# FORUM

## Radar as an Anti-Collision Aid: The Ultimate Essentials in Presentation

*from* Captain F. J. Wylie, R.N.

MUCH is written about the use and misuse of radar, but little has been said of what the mariner really needs to help him in his use of radar as an aid to avoiding collision in fog. In considering this, one must have particularly in mind the bridge on which the radar observer is also the watch officer and navigator.

It is generally accepted that he needs to be sure which targets are potential hazards and this must include those with whom the collision risk will be increased by alterations of his own course and/or speed, made to avoid others or in the course of navigation. In the commonly encountered multi-ship situation, there will, therefore, be several ships, maybe six or eight, about which detailed and up-to-date information is highly desirable.

This detailed information is of two kinds, relative to own ship and true. The relative data gives the degree of risk of collision of each target, in terms of the C.P.A., or closest distance of approach on present courses and speeds, and the time interval before this position would be reached. As a means of assessing priorities, the time is just as important as the distance. The bearing of the C.P.A. is less important, except in so far as it indicates on which side the other ship would pass.

The true information required comprises the courses and speeds of the other ships for which the degree of risk is significant. It is perhaps superfluous to add that all this information needs to be confirmed minute by minute, so that changes may be detected as soon as possible; this is particularly vital after own ship has herself made alterations of course or speed. The value of any system designed to provide these foundations of intelligent appreciation will be greatly enhanced if it includes the means of showing the effect of an alteration by own ship before it is made.

A fundamental question is the form in which the information is presented to the navigator, and a crucial part of the question is whether the number of targets to be dealt with may be limited to quite a small number or that all must be dealt with simultaneously. The main disadvantages of a system depending on a limited selection are firstly, that a choice will have to be made by the navigator, which will occupy time that can ill be spared, and secondly, that the choice may be wrong initially or may require amendment due to changes in the movements of others.

A decision that information on all targets must be presented simultaneously would obviously be in the direction of minimizing both the load on the navigator and the risk of his effort being misdirected. It would also narrow the choice of forms of presentation by ruling out any but graphical methods. Clearly the digital counters used in some developments could not be applied to an unlimited number of targets each needing at least five counters. It confines the choice to

graphical presentation, either on the PPI itself or on a separate cathode ray tube.

Graphical presentation on the PPI has the great attraction of permitting the observer to concentrate on one instrument and avoiding any problem of identification between the echo and the tracks referring to it. However, it is quite essential that the method of displaying the tracks on the PPI should not cause any significant obscuration of echoes.

One further and highly important factor is that of the permissible delay in providing any particular piece of intelligence when the need for it arises. Supposing that the observer was using a conventional PPI and was dependent upon the echo trails for giving him either true or relative information; apart from the normal imperfections of this source, a change from relative to true presentation or vice versa involves a delay of several minutes for the new trail to build up. This kind of hiatus would be quite unacceptable in connection with the ultimate need; only a very few seconds delay would be tolerable. Also, the normal radar picture on the PPI must continue to show the latest position of all echoes to within a few seconds.

The requirements for this kind of presentation, which would leave the navigator with little to do but concentrate intelligently on the information displayed so coherently, may be summarized as follows:

(i) To show, on the PPI, on demand and with minimal delay, the tracks of all vessels simultaneously, whose echoes are on the screen;

(ii) The tracks to be relative or true at choice and to extend over a maximum period to be determined, up to the latest positions of the echoes;

(iii) The execution of this choice must not cause any displacement in the positions of echoes on the screen;

(iv) The tracks to show time intervals, from which speeds may be assessed; an indication of own ship's speed in a similar manner would be a great convenience;

(v) There must be no significant obscuration of echoes by the tracks;

(vi) Means should be provided for showing the effect upon the relative tracks of an intended alteration of course and/or speed.

This arrangement will suggest that neither computers nor any form of automatic plot, operating on a limited number of pre-selected echoes, will meet the ultimate requirement, however graphic the presentation of intelligence may be. This is thought to be true, whatever kind of ship is in mind, but it is quite certainly so in the very large number with one officer on the bridge.

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# Some Suggestions on the Rules for Preventing Collision at Sea

## *from* J. F. Kemp

In recent years the Regulations for Preventing Collisions at Sea have been the subject of considerable interest to mathematicians. It has been demonstrated that the