Radar and the Compass Bearing

from Captain F. J. Wylie
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To quote the Collision Regulations—'Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel.' Most seamen are so familiar with this injunction and with the practice it describes that any particular significance in the wording probably escapes them. It is, however, important in considering the operational use of radar to note that the compass bearing and no other kind is specified and to appreciate that this is so because the relative bearing will only give quite comparable assurance when own ship maintains a perfectly steady course during the approach.

That familiarity with the practice makes it all the more surprising that very many seamen who use radar prefer the kind of display which has ship's head upwards. On any British radar, the use of the ship's-head-upward display prevents any kind of bearing other than relative being seen on or read directly from the PPI. Some U.S. radars provide a second bearing ring which can be compass stabilized, but the display in these cases cannot be. It is probably safe to say, also, that a large proportion of seamen of all countries who plot their radar observations to assist them in avoiding collision do so on a ship's-head-upward plot on which no bearings other than relative can be seen or laid off.

In the case of the PPI, the preference may be understood even if disputed, and in some cases, of course, it is impossible to stabilize the display owing to the lack of a transmitting compass. Failure to draw the plot to a compass datum whenever possible is less easy to understand, since it can usually be turned head up when desired; no doubt the nuisance of having to convert the relative bearings obtained from an unstabilized PPI to compass bearings for plotting is a contributory factor.

The disadvantages of the ship's-head-upward display have been described elsewhere; the main one which concerns the present subject is that, since nothing but relative bearings of echoes can be seen and since they all change whenever own ship alters course, there is danger of losing track of the behaviour of the all-important compass bearing and even, in moments of crisis, of confusing the relative with the compass bearing. The disadvantages of the ship's-head-upward plot are more numerous. Whenever own ship alters course, all tracks on the plot terminate and restart with an angular displacement equal and opposite to the alteration; this impedes the forecasting, which provides early warning of alterations by the other ship, and it renders virtually useless the earlier part of the plot which may indeed need to be erased. The main disadvantage, however, is exactly the same as that of the ship's-head-upward display—that the compass bearing cannot be watched.

It is not suggested that the compass bearing cannot be derived without difficulty from the relative bearing at any time if the exact direction of ship's head is known. The point is that in the arrangements which seem to be employed or preferred in the great majority of ships, it is not immediately *evident* at all times, while the moment at which it becomes of crucial importance is hardly the time to make arithmetical calculations, however trivial. It would be interesting to

know how many of those who seem to prefer to think in terms of the ship's head when using radar would, during a visual clear-weather encounter with another ship, watch the relative bearing rather than the compass bearing. Probably none would, and yet the reasons for using the compass bearing apply equally to the two cases.

It is, of course, impossible to say to what extent failure to keep the compass bearing in mind and in immediate evidence has been responsible for collisions. It is probably safe to say that extremely few, if any, of the ships involved were using the compass-stabilized display. Only one case is known to the writer in which a ship in collision had plotted. A very important related factor, which seems to be common to all collision cases in recent years where radar has been involved, is that one or both of the parties altered course during the approach and so caused a change in the relative bearing of the other ship which bore no relation to the change, if any, in the compass bearing. It would be interesting to

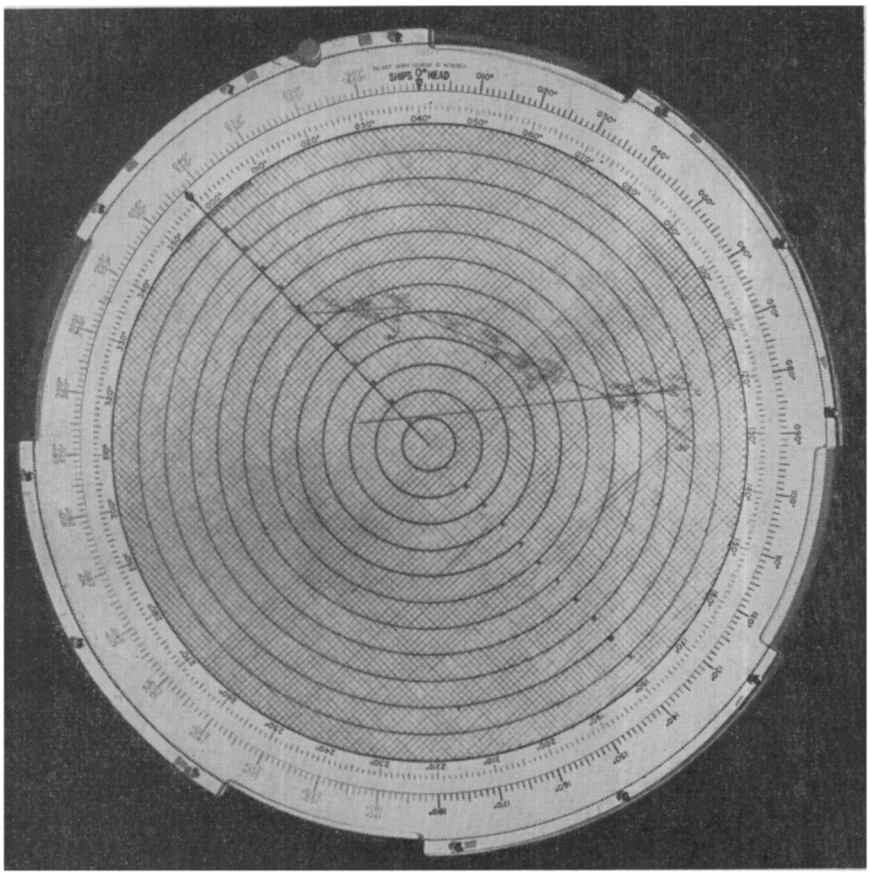

Fig. 1. The compass-datum computer. The relative bearing (outer) ring may be turned to set ship's head *to any desired point on the compass course or bearing scale and then clamped. The compass scale is fixed to the plotting surface. The graticule with its pointer is on a disk which may be turned independently of either bearing scale. The computer, being circular, may be held with either* ship's-head *or* north (000°) *upwards, according to preference.*

https://doi.org/10.1017/S0373463300045379 Published online by Cambridge University Press

know how many of the parties concerned were misled by this. In the writer's submission, really competent use of the stabilized or north-upward display and of the north-upward plot should increase safety. The dangers mentioned, of course, are themselves strong reasons in favour of plotting and against crystal-gazing.

If the plot is taken seriously, it can, as already remarked, be drawn to a compass datum, e.g. north upwards, even if the display cannot be stabilized. There is also one kind of mechanical computer which can achieve the desired result despite a ship's-head-upward PPI and a prejudice against converting bearings from relative to compass. This computer (Fig. 1) provides for a relative plot in which two bearing scales are used. The compass scale 0–359° is fixed to the plotting surface and the relative scale is fixed to a rotatable ring beneath and visible through the plotting surface. The scales are, of course, concentric and can be locked in any desired relationship to one another. Provided that this relationship is always such that the ship's head point on one scale is opposite the compass course being steered on the other, it is immaterial whether bearings are plotted as relative or compass, as long as the appropriate scale is used. The plotted track will in either case appear as if plotted to a compass datum and the compass bearing of the plotted echo will always be in plain sight. This kind of computer can be a separate unit for transferred plotting or be in the form of a reflection plotter over the PPI. In the latter, as the compass bearing scale has to be in fixed relation to the plotting surface, it follows that if the PPI display is always ship's head upward with the relative bearing scale fixed to it, the plotting surface with the compass scale must be made rotatable, so that the two scales may be correctly aligned. If and when the PPI display is stabilized north upwards, the plotting surface would be turned so that its scale is also north upwards. This facility is not yet possible on all existing reflection plotters, but it is thought worthy of incorporation.

Radar and Collision at Sea

IN the July number of the *Journal* (Vol. VI, p. 313) Captain F. J. Wylie suggested that members and other readers of the *Journal* should contribute their suggestions as to rules of conduct to be observed by ships using radar in fog. It is possible to print only a selection of the comment received, but all the contributions sent in have been made available to the Technical Committee.

from Captain H. C. Fellingham

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I THINK that, before attempting to frame a code of conduct in fog with radar, the feasibility of applying a code in many circumstances should be considered. I cannot see, for example, how a code of behaviour can possibly emerge to deal with situations such as that of making a navigational focal point, as Finisterre or Ushant, with many ships converging on different courses and with the inevitable fisherman to complicate matters. The radar cannot distinguish between ordinary vessels and fishermen, and the average fisherman is not likely to be equipped with radar. Thus the situation will have to be dealt with as it was before radar was invented, except that radar will give advance warning of the existence of such a