



## Establishing a fix using a hand held compass

(See also Cruising Fundamentals page 83)

A fix is the position of the boat derived from observations of the relative positions of landmarks. In the case of coastal cruising we use features that are visible and also are marked on the chart. Examples of these features are towers, chimneys, light houses, range markers or steep cliffs. Although we can also use buoys their position is less certain.

We usually use a handbearing compass to measure the bearing of the landmark. Examples in order of ascending price and accuracy are:

**pistol type compass,**



**prismatic ("puck") compass**



**compass built in to binoculars.**



The latter does double duty as binoculars however so are well worth the extra cost if you are buying binoculars anyway.



### ***Taking bearings:***

You should pick 2 objects about 90 degrees apart or better still 3 objects about 60 degrees apart, to get the best accuracy of the fix. Make sure you can identify them on the chart too! One person should take the bearings preferably at the mast. This provides a stable platform away from sources of magnetic interference. They should call out the bearings for example

- Penitentiary Chimney 324 degrees
- Warehouse chimney 358 degrees
- Hospital chimney 047 degrees
- Martello tower 057 degrees

and another person should record them along with the time that they were taken.

At 6 knots the boat will move by 1/10 mile in one minute so the readings should be taken in as short a time as possible to avoid having to correct for movement of the boat.

### ***Plotting Bearings:***

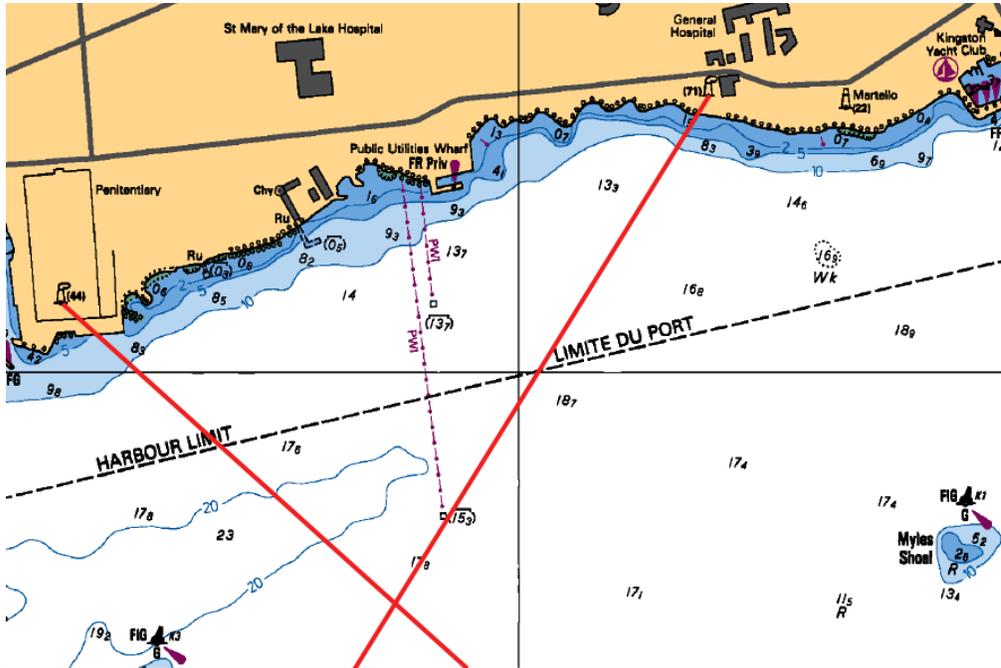
We always convert the readings to true readings before plotting on the chart. We assume no deviation of the handbearing compass so I just need to correct for the variation as below

Land mark	True	Variation	Magnetic	Deviation	Compass	Time
Penitentiary chimney	311	13W	324	0	324	1030
Warehouse chimney	345	13W	358	0	358	1030
Hospital chimney	034	13W	047	0	047	1030
Martello tower	044	13W	057	0	057	1031

Suppose we only had two of the readings then the best would be the penitentiary chimney and the Martello tower (93 degrees apart) but let's assume we cannot readily make out the Martello tower and can only see the penitentiary chimney and the hospital chimney. We can plot the bearings on the chart as on the next page.

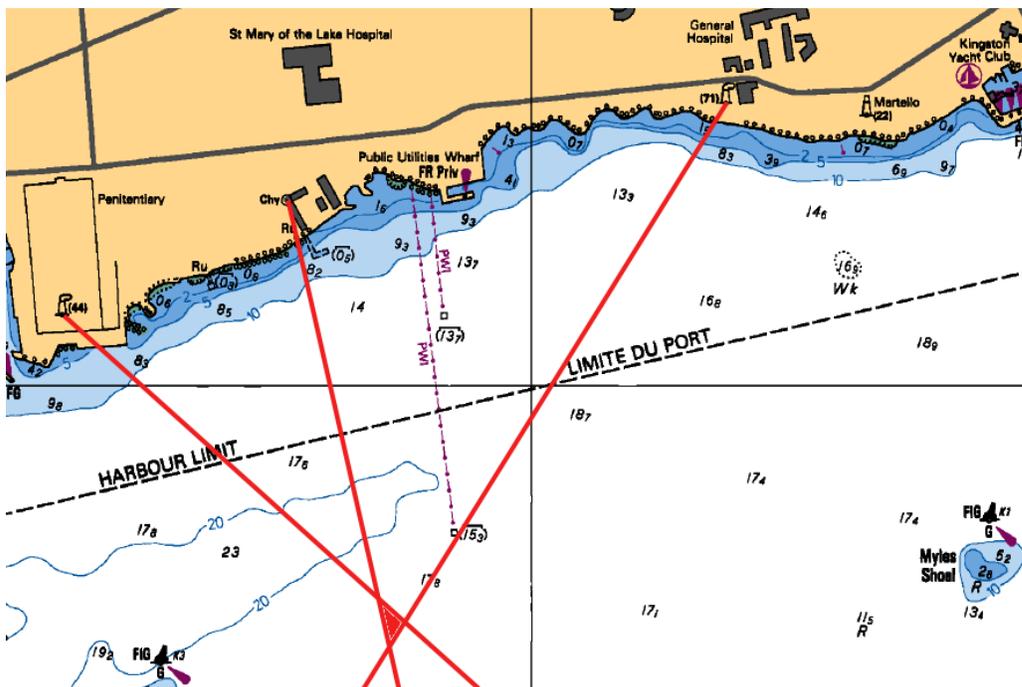
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RR3 Bath On K0H1G0

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The lines are known as lines of position (LOP) and we know the boat is somewhere on each line. So the only place it can be is at the intersection of the two lines.

Adding a third bearing gives a third LOP as below



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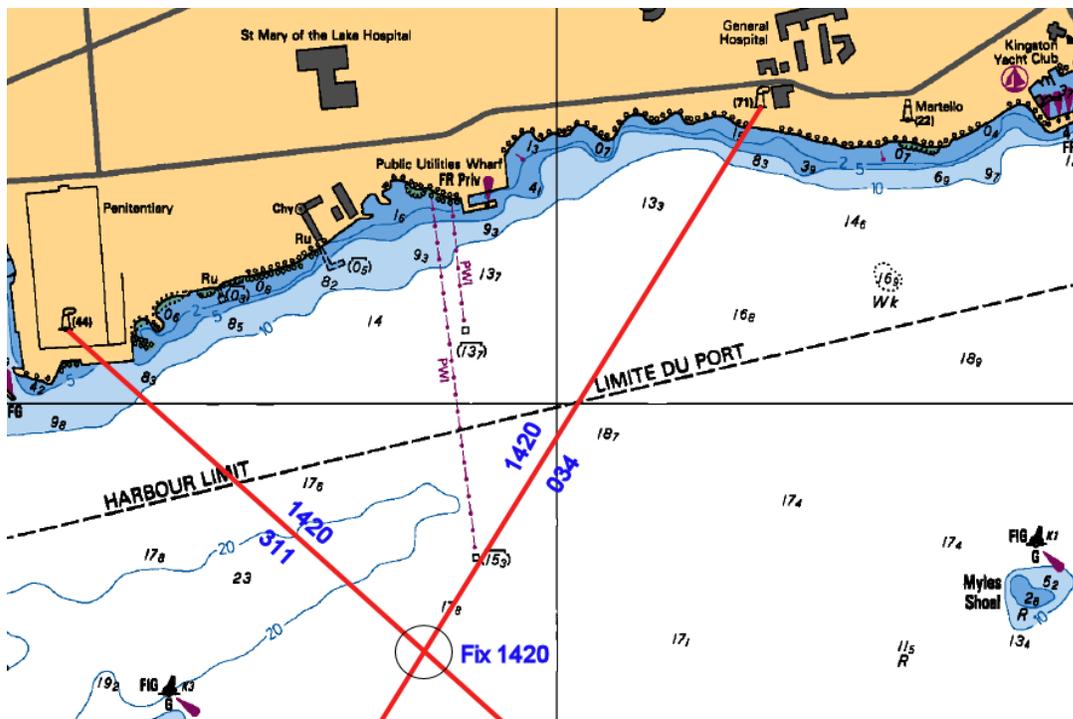
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Now there are three intersections and even Wavelength can't be in 3 places at once. What it is saying is that Wavelength is probably in the red triangle (sometimes referred to as a cocked hat). If all three bearings were accurate they would all intersect at a point. The fact that they don't is a measure of the accuracy of the fix. So if the triangle is very large you should repeat the fix.

By convention the position of the fix is taken to be the intersection of lines drawn from the apex of the triangle to the midpoints of the side.

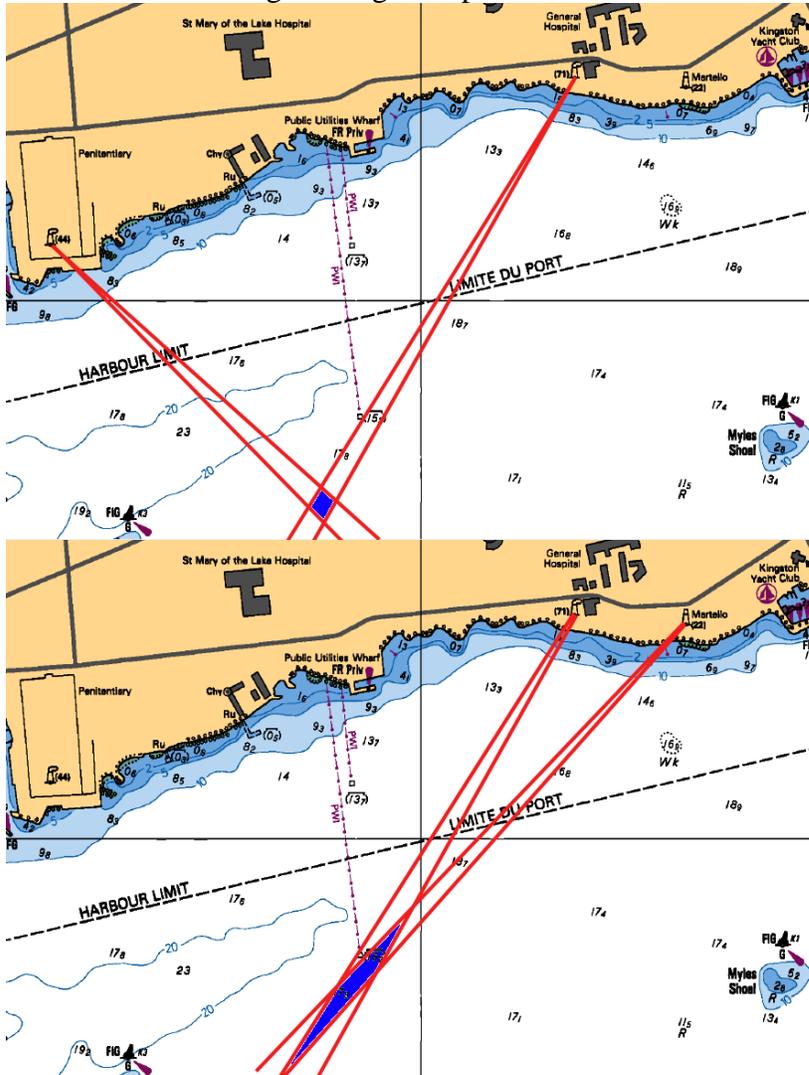
The LOP should be labeled with the time above the line and true bearing below and the fix should be circled and labeled with the time as in the following figure.



The Latitude and Longitude of the fix should be recorded in the boats log.



I said earlier that we should try to get 2 bearings on landmarks approximately 90 degrees apart. Let's look at why this is. In the figure below I plotted the fix as above but show the inaccuracy in the two measurements of the bearings, first with bearings 83 degrees apart and then with bearings 10 degrees apart.



See how much greater the area of uncertainty in the position is with the bearings 10 degrees apart. This is why it is much better to use bearings spaced by about 90 degrees (or 60 degrees in the case of 3 bearings).