RADAR AND RADAR CHARTS

Foreword to "Radar and Charts"

by Vice-Admiral Sir Guy WYATT, K.B.E., C.B.
Hydrographer of the Navy.

1.—After an interval for experiment and discussion it was decided to publish Chart No. 2649 and to invite users to return their copies with their remarks and criticisms in exchange for a new copy. The area chosen was the western half and approach to the English Channel in order that a large and representative section of both naval and merchant shipping should have the opportunity of testing the new chart.

The response was good and a large number of copies of the chart was returned with remarks from users afloat and, in addition, we received the benefit of criticism from H. M. Navigation School and members of the Institute of Navigation.

Criticism of the new chart was, on the whole, favourable but varied widely between those who thought no need existed for any change from existing practice and those who would like special charts designed solely for use with radar without regard to visual navigation.

2. — After a careful study of all reports received and discussions held at the Institute of Navigation, it was clear that the variables which affect the "radar picture" are :-

(i) The position of the ship.

(ii) The height of the aerial.

(iii) Variations from a "standard atmosphere".

(iv) The type of set, 3 cm., 10 cm., etc., and its performance.

(v) The reflecting properties of the land and other objects which vary with the aspect.

Clearly, therefore, no chart can truthfully represent the land as it will appear in the radar to all users at all times, except possibly the coastline when this is within the radar horizon.

3.—The conclusions reached are that :-

(i) Modification for use with radar must not affect the suitability of the chart for visual navigation, therefore special radar charts will, if produced, be confined to very limited areas such as the approaches to major ports.

(ii) For charts on larger scales than about 1 : 150 000, the coastline will usually lie within the radar horizon of a vessel and will be the feature normally used for radar fixing. Therefore it is this feature which needs emphasizing

and this can be achieved by strength of line and a land tint which gives good contrast with the water under all conditions of lighting (e. g. red); little modification to modern topographical representation is needed except to indicate any features which may be especially radar conspicuous e. g. by over-printing in magenta a legend Ra. Conspic 275° to 290° (bearings of course being from seaward).

(iii) For charts on smaller scales than about 1 : 150 000, the topographical representation becomes important for offshore fixing and making landfalls; a practical representation will be given by :

(a) Accurate contouring at suitable intervals, when available, otherwise by form lines.

(b) Providing numerous spot heights.

(c) Stating the height of the contours in those parts where spot heights do not provide sufficient guide for quick identification.

(d) Omitting or suppressing contours on ground which is not visible from the sea except so far as they are necessary to define a ridge or summit.

(e) Omitting hatching of built up areas except those on the coast and those inland villages and towns lying on seaward slopes or crests and which are not masked by higher ground.

(f) Omitting all roads, railways, rivers and other topographical detail not of interest to the navigator.

(g) Emphasis on the outer coastline as in (ii) but omitting such emphasis within the entrance points of narrow inlets.

(h) Indicating features known to be conspicuous to radar by legend as in (ii) in those cases where this characteristic may be unexpected.

(j) Paying particular attention to include all beacons and light towers with their elevations, and all buoys, light vessels, etc., on off-lying dangers, likely to appear on the radar, even though the scale of the chart may not otherwise warrant their inclusion.

(k) Provide a table or nomograph giving the approximate distance at which objects of different elevations may be expected to appear on the radar under conditions of standard atmosphere.

(iv) Charts on a scale of about 1 : 150 000 are border line cases to be treated on their merits as (ii) or (iii).

4.—The experiment of emphasizing the contours where the steepness of the slope and/or aspect was thought likely to give a radar reflection, has not proved useful; moreover, at times this practice makes it difficult without close scrutiny to distinguish between hollows and ridges; contours of equal strength throughout also may confuse quick interpretation of relief; it has therefore been decided to revert to the former practice of emphasizing the contours on slopes facing south and east.

5.—A new edition of Chart No. 2649 embodying the modifications under 3 (iii) and 4 is now in preparation and, when issued, further criticism will be invited.

6.—A device termed a Radar Station Pointer, diagram 5028 printed on a transparency, will shortly be published and it is hoped that this will assist radar fixing and identification of radar targets on all charts and particularly when used with 2649 and future charts of this type.

7.—It is hoped next to adapt Charts Nos. 1825 A and B, the general charts of the Irish Sea, for radar fixing in order to give shipping using our West Coast ports an opportunity to contribute to this development.

RADAR AND CHARTS

A discussion following a Report on Admiralty Chart 2649

(Reproduced by kind permission from the *Journal of the Institute of Navigation*, Vol. III, No. 2, April, 1950. With Introduction by the British Hydrographer. London, May 1950.)

A discussion on the adaptation of marine charts for use with radar was held at a meeting (16 December 1949) to which Lieutenant Commander P. G. Satow, D.S.C., R.N., presented his report on the experimental Admiralty Chart No. 2649. The report, which was published in the last number of the *Journal* (Vol. 3, No. I, pp. 22-23) had been made as a result of sea trials in the area. The chart under review was issued by the Admiralty in May 1949 and users were invited to comment on certain features. The principal features under trial were :

(1) An improved clarity of coastline ;
(2) Additional spot heights and contouring, giving a more detailed picture of inland topography ;
(3) Emphasis to contours where hill aspect and gradient might provide prominent radar targets ;
(4) Block shading of built-up areas.

The report commented on each of these features and, as a result of the trials and of other operational experience, the following general conclusions on position fixing by radar at long range were drawn :

(1) The influence of atmospheric refraction must be considered before evaluation and plotting of echoes ;
(2) Apart from prominent high points, radar at long ranges tends to emphasize topographical features (notably coastlines) in the horizontal instead of, as with visual recognition, in the vertical plane ;
(3) Gradient and nature of surface may vary extensively over short distances on land, therefore aspect may have an important bearing on echo quality and extent ;
(4) Echoes from inland are only of value when the ship is well offshore and without sufficient coastline under radar detection for positive recognition ;
(5) Insufficient data on elevation and gradient of coastal ground makes plotting at long ranges unreliable and may delay landfalls ;
(6) Built-up areas are only of value when the coastline is low-lying and otherwise insignificant ;
(7) The value of visual information is often greatest *at night* when accurate bearings of a lighthouse are obtained in good visibility at ranges at which recognition would probably be out of the question by day.