

RADAR CHARTS

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The Coast and Geodetic Survey has devoted a great deal of time and thought to determine how it can best meet the needs of spectacular war-time development in the use of radar to determine a vessel's position. With hostilities ended and security restrictions removed, it is obvious that in addition to Naval vessels already so equipped, a large number of commercial vessels will also be equipped with radar.

The maximum benefits from this electronic equipment can only be obtained if navigational charts present the targets in such a manner that they can be identified at a glance and the ship's position readily determined. Basically, this problem of charting radar targets is no different from that of charting buoys, beacons, lighthouses, and other features which must also be so presented as to insure ready identification.

In the beginning it was believed that before any real progress could be made to determine the best way to present radar data to the mariner, the question of whether or not a special chart was needed for the radar equipped navigator must be decided. Aside from the technical aspects of the case, it was considered that every effort should be made to combine on one chart all data required for the non-electronic navigator as well as that necessary to the radar equipped mariner. A combined chart should in no way impair the usefulness of a standard chart to the non-electronic equipped vessel, but should eliminate the necessity for a radar equipped vessel to carry a second set. If, however, by publishing a separate radar chart, appreciable assistance could be given the radar equipped mariner, these charts were not to be combined.

It was determined that an accurate delineation of the shore line would be sufficient in most cases when the coastal features are within range of the radar equipment. This is particularly true in areas of rather steep shores where features will appear on the screen very much as they are charted. In such areas it is believed that the normal navigational chart can best be adapted for use with radar by merely accentuating an already accurately delineated shoreline, offlying dangers, rocks, islets, etc. The charting of radar responder beacons, reflectors, and so-called radar conspicuous objects presents no problem, since their positions can be denoted by the symbols and abbreviations proposed at the recent I.H.B. meeting in Monaco.

In the approach to harbors and along low-lying coasts a position from dead reckoning is a necessary adjunct to accurate interpretation of the P.P.I. presentation. Most buoys, even without radar reflectors, can usually be picked up and seen on the scope at a distance of a mile or two. After the entrance buoy to a harbor is made, it is relatively simple to pick up the next buoy ahead and continue in to an anchorage or berth. No special charts are needed for this type of piloting as long as the positions of the buoys are clearly and accurately shown. The mariner must remember that although he has electronic aids at his disposition there are other tried and true aids available to ensure the safety of his vessel—for example, a continuous line of fathometer soundings, radio bearings, characteristic signals from buoys and fog signals. He must understand that radar is merely another aid, and although simple to use, he must not place sole reliance on it.

On the other hand, when the shore line and adjacent bluffs are below the radar horizon, the navigator must make use of interior topography, and it is the delineation of this topography which presents the greatest problem. Many suggestions have been received how this should be accomplished, as well as recommendations that only prominent peaks or hills be shown by hachures and that seaward faces only of potential targets be contoured. Both of these points have merit in that the chart would be kept cartographically simple and economical

in production. A chart, incorporating the above features and based upon a proper amount of field investigation, would be satisfactory for average conditions of radar reception. Yet the picture would be far from complete and under abnormal conditions of reception could be confusing or useless to the mariner. Interior topography should be shown completely. Regardless of the interval used or the skill with which they are drawn, contours alone are not sufficient to picture relief for the mariner.

The Coast and Geodetic Survey has produced a few experimental charts with the contours and gradient tints in brown to emphasize the relief. On these charts the relief stands out with clarity, and the relative heights and masses of hills and mountains—the natural radar targets—can be determined quickly and easily.

Gradient tints, if proved successful for the purpose intended, will be confined to coast charts of intermediate scale. Large-scale charts need no such treatment, because the shore line, together with artificial and natural radar beacons and objects which will be charted by conventional symbols, will suffice.

As the gradient tint method of emphasizing relief on the above-mentioned charts was favorably received, the Bureau decided to produce an experimental radar chart embodying these tints. The chart of the approaches to the Strait of San Juan de Fuca, including the coastal areas of the State of Washington and Vancouver Island, Canada, was selected as one well suited to the experiment. The prevalence of fog, the great volume of traffic, the type of terrain, and the width of the waterway made this area especially suitable. On a scale of 1:176 253, chart number 6102 was then constructed, published, and issued to the maritime public in September of 1946.

In addition to the conventional hydrographic information shown on all nautical charts, the shoreline and offlying rocks, reefs, islands, and dangers were accentuated on this chart. The land forms were contoured at five hundred foot intervals, and the terrain formation was emphasized by the use of a series of gradient tint tones at 1,000 foot intervals.

A special process which utilizes screens and permits the printing of five gradient tint tones from printing plate has been developed. These charts are, therefore, reproduced without increasing the number of press runs.

Evaluation reports on this chart are slow in reaching the Bureau, but those received to date indicate that chart 6102 has been well received and is an improvement over the conventional nautical chart for use with radar.

The real value of interior topography in fixing a vessel's position by radar has not been determined, and the value of gradient tints in showing relief is not yet known. The number, types, and characteristics of radar beacons to be installed along the coastline and approaches to harbors is still problematical.

These are but a few of the problems that have arisen in connection with the construction of radar charts and which are being studied and evaluated by the U. S. Coast and Geodetic Survey. When further reports from the users of radar in both the Navy and the Merchant Marine have been received and evaluated by this Bureau, a more definite procedure will result.

