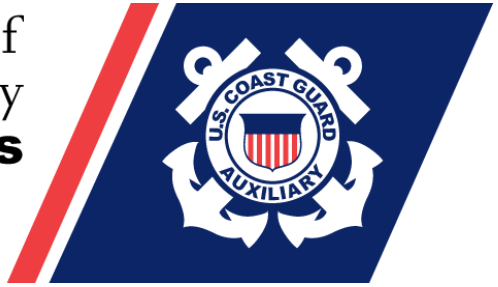
U.S. Department of Homeland Security
United States Coast Guard Auxiliary



Surface Guide to Operational Navigation

National Response Directorate

Disclaimer

- This guide is not a substitute for applicable policy.
- The best practices presented in this guide should augment and support the **safe** completion of our surface operations responsibilities.
- Applicable instructions and/or local regulations from your OIA and chain of leadership must always be followed.

Warning

Navigation and charting is an inherently hands-on activity. This class session alone will not sufficiently prepare you to succeed with boat crew navigation tasks.

Further hands on (one-on-one or small group) and on the job training is essential for your success in this discipline.

Our Emphasis is on Safety

"He who lets the sea lull him into a sense of security is in very grave danger."

- Hammond Ines, Novelist

Navigation Standards

- COMDTINST M3530.2(series), Coast Guard Navigation Standards Manual, applies to all USCG surface forces *including* Auxiliary facilities. Remember when under orders we are USCG vessels and personnel.
- Covers requirements for charts, eNav, briefings, logs, etc.

Setting Watches for Safety

- Underway Lookout
  - Nav Rule 4
    - States that rules apply to any condition of visibility.
  - Nav Rule 5
    - Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Safety- Lookout Locations

- Place lookouts at the point best suited for the purpose of hearing and observing the approach of objects likely to be brought into collision with the vessel.
- The lookout is expected to be an individual who is not the helmsman and is usually located in the forward and/or aft parts of the boat, away from the distractions and noises of the bridge.

Where am I?

- A vessels positon can be fixed by three principal methods.
  - Visual observation of the range or bearing of landmarks or ATONs and triangulated on the chart. This is called *piloting*.
  - Use of electronic navigational systems such as GPS or radar. This is called *electronic navigation.*
  - Observation of the angle of heavenly bodies (sun, moon or stars) called *celestial navigation.*

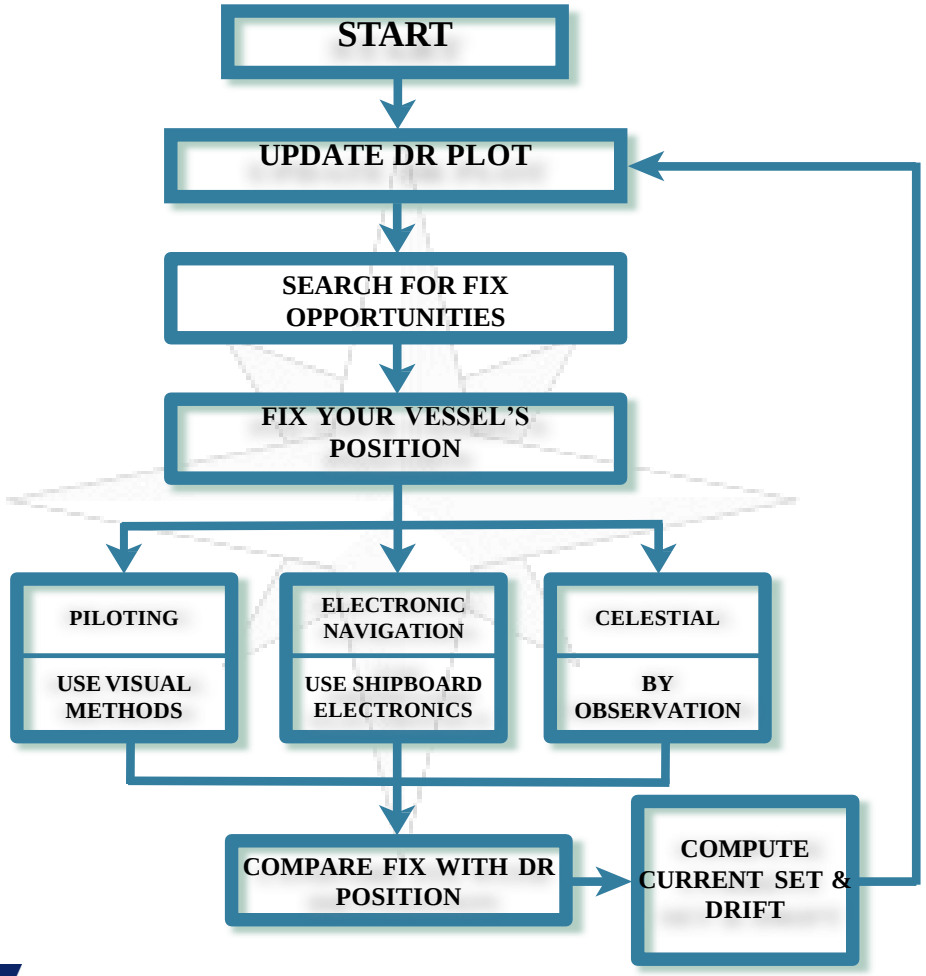
Dead Reckoning

- Deducted Reckoning (also called “ded” or DR) is the process of calculating one’s current positon by using a previously determined position, or fix, and advancing that position based upon known or estimated speeds over elapsed time and course.
- DR can be an unreliable method of navigation. Do not rely on it. Notice it’s called “DEAD”!

Updating Fix

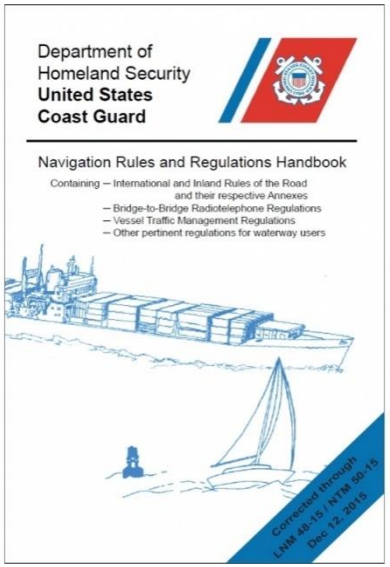
- Once a true fix is determined it is plotted on the tactical DR plot (chart) and the plot is updated with this fix.
- A comparison of the fix with the DR position can be used as a “reality check”.
- Differences can be used to compute set (direction of current) and drift (speed of current).

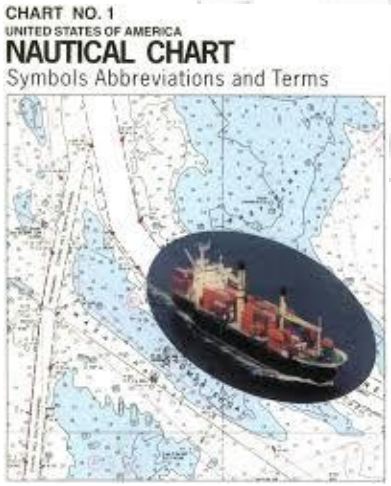
Steps in U/W Navigation



Navigation Operations Guide

Safety- Key Publications



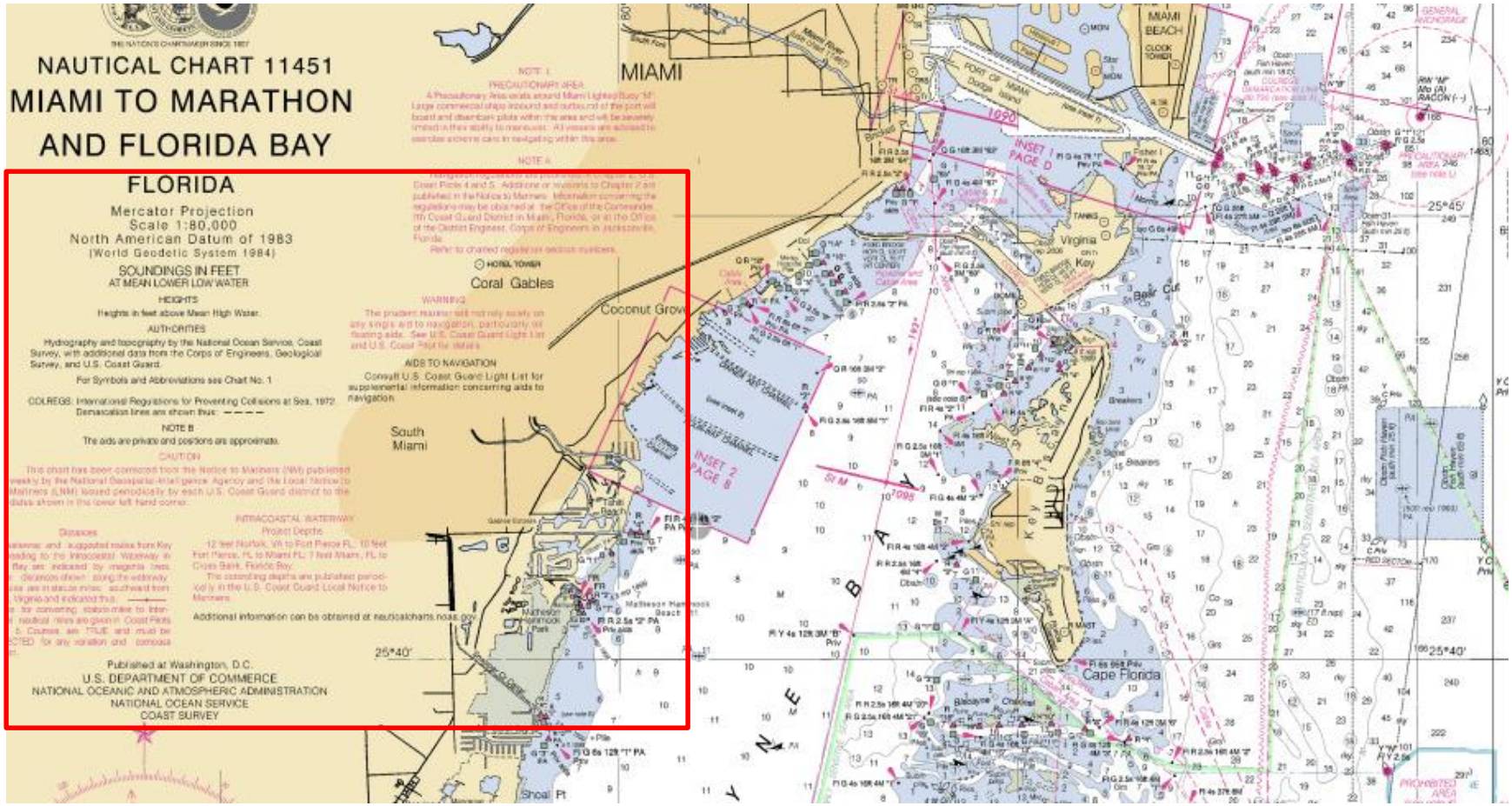


- Navigation Rules and Regulations Handbook
  - The definitive rules of vessel navigation
- Chart Number 1
  - Nautical Chart Symbols, Abbreviations, and Terms published by NOAA

The Nautical Chart

1. General Information Block
2. Scale of a chart
3. Longitude scale
4. Latitude scale
5. One nautical mile using the latitude scale
6. Horizontal and vertical clearances of overhead bridges and cables
7. Sounding numbers (feet/fathoms/meters)
8. Depth curves (contours)
9. Different colors and meaning of each
10. ATONs
11. Symbols for wreck, rock or other submerged object
12. Compass rose
13. Latest changes to the chart determined by LNM

General Information Block



Scale of Chart

- A simple ratio or fraction, known as the representative fraction.
- For example, 1:80,000 or 1/80,000 means that one unit (such as a meter) on the chart represents 80,000 of the same unit on the surface of the earth.

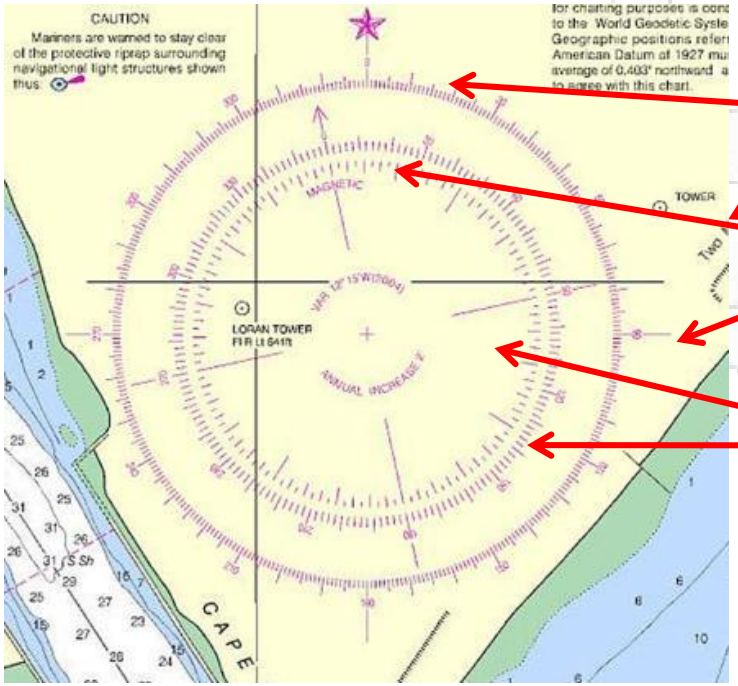
Compass Rose

Outer ring: Shows True direction (true north)

Inner ring: Shows Magnetic direction (magnetic north)

Center Point Info: Shows variation and annual changes

Variation is the Difference Between true & magnetic north pole



True North

Magnetic North

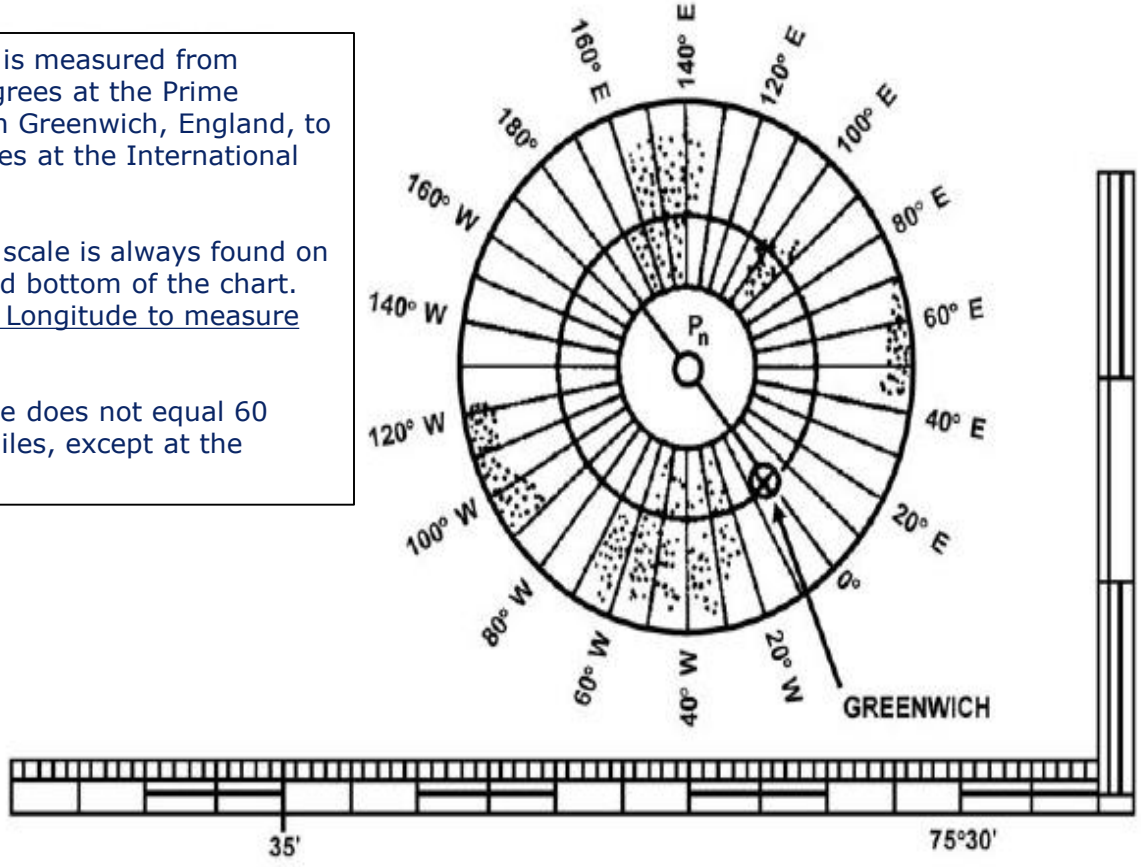
Magnetic Variation and Annual Increase

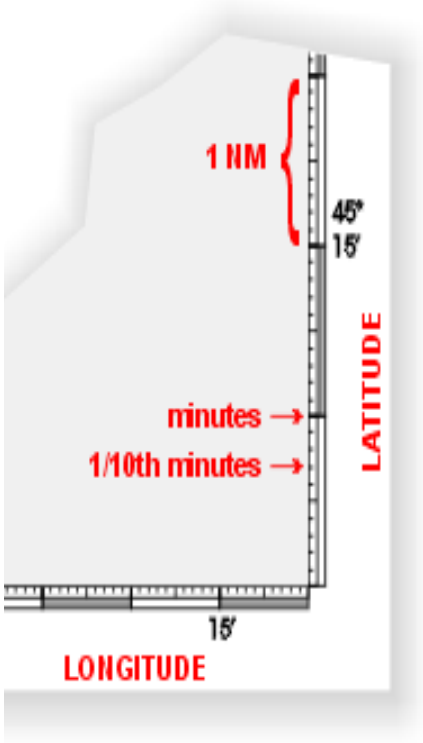
Longitude and Latitude Scale

Longitude is measured from "Zero" degrees at the Prime Meridian in Greenwich, England, to 180 degrees at the International Date Line.

Longitude scale is always found on the top and bottom of the chart. Never use Longitude to measure distance.

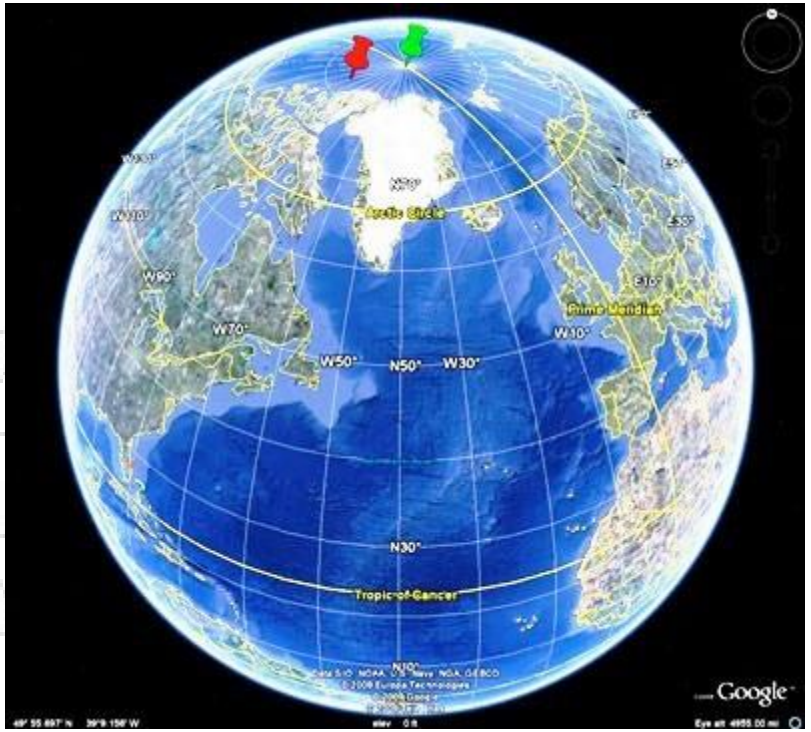
One degree does not equal 60 nautical miles, except at the equator.





Where is North?

- Conversion of Magnetic and True North
- Conversion from magnetic to true is a simple matter of subtraction of a westerly variation, or addition of an easterly variation.



The green pushpin is true north while the red pushpin is magnetic north. They are actually over 500 miles apart (Courtesy of Google Earth)

True to Magnetic

- **T**ele**V**ision **M**akes **D**ull **C**hildren, **A**void **W**atching.
- T=True Course
- V=Magnetic Variation
- D=Magnetic Deviation
- C=Compass Course
  - And the reminders;
- A= Add
- W= West

"West is best, East is least".

Add west, subtract east.

- Example: what is the compass course to steer if true course is 060, variation is 015 west and deviation is 5E?

060(T) + 015(V) (add west) = 075.

075 – 005(D) (subtract east) = 070(C)

Steer 070 on your compass.

Magnetic to True

- **C**an **D**ead **M**en **V**ote **T**wice? **A**t **E**lections!
- C=Compass
- D=Deviation
- M=Magnetic
- V=Variation
- T=True
- A=Add
- E=East

- Example: Compass heading is 065. Object is sighted dead ahead in an area with a variation of 015 west. What is the true bearing? Assume a deviation of 5 degrees east.

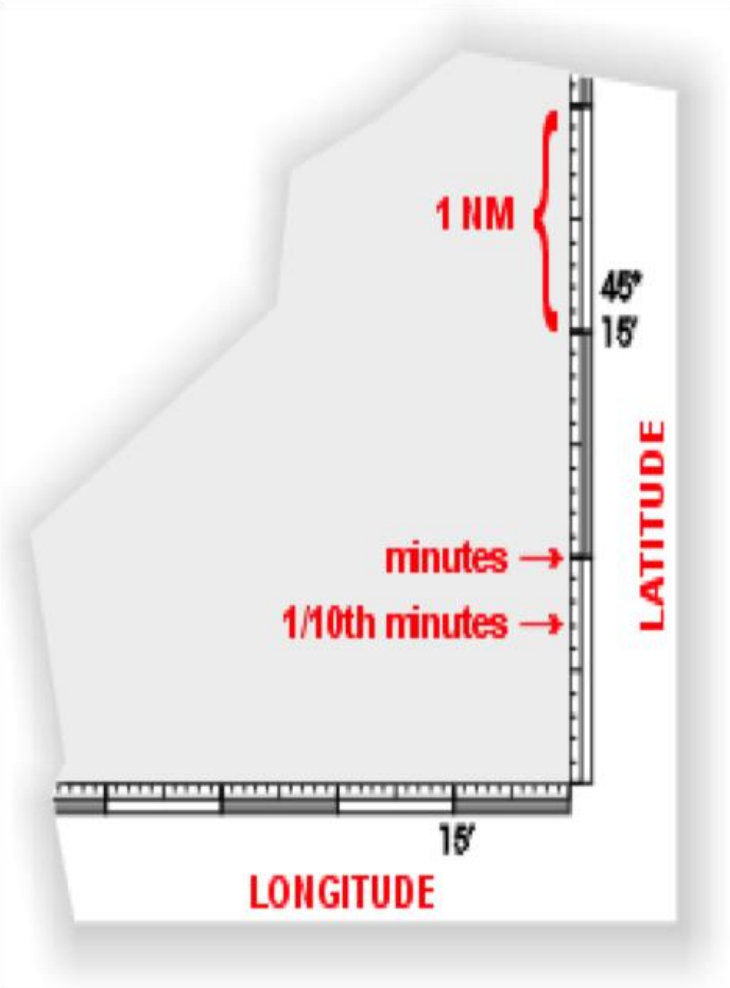
065(C) + 005(D) = 070(M)

070(M) – 015(V) = 055(T)

The object lies 055 degrees true from your location and can now be easily plotted on the chart.

1 Nautical Mile

- One minute of latitude is 1 nautical mile anywhere on the earth.
- This consistency is why you only want to measure distance using the latitude scale (right and left sides).

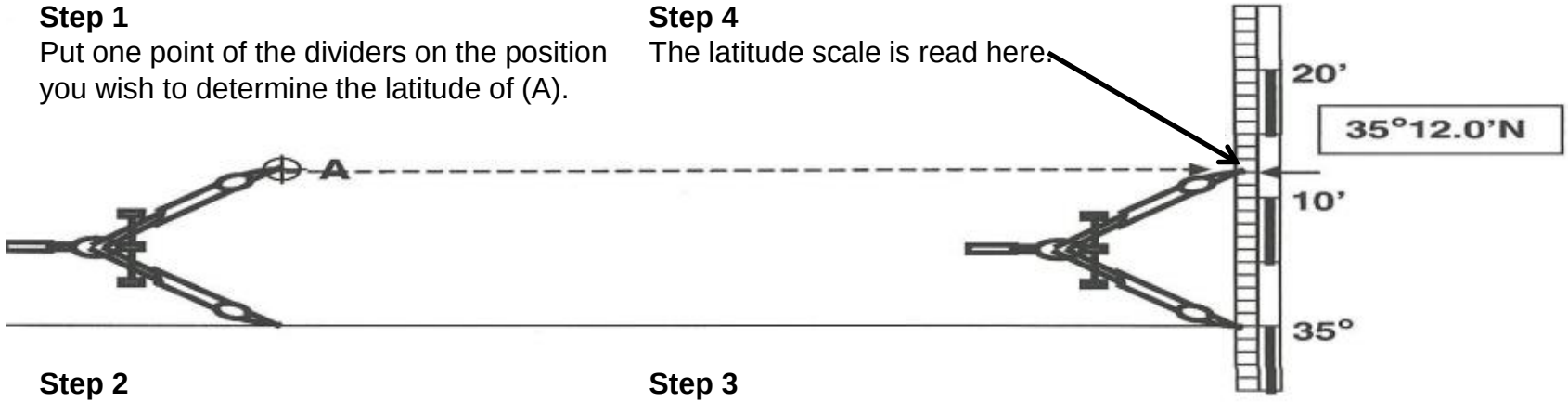


Determine Latitude

Use dividers and the latitude scale to determine the latitude of a position on the nautical chart.

Step 1
Put one point of the dividers on the position you wish to determine the latitude of (A).

Step 4
The latitude scale is read here.



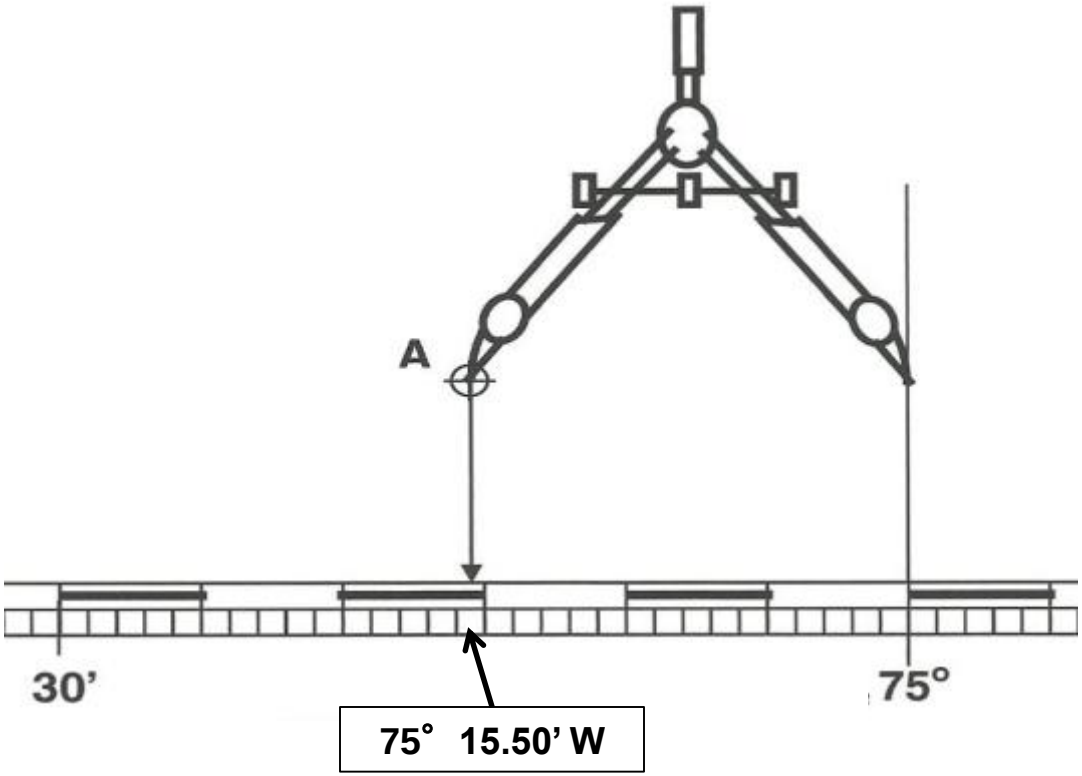
Step 2
Extend the dividers so the other point touches the nearest latitude line on the chart.

Step 3
Move the dividers (and their fixed width position) to the latitude scale on the side of the chart by tracing the latitude line you touched in step 2.

Note that this latitude is recorded as 35° 12.0'N as indicated on the scale: 35 degrees, 12 minutes.

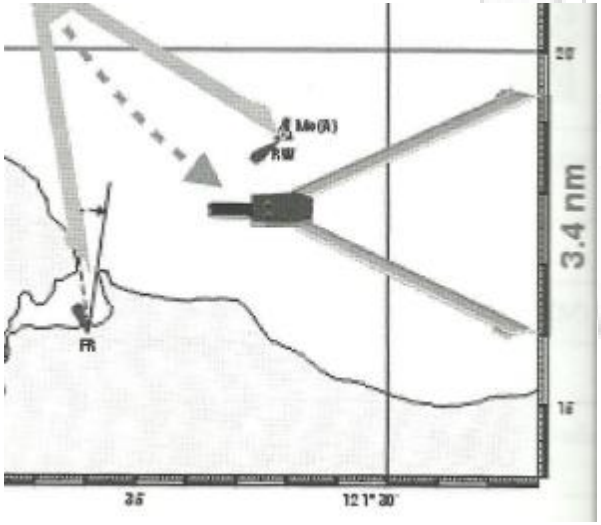
Determine Longitude

- Repeat the process to determine Longitude, but be sure to use the Longitude scale along the bottom of the chart.

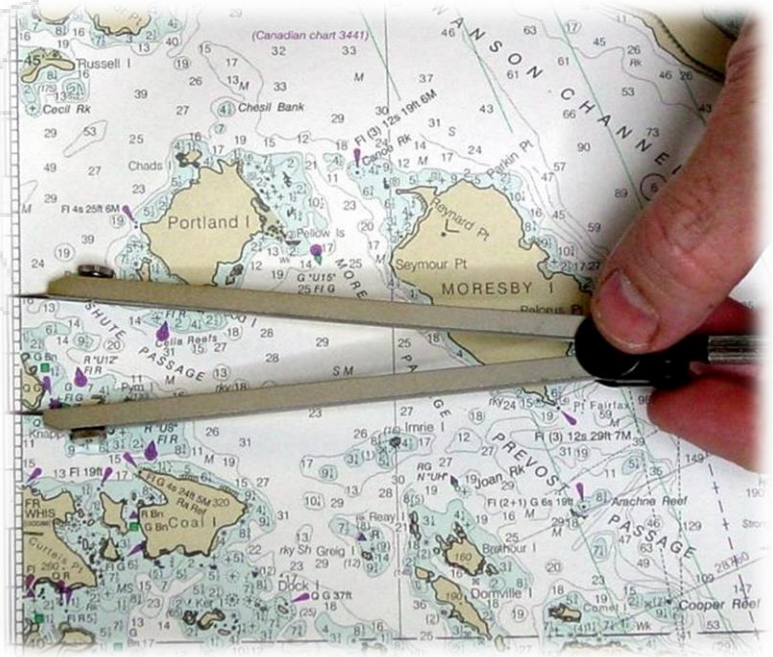


Measure Distance

- Place one end of a pair of dividers at each end of the distance to be measured being careful not to change the span of the dividers.



- Transfer them to the latitude scale closest to the latitude being measured. Read the distance in minutes, then convert to the NM or yards.



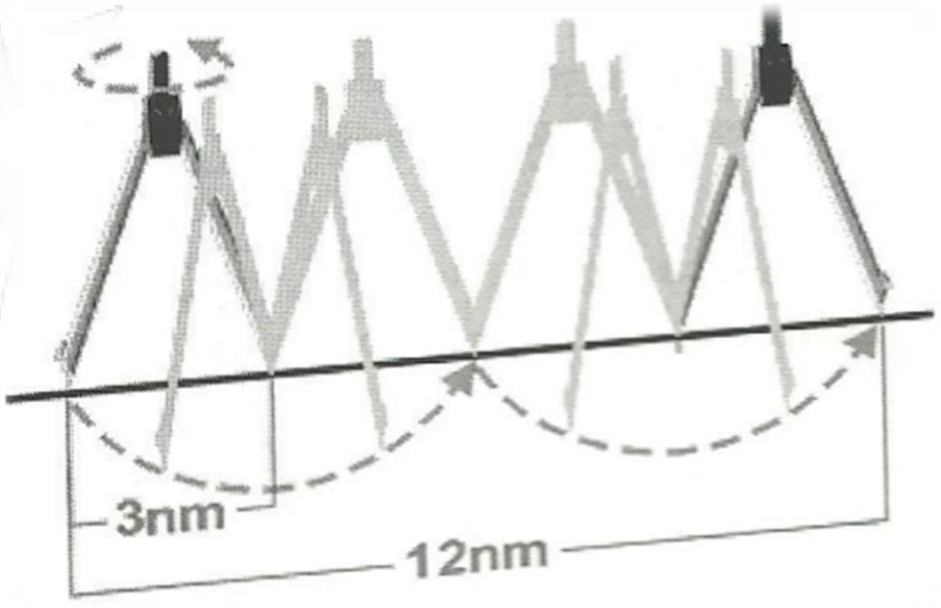
Measure Distance

When distance being measured is greater than the span of the dividers, use the scale to set the dividers to a span of one or more minutes of latitude. Place one point of the dividers at the starting point and then rotate ("walk") the dividers between the starting point and the end point being measured.

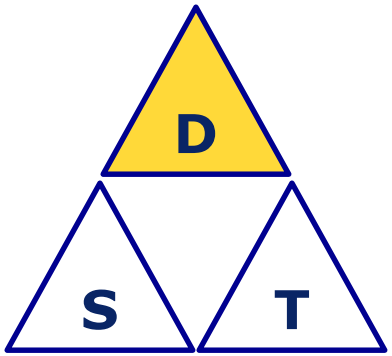
Step 2
If the last span of the measurement is not equal to the setting of your dividers, it must be measured separately. Step the dividers once more, but close them to fit the exact distance needed.

Step 3
Measure the distance of this final measurement on the scale, and add it to the sum of the other measurements.

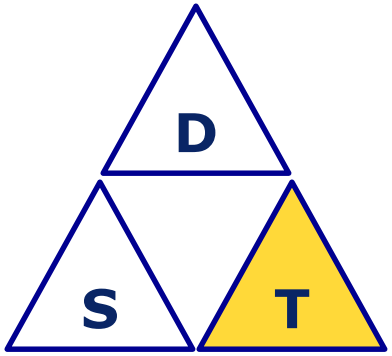
For example, if your dividers are set at 3nm and you have measured a total of 4 lengths + the length of one additional nautical mile (the final measure), your total distance is 4 x 3 + 1 = 13nm.



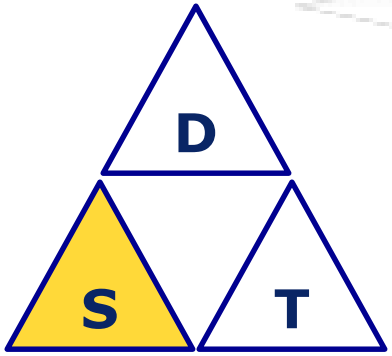
Time, Speed, Distance



Distance = Speed x Time



Time = Distance / Speed



Speed = Distance / Time

It is critical that you use consistent units of measurement. Express:

- Time in hours and tenth of hours;
- Distance in nautical miles and tenths;
- Speed in knots.

Time, Speed, Distance

- 3-Minute Rule

Distance traveled in yards for 3 minutes, divided by 100, equals speed in knots. So if in a 3-minute period you travel:

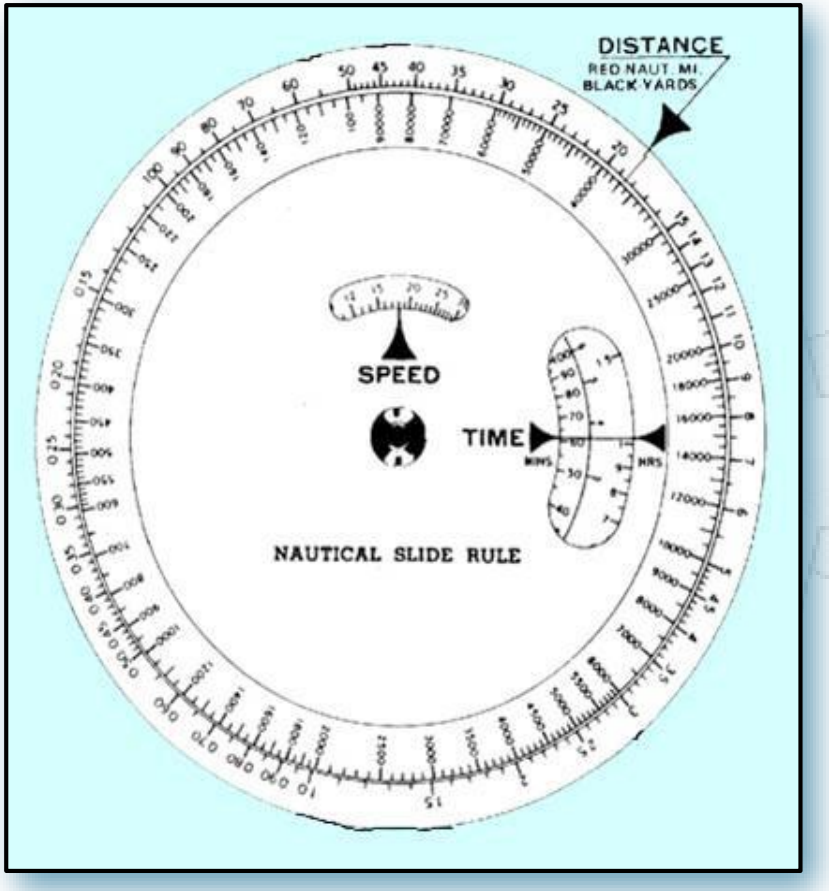
  - 1000 Yards / 100 = 10 knots
  - 1050 Yards / 100 = 10.5 knots
  - 2500 Yards / 100 = 25 knots
  - Etc…

- 6-Minute Rule

Distance traveled in nautical miles (NM) for 6 minutes, multiplied by 10, equals speed in knots. So if in a 6-minute period you travel:

  - 1.5 NM x 10 = 15 knots
  - 2.3 NM x 10 = 23 knots
  - 10 NM x 10 = 100 knots
  - Etc…

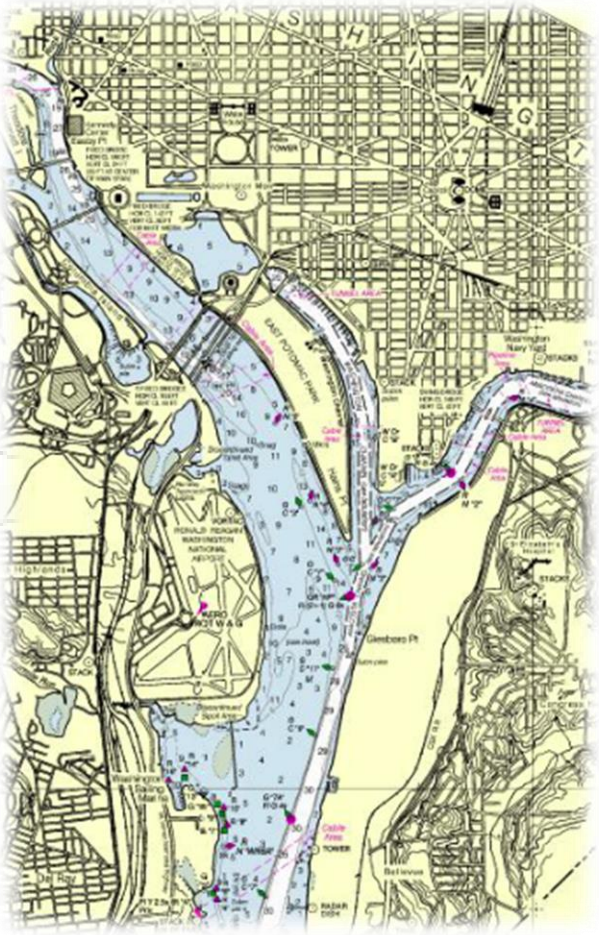
Nautical Slide Rule



- The nautical slide rule has three clearly labeled scales: speed - time - distance. By turning the appropriate dials, values can be independently set into the indexes.
- With values set into any two scales, the third or unknown value, will automatically appear at the appropriate index. Directions supplied with the rule will indicate its use and how to read the device.

Helpful Hints for Plotting

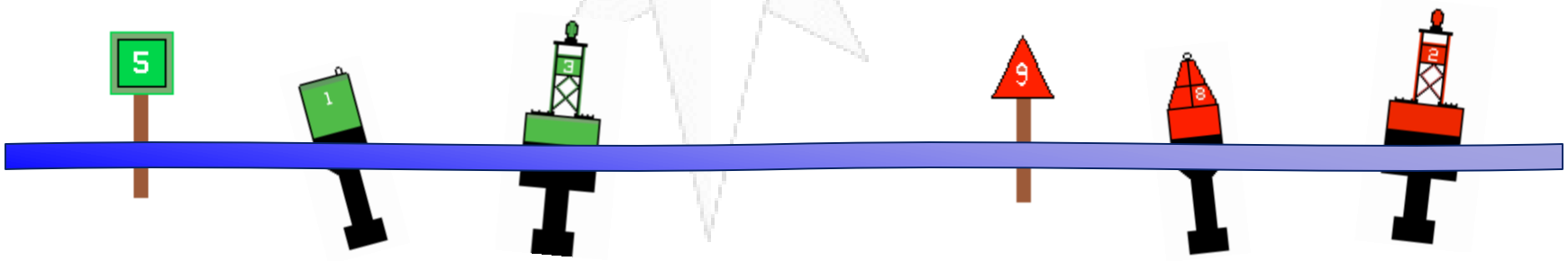
- 60 Miles = 1 Degree
- 60 minutes = 1 Degree
- 1 Minute = 1 Nautical Mile
- Always use the latitude scale to measure distance on a chart.
- 3 Min rule= Convert yards to knots
- 6 Min rule= Coverts to NM
- 3 Min= 15knts = 1500 Yards
- 6 Min= 30knts = 3 NM
- **Variation**: Difference Between true & magnetic north pole.
- **Deviation**: Amount the magnetic compass needle is deflected by magnetic influence.



Lateral Aids to Navigation

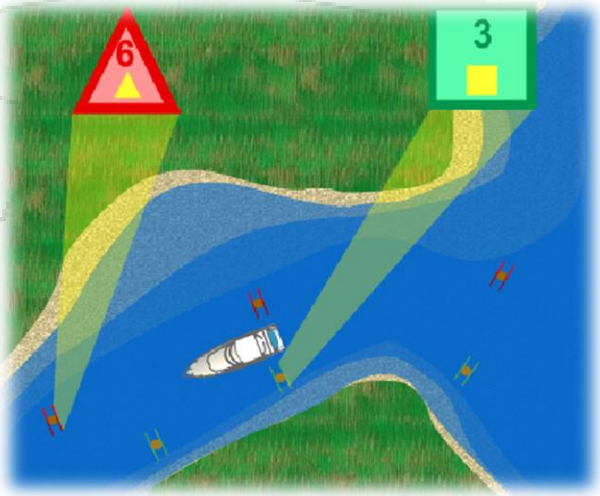
- When returning from sea, markers kept to your port side will be:
  - Green;
  - Can-shaped;
  - Green colored light;
  - Featuring odd numbers that increase further inland.
- Beacons will have green square daymark (used in shallow water instead of buoys).

- When returning from sea, markers kept to your starboard side will be:
  - Red ("RED-RIGHT-RETURNING")
  - "Nun"-shaped
  - Red colored light;
  - Featuring even numbers that increase as you proceed inbound.
- Beacons will have red triangle daymark (used in shallow water instead of buoys).

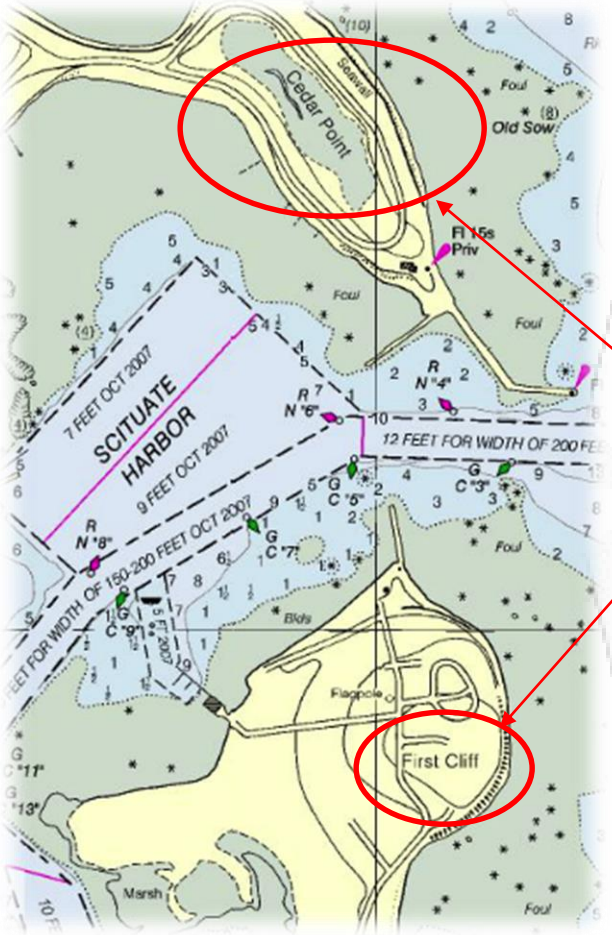


Intracoastal Waterway (ICW)

The ICW runs for 3,000 miles along the coast of the Atlantic Ocean and Gulf of Mexico.
Markers are denoted by small yellow reflective stickers that are attached to the standard buoys and daymarks.



Local Landmarks



Know your Area of Responsibility (AOR) and the local landmarks in order to have a better understanding of where you are operating your vessel at any given time.

An example of a local landmark is First Cliff or Cedar Point. Knowing these landmarks can help you determine your position relative to them.

Electronic Navigation

Electronics can and will fail.

NEVER put all your faith in any one piece of equipment.

ALWAYS check your position with all available means!!!

GPS Navigation

- Global Positioning System (GPS) uses a constellation of roughly 24 satellites in orbit around the earth.
- Each satellite transmits a signal that basically says “I am here at this time”.
- The receiver continues the location process with 3 or more satellites and triangulates it’s position.

Safety- GPS Waypoints

- Let your route dictate the position of your waypoints, not vice versa.
- If possible, position waypoints where your arrival can easily be checked by traditional methods – such as on a contour using the depth sounder or taking sightings.
- Never use a waypoint from a book or magazine without checking it on a chart; it may involve a dangerous short cut or an unnecessary detour.
- Check the legs of the route between waypoints, not just the waypoints themselves. Does the route pass dangerously close to a hazard?

Electronic Charts

- There are two basic types of electronic charts in wide use today.
  - Raster Charts are photographs or facsimiles of paper charts. They look exactly like the paper charts.
  - Vector Charts are based on raster charts but include much more information. For example a buoy can be selected and information about that ATON can be displayed.

RADAR

- For information on RADAR please refer to the “Radar Familiarization Guide” located on the National Response Directorate web site.
- http://wow.uscgaux.info/content.php?unit=R-DEPT&category=surface-safety

Radar and COLREGS

- Rule 5
  - Radar is covered by the catch-all phrase “all available means”.
  - “Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate to the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision”.

Radar and COLREGS

- Rule 7
  - Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.
  - Proper use shall be made of radar equipment if fitted and operational, including long- range scanning to obtain early warning of risk of collision and radar plotting or equivalent systematic observation of detected objects.

Know your Equipment

NOTE: ***For questions about your equipment, read the manual!*** *Many equipment offerings from myriad manufacturers differ greatly between one another.*

It is essential that the prudent navigator be extremely familiar with his or her own equipment and that on each vessel which he or she operates to provide navigational information prior to the voyage so as to make adjustments to it and obtain needed correct information from it while underway.

Summary

- Safe and professional vessel navigation is a sign of a good mariner and a requirement of all US Coast Guard coxswains.
- It is very easy to get “tunnel vision” and lose situational awareness.
- Always be adaptable to changing conditions.

References

- ActiveCaptain.com
  - Anchor Alarm Surpises
- AUP 210 Lesson 9
  - Auxiliary University Program Boat Operations Course
- COMDTINST M3120.29 (series)
  - Tactical Boat Operations
- COMDTINST M16114.33 (series)
  - Boat Operations And Training Manual
- COMDTINST M16114.5 (series)
  - Boat Crew Seamanship Manual
- COMDTINST M16790.1(series)
  - USCG Auxiliary Manual
- COMDTINST M16798.3 (series)
  - Auxiliary Operations Policy Manual

References

- COMDTINST M3530.2 (series)
  - Navigation Systems Manual
- COMDTINST M10470.10G (ch-1)
  - Rescue and Survival Systems Manual
- COMDTINST M16114.28
  - Non-Standard Boat Operators Manual
- COMDTINST M16411.30A
  - Boat Forces Operations Personnel Qualification Standard
- COMDTINST M16130.2D
  - USCG Addendum to the US National Search and Rescue Supplement (NSS) to the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR)

References

- COMDTINST 16672.5D
  - Deck Watch Officer Examination Program
- COMDTINST 16794.4
  - Auxiliary Operational Excellence Program
- COMDTINST M16794.5x (series)
  - Auxiliary Boat Crew Qualification Guide
- NTP 13 (B)
  - Flags, Pennants & Customs
- US Coast Guard
  - Navigation Rules and Regulations Handbook
- National Atmospheric and Oceanic Administration
  - Nautical Chart 1

Thank You

Please send your comments to:

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