Reporting Near Misses at Sea

W. B. R. Taylor

It is suggested by D. Nicolson (this *Journal* **29**, 414) that there is a need for reporting near misses at sea, similar to the system which has been in force for air navigation since the late 1950's. He also suggests that the primary function of such a system would be as a training aid in nautical colleges and training establishments, but that it could also provide statistical evidence. While agreeing on the urgent need for a reporting system I would expect a different order of priorities.

An internationally established system of reporting near misses at sea could serve many valuable purposes. It would indeed provide a useful training aid if the reports were given in full detail. The system as suggested would not, however, be complete since it would not be international in character, and might only flourish in vessels whose officers still require to sit for further professional qualifications. To be statistically valid a reporting system would have to be international and apply to all types of craft, from the warship and passenger liner to the fishing vessel and yacht.

Airline pilots may submit their near-miss reports at the normal debriefing after a flight, since the memory can be expected to be reasonably accurate for this length of time. In the marine case it might be days or weeks before a report could be submitted to the reporting centre. This means that the watchkeeping officer would have to write his report at the end of the watch while the incident was fresh in his mind—yet another unwanted chore at the end of a tiring watch. How many would be altruistic enough, or sufficiently public spirited, to undertake this task conscientiously unless some incentive is offered? Those who would benefit most from such a scheme are the obvious ones to offer the incentives. These include the underwriters, the shipowners, the deck watchkeepers themselves and all who take passage in ships, either as crew or passenger.

Since in any transport system there must inevitably be more near misses than collisions, the chief virtue of a full reporting system of near misses is the valuable data bank of information that could be built up concerning the circumstances leading up to a close shave situation, if these reports are comprehensive. Even present day casualty returns do not include all the data on the events leading up to a collision. The details only come to light under cross examination when there is an official inquiry or a court action for damages, and the number of such cases is declining rapidly. Only eight collision cases came before the Admiralty Courts in 1974, and only one of these occurred on the high seas; most cases are settled by arbitration for various reasons including cost, difficulty of getting cooperation from foreign ships, and the fact that a case at law is likely to come up at least two years after its occurrence. One result is that the witnesses' testimony, after this time lapse, can leave out vital details leading up to the event, and vessels fitted with course recorders and automatically recording telegraphs are still in the minority.

Once such a data bank is established it can be analysed statistically to test various hypotheses on the effectiveness of particular manœuvres, and also the effectiveness of the International Regulations for Preventing Collisions at Sea.

Though Mr. Nicolson might not envisage the integrity of these Regulations being violated I would like to see a full statistical analysis bearing on the Rules, and this can only be done when sufficient data is available on all the circumstances which lead up to a situation where a collision did take place, or could conceivably have taken place. It is heartening to see that work is being undertaken in this direction by the United States Coast Guard and by the City of London Polytechnic; they are obviously concerned to find the weaknesses which lead to the high collision risk at sea; a risk higher than is tolerated in most other transport systems.

As far as I know the viability of the International Regulations for the Prevention of Collision at Sea has never been questioned in a law suit, which is amazing since in every other transport mode one of the first objectives of an official inquiry is to validate (or amend) the Regulations as they existed at that time, as well as to confirm whether the Regulations have been obeyed.

The present Regulations started life less than two hundred years ago as a hierarchical set of rules as pointed out by J. F. Kemp (this *Journal*, **29**, 341). They have been added to piecemeal over the last two hundred years and there have been very few subtractions, so that today's Regulations are a cocktail of hierarchical, definitive, anarchical and pseudo-mathematical clauses (in some cases they have been found at variance with modern scientific experiment). The hierarchical rules, such as Rules 20, 26 and 27 (and the corresponding types in the new Rule 18 when it comes into force), are those which grade vessels according to their occupation, or some other easily recognizable characteristic which is loosely related to a vessel's ability to manœuvre out of the way of another approaching vessel. The definitive rules, such as Rule 16, Rule 18 and Rule 25(a) are those which prescribe the precise action to be taken on the part of both vessels in an encounter. Obviously there are no anarchical rules, as such, but a state of anarchy (apart from the injunction of moderate speed) does exist under the banner of the Rules during that interval between first radar detection of a target in poor visibility and the hearing of the other vessel's fog signal. It is true that when the 1972 Rules come into force there will be some tightening up in this situation. As to pseudo-mathematical rules, some of the rules are mathematical insofar as they do take account of the geometry of the encounter—crossing, overtaking and meeting; they depend also upon a relative-bearing frame of reference for vessels. I consider them pseudo-mathematical since there is an empirical división between overtaking and crossing, but an exceedingly woolly and ill-defined division between the other two types of encounter, meeting and crossing. The latter has proved to be the most prolific source of collisions at sea, 72 per cent of all collisions according to A. N. Cockcroft (this *Journal*, **29**, 315). Because of these arbitrary or ill-defined distinctions between the encounters, coupled with the differing hierarchies of responsibility and with unilateral action, the present Rules will not lend themselves to any continuous mathematical logic. This defect will preclude full automation or full computer simulation. There are of course other considerations which also preclude the complete automation of collision avoidance because the whole process consists of six steps which may be set out in chronological order as follows:

(i) Discover the presence of the other ship
(ii) Collect information on the other vessel's position and historical movements since discovery
(iii) Predict the degree of danger

(iv) Make a judgment based on (iii) whether to manœuvre or not, and by how much; what type of manœuvre to execute and when; the effect of the projected manœuvre or manœuvres
(v) Take action in line with the judgment formed at (iv)
(vi) Keep a check on the effectiveness of the action taken until the danger is finally past and clear.

It has been found that technology cannot infallibly automate stage (i) under all conditions, for two reasons—saturation of the equipment occurs with a multitude of land targets, also false information arises due to the many spurious and fleeting returns that appear on the marine radar screen (whatever wave length is used). Stages (ii) and (iii) have been successfully automated. It is at stage (iv) that the difficulty of further automation arises. This time the difficulties are brought about by the conflicting logic of the present Regulations and the almost infinite choice of manœuvres (type, amount, timing) that are allowed under the present flexible rule system. There are also many imponderables—hierarchy of vessels, state of tidal stream, effects of weather, other navigational hazards, &c. The 'tree building' involved would be truly astronomical. The last two stages (v) and (vi) should be capable of automation if a method could be devised to get so far, and assuming it worth-while and cost effective. It seems that for the foreseeable future there will be a human watch-keeper, but that he must be presented with data in an unambiguous and digestible form on which he can make judgments based on a set of unambiguous principles. Under the present rules the number of judgments to be made at this stage is often more than can be expected of human flesh and blood, acting under stress or in a state of tiredness. Even though full automation is not likely in marine collision avoidance, there is no reason why the Rules should continue to contain this doubtful logic.

Most of those who defend the present Collision Regulations state in their defence that they have stood the test of time, and proudly quote the fact that they have remained virtually unaltered for the last seventy years. I would submit that the rules were conceived when shipping was considerably less sophisticated, when commercial pressures for speed were not so great, and when marine vehicles had a large degree of homogeneity. This last factor definitely does not hold good today, and with the single responsibility system of the current rules it means in effect that in about half the crossing encounters the least manœuvrable vessel will be required to keep out of the way of the more manœuvrable one, which is required to maintain her course and speed.

Due to piecemal additions, the Rules have now become completely circular, so that in an inquiry the Rules themselves can never be found at fault. As they are worded, there must *ipso facto* be a breach of the Rules if an incident occurs. In the last two decades many observers have felt this an unsatisfactory state of affairs and have offered alternative solutions; they do not however agree on the nature or the amount of change required. It is heartening that the new 1972 Regulations do incorporate some of these ideas, but there has been no overall change in principle.

In other transport industries the usual method of discovering where the system may be lacking in safety is to conduct an exhaustive analysis of casualty statistics. For shipping, the statistical analysis tends to concentrate on isolated areas of interest, such as loss ratios, faulty design features, &c. Casualties due to collision, which are frequently said to be due to human error, are rarely examined exhaustively. In

professional sport if there are too many injuries it is not the players who are automatically blamed, the authorities take a long, hard look at the rules. It seems that the whole subject of collision at sea is highly emotive, perhaps because statistical data on the events leading up to a collision or a near miss are just not available. This is the more remarkable when insurance covers a large proportion of total costs; the road haulage industry is tightly bound up with technical legislation to improve the safety record. It could be that the public will demand similar restrictions on shipping if there are serious collisions in coastal or narrow waters with hazardous cargoes, and the probability of such a disaster is increasing. A full reporting system on near misses, in addition to an extended reporting system on all collision casualties, would provide the necessary data for testing the effectiveness of the existing rules, and be achieved at a cost to the industry probably less than that of the mounting insurance costs.

D. Nicolson comments:

In my original note I emphazised training rather than research because I doubted if a reporting system for near misses, such as would be needed for international research, could be achieved. Professional inhibitions (peculiar to mariners) might discourage accurate reporting to official centres and there is no outside control like ATC in aviation (except to some extent surveillance in the Dover Strait) to provide a parallel monitoring system. Long voyages could render accurate and regular reporting difficult.

Nevertheless, for the officer-of-the-watch a near miss is an agonizing experience which he is not likely to forget, particularly if his report is likely to lead somewhere. Of course he may 'weight' the thing in his own favour, but it can still be of educational value although useless for statistical research (the specimen near miss in the original note was written up—perhaps not very accurately—after an interval of eleven years). With this in mind a simple and 'anonymous' situation recording device could easily become a standard item of bridge equipment, leading to a store of model situations of common and less common types available at training centres for simulation games, exercises, group seminars and general tuition. Of course a fully international and official reporting system would be ideal.

Detailed criticism of the Collision Rules is a matter for specialists, but it is hard to picture a situation where the rules would have to stand up to criticism (or even eventual amendment) at a collision inquiry. At times the rules may indeed seem to have been brought down from on high, but even this can have a stabilizing effect, and perhaps it is a desire to maintain the *status quo* rather than a lack of interest that keeps things as they are.

What rules would emerge, and how far they would resemble the 1972 Rules or a mathematical model, if compiled in isolation from past rules or other constraints is a matter for conjecture. Extensive changes are already afoot in the navigational field; the new buoyage change over will no doubt be achieved with the same efficiency as we have seen with metrication. But could we ever achieve a change over to 'optimum' rules?

Much has been said about the saturation of the officer-of-the-watch in heavy traffic. He may be assisted by a variety of automatic plotting devices which can ease the situation (if he remembers that it is the equipment that is assisting *him* and not the other way round!). If he is still overloaded, then clearly controls

outside the collision avoidance rules have to be sought. Traffic separation schemes go a long way and further measures may eventually be called for, such as the application of queuing theory, scheduling systems in narrow waters, &c. This suggests industrial integration far beyond the area of maritime transport.

An appreciation of the build up of events preceding a close quarters situation is encouraged by the simulation exercises used in navigation schools. It would be enhanced by the personal involvement resulting from a study of near misses which had actually been experienced. No improvement short of complete and universal automation can be of much avail until the collision avoidance instinct within each officer has been developed to the full.

The Operation of Light Aircraft

An informal discussion on the operation of light aircraft took place at a meeting of the Technical Committee of the Institute in London on 21 April 1976. A personal view expressed by Mr. F. S. Stringer and comments by Mr. C. Powell and Professor A. N. Black are printed below.

F. S. Stringer

RECENT technical press disclosures have highlighted C.A.A. concern that the London Air Traffic Zone is being entered by unauthorized light aircraft, the infringements varying from minor boundary incursions to major crossings of the area. The pilots involved vary in experience, and in most if not all cases have been flying under VFR rules and out of radio contact with Air Traffic Control. It seems very probable that these pilots are lost, or at least very unsure of their position; the topographical relation of charts to places on the ground is becoming increasingly difficult to interpret due to the complexity of built-up areas, especially around the T.M.A.s. Not all aircraft carry VOR or ADF and the map and DR are the main navigational aids; some pilots are reluctant to call for radar assistance for a variety of reasons.

A ground positioned strobo-flash can be seen from the air in marginal visibility, as witnessed on many general aviation aircraft already fitted with these lights for normal identification purposes. A small number of such lights positioned strategically in and around the T.M.A. could be used as a safety check by pilots flying VFR to ensure that they do not stray into the zone. The number of beacons could be limited and placed at points of particular traffic density, such as the southern boundary extremities of the London Zone. Pilots could ensure that in VFR the beacon was seen, and identified as positioned correctly relative to their flight path, before turning on to a new heading to complete a track around the prohibited zone. The beacons would be no more expensive than those now fitted to aircraft and no special flashing code would be necessary, though this would probably be advantageous. The beacons could be fitted on telegraph poles and shielded from ground observation to prevent annoyance to the general public. Since the real estate required could be minimal and probably rented, say on the roof of a building, one difficulty in providing ground based radio aids to navigation should not be experienced.