Radar and Marine Collisions Today

Philip N. Schmidt
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By Philip N. Schmidt*

Introduction

World headlines were made when the Italian passenger liner Andrea Doria and the Swedish liner Stockholm collided in a disputed fog. The newspaper accounts of anguished drownings and heroic rescues filled the front pages, and much was said as to how this could all happen when the ships were equipped with radar. Many landlubbers, knowing this writer to be a seaman, queried in the same tone, and to coin a metaphor, supposed radar to be an all-seeing "jinni" whose sole duty was to prevent the incompetent mariner from inevitably sinking his ship.

Honorable justices in the courts of admiralty have managed, perhaps through able arguments of maritime counsel, to avoid in their considered opinions the bestowing of such magic-like qualities upon this electronic machine, but even they, while recognizing that radar is but an aid to navigation, still often speak in terms of an all-seeing eye.

Officers who man the merchant ships should certainly be cognizant of the many shortcomings of present day radar equipment; but, alas, many a ship's master with full or limited knowledge of these shortcomings nonetheless feels some mystic sense of collision-avoiding power because his vessel is equipped with radar. (Thus spellbound he proceeds pell mell and full ahead through rain squall encompassed or fog enshrouded waters, which are all too often harbor approaches or other sea lanes crowded with craft of all description and bound in all directions). But to the layman, lawyer, and the seaman there are many mysteries of this exploding scientific era that put reason asunder so that things once thought impossible are now considered plausible despite lack of concrete knowledge upon which to base such plausibility.

Radar then is still something new; but its effect upon ship navigation, its use and misuse by the men who operate, watch, and interpret its revela-

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1 This tragedy occurred on July 25, 1956, in the Atlantic Ocean off Nantucket Island. Fifty lives were lost. Newsweek, Aug. 6, 1956, p. 21. For a discussion of radar in relation to this collision, see Newsweek, op. cit. supra at 54.

2 In Wood v. United States, 125 F. Supp. 42, 51 (S.D.N.Y. 1954) the court said: "Radar is an aid, not a substitute, for prudent seamanship."

3 In The Hindoo, 74 F. Supp. 145, 149 (S.D.N.Y. 1947), modified sub nom., United States v. Australia Star, 172 F.2d 472 (2d Cir. 1949), cert. denied, 338 U.S. 823 (1949), the court said: "The fault of the Australia Star is that she chose to remain blind when she had the means to see." And in Dagmar Salen v. Puget Sound Navigation Co., [1951] 4 D.L.R. 1, 4 (Canada), the court said: "If radar is to furnish new sight through fog . . . ."

4 Quotes or articles to substantiate such antics will not likely be found as an admission anywhere, but such has been discovered by personal experience and in harrowing tales related by fellow seamen.
tions, and its applications when viewed from the demand of the Rules of the Road5 are of growing concern in the law of collision.

This problem will be approached by first discussing the questions of whether there is: 1) a duty to equip a vessel with radar; 2) a duty to keep it in repair if so equipped; and 3) a duty to man the vessel with personnel competent to satisfactorily operate the equipment and to interpret what it reveals. After this essential groundwork has been laid the applicable law in relation to negligence and to the Rules of the Road may be approached.

Is There a Duty to Equip a Vessel with Radar?

This section (and the article as a whole) can best be handled by a necessarily limited description of a radar's functioning in layman's language. A transmitter sends out frequent intermittent radio waves of such a frequency that upon striking objects they have the effect of bouncing back, and because of the electrical nature of these waves those objects that are the best conductors of electricity are also the best reflectors. Steel ships or wooden vessels with considerable metal attachments make better targets than wooden vessels with but little metal attached thereto. The higher or more massive target has better reflective qualities because it presents a broader vertical area for such reflection; hence high rocks, large vessels, or precipitous coastlines afford a better reflecting mass than low lying rocks, smaller vessels, and sandy low beaches.

The returning signals are picked up by the ship's radar antenna and the receiver unit of the radar equipment. This information is digested by the indicator unit so that returning signals show up on the indicator screen or scope, a tube not unlike the picture tube of a television set. There will be no picture as appears on a television set, but rather a bright solid image on the dark background of the tube face, which if extended in length, as a coastline, will approximate the actual contours of the shore or island. A ship, however, will appear as an exaggerated oblong, becoming more oval-like as it nears the transmitting vessel.

Finally, the indicator unit is so calibrated that the distance off the "target" and its bearing can be ascertained with considerable accuracy. If the target is another ship, successive bearings and ranges thereon will give the navigator a close approximation of the course and speed of the "target" vessel, provided that he also takes into consideration his own course and speed.

However, the operator must be capable of interpreting what he sees on the tube, and must always keep in mind the many facets of radar's shortcomings, some of which will be mentioned in this article.

Radar then is obviously a very valuable aid in thick weather. It is also

5 International Rules for the Prevention of Collision at Sea, 65 Stat. 406 (1951), 33 U.S.C. §§ 143–147d (1952). These rules are commonly called the Rules of the Road, and this term will be used throughout this comment. They may best be described as the "traffic laws of the sea."
a great aid for the purposes of navigation, even in clear weather, as it assists the mariner to feel his way through narrow current-beset channels, along rock strewn coasts, and among shoal and reef-burdened islands.

Yet there are no compulsory statutes or regulations requiring vessels to be outfitted with radar. This is so despite the fact that radar has to a considerable degree lessened the importance of other types of navigational equipment long required as mandatory aboard various classes of vessels.

That radar will some day become required shipboard equipment on tank, cargo, and passenger vessels of larger tonnage is perhaps a certainty. Until the enactment of such regulations, vessels which do have operative radar will be held to an additional standard of care (in fog) in relation to those ships which are not so equipped. Meanwhile mariners who navigate in fog banks with such electronic aid can never be sure which of other ships in the vicinity that appear on the radar scope are also thus equipped. Though vessel A can ascertain the presence of vessel B, and determine its bearing and distance (and its course and speed after successive observations), it cannot know that B also has that advantage.

Is there a Duty to Keep Radar in Repair?

Must a vessel that is equipped with radar maintain that set in operative condition?

Apparently this precise point has not yet been determined as a matter of law. In the Petition of the United States, the court in speaking of this matter said:

At this point it is well to refer to the Duke's radar. Its use would have avoided the collision and its unavailability was due to neglect of repair. There was ample warning—a day or two—of its disrepair. However as the Duke of York's excessive speed was the predominant fault leading to the collision, it is not necessary in this case to pass upon the question of whether or not, in the absence of statute requiring radar, a lack of diligence in maintaining existing radar facilities is negligence.

Nor are the courts likely to formulate such a duty. In Anglo-Saxon Petroleum Co. v. United States, 88 F. Supp. 158 (D. Mass. 1950), there was a collision between a British motor vessel and a United States destroyer, the Wilkes. The destroyer had a radar primarily designed to pick up aircraft. The court said at p. 160: "The failure of the Wilkes to carry navigational radar did not make it unseaworthy."

Among such equipment are the radio direction finder, 46 C.F.R. § 32.15-25 (Supp. 1957), § 77.15-5 (1952), § 96.15-15 (1952), and the mechanical deep sea sounding apparatus, 46 C.F.R. § 32.15-10, § 77.27-1, § 96.27.1 (1952). These instruments are not used as an aid in the prevention of collision but rather to aid in position finding. However, radar in addition to its use in fog greatly supplements these installations in their use as position finders.

In The Medford, 65 F. Supp. 622, 626 (E.D.N.Y. 1946), the court summed up a discussion on radar by stating that: "The perfection of that device is thought to have invoked a new concept of the responsibilities attaching to vessels so equipped, touching their handling and operation in or near a fog-bound area."

Of course even if all ships of larger tonnage were outfitted with radar the possibility of radar disrepair would always be a factor to consider.
It would seem an undue burden to require a radar equipped ship to assume this additional duty when there are no mandatory installation statutes. This duty should at least wait until there are statutes making this equipment obligatory aboard vessels of U.S. registry, or until such regulation is made world wide as a result of international conference. Also if ships of all nations are equipped with radar and required to keep them in repair, companies and agencies specializing in such repair and maintenance will soon become common in even the more obscure ports of the world.

The Duke of York was a ferry on a frequent and regular short cross channel run, and in her case a duty to repair seems more natural than in the case of vessels engaged in long journeys in the international trade.

**Is There a Duty to Man the Vessel with Competent Operators and Interpreters of Radar?**

The persons who operate the radar aboard merchant vessels are the deck officers, and perhaps on occasional instances, the ship's radio officer, though the latter is more intimately concerned with matters of ship board repair.

At present no deck officer is required by licensing authority to have any special certificate indicating any training in the operation, understanding and interpretation of radar and its peculiar problems. In the regular examinations for the licensing of ship's officers questions on radar may be included, but they are of a general nature and to answer them does not require any practical training and schooling in the use of radar.

There has been much pressure in the direction of mandatory certification, and apparently deck officers in the British Merchant Marine are now required to obtain such certificates of proficiency before they sit for their second mate's ticket.\(^3\)

Without compulsory radar installation a licensed officer who obtains his radar certificate is very likely to find himself sailing for several years aboard a vessel without such electronic device. If he thereafter takes a berth on a vessel with radar he will probably discover that his two or three week training period was long forgotten. However, such a requirement would probably decrease the number of accidents that are of a nature that radar may be said to have *caused*\(^4\) through improper interpretation, use, or reliance thereon.

There is nothing in the cases indicating that the ship owner or the

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\(^{12}\) Some of the equipment that is required by regulation aboard merchant vessels is expressly required to be kept in working condition; for example, the deep sea sounding machine, 46 C.F.R. 32.15–10 (1952).

\(^{13}\) See McGovern, *Head to Head with Radar*, PROCEEDINGS OF THE MERCHANT MARINE COUNCIL 155 (Oct. 1957). Also see note 22 infra.

\(^{14}\) McGovern, *op. cit. supra* note 13, at 155, quotes from the Anna Salen [1954] 1 Lloyd's L.R. 475: “It is a melancholy reflection that the collision probably would not have happened if the ships had not been equipped with radar.”
master has any duty to hire ship's officers who are particularly qualified to operate and understand the radar.

Radar, Collision, and the Rules of the Road

When ships collide at sea the responsibility for the collision depends primarily upon which vessel, if not both, has violated the International or Inland Rules of the Road. Consequently, it becomes of great interest to discover how radar affects behavior under certain of the various rules, and further how the misuse of, or the failure to use, radar, may of itself be such negligence to impose liability upon a vessel. I separate the negligent use of radar from the applications of the Rules of the Road thereto because, surprisingly, in the cases which are concerned primarily with the failure to use radar, or the failure to properly use radar, the courts generally do not expressly link this negligence with Rule 29 which reads:

Nothing in these Rules shall exonerate any vessel, or the owner, master, or crew thereof, from the consequences of any neglect to keep a proper look-out, or the neglect of any precaution which may be required by the ordinary practices of seamen, or by the special circumstances of the case. (Emphasis added.)

The Duty to Use Radar in Areas of Reduced Visibility

When is there a duty to use radar? Under what circumstances might this duty be abandoned? What are the borderline situations wherein there is conjecture as to whether this duty exists? If the radar is in use, has it been used adequately and properly? These are the questions which must be answered, and Rule 29 is applicable whether or not the courts expressly so hold. We turn first to the duty to use radar in a fog (or other conditions of reduced visibility).

The Medford is the leading case concerned with the absolute failure of a vessel to utilize her radar upon approaching or steaming in a fog bank. The S.S. Thomas Barry, a U.S. Army Transport, enroute from New York to Le Havre was steaming at a speed of 18 knots when fog loomed ahead. She entered the bank without reducing speed and a short time thereafter collided with a fishing trawler, the Medford.

The sins of the Barry were many. In addition to her failure to lessen speed she was on automatic steering; she had no lookout posted at the bow; and she had not blown her whistle until just prior to the collision.

However, these failures to observe the Rules of the Road and other practices of good seamanship pale, in the conception of the court, before

15 The Inland Rules of the Road are generally similar to the International Rules, the former being applicable to certain inland waters and the seaports of the United States. For these correlative Inland Rules see 33 U.S.C. §§ 154-232 (1952).
17 For a case that does specifically apply Rule 29, see The Hindoo, 74 F. Supp. 145, 149 (S.D.N.Y. 1947).
the failure of the Barry to use her radar which was in operative condition. Said the court:

The failure of the Barry to use her radar is the most serious and sinister aspect of these causes. The perfection of that device is thought to have invoked a new concept of the responsibilities attaching to a vessel so equipped, touching their handling and operation in or near a fog-bound area. . . . Under such circumstances, it is impossible to yield to the argument for Barry, that her conduct is to be condoned to any extent, in view of her failure to employ the very device which was installed to prevent collision, and to operate which she carried two men having a special rating in the U.S. Navy to attest their qualifications, and who had no other duty on the ship other than to operate the radar unit.

There is then, an affirmative duty to use operative radar when approaching an area with known poor visibility, or when steaming therein.

One cannot argue with this additional duty put upon radar equipped vessels. It should be apparent at once to all mariners that a failure to use radar under these circumstances is a clear breach of the practices of good seamanship under Rule 29.

May a vessel proceeding in thick weather abandon the use of its radar when uncertain as to its effectiveness? In May, 1948, the S.S. Isaac T. Mann and the S.S. Esso Aruba collided in a dense fog in Narragansett Bay. The Mann was equipped with radar, but the master felt it had become unreliable because of false images and interference and so discontinued its use. Said the court in Pocahontas Steamship Co. v. The Esso Aruba:

. . . While radar is one of the greatest boons devised for navigation, it is not a fixed and invariable rule that the navigator must use it in all events. There might be times when the continued use of radar by a navigator who was uncertain of the results he was observing and unwilling to place reliance thereon might be foolhardy and hazardous.

The captain of the Mann spoke at the trial of false targets and interference. Certainly if this occurs he should not rely on his radar. It is equally true, however, that even though the radar is in good operating order reliance thereon by those who cannot interpret what they see is just as "foolhardy and hazardous." This points up again the need for special operational training earlier discussed; and also brings up the hypothetical question

19 Id. at 626.
20 Today aboard civilian manned government transports the ship's deck officers operate the radar.
22 Subsequent to the writing of this comment the United States Coast Guard Licensing Authority has issued a regulation requiring deck officers in the merchant marine seeking an original license, raise in grade or increase in scope of license to display an adequate knowledge of the multiple phases of radar operation and interpretation, or in lieu thereof present a certificate from a radar school. 46 C.F.R. § 10.05—46 (1958) to become effective as of January 1, 1959. The author feels that, though this is a step in the right direction, the failure to include those officers seeking merely to renew their present licenses is a serious mistake. It is the various ship's masters in the latter class who will be in charge of vessels for years to come and whose orders regarding the use of radar the younger ship's officers will be required to obey.
as to whether or not the Aruba-Mann collision could have been avoided if there was an officer aboard who could properly orient what was seen on the radar scope. Such conjecture is of course not intended to derogate the rule of this case nor the judgment of the master of the Mann.

However, the case leads to the question as to whether or not the master is to be the sole judge of the radar's reliability. Suppose in fact that the radar could be clearly interpreted and that the failure to appreciate what was seen on the scope was the result of inadequate training and understanding of radar operation by the ship's master, and yet there were other deck officers aboard who could have put the set to proper use. Assume then that the set is secured by orders of the captain. There is a collision. Is the master in such a case to have complete discretion when in fact the other vessel could have been discovered on the radar screen and the collision thereby avoided?23

Is there a duty to have the radar in operation on apparently clear nights when the vessel is steaming in waters where fog banks are not uncommon and traffic is not infrequent? The case of the Petition of the United States24 meets this problem squarely. The S.S. Duke of York, running between the Hook of Holland and Harwich, England, was steaming in a thick fog and at an excessive speed. Her radar was in disrepair. She burst out of the fog bank and collided with the Bremerhaven bound Haiti Victory. The Haiti was also making full speed, and was not using her radar for purposes of vessel search.

That the Duke of York was at fault because of her excessive speed in fog in violation of Rule 16 of the International Rules of the Road was found as a matter of fact and law. But counsel for the Duke strenuously insisted that the Haiti Victory was also a culprit because of her failure to utilize her radar, and that this was particularly so since the second mate on the Haiti had some moments prior to the collision put the radar in operation and used it to obtain a distance off the Galloper Light Ship. At this time had he carefully inspected the screen he probably would have seen the pip made thereon by the nearing Duke. He did not.

The question was whether or not the Haiti should be charged with knowledge of the fog, and if not should the fact that such fogs were not uncommon in these waters have been sufficient warning to utilize the radar, and if it was in operation, to scan the screen for vessels.

The court found that though the master took steps to prepare for fog, such as not fully undressing, that this merely was a precaution against fog and not a suspicion of it. Shortly prior to the collision the Haiti had seen

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23 A failure to use radar under such circumstances could be found as negligence. In any future collision where the use of the radar has been discontinued an investigation in this direction by opposing counsel might bear fruit.

the lights of another vessel in the same general direction from which the Duke came. The court said:\(^{25}\)

Signs of fog were not seen by the Haiti Victory until after the Duke revealed herself. They were not overlooked; they were not there.

The court negated any duty to use the radar where there was no suspicion of fog by clearing the second mate of negligence even though the radar had been used by him shortly before the collision. Stated the Court:\(^{26}\)

\[\ldots\] But he was not looking for anything to the starboard; he had no reason to go to search in any direction. His failure to see the Duke was not negligence, for it was not the result of neglect of an obligation. No obscurity obligated him to use his radar, and there was nothing else to put him on notice of any need of it.

The logic of the court, though not unassailable, appears sound. If this duty were foisted upon radar-equipped ships, \textit{i.e.}, to take such precautions in waters where fogs were not uncommon, mariners would never be certain of the circumstances under which a vessel should put her radar in operation for purposes of a vessel search.\(^{27}\)

A somewhat analogous problem is presented under wartime conditions where vessels for protection against enemy submarines proceed without their navigation lights burning. It is a clear night. One ship has her radar working. She picks up an approaching target, a crossing ship. Disregarding here any duties either ship might owe to the other under the Rules of the Road sections dealing with crossing situations, does the radar-equipped vessel have a duty to continue close observance of the antics of the other blacked-out ship even though there may have been no duty to have her radar in actual operation?

This question was answered in the affirmative by the court in the case of \textit{The Hindoo}\(^{28}\) where, during the war year of 1944, on a dark night in the Caribbean Sea the Australia Star and the United States owned Hindoo met in collision under such circumstances.

The Star had her radar in operation and she received a pip from the Hindoo 27 minutes before the ultimate collision. The radar operator gave the master several bearings and distances off the Hindoo, including information on another pip (a naval escort with the Hindoo). At 9:20 p.m., twelve minutes prior to the smash-up, the master, his running lights now burning to apprise the Hindoo of his presence, ceased to request further information from the radar operator and up to the time of impact no more

\(^{25}\) \textit{Id.} at 716.

\(^{26}\) \textit{Id.} at 717.

\(^{27}\) On many ships the master or his mates consider it wise seamanship to keep the radar operating when navigating in such waters, not for the purposes of continued radar observation, but for casual scanning to anticipate just such an occurrence as in the principal case.

was offered by the operator. The Hindoo failed to switch on her lights until
the ships were upon one another. The court perused: \(^{29}\)

Had the master made more intelligent use of his radar he would have
known at 9:24 p.m. that he was almost certainly on a collision course and
would have taken precautionary measures.

During the moments leading up to the collision the escort vessel had
been futilely attempting to communicate with the Star by blinker light,
and in response to this episode the court said: \(^{30}\)

The failure to make adequate use of his radar facilities is all the more
astonishing as the master knew that a naval craft was making unsuccessful
efforts to communicate with him. The watch officer had managed to trans-
late the word “keep”. He could have hardly supposed the whole message
was “keep well”. He should have sensed some apprehension which should
have sent him scurrying to the radar scope. The notion that a ship, equipped
with radar, may, once her navigation and range lights are bright, plunge
through the seas at 15 knots in the hope that all other craft will keep clear
of it cannot be accepted as a rule of safe and prudent navigation.

Apparently the rule to be drawn from this case is not to be understood
to mean that such a vessel must have her radar in continuous operation
while traveling blacked-out, but rather, having it on, and discovering an-
other blacked-out vessel, a duty arises at this point to keep track of that
other vessel.

This raises the interesting question as to whether a radar-outfitted ship
proceeding on a clear night under normal operating conditions, discovering
the lights of another vessel, indicating a crossing or meeting situation, must
turn on its radar, or having it on, use it to track the approaching vessel.
If so, then this would initiate a practice not at present carried on aboard
most merchant vessels, other than as practice sessions by the officer of the
watch. \(^{31}\) Under ordinary conditions, with visibility good and running lights
bright, observance of the Rules of the Road make a collision so highly
improbable that resort to other aids is unnecessary. Concentration by the
deck officer in obeying these rules without needless reference to the radar
should then be the best and most seamanlike action because the frequent
transition from radar observation to visual observation in the dark of night
may tend to distract and confuse the watch officer as well as to disturb his
orientation in relation to the precise nature of the situation that confronts
him.

\(^{29}\) Id. at 148.

\(^{30}\) Id. at 149.

\(^{31}\) It should be recognized that aboard merchant vessels in absence of thick weather or
dangerous waters the officer on watch is, with the exception of the helmsman, alone on the
bridge. Larger passenger vessels, however, also carry a junior watch officer. Too, radar sets as
presently designed and built do not operate successfully without breakdown when they are
kept in continuous transmission. Also, when a radar set is switched on and off at frequent inter-
vals, its many tubes tend to have short life.
The question was approached in a relatively recent case, *Oliver J. Olson & Co. v. The Marine Leopard*, involving a collision off the coast of California between the southbound Leopard and the northbound Howard Olson. Their lights were bright and the night was clear. Both ships were equipped with radar and the Leopard had her set in operation. The Olson’s radar was secured. The Leopard’s watch officer used his set only to take occasional observations on the Olson after sighting her visually. Visual bearings by both vessels on the lights of the other revealed no appreciable change indicating that the ships were on courses which would result in possible collision. The court felt that if radar plots had been taken the ships would have been better appraised of the approaching danger, but concluded its discussion in regards to radar usage under such circumstances with the following statement:

> While I hesitate to go so far as to hold that each vessel was at fault for failing to utilize the full potentials of its radar, I do not believe that Snow [master of the Leopard] and Zinkiewicz [watch officer of the Olson] actions in this regard constituted poor seamanship.

This is the correct approach. The fact that the bearing of the other vessel failed to appreciably change was sufficient notice that there was danger of collision and that action must be taken by the burdened vessel or vessels.

However, in the *United States v. S.S. Washington* the court appears to feel that it was negligence for the second mate of the Washington not to use his radar on a clear night when he breached the starboard hand rule in cutting across a lighted peacetime naval convoy and collided with a tanker. It was, however, the violation of the starboard hand rule upon which the fault of the Washington was basically formulated. But the court, in speaking of the conduct of the second mate, said:

> The Washington was equipped with radar and he admits that he did not look at it after 2 a.m., which was 15 minutes prior to the collision. ... If proper attention had been paid to the radar on the Washington, the danger of collision ... should have been seen. *Furthermore the second mate was keeping no adequate lookout.* (Emphasis added.)

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33 The International Rules of the Road provide, as a preliminary consideration to the Steering and Sailing Rules thereunder, that: "Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist." 65 STAT. 417 (1951), 33 U.S.C. § 146 (1952).
34 152 F. Supp. at 206.
36 Where vessels are crossing and a risk of collision is ascertained, the vessel which has the other on her own starboard (right) side is under a duty to take such action as is necessary to avert the collision risk. 65 STAT. 418 (1951), 33 U.S.C. § 146c (1952).
37 241 F.2d at 823.
The last sentence of the above quote is destructive of the court's statement that more attention should have been given to the radar by the second mate. Clearly he was negligent in not avoiding the convoy when he sighted it, for the starboard hand rule was strictly applicable; but no man can give proper attention to what the radar reveals so that he may determine the action he should take therefrom and at the same time keep a proper lookout and base his actions thereon. This case should not be authority for the proposition that the radar must be used on clear nights with lights bright merely because another vessel or vessels have been sighted. If such a duty is to arise when other vessels are thus sighted then there should be a correlative duty to call the master or another ship's officer to the bridge so that one might man the radar while the other cons the vessel. Furthermore, this duty should then extend to the daytime hours as well as the dark hours for a visual sighting of the ship itself is often less revealing as to its course than is a proper interpretation of its lights at night.

The Matter of a Radar Plot

There has been considerable literature in the trade magazines on the appropriateness of making radar plots of vessels appearing on the radar scope by the use of maneuvering boards (charts made for this purpose) or on the vessel’s plotting sheets (charts used for navigation upon the high seas). The cases too have indicated that this should be the proper practice, and that it might be negligence not to make such a plot.38

This may be good practice aboard a naval craft where there are usually several men aboard as specialists whose sole duty is radar observation and interpretation, and therefore an accurate track can be kept of other vessels at every moment. But aboard merchant ships it is this writer's experience that such plots are not a necessity and that even in fog continued reference to the other vessel's bearing by radar and its distance off is sufficient to appraise the master of any danger of collision as he cons his ship. A plot involves several computations with reference to time, distance, and bearings, before the course and speed of the other ship can be ascertained. This results in a much greater chance of error than where a close check on the bearing and distance off of other vessels is the method chosen. Further, it can never be known when the vessel being plotted will suddenly change her course or alter her speed, thus making such computations reliable only momentarily.

It is therefore submitted that as a method of collision avoidance by use of radar that the plot aboard the average merchant vessel need not be taken to ascertain the danger of collision either in clear or foggy weather. That there should be one exception to this conclusion will be discussed under that section of this article dealing with that Rule of the Road which requires a vessel in restricted visibility, upon hearing the fog signal of an-

38 See Polarus Steamship Co. v. The T/S Sandefjord, 236 F.2d 270 (2d Cir. 1956), cert. denied, 352 U.S. 982 (1957).
other vessel apparently forward of her beam, to stop her engines if the position of that vessel is not ascertained.

Radar Considered in Relation to Particular Rules of the Road

\textit{Speed in Fog}

Rule 16\textsuperscript{30} of the International Rules of the Road is often called the moderate speed rule. The rule has two parts and each involves problems concerning the use of radar. We will first discuss that part of the rule which in effect requires every vessel when in fog or any conditions of similarly restricted visibility to “go at a moderate speed, having careful regard to the existing circumstances and conditions.”

What is a moderate speed? Robinson in his Hornbook on Admiralty gives this definition:\textsuperscript{40}

Moderate speed is a variable with regard to the existing circumstances, but it has tended to the formula that the vessel shall not proceed in a fog at a speed at which she cannot be stopped dead in the water in one half the visibility before her.

This doctrine that moderate speed is a speed whereby a vessel can be stopped within one-half the distance of visibility received its impetus from an 1896 Supreme Court decision.\textsuperscript{41} Many later cases have spoken of existing circumstances and conditions as being the ingredients to vary the formula, but the courts nonetheless always seem to return to the one variable, the visibility; that is, the greater the visibility the faster a moderate speed.

Whether or not radar will be a circumstance or condition which may abrogate the one-half the distance of visibility concept has not been made precisely clear by the courts, but the approach seems to be that the same standard will be applied to vessels with radar as is applied to those without it.\textsuperscript{43}

A British court said:\textsuperscript{44}

\ldots [T]he possession of radar is not a good excuse for defying the Collision Regulations, or for proceeding at an immoderate speed in fog.

\textsuperscript{40}ROBINSON, ADMIRALTY LAW IN THE UNITED STATES § 110 (1939).
\textsuperscript{41}The Umbria, 166 U.S. 404 (1896). Formula or no, on the high seas at any rate, ship's masters will continue to propel their vessel at cruising speed. Thick to dense fogs often shroud vast ocean areas, sometime for the duration of an entire crossing. Should in these instances the master proceed at a moderate speed he would soon be looking for a new berth. Ship-owners demand that schedules be kept. If the master should find himself in a collision under such circumstances he will surely find his license revoked. If he had radar in use he will find that this will not excuse him. That a ship's master has been sentenced to imprisonment for negligence in fog through reliance on radar and the antics causing the collision see, \textit{Radar and the Rules of the Road, 12 Proceedings of the Merchant Marine Council 2 (1955)}.
\textsuperscript{42}For the general confusion surrounding the definition of what is a moderate speed and as this term is conditioned by the ability to stop, see 33 U.S.C.A. § 145n (1957).
\textsuperscript{43}See note 38 supra.
\textsuperscript{44}The Miguel de Larrinaga, [1956] 2 Lloyd's L.R. 530, 538.
Why should not the fact that the vessel has radar be such an existing circumstance so as to allow a radar-equipped ship to proceed in foggy weather at a clip greater than that which would be allowed a ship without radar? The answer is that radar is not the all-seeing eye as it is sometimes referred to. Such a vessel may in fact steam full ahead in a fog, avoiding many collisions which she would otherwise have been unable to do because of fine interpretation of what is seen on the scope and subsequent excellent navigation in putting such information to practical maneuvering use. But there are many other factors that negate this apparent safety and they may arise no matter how competent the personnel and how sharp the equipment.

First, though radar may well pick up all large vessels and most smaller ones, certain fishing boats and other small craft made of wood are also entitled to be protected under conditions of poor visibility. These vessels may be completely missed by the radar, or by the operator who fails to see them on the scope due to the weakness of their signal return or because such a small and weak pip may be lost in the “sea return.”

This inadequacy was recognized in *Wood v. United States* where a troop transport steamed at 15 knots in one-half mile visibility with her radar in operation. She struck a fishing trawler after futilely reversing her engines at the last moment. The court said:

There is upon this record no plausible explanation for failure to exercise the same caution displayed earlier when the Wilson Victory was slowed down in heavy fog unless we accept the pilot’s statement that considerable reliance was placed upon radar. . . . Respondent’s expert conceded that the radar model on the Wilson Victory could readily miss low-lying ships or fishing trawlers. . . . The fact is that the radar did not pick up the Bucen-taur before it was struck.

In *Borcich v. Ancich* two fishing boats collided outside the breakwater entrance to San Pedro Bay in California. In discussing their maneuvering the court mentioned without elaborating thereon, that one of the ships passed into a blind spot in relation to the other’s radar, and hence was not visible on the screen of the radar-equipped boat. A ship that has such a blind spot has to that extent no radar. There are many large modern ships afloat today with excellent radar equipment aboard that under certain conditions have blind spots that extend outwards from just ahead to several miles. This writer served aboard a fast Mariner class freighter recently and discovered that when this ship had a deep draft aft and a shallow draft

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*Sea return* consists of targets on the radar screen reflected off the ocean waves in moderate to rough weather. They may be so strong and numerous when the seas are very rough to blot out the pip from a small vessel, and in some instances even a large ship.


Id. at 50.

191 F.2d 302 (9th Cir. 1951).

A blind spot is an area, usually covering a few degrees of arc, where due to structural conditions of the radar-equipped vessel (the stack, booms, masts and the like) the transmitted radio wave will not hit the target.
forward that a blind spot of a few hundred yards on the port bow became extended to such a degree that the radar would not pick up a rocky island eight miles away. A steamship bearing down within this area would never be seen upon the scope of the radar.

However, in a few cases there are at least insinuations that a radar-equipped vessel might proceed at a speed otherwise immoderate. In a Canadian case, "Dagmar Saten" v. Puget Sound Navigation Co.,50 the court having found that eighteen knots was an excessive speed for a vessel with radar in operation, nonetheless stated51 (in discussing an improper course change on the part of that vessel):

On the other hand, "Chinook" relying on radar and the stopping power of its engines, was traveling at a speed, that in the absence of radar, would have been greatly excessive, and it called for unrelenting attention to the screen and the sharpest appreciation of what it revealed. If radar is to furnish new sight through fog, then the report which it brings must be interpreted by active and constant intelligence on the part of its operator. (Emphasis added.)

One might draw an inference from this quote that in Canadian waters a ship with radar in operation and expertly and attentively manned might proceed through fog at a speed which the court would otherwise find excessive.

An English case52 also made rather ambiguous statements indicating that there might be certain conditions wherein a vessel with radar might have that factor considered in determining whether or not its speed was immoderate. Other English cases have not emitted any such ambiguities.53

For the following reasons, then, a vessel with radar should be treated exactly the same as any other vessel insofar as moderate speed is involved: 1) radar's inability to pick up low-lying craft under certain conditions; 2) the smothering of small craft by sea return; 3) possible blind spots; 4) trapping effect;54 5) change in radar's tuning and sensitivity while in operation;55 and 6) interpretation errors by the radar operator.

The other part of Rule 16 requires that a ship steaming in restricted visibility and presumably at a moderate speed shall, upon hearing apparently forward of her beam the fog signal of another vessel whose position

50 [1951] 4 D.L.R. 1 (Canada).
51 Id. at 4.
53 See The Prins Alexander, [1954] 1 Lloyds L.R. 281, 290, aff'd [1955] 2 Lloyd's L.R. 1, where it was held that the use of radar does not justify any relaxation of the interpretation of Rule 16.
54 Trapping effect is an apparently very rare occurrence wherein the radar wave is trapped by the air strata when there are sharply defined layers of a considerable temperature difference. This prevents the wave from striking objects on the surface of the sea.
55 A set may lose its sensitivity while in operation which will require adjustments by the operator. But he may fail to notice that this has occurred. Most sets have a test device to determine whether or not the equipment is properly receiving, but this requires a test by the operator which he ordinarily might not do unless his suspicion was aroused.
is not ascertained, stop her engines and navigate with caution until the
danger of collision is over.

A radar-equipped ship, however, will probably have picked up the other
vessel on the radar screen long before its whistle is within hearing range,
and there will be no doubt aboard the radar-manned vessel as to the bear-
ing and distance off of the other ship when its fog signal is heard. Does this
mean that for the purposes of Rule 16 that the position of the other vessel
is ascertained? The answer, apparently, is no. The courts have put upon
the word "ascertained" a necessarily strait-jacketed meaning.

In The Beaver, a case involving a collision long before the advent of
radar, the officer of the watch gave as an excuse for not stopping his vessel
when hearing a fog signal forward of his beam that he had located the
sound as well as possible, and that there was no danger of collision. The
court refused to accept this and felt that the duty was almost absolute to
stop under such circumstances, in effect stating that if the other vessel
could not be seen, there was a duty to stop. The court concluded:

... As pointed out by the trial court, the law is that, where a vessel has
committed a positive breach of duty she must show not only that probably
her fault did not contribute to the disaster, but that it could not have done
so. (Emphasis added.)

In The Dagmar Salen, discussed in a preceding section of this com-
ment, a dissenting judge quoted from another case, thus:

In order that the position of a vessel may be ascertained by another ves-
tel within the meaning of the article she must be known by the other vessel
to be in such a position that both vessels can safely proceed without risk of
collision. (Emphasis added.)

Thus it can be seen that if a radar-equipped vessel is to avoid the re-
quirement of stopping when hearing the fog signal of another vessel appar-
ently forward of her beam, she must have done more than merely "sight"
the other vessel on her radar. To know that the other vessel is in such a
position that both can safely proceed she must have actually tracked the
other vessel by a physical plot on the maneuvering board or plotting sheet
so that she can be certain that if the other vessel continues to observe the
Rules of the Road that the ships will pass clear.

If this is done, and then the other ship makes some flagrant violation
of the rules such as increasing speed and changing course so that a collision
results despite all efforts by the radar-equipped ship, it would seem that
both the rule of The Beaver and of The Dagmar Salen have been satisfied.

56 See note 53 supra.
57 219 F. 134 (9th Cir. 1915), aff'd sub nom., Lie v. San Francisco & P.S. Co., 243 U.S.
291 (1917).
58 Id. at 138.
61 See note 55 supra.
Crossing, Meeting, and Overtaking Situations

Rule 19 and Rule 21, taken together, cover what is known as the crossing situation and in effect state that the vessel which has the other on her own starboard (right) side has the duty to take avoiding action if it appears that the vessels will not pass clear of one another. The non-burdened vessel in such a situation is obliged to keep her course and speed, but if after adherence to this obligation she discovers that collision cannot be avoided unless she takes positive action she then must take such action. These rules presuppose that the vessels are in sight of one another and can check each other by bearings to ascertain whether or not the risk of collision exists; and hence they are not applicable to situations arising under the fog rules previously considered.

In The Hindoo, discussed in that section of this article dealing with the duty to use radar, the question was not answered as to the effect of radar, if any, upon the starboard hand rule. The Hindoo and the Australia Star were running blacked-out when the Star picked up the Hindoo on her radar. The master of the Star switched on his running lights, but the Hindoo did not until collision was upon them. The Star had the Hindoo on her starboard side and hence if the starboard hand rule was applicable she was the burdened vessel. The court found that the Star was negligent in not making more practical use of her radar, and, because of its information, failing to take positive collision avoiding action. The court also found that the Hindoo was at fault in not taking action under Rule 27 which provides:

In obeying and construing these Rules due regard shall be had to all dangers of navigation and collision, and to any special circumstances, including the limitations of the craft involved, which may render departure from the above Rules necessary to avoid immediate danger.

The Hindoo, however, contended that the starboard hand rule was applicable in this instance since the Star knew that the Hindoo was on the former's starboard side and that therefore she had to keep clear of the Hindoo, and conversely that the Hindoo was bound to maintain her course and speed, she being held cognizant of the lights of the Star. But the circuit court on appeal said:

... [The starboard hand rule] has no relevance in considering the navigation of the Hindoo for no one aboard her had any knowledge that the Australia Star was equipped with radar. (Emphasis added.)

The court seems to say that if the Hindoo knew that the Star had radar

working, then the crossing rules would have been the proper ones to observe. However, this interpretation should not be given to the court’s conclusions because no ship can ever be certain that the other vessel has her radar in operation, or that if it does, that it is receiving properly.

It is submitted, therefore, that when vessels are running blacked-out the crossing rules are not to be used, but rather that under Rule 27 and Rule 29 both vessels are burdened to take whatever action is most appropriate to avoid collision. If both vessels are equipped with radar and discover danger of collision and for some reason do not turn on their lights and one of them first takes avoiding action, it would then be good seamanship on the part of the other to maintain her course and speed, leaving evasive action once started by the action taking ship to be completed. The discussion above in relation to the crossing situation should be equally applicable to situations where the vessels are meeting head and head, or where one vessel is overtaking another.

The Duty of a Radar-equipped Vessel to Warn Other Ships That They Are in Danger of Collision

Under what circumstances does a radar-equipped ship which observes upon its radar scope that there is a risk of collision between other vessels have an affirmative duty to warn one or both of these ships? Apparently this duty arises only when the radar equipped ship is already obligated to escort, control, or warn the other vessel or vessels.

In The Sobieski this duty was charged to the senior escort officer of a fog encircled convoy. He failed to inform an escorted vessel of the danger of collision with a vessel bearing down upon the convoy despite the fact that his radar fully warned him of a possible disaster. The court realizing that all ships in the convoy had radio-telephone communications stated that warning of such a collision was part of the officer’s duty, and that this was particularly so since he knew that the Sobieski was steaming at a speed which was greatly excessive in the fog, depending, therefore, upon the escort commander for exactly such a warning.

In the United States v. Australia Star the United States was held liable for the failure of a naval escort ship to properly warn the vessel she was escorting of a risk of collision with another ship. The court found further that this duty also extended to the other ship involved in the collision.

Apparently the basis for finding this duty towards the non-escorted ship was founded upon the fact that under the emergency war time conditions the escort had authority to give emergency orders to any allied merchant ship.

60 Ibid.
70 172 F.2d 472 (2d Cir. 1949), cert. denied, 338 U.S. 823 (1949).
The court recognized that the situation was singular and acknowledged that it was unlikely any such duty would be imposed upon a stranger to the scene.\footnote{See note 35 supra.}

**Conclusion**

The increasing number of collisions involving ships equipped with radar makes the problem of materially reducing such collisions imperative.

The need for statutory regulation in the direction of compulsory radar installation, by International Convention if need be,\footnote{That at the International Convention for the Safety of Life at Sea, 1948, the American delegates pressed for an inclusion of radar material in the Rules of the Road as revised at that convention, see McGovern, *Head to Head with Radar*, supra note 13.} is obvious. Such a valuable safety-at-sea measure should everywhere receive favorable response. The cost of such installation when compared to the cost of the vessel and the millions of dollars of cargo carried (to say nothing of the immeasurable value of human life) is negligible.\footnote{The cost of a complete radar installation by Sperry Gyroscope Company approximates $16,000 to $17,000. To build a modern freighter runs into the millions of dollars.}

That many ship's officers are painfully lacking in basic understanding of the principles of radar operation, and equally inadequate, in interpreting what the equipment reveals, is obvious from the cases. Equally obvious is their frequent over-reliance upon radar as they take chances they would never dream of taking had they full comprehension of radar's inadequacies.

The situation demands that prior to the licensing of future deck officers and prior to any re-issuance of presently expiring licenses, the applicants take some sort of practical examination in radar operation and in radar interpretation before the Coast Guard, or obtain a certificate of proficiency from some other governmental agency, or from a school run by a radar manufacturer.\footnote{Sperry Gyroscope Company has radar schools for merchant marine officers and others interested. See note 75 infra regarding schools established by the Federal Maritime Administration.}

Further, as part of the oral examination given to license candidates, the Coast Guard officer in charge should give extensive questioning on the relationship of radar to the Rules of the Road so as to clear up once and for all any false ideas in that direction.

The accomplishment of these suggested goals should be a matter of unified action by governmental agencies,\footnote{The Office of Merchant Marine Safety of the Coast Guard has recommended to the House of Representatives that action be taken in the direction of requiring deck officers certification in radar operation. Hirschfield, *Coast Guard Action Since the Andrea Doria Loss*, 15 PROCEEDINGS OF THE MERCHANT MARINE COUNCIL 1 (1958). Increased governmental activity in another direction is indicated by the recent re-opening of schools by the Federal Maritime Administration for the sole purpose of affording radar training for merchant marine officers. Also see note 22 supra.} insurance underwriters, ship owners, the men who man the ships and their unions, and finally the general public, many of whom, after all, might some day book passage on another "unsinkable" Andrea Doria.\footnote{At this writing the United Nations has in progress at Geneva, Switzerland, a 57 nation conference on the laws of the sea. Perhaps something in the direction of compulsory radar installation will be recommended as a result of this conference.}