plaints appear to be directed at them. It would also appear that a majority of these offenders are manned by members of one particular nationality.

Today's low safety record is due almost entirely to the failure of man himself. Standards of manning and seamanship appear to be suffering from a steady deterioration, and with the increasing number, size and speed of ships the outlook is becoming a matter of increasing concern. Whether this lowering of standards is due to ignorance on the part of seamen, or to their rejection of the principle of traffic discipline, is not the important factor. What is important is that such people are permitted to carry on, endangering the lives and property of others with comparative immunity—in terms of road traffic it would mean that it was no offence to drive on the wrong side of the road unless a person or another vehicle was struck.

The present rules are not at fault and new rules will not be of any advantage until means can be found to impose the necessary compliance, and to make non-compliance unprofitable to both the seaman and the vessel's operators or owners. If these means cannot be adopted then any hopes for an improvement in the record of accident statistics in the future are unlikely to be fulfilled.

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Collisions Involving Very Large Ships

J. Watt

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COMMANDER P. C. H. Clissold, in a contribution to Forum in the April 1971 issue of the *Journal*, makes a point concerning the collision-avoidance handling of very large single-screw ships. Commander Clissold writes:

> 'Because of their unwieldiness an avoiding action must be initiated while still at a considerable distance from the threat, if it is to have any effect. This distance is beyond that at which the eye of the navigator can accurately assess the risk of collision or the need to manœuvre. He must, therefore, depend upon instrumental information for making his decisions; in other words, in clear weather as in thick, he must use his radar and plot continuously if he is not to hazard his ship. If the argument is put forward that this will require two men on watch together and the state of manning does not permit this to be done, the answer is that a change in organization must be made to make it possible.'

I would agree with Commander Clissold as to the great amount of additional information provided by a continuously maintained plot; and as to the potentially

vital contribution to safety this additional information can make even under conditions of clear visibility.

It is not given to every officer to be able to assess correctly, at sufficiently long range and without exception, the aspect of every vessel in a multi-ship situation, and the degree and imminence of any threat of collision each represents, when he does so only from visual observation of their appearance by day or of their navigation lights by night (coupled, where considered necessary, with observations of compass bearing behaviour).

Equally, all officers do not have the ability to make the same assessments, correctly, every time, and in good time, by intently but passively studying a conventional radar screen.

I suggest, therefore, that there would seem to be much to support a proposition that in the very large or fast ships in service in increasing numbers, radar should be used and plotting carried out continously when in traffic and regardless of visibility conditions.

But when only a single officer is on watch, radar plotting is a substantial added chore and, if it is carried out, it *detracts* from the efficiency of the visual watch in proportion to the amount of threatening traffic present. There is thus a very powerful incentive not to plot.

Danger can come even to the well trained, plotting-conscious officer when, in clear visibility but in a traffic situation potentially more hazardous than he realizes, he has decided not to maintain a continuous plot. Then when danger looms unexpectedly, he would give his eye teeth to be able to consult a clear and comprehensive plot begun several minutes previously. On the necessity for continuous plotting, therefore, I am in complete agreement with Commander Clissold.

I would not, however, subscribe entirely to his recommendation as to the method to be employed to obtain all the additional information and advice which only continuous plotting can provide. An extra man on the bridge would certainly enable continuous radar plotting to be carried out, but because of human limitations, its effectiveness would be incomplete. Manual plotting is tedious, is subject to dangerous omissions as saturation in traffic is easily reached, and can be subject to gross error as fatigue or boredom set in.

As I believe Commander Clissold to imply, extra manning to permit continuous plotting as he envisages it would also be expensive, involving as it would the employment of an additional qualified man whose services would be required only in heavy-traffic areas.

A self-plotting radar, the 'Predictor', was developed specifically to meet this need, and was described in the April 1969 issue of this *Journal*. In this development, safety was the watchword and the basic principles of operation of the system were chosen accordingly. As just one example, in this system chosen targets are at no point handled individually. This eliminates any need for the watch officer to pre-select targets, or for tracking to be initiated by either manual or electronic means. The system is therefore inherently non-saturable and basically reliable, and maintains the plot as a continuous automatic process. All targets are handled equally and none are excluded. This obviously is specially important to safety when threats are being assessed or when the effects of a proposed manœuvre are being pre-tested. Prolonged use in real earnest in commercial ships has proved the reliability and accuracy of the equipment. It has demonstrated also that the 'Predictor' system not only eliminates any need for a plotting officer but in fact provides a service which vastly excels anything which could be

achieved by manual plotting, in terms of speed, accuracy, and immediacy and comprehensiveness of the information displayed.

Commander Clissold's proposed method of reducing the danger is the provision of an extra man on the bridge, charged with the duty of plotting continuously, i.e. not merely regularly recording the successive positions of targets, but also regularly constructing and revising relevant vector triangles. I suggest that the self-plotting radar now available, which at the push of a button brings up on the main radar screen continuously up-dated, high integrity 4-plot tracks of all targets, in true motion, actual relative motion or relative motion predicted for a proposed manœuvre by own ship, is in practice a substantially greater asset to safety. It is also one which may well be more easily and economically provided.

A Manœuvring Diagram for Avoiding Collisions at Sea

Captain A. N. Cockcroft

INTRODUCTION. In 1970 the Institute formed a Working Party to formulate views on the revision of the collision regulations. Its Interim Report is published in the *Journal* for October 1970 and two further contributions, by Calvert and García-Frías, were published in a subsequent number (24, 413–20). The Interim Report referred to the value that a manœuvring diagram along the lines originally proposed by Calvert and Hollingdale would have in helping the mariner to assess the effects of collision situations on alterations of course and speed. It has not been possible to secure unanimity about the form of this diagram, but the one illustrated below is based on the contributions of several members and has met with the approval of the majority of the Working Party.

PRINCIPLES AND CONCEPTS. (1) Manœuvring guidance is likely to be of greatest value when navigating with radar in restricted visibility. In such conditions bold alterations of course and speed are necessary if the action is to be readily detected by other vessels. The recommended alterations are in accordance with helm action normally taken by power-driven vessels under the Steering and Sailing Rules, but smaller alterations are usually sufficient for visual situations. For greater compatibility with the in-sight rules it would be desirable to allow earlier action by the privileged vessel than is permitted under the existing Rule 21.

(2) The diagram is restricted to course alterations. Advice on speed changes is given in notes accompanying the diagram. It is considered that reductions of speed should not be prohibited for any sector in poor visibility and, as vessels generally proceed at the greatest speed compatible with safety, appreciable increases of speed are usually either dangerous or impossible.

(3) Course alterations which will cause anti-clockwise rotation of the sight-line if the other vessel keeps her course and speed are recommended, except for the port beam sector where they would be ineffective. Turns which would cause clockwise rotation but maximum disengagement are recommended as a