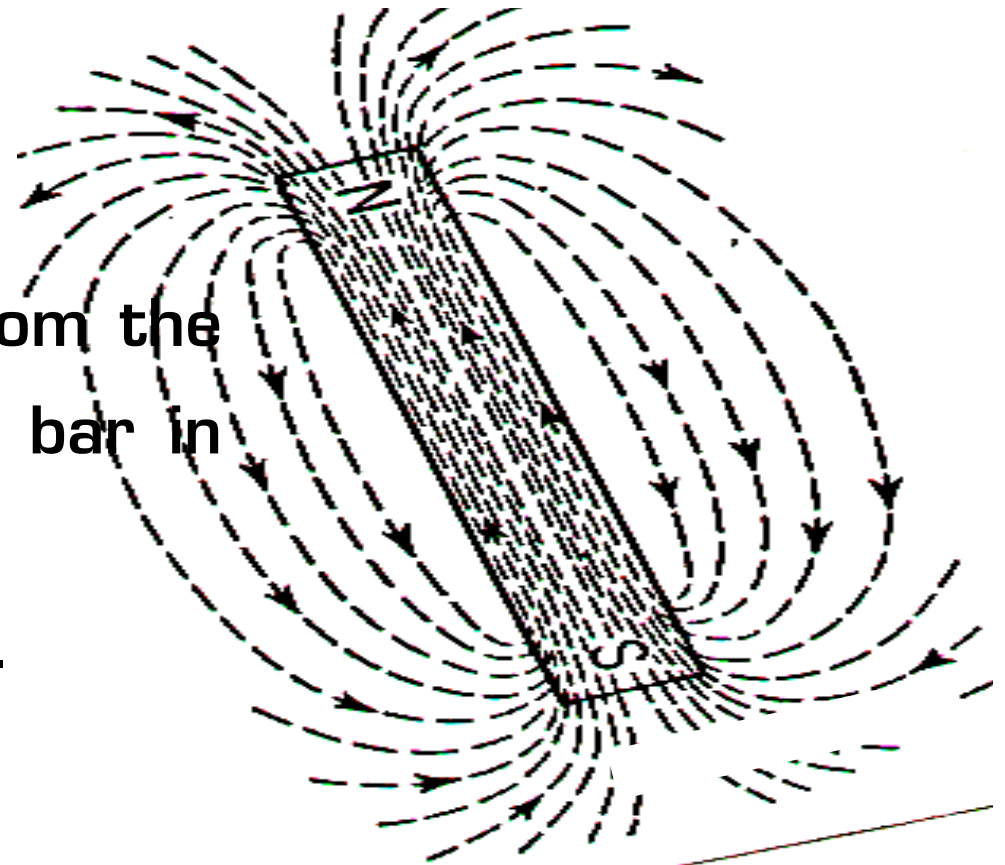
- It was discovered that a freely suspended magnet **ALWAYS** pointed in the same direction - North / South
- This was discovered over 3,000 years ago by the Chinese in 1110 BC and has been used as a basic navigation tool ever since.
- Until the 16th century it was believed that magnetic north coincided with geographic north.



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# How does a compass work?

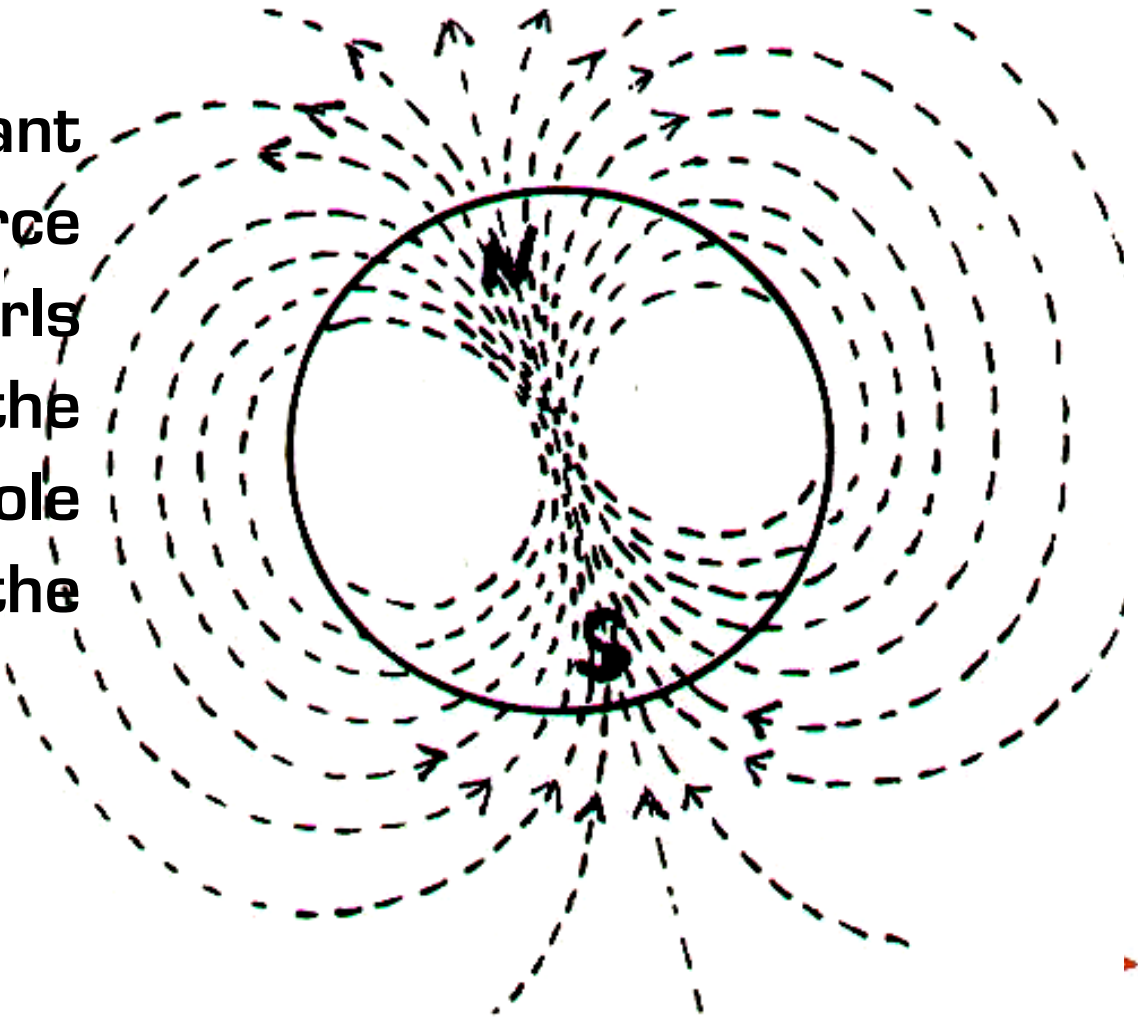
- Think of a bar magnet.
- Lines of force emanate from the North Pole, surround the bar in concentric whorls & re-enter at the South Pole.



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# Magnetic North Pole

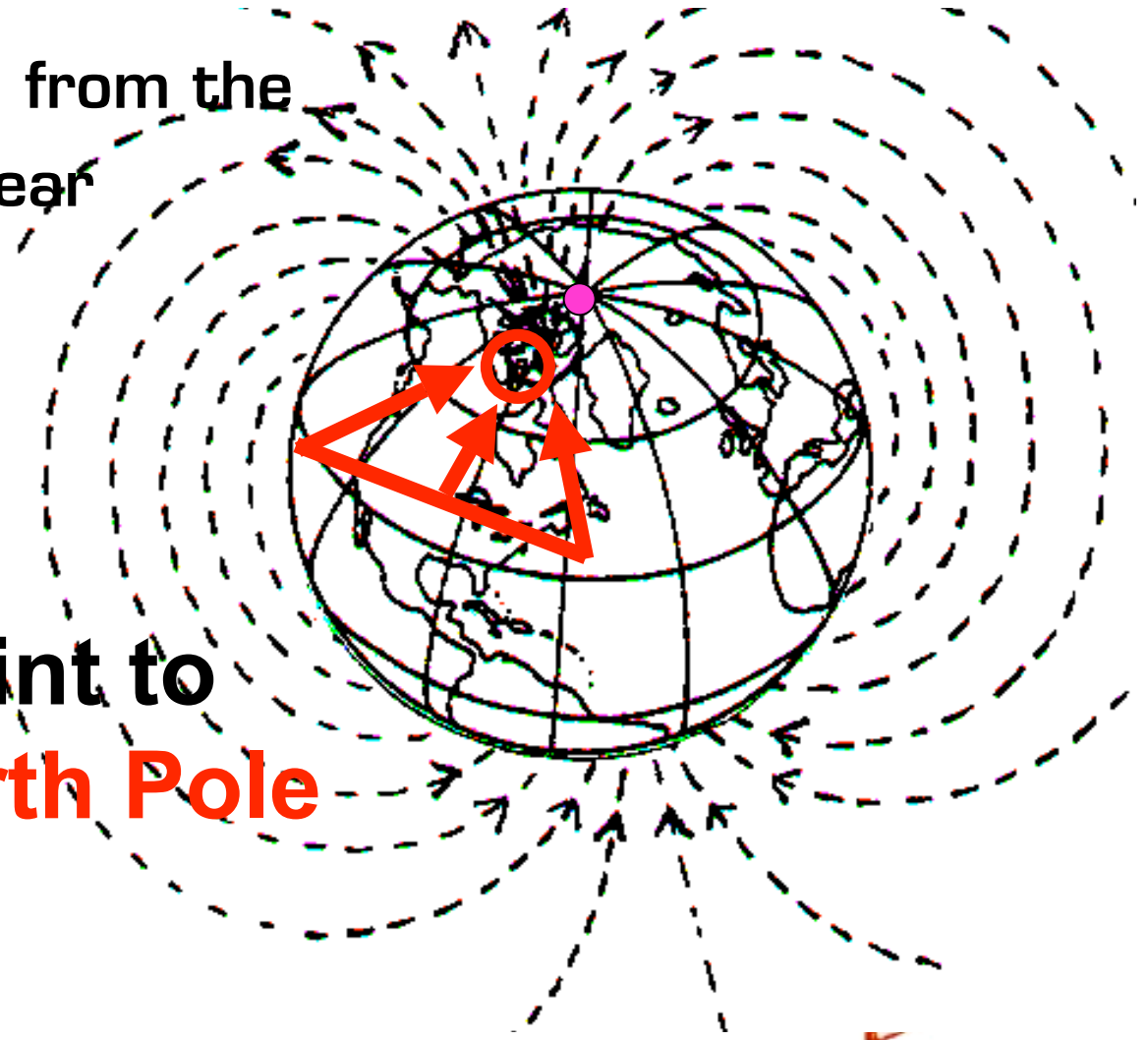
- **EARTH** is a giant magnet. Lines of force envelop Earth in whorls emanating from the **Magnetic North Pole** then re-entering at the **South Magnetic Pole**.



# Magnetic North

Lines of force emanate from the  
Magnetic North pole near  
Bathurst Is. NWT

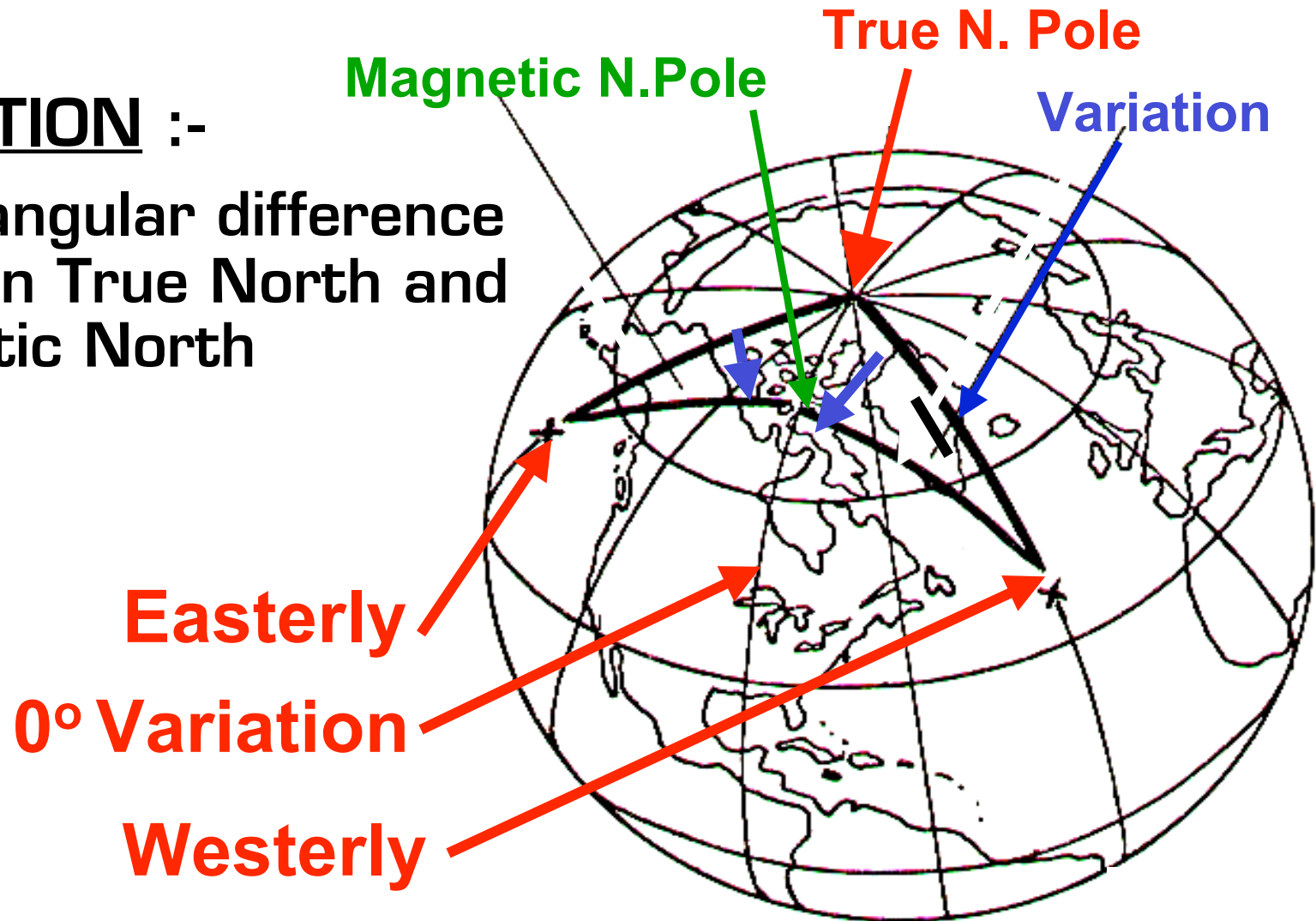
Compasses point to  
**MAGNETIC North Pole**



# VARIATION

## VARIATION :-

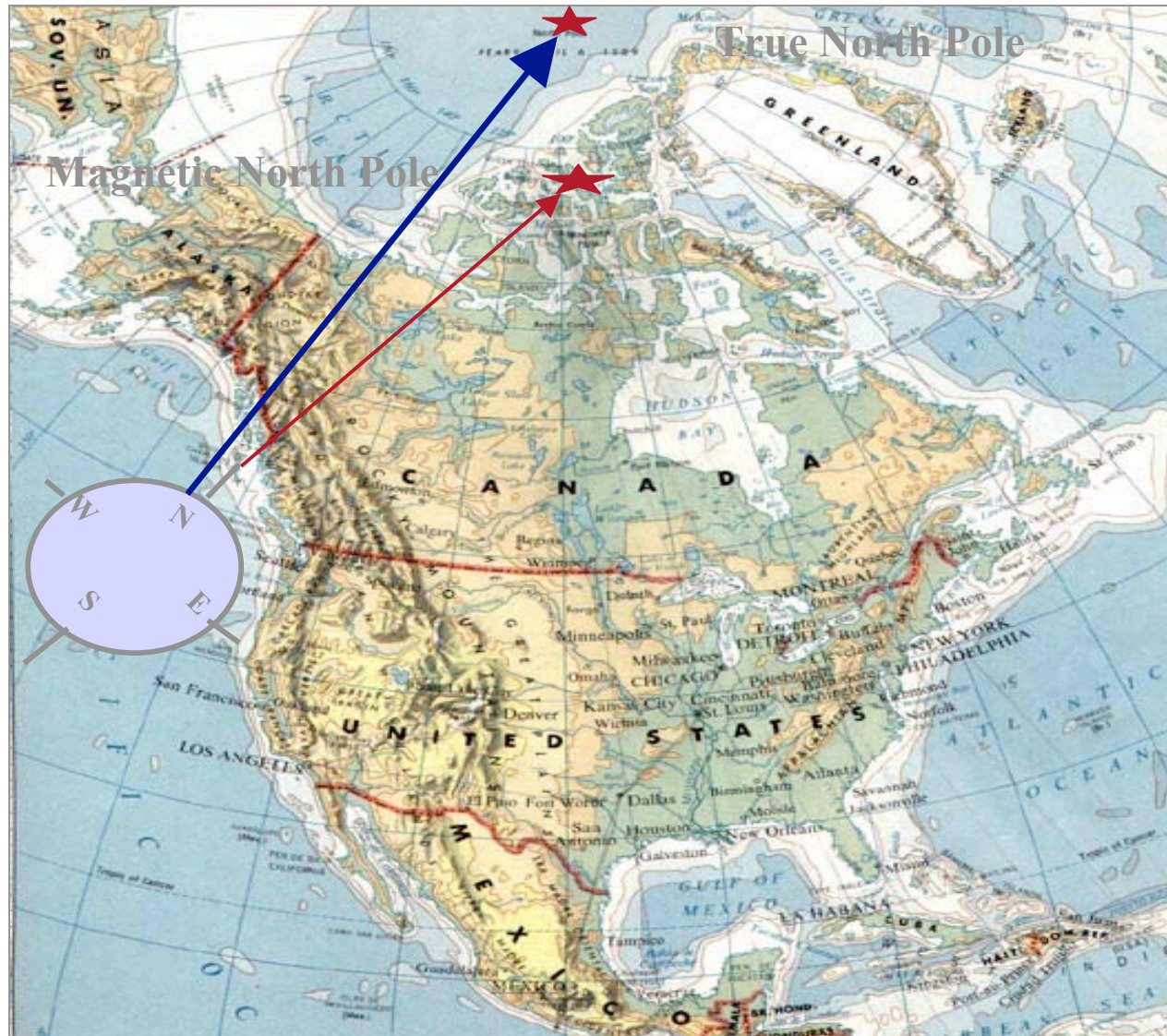
Is the angular difference between True North and Magnetic North



# Variation- is the difference between true north and magnetic north



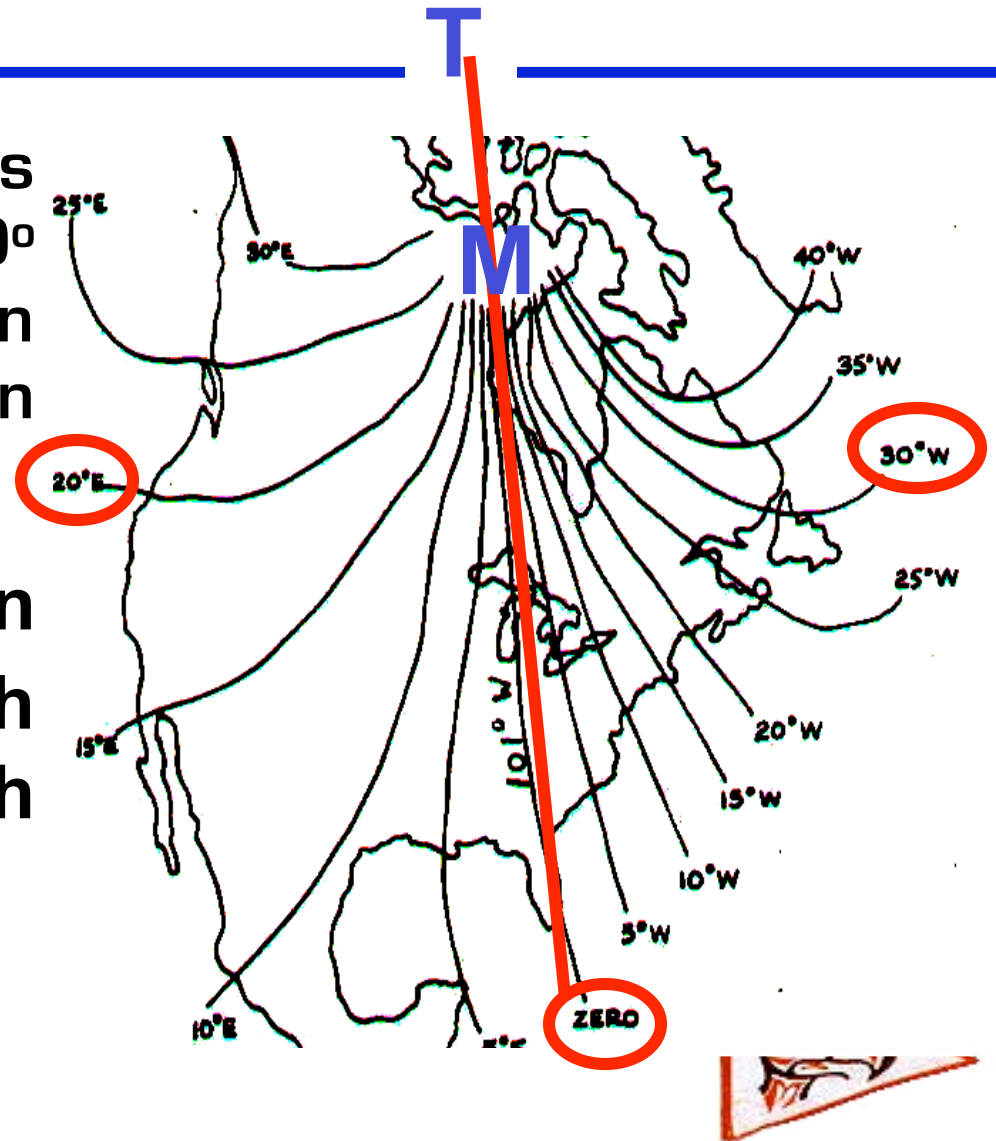
# Variation Variation changes with geographic position



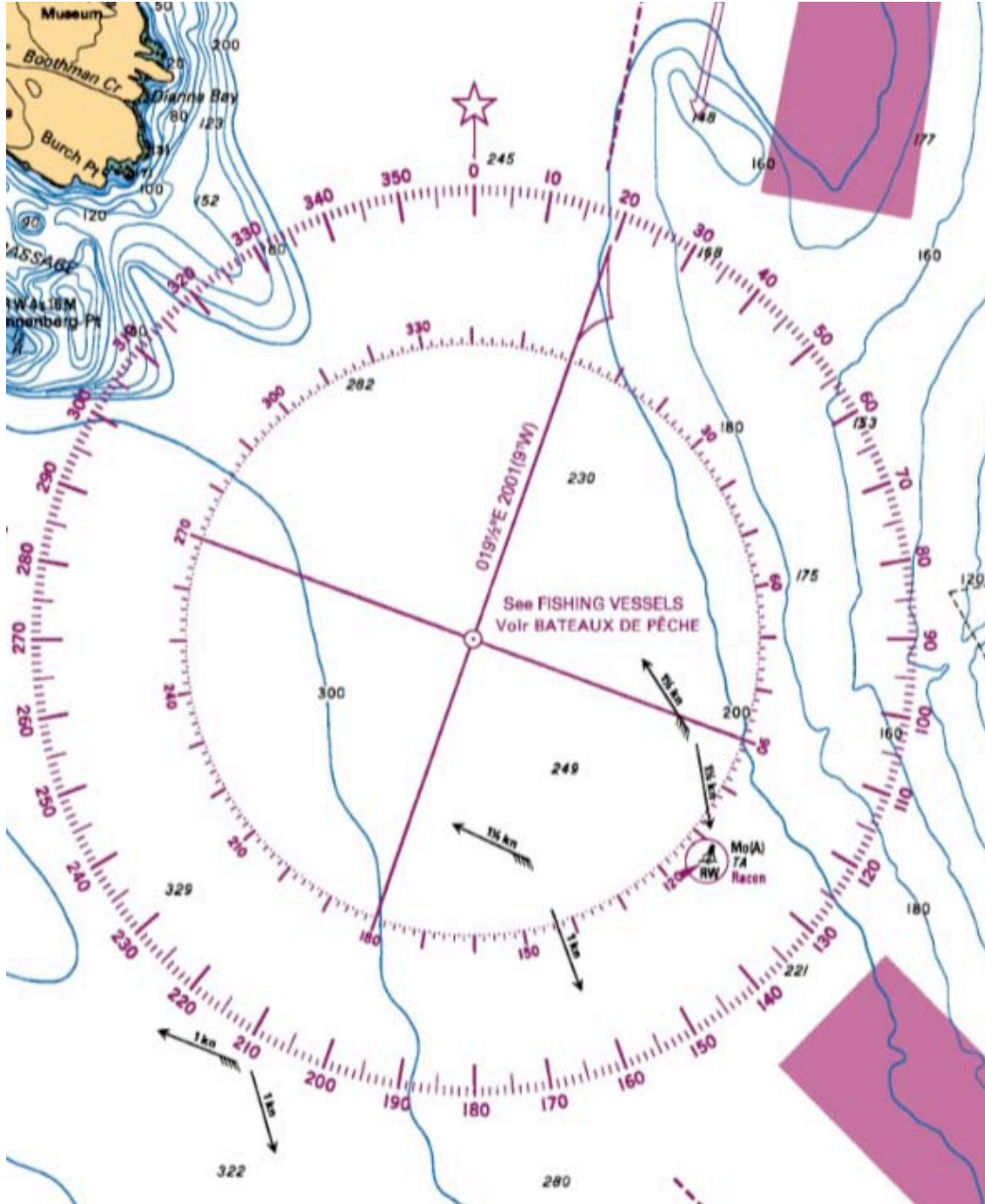
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# VARIATION

- In local waters Variation is  $20^{\circ}\text{E}$ , decreasing to  $0^{\circ}$  near Thunder Bay, then increasing to  $30^{\circ}\text{W}$  in Newfoundland.
- Variation is zero when the Magnetic North Pole and the True North Pole are in line.



# Variation



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# Summary so Far

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**TRUE** North is the top of the world and the lines on your chart.

**MAGNETIC** North is where your compass points.

**VARIATION** is the difference between them

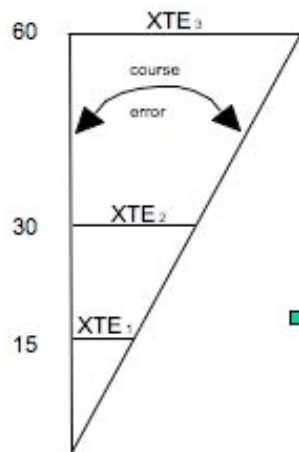


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# Track Errors

## True vs Steering (Compass) Course

Variation + Deviation (deg.)	XTE <sub>1</sub> (course distance = 15 mi.)	XTE <sub>2</sub> (course distance = 30 mi.)	XTE <sub>3</sub> (course distance = 60 mi.)
20 (W or E)	5.4	10.8	21.5



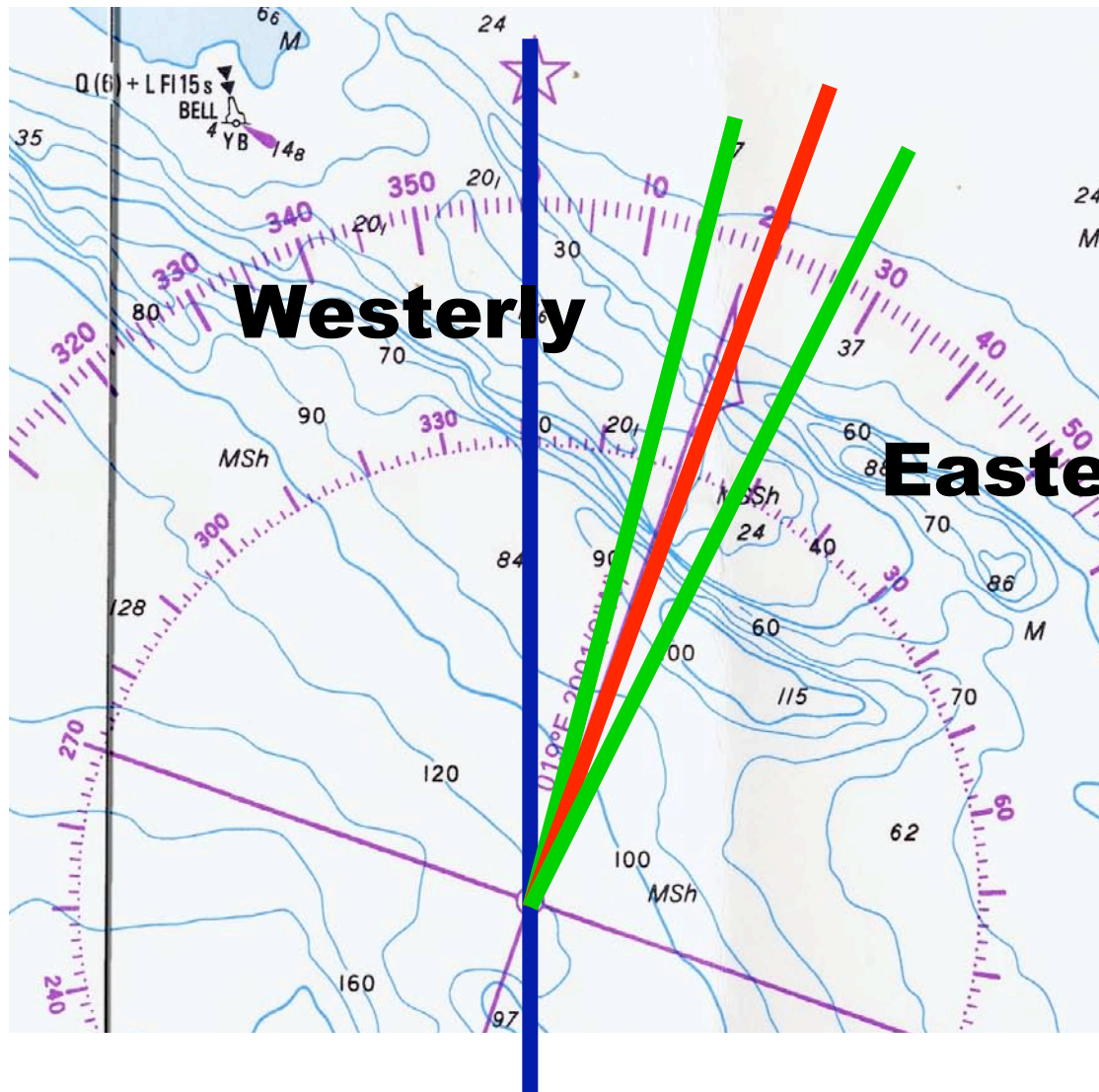
Course Error (deg.)	XTE <sub>1</sub> (course distance = 15 mi.)	XTE <sub>2</sub> (course distance = 30 mi.)	XTE <sub>3</sub> (course distance = 60 mi.)
5	1.31	2.62	5.25
10	2.64	5.29	10.58
15	4.02	8.04	16.08

$$\tan. (\text{course error}) = \text{XTE} / (\text{course distance})$$



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# Deviation



**True**  
**Magnetic**  
**Compass**



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# DEVIATION

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Magnetic lines of force are distorted by any local magnetic influence

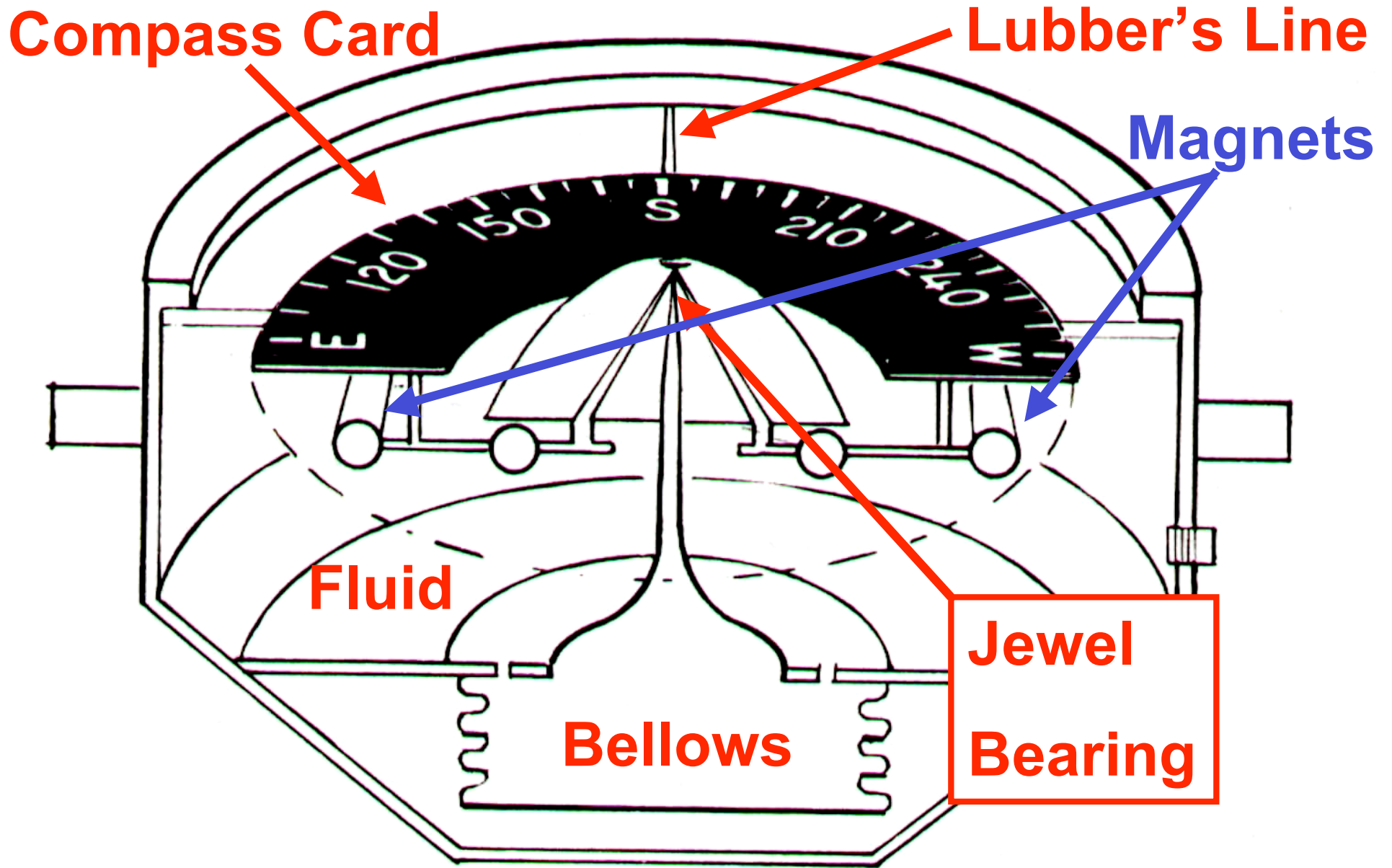
- Deviation: a compass error caused by magnetic influences on your vessel – eg. steel engine block, wiring, speakers etc.
- The angular difference between magnetic north and compass north
- Deviation varies with your heading because of the varying angle to Magnetic Nth



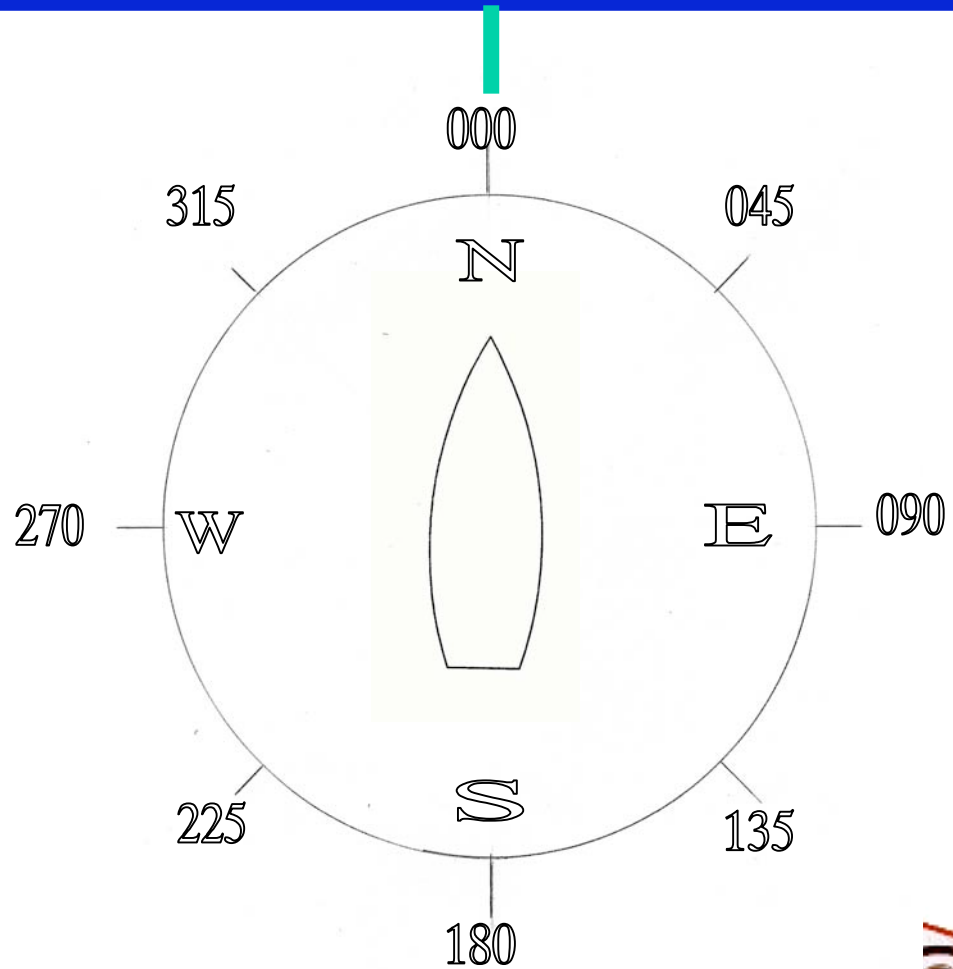
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# Compass Cutaway

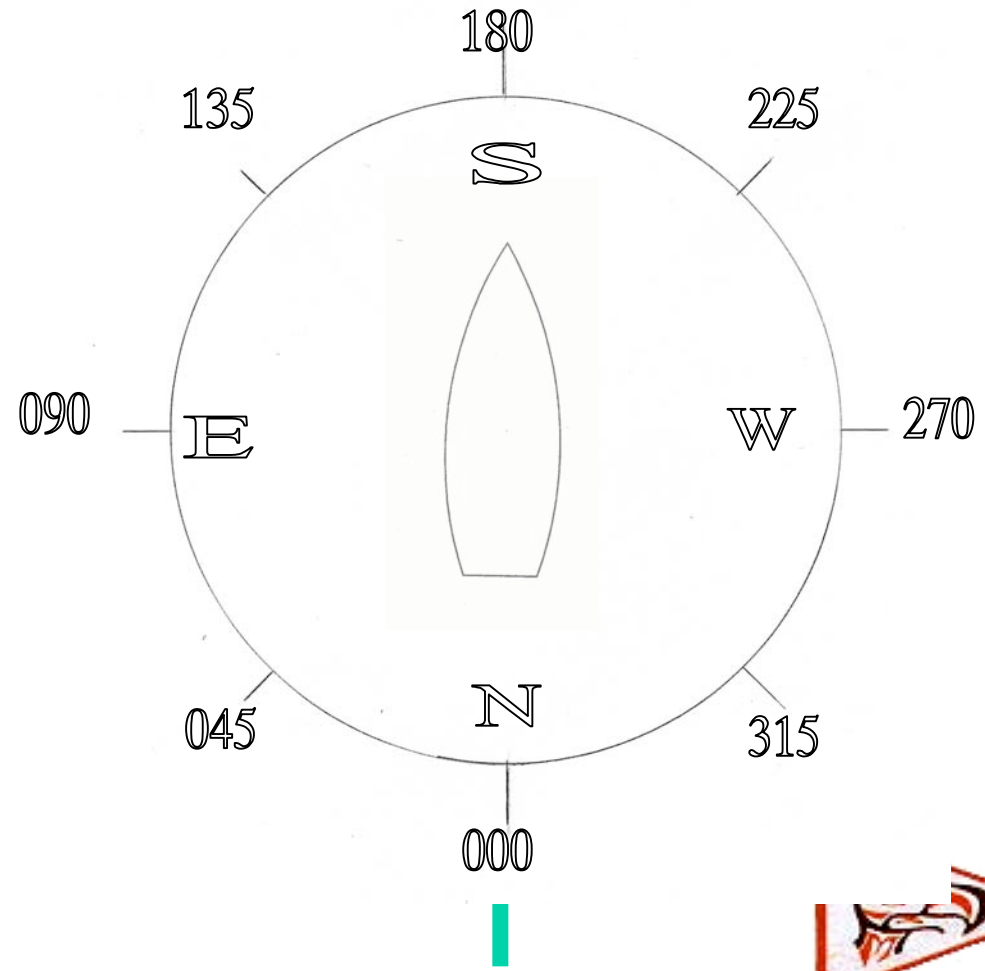


# Direct Reading Compass

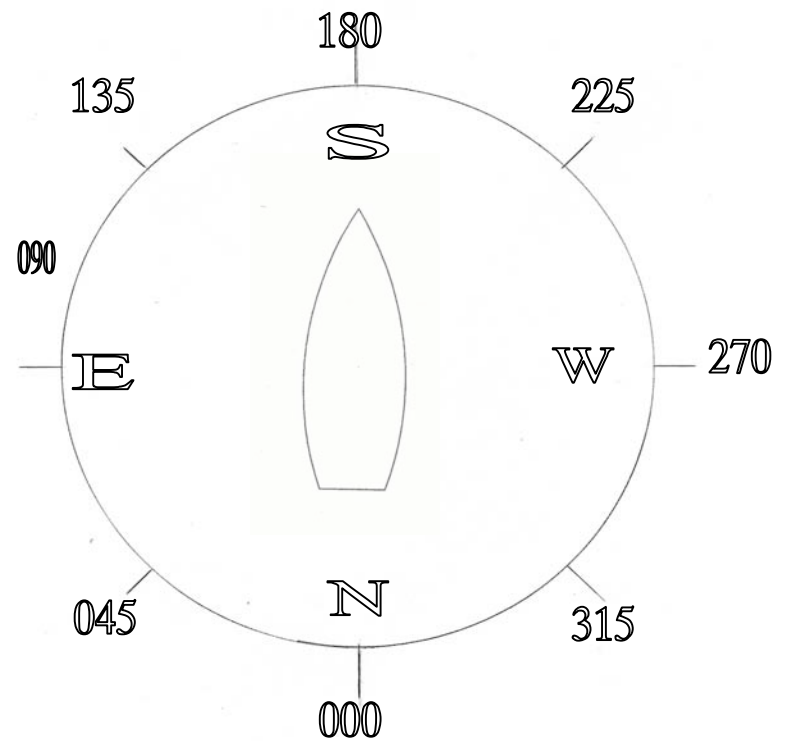
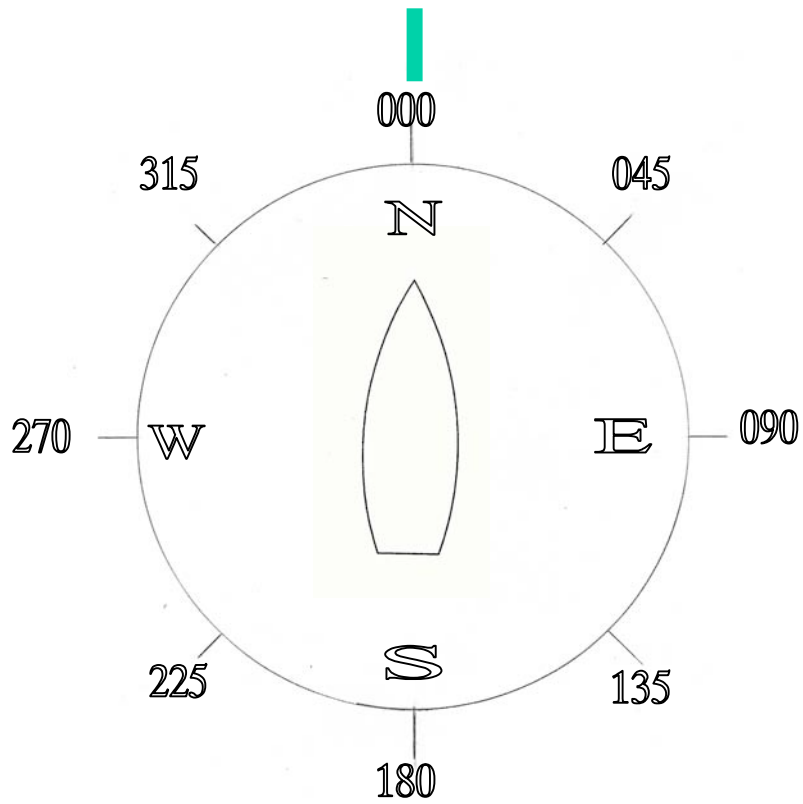


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# Reverse Reading Compass



# Comparison



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# Mounting the Compass

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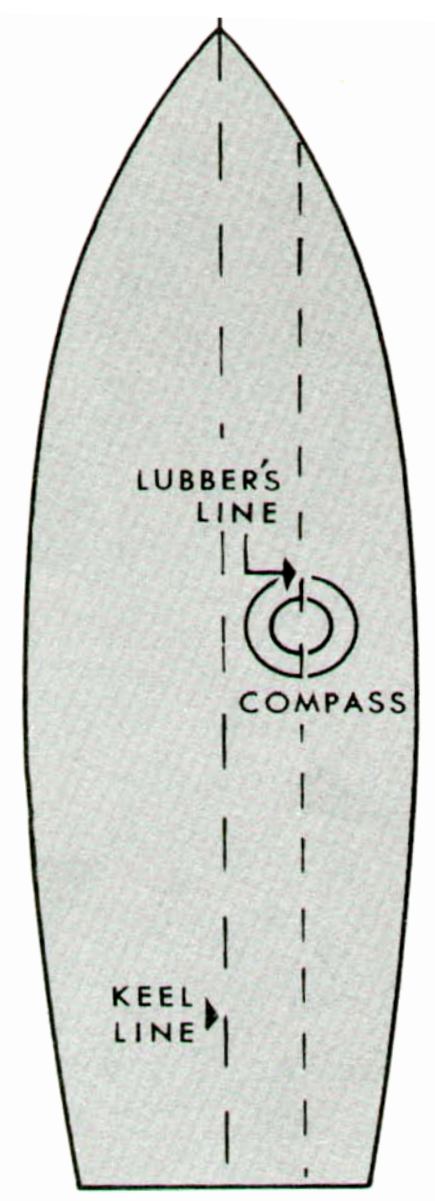
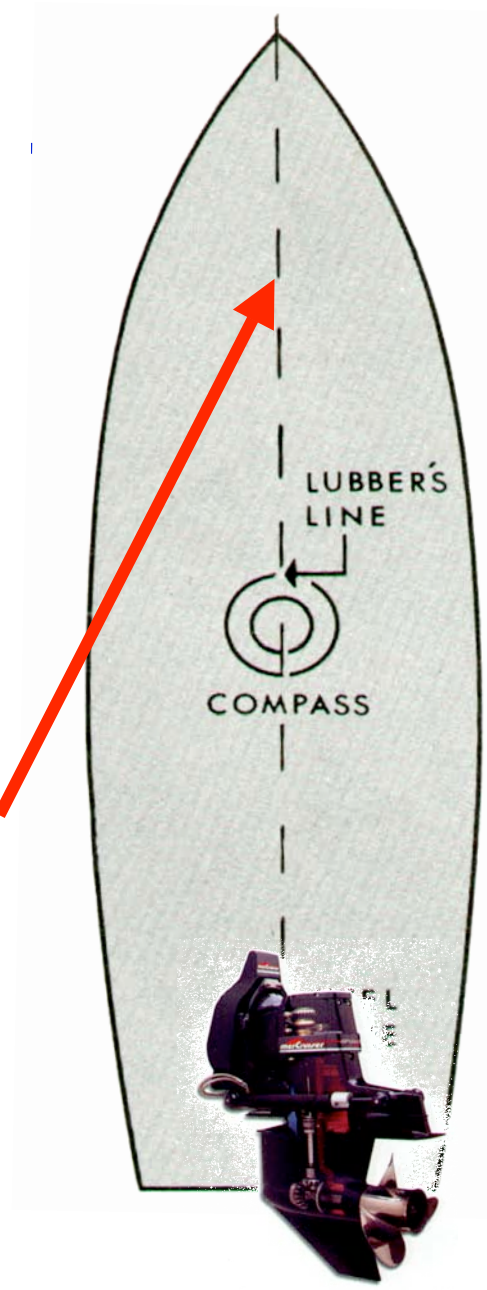
- Must be clearly visible to the helmsman
- Must be permanently fixed so that the compass fore & aft line is parallel to ships longitudinal axis (keel)
- Location free of magnetic influences



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# Mount Compass on Lubber's Line

Lubber's  
Line



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# Hand Bearing Compass

- Used to obtain a Line of Position (LOP) from your vessel to any charted object.
- Use it away from any magnetic influences



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# Steering by Compass

- Constantly trying to maintain course.



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# NAVIGATION:

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The process of plotting a course & directing a vessel *safely* over the water.



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# Navigation

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- **Three major components**
  - ❑ **Correcting compass directions**
    - ❑ Time and distance calculations
    - ❑ Putting it all on the chart.



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# Direction

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- **Direction is defined as:**

The angle between a reference line and a line that joins a point on that reference line to some other point.



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# Direction

The angle between a reference line and a line that joins a point on that reference line to some other point.

Point on Reference Line

Reference line (direction)

Some other point

090°



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# Directions

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- ❑ **True** - direction plotted on your chart
- ❑ **Magnetic / Compass** - direction [course or heading] as measured by the compass without correction.
- ❑ **Heading [Ships]** - the actual direction the ship is going in by Correcting Compass Directions



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# What have we learned ??

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- ❑ That a compass will work when all else fails
- ❑ That a compass does **NOT** point to **True North** - but to **MAGNETIC North** - the difference is called **VARIATION**
- ❑ We have to adjust for that depending on where we are.
- ❑ How to mount the compass on our boat and allow for the metal around it that causes **DEVIATION.**
- ❑ Next we need to learn how to correct these compass errors to get an accurate heading.



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# T V M D C

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**T** **V** **M** **D** **C**  
True Variation Magnetic Deviation Compass

Thanks Very Much District Commander.

True Virgins Make Dull Company

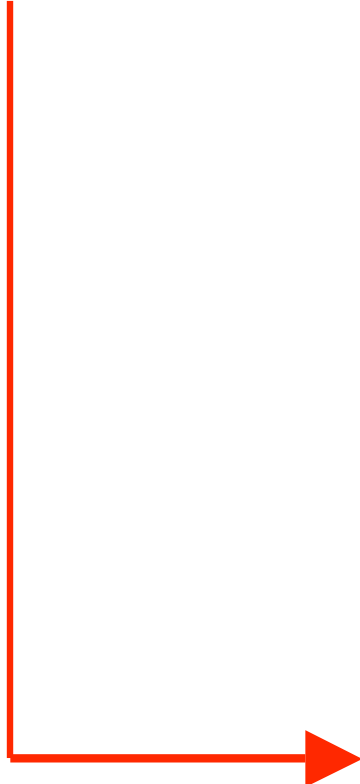


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**End Sect. 5**