NATIONAL SCHOOL SAILING ASSOCIATION

DOUBLING THE ANGLE ON THE BOW

Curriculum Development Paper No 16

Cdr. B.W. Lucke (H.M.I.Rtd)

DOUBLING THE ANGLE ON THE BOW

Finding a ship's position by "Four Point Bearing" is probably the oldest and simplest trick known to navigators.

In the old days when compasses were marked out in 32 "points" instead of the more modern degrees, a right angle was 8 points and 4 points was therefore gs . The trick was to note the time when a sea-mark was 45 "on the bow", i.e. 45o from the ship's head and again when it was abeam i.e. at right angles to the course . Knowing the speed, either by hand-log or from watching the passing coast, the navigator could tell how far he had sailed between the two bearings. "This distance" he said " is my distance off-shore".

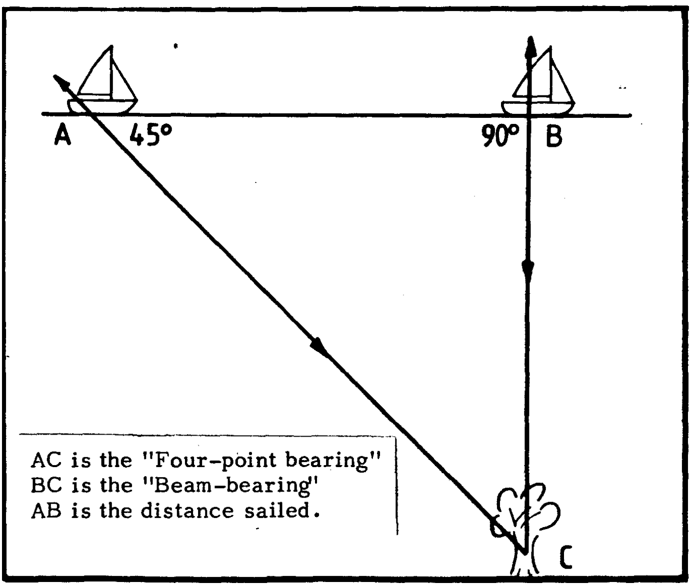
The geometry is simple enough:

$$180° - (90° + 45°) = 45°$$

Angle C= 45°

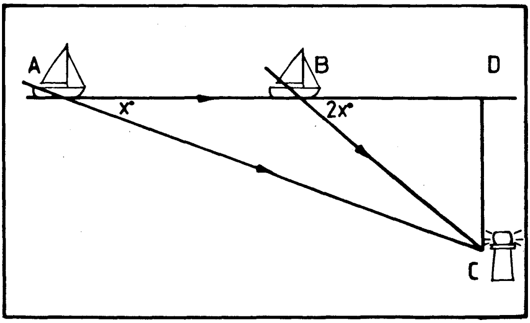
Triangle ABC is isosceles

AB = BC



It is not of course necessary for C to be a light-house in order to get the distance off shore. Since the bearing must be watched until the angle is correct it is perhaps advisable to choose something of greater aesthetic appeal, say a suitably furnished bathing raft. Provided the employer's recruitment policy is sufficiently selective, an ice-cream kiosk will serve the purpose.

At some time very early in the history of navigation a sharp witted watch-keeper, brooding over his wrongs, noticed that twice 45° = 90°. He wondered whether he could devise a system of "doubling the angle" and take a bearing whenthe sea mark was say 30 on the bow and again when 60°, thus being able to take shore observations before the captain monopolised the telescope. He found it worked and again justified the method by simple geometry.



AC = First Bearing BC = Second Bearing AB = Distance Run

$A\hat{B}C + C\hat{B}D = 180°$

$A\hat{B}C + B\hat{A}C + B\hat{C}A = 180°$

$C\hat{B}D = B\hat{A}C + B\hat{C}A$

$B\hat{C}A = C\hat{B}D - B\hat{A}C$

but $B\hat{C}A = \frac{1}{2}$ of $C\hat{B}D$

$B\hat{C}A = B\hat{A}C$

The triangle ABC is isosceles

AB = BC

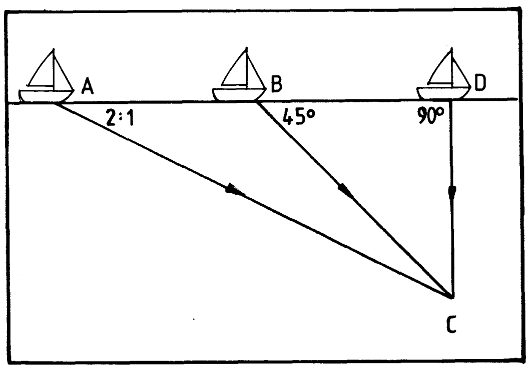
The distance run equals the distance off-shore at the second bearing.

This method continued unchanged until the number of ships running aground through too assiduous observation of the denizons of bathing rafts (and through not knowing the distance offshore in advance) became too numerous to tolerate.

An unfeeling mathematician devised an improvement which forced the navigator to estimate his distance off-shore while still far too distant to temper utility with enjoyment.

The trick now is to time the ship when the sea mark is at an angle of 2:1 (22$_1$°) and again when 45$_o$. The run between the two bearings will give the distance off shore when the ship is eventually ABEAM.

Again the geometry is not too difficult.



AB = Distance run

BAC= Angle of 2:1 or about 22½°

AB = BD DAC= 45° BDC= 90°

Angle DAC = 2:1

AD = twice DC

DC = DB (45° Isosceles Triangle)

BD = ½ AD

BD = AB

AB = DC

To recap.

1. Distance run between 45° and beam bearings equals the distance off when abeam.

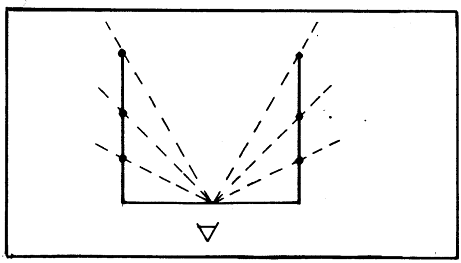
2 . Distance run between any pair of bearings (when the second is twice the angle on the bow compared with the first) gives the distance off at the second bearing.

3. Distance run between 2:1 and 45° bearings gives the distance off shore when the ship is later abeam.

The equipment needed is of the simplest. A hand-log will

give the speed through the water. If a light lead is substituted for the "chip" you have a "ground log" and can measure speed "over the ground" thus getting more accurate results. A watch will enable you to time your .passage past charted shore marks so that ground speed can be obtained without even a log.

To get the bearings themselves a few round headed brass screws driven into the cabin top or fore deck will serve the purpose excellently.



The great advantage of this system is that there is no plotting or calculation to be done and this is a tremendous advantage is small craft.

Another great advantage is that one can decide beforehand what is the safest distance off shore to avoid going aground on either the beach or an off lying reef. Having found the speed one can decide the safe time to elapse between bearings. If the calculated time is exceeded the ship is too far out, if the time taken is less than calculated, she is too far inshore.

By using the 2:1 bearing where reefs extend out from the shore one can have warning that one is going to be too close in before ever one gets into a dangerous position.

Finally one does not need charted seamarks to establish ones safety and no-one can deny that the foreshore on a hot summer's day can present sights far more worth while watching than a candy-striped lighthouse.