



1966

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## Recommended Citation

Raymond T. Letulle, *Electronic Aids to Navigation and Their Basis as Fault in Marine Casualties*, 12 Vill. L. Rev. 160 (1966).

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## ELECTRONIC AIDS TO NAVIGATION AND THEIR BASIS AS FAULT IN MARINE CASUALTIES

### I. INTRODUCTION

Sometime between the years 350 and 300 B.C. Pytheas of Massalia, a Greek astronomer and navigator, sailed from a Mediterranean port to England, Scotland, Thule, Norway and Germany. He carried no sextants, no chronometers, no electronic aids to navigation and, as far as can be ascertained, was involved in no groundings or collisions. The modern merchant vessels of today are normally equipped with an accurate sextant, a reliable chronometer, a gyrocompass which indicates true north, regardless of variation and deviation, and electronic aids to navigation capable of being used in fog or reduced visibility which give a vessel's position within yards and indicate the presence of other vessels up to forty miles away. But in spite of this equipment, an outstanding number of today's vessels are involved in groundings and collisions.<sup>1</sup> The purpose of this comment is to examine these casualties as they have been effected by the misuse or non-use of some of the electronic aids to navigation mentioned above.

### II. BASIS OF FAULT IN MARINE COLLISIONS

In an admiralty collision, the first inquiry is directed at determining whether a vessel has violated a statutory rule. If a violation is found, fault is almost conclusively presumed under the rule of *The Pennsylvania*:

[W]hen, as in this case, a ship at the time of the collision is in actual violation of a statutory rule intended to prevent collisions, it is no more than a reasonable presumption that the fault, if not the sole cause, was at least a contributing cause of the disaster. In such a case the burden rests upon the ship of showing not merely that her fault might not have been one of the causes, or that it probably was not, but that *it could not have been*.<sup>2</sup> (Emphasis added.)

The statutory rules which can be violated in a maritime casualty include the International Rules,<sup>3</sup> the Inland Rules,<sup>4</sup> the Great Lakes Rules,<sup>5</sup> the Western River Rules<sup>6</sup> and the Pilot Rules for Inland Waters.<sup>7</sup>

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1. Casualties such as collisions, fires, and groundings reported and investigated by the United States Coast Guard Marine Inspection Officers totaled 2,134 in 1963; 2,308 in 1964; and 2,179 in 1965. 22 PROCEEDINGS OF THE MERCHANT MARINE COUNCIL, No. 11, at 254 (1965).

2. *The Pennsylvania*, 86 U.S. (19 Wall.) 125, 136 (1874).

3. 77 Stat. 195 (1963), as amended, 33 U.S.C. §§ 241-95 (1964).

4. 28 Stat. 672 (1895), as amended, 33 U.S.C. §§ 151-232 (1964).

5. 28 Stat. 645 (1895), as amended, 33 U.S.C. §§ 241-95 (1964).

6. 26 Stat. 320 (1890), as amended, 33 U.S.C. §§ 301-52 (1964).

7. These rules are issued by the Commandant of the United States Coast Guard as authorized in the Inland Rules, 30 Stat. 102 (1897), as amended, 33 U.S.C. § 157 (1964).

The International Rules, to which this discussion is limited, have the greatest impact on judicial decisions concerned with the use of electronic aids to navigation. They have been adopted by all of the leading maritime nations, and are applied on the high seas and territorial waters of most foreign countries which do not have local navigation rules of their own. The rules have been revised from time to time at international meetings known as Safety of Life at Sea Conferences.<sup>8</sup> The present rules<sup>9</sup> were revised at a 1960 conference and became effective on September 1, 1965.<sup>10</sup> Although the International Rules do not specifically mention the electronic aids to navigation, several courts have found violations of the rules in the failure of vessels to properly use various electronic devices. Of the navigational aids involved in these decisions, radar has received the most notation and comment.<sup>11</sup>

### III. RADAR AND ITS BASIS AS FAULT

#### A. Definition and History

The word RADAR is derived from the phrase RAdio Detection And Ranging. Radar is basically a system for determining the distance of an object by measuring the time interval between the transmission of a pulse signal and the return of the signal as an echo by a transmitter triggered by the outgoing signal. The bearing of the object can be determined by noting the orientation of the directional antenna.<sup>12</sup>

The advent of radar was hailed as the greatest achievement in the history of shipboard safety, yet its use has not resulted in the significant reduction in marine collisions and groundings originally prophesied. On the contrary, radar has caused many collisions that might have otherwise been avoided.<sup>13</sup> The United States Coast Guard has indicated that, in almost every collision case involving radar that was investigated by them, improper use of radar or improper interpretation of the information provided by it was a major cause of the disaster.<sup>14</sup> These statistics are attributable in large part to the fact that many ship operators were not properly schooled in the use of radar.<sup>15</sup> Furthermore, ship officers were

8. These are sometimes known as "SOLAS" Conferences.

9. For a history of the International Rules see MARSDEN, COLLISIONS AT SEA 423, 446 (11th ed. 1961).

10. 77 Stat. 195 (1963), 33 U.S.C. § 1053 (1964).

11. See generally Healy, *Radar and the New Collision Regulations*, 37 TUL. L. REV. 621 (1963); Schmidt, *Radar and Marine Collisions Today*, 10 HASTINGS L.J. 71 (1958).

12. PRINCIPLES OF ELECTRONICS AND ELECTRONIC SYSTEMS 332 (2d ed. 1962).

13. See *The British Aviator*, [1965] 1 Lloyd's List L.R. 271, 273, wherein the court states: "It was a collision which never ought to have happened at all; and one can confidently say that it would not have happened if the ships had not been equipped with radar. . . ."

14. Slack, *A Fresh Look at the Rules of the Road and Radar Navigation*, 21 PROCEEDINGS OF THE MERCHANT MARINE COUNCIL, No. 7, at 113 (1964).

15. This situation has been at least partly remedied by a requirement that every applicant for an original license or raise of grade for service on ocean, coastwise, or Great Lakes vessels of 300 gross tons and over shall demonstrate, by professional examination, his qualifications as a radar observer. 46 C.F.R. § 10.05-46 (1966).

lulled into a false sense of security by the "all seeing eye" and plunged head-on into dangerous situations without regard for its very significant limitations.<sup>16</sup> In addition, many ship's masters viewed radar as a justification for their failure to fully comply with the Rules of the Road. In response to these abuses, courts of law began evaluating radar in terms of its relation to the Rules of the Road.

### B. Radar and its Effect Upon the Rules of the Road

1. *Radar and Rule 16(a)*. — The question of proper speed in fog is perhaps the most perplexing problem of maritime law. A normal ship operator, in order to satisfy sailing commitments, maintain schedules, and effectively compete with other modes of transportation, must keep his vessel moving. In the heavily traded areas of the North Atlantic, it is not uncommon for a ship to travel from New York to Northern Europe under heavy fog. If a ship were required to wait for clear visibility, a normal eight day run for a typical C-2 freighter might be stretched into two or three weeks. Under these conditions, it is doubtful that any steamship company could stay in business. The Rules of the Road that the courts have formulated with regard to speed in fog have been utterly unrealistic and, as a result, have been ignored by probably every steamship company.<sup>17</sup> Several recent decisions, and certain language contained in the new International Rules, indicate that the courts may arrive at new standards which allow speeds in fog that are more in keeping with the necessities of the maritime industry, and which will be applied only where a vessel is equipped with radar.

Rule 16(a) of the International Rules requires a vessel to maintain a *moderate* speed in fog, mist, falling snow, heavy rainstorms or any other conditions similarly restricting visibility.<sup>18</sup> The word "moderate" has received various definitions by different courts, but it is most frequently defined as "a speed sufficiently low to permit a ship to come to a complete stop within a distance equivalent to half that of visibility."<sup>19</sup> In common situations where a ship cannot see its bow or anchor, the courts will sometimes recognize the "Bare Steerageway Rule."<sup>20</sup>

Prior to the adoption of the amendments to the International Rules, the courts were more or less consistent in condemning any departure from

16. These limitations include: (a) Inability to pick up low-lying wooden vessels at times; (b) "Ghost echoes" due to false reflection of radar signals; (c) Possible blind spots on the vessel caused by masts or the smoke stack interfering with the radar signal; (d) Smothering of closely situated vessels due to excessive sea-return.

17. This is the opinion of many ship's officers who have talked or sailed with this writer.

18. 77 Stat. 205 (1963), 33 U.S.C. § 1077(a) (1964).

19. The Silver Palm, 94 F.2d 754 (9th Cir. 1938).

20. This rule allows a vessel to use short bursts of speed in order to maintain bare steerageway. See *Pennsylvania R.R. v. Central R.R. of N.J.*, 103 F.2d 428 (2d Cir.), *cert. denied*, 308 U.S. 591 (1939) (*dictum*).

these rules merely because a vessel was equipped with radar.<sup>21</sup> But when the problem of moderate speed was considered by the Safety of Life at Sea Conference in 1960, it was recommended in the Annex to the International Collision Regulations that "information obtained from the use of radar is one of the circumstances to be taken into account when determining moderate speed."<sup>22</sup> The Annex also contained the warning that small vessels, small icebergs, and similar floating objects may not be detected by radar, and that radar indications of one or more vessels in a particular area may mean that "moderate speed" should be slower than a mariner without radar might consider moderate under the circumstances.<sup>23</sup> This language is obviously not a model of clarity; only litigation will reveal precisely what these sentences imply. However, it is significant that the Convention did not ignore radar, but explicitly included it as one of the factors to be considered in determining moderate speed. For this reason it is at least arguable that vessels properly using radar in areas normally free of icebergs and small vessels may proceed at speeds greater than vessels not equipped with radar. After the Annex to the collision regulations was proposed, it was asserted in *The Kurt Artl*:<sup>24</sup>

[R]adar, as well as being an aid to navigation, is an aid to safety and should be used as such; while if properly used and relied [sic] to indicate all potential dangers in ample time safely to avoid them, it may give some justification for a speed in restricted visibility which would otherwise be immoderate, such a speed can only be justified so long as it is safe to proceed, and provided that timely action is taken to reduce it or take off all the way in the light of the information supplied or to be inferred from the radar.

In another English case, *The Sitala*,<sup>25</sup> the court implied that radar may justify what would normally be immoderate speed, if it is used properly and with seamanlike prudence with regard to the indications and inferences which are derived from it. While the language referred to in *The Kurt Artl* and *The Sitala* decisions was dicta, it does reveal a tendency of the courts to consider the proposition that, in certain circumstances, ships using radar may be permitted to travel at greater speeds than vessels without radar. It remains for future cases to define the situations in which greater speeds will be permitted.<sup>26</sup>

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21. *Wood v. United States*, 125 F. Supp. 42 (S.D.N.Y. 1954); *The Miguel de Larrinaga*, [1956] 2 Lloyd's List L.R. 530.

In one case, the failure of a vessel owner to properly supervise his ship's officers in their use of radar in fog caused him to lose his right to limit liability in a collision case. *The Lady Gwendolen*, [1965] 1 Lloyd's List L.R. 335. For a discussion of this case see Ramberg, *Radar Navigation and Limitation of Liability*, 1966 J. Bus. L. 115.

22. 77 Stat. 209 (1963), 33 U.S.C. § 1094(2) (1964).

23. *Ibid.*

24. [1962] 2 All E.R. 27, 32.

25. [1963] 2 All E.R. 290, 292.

26. These circumstances should include the location of the vessel, type of ship, and accuracy of the radar equipment.

2. *Radar and Rule 16(b)*. — Rule 16(b)<sup>27</sup> of the International Rules provides:

A power driven vessel hearing, apparently forward of her beam, the fog-signal of a vessel the position of which is not ascertained, shall so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over.

Until recently, most courts agreed that a vessel could not employ radar to ascertain the position of another vessel.<sup>28</sup> However, several cases and the newest amendments to the International Rules imply that a contrary rule is in the offing. *Weyerhaeuser S.S. Co. v. United States*<sup>29</sup> involved a collision between the S.S. *Weyerhaeuser*, proceeding southbound from Coos Bay, Oregon, and the S.S. *Pacific*, sailing northbound from Bandon, Oregon. Visibility was reduced, and each vessel was aware of the other's presence by means of radar; neither vessel stopped its engines when it heard the fog signal of the other. The court was of the opinion that "ascertainment" of a vessel's position by radar was an adequate justification for failing to comply with the technical requirement that engines be stopped.<sup>30</sup> An English court had occasion to consider the propriety of a vessel using radar to ascertain the position of another vessel in *The Prins Alexander*.<sup>31</sup> In that case the court asserted that position could not be ascertained unless both vessels could proceed without risk of collision. While conceding that the proper use of radar might meet this requirement, the court did not find it present in the case at bar.<sup>32</sup>

In the preliminary note to rules 15 and 16, it is stated that possession of radar information does not relieve any vessel of the obligation of conforming strictly to the obligations imposed by the rules. The Annex states that radar range and bearing alone do not constitute ascertainment of the position of another vessel under rule 16(b). Several English decisions<sup>33</sup> have interpreted this part of the new rules to mean that ascertainment requires, at the very least, knowledge of the other vessel's course and speed and, perhaps, her probable future course and speed. One commentator has suggested that this part of the rule indicates that a plotting of the vessel's course and speed by a series of radar ranges and bearings may meet the required "ascertainment".<sup>34</sup>

This problem will certainly be the subject of much discussion in the future. Its proper solution should be a relative one, depending not only

27. 77 Stat. 205 (1963), 33 U.S.C. § 1077(b) (1964).

28. *Afran Transp. Co. v. The Bergechief*, 274 F.2d 469 (2d Cir. 1960); *Avondale Marine Ways, Inc. v. The Crescent Cities*, 184 F. Supp. 773 (D.C. La. 1960).

29. 174 F. Supp. 663 (N.D. Cal. 1959), *aff'd*, 294 F.2d 179 (9th Cir. 1961). See Note, 33 TEMP. L.Q. 231 (1960).

30. 174 F. Supp. at 668.

31. [1955] 2 Lloyd's List L.R. 1.

32. *Id.* at 8.

33. *The Gunnar Knudsen*, [1961] 2 Lloyd's List L.R. 433; *The Sitala*, [1963] 2 All E.R. 290.

34. See Wylie, *Radar and The Rules of the Road*, 19 PROCEEDINGS OF THE MERCHANT MARINE COUNCIL, No. 4, at 63 (1962).

on plotting, but also on the location of the vessel and the type of ships or small boats normally found in the vicinity. Great difficulties are involved in discovering small vessels by means of radar, and there is a danger that the fog signal heard may not be from the vessel present on the radar screen, but from a different source.

3. *Radar and the Steering and Sailing Rules.* — Prior to the advent of the newly amended rules, the courts were in disagreement over the proper application of rules 17 to 24, known as the "Steering and Sailing Rules."<sup>35</sup> The majority of courts found fault in a vessel relying on radar observations for the purpose of executing rudder actions in compliance with these rules,<sup>36</sup> while a few decisions held that a vessel was at fault for not taking rudder actions on the basis of radar bearings and ranges.<sup>37</sup> The new rules appear to solve this problem by stating that "rules 17 to 24 apply only to vessels in sight of one another."<sup>38</sup>

4. *Radar and Rule 29.* — Rule 29 requires a vessel to maintain a proper lookout.<sup>39</sup> While it has been argued that the use of radar alleviates the need for this requirement, the courts have uniformly held that radar will not excuse the neglect to maintain a proper lookout.<sup>40</sup>

### C. Use or Non-use of Radar as Fault

1. *Failure to Equip a Vessel with Radar.* — At the present time no country requires that vessels be equipped with radar by its statutory law,<sup>41</sup> nor did the International Convention for the Safety of Life at Sea include such a requirement in any of the amendments to the International Rules. The Convention did recommend, however, that the various contracting governments should encourage the installation of radar on certain types of vessels.<sup>42</sup>

Several cases have considered the effect of the failure to equip a vessel with radar on the seaworthiness of the vessel. Until 1960, most courts were of the opinion that failure to supply a vessel with radar did not render a ship unseaworthy.<sup>43</sup> However, several recent decisions indicate that a shift to a contrary rule may be forthcoming. In *Afran Transp. Co.*

35. 77 Stat. 205 (1963), 33 U.S.C. §§ 1078-89 (1964).

36. *Dagmar Salen v. Puget Sound Nav. Co.*, [1951] 4 D.L.R. 1. See also Healy, *Radar and the New Collision Regulations*, 37 TUL. L. REV. 621, 632 (1963).

37. *Weyerhaeuser S.S. Co. v. United States*, 174 F. Supp. 663 (N.D. Cal. 1959), *aff'd*, 294 F.2d 179 (9th Cir. 1961).

38. 77 Stat. 205 (1963), 33 U.S.C. § 1078(4) (1964).

39. 77 Stat. 208 (1963), 33 U.S.C. § 1091 (1964).

40. See *Wood v. United States*, 125 F. Supp. 42 (S.D.N.Y. 1954).

41. 17 AM. JUR. *Proof of Facts* § 9 (1966).

42. See *International Convention for Safety of Life at Sea* (1960) § 146 ANNEX D. REC. 45.

43. *White Stack Towing Corp. v. Bethlehem Steel Co.*, 279 F.2d 419 (4th Cir. 1960); *Afran Transp. Co. v. The Bergechief*, 274 F.2d 469 (2d Cir. 1960); *President of India v. West Coast S.S. Co.*, 213 F. Supp. 352 (D.C. Ore. 1962), *aff'd*, 327 F.2d 638 (9th Cir. 1964), *cert. denied*, 377 U.S. 924 (1964).

*v. The Bergechief*,<sup>44</sup> the Court of Appeals for the Second Circuit suggested that a rule requiring radar, subject to certain limitations and qualifications, would sooner or later be put into effect. In making this statement the court relied on Judge Learned Hand's opinion in *The T. J. Hooper*,<sup>45</sup> where a tug was held unseaworthy for failure to be equipped with a radio receiving set, even though no statute, regulation, or custom required it. *The President of India v. West Coast S.S. Co.*<sup>46</sup> involved a tramp steamer built during the Second World War, which ran aground on a reef in the Pacific Ocean. The court, while recognizing that the absence of radar on such ships might well make them unseaworthy in the not too distant future, nevertheless found the *President of India* seaworthy. Crucial to the court's decision was the fact that it was not customary at this time for ships of this type to be equipped with radar:

Improvements in the means and modes of navigation frequently require new implements or new forms of old ones, and these though not necessary at first, become so when there is an established usage on ships of a certain quality, or those to be sent on certain voyages or used for certain purposes.<sup>47</sup>

In the light of these recent decisions, it is quite probable that a newly-constructed passenger vessel frequenting the North Atlantic Trade Route, where fog is prevalent, would be found unseaworthy if she had a collision and no radar were on board. However, as the language of the *West Coast S.S.* case indicates, an older freighter traveling the South Pacific, where fog is rarely encountered, would probably not be held unseaworthy for not being equipped with radar. The test to be employed appears to be a relative one, dependent on the type of vessel, its ports of trade, and its age.

2. *Failure To Use Radar When Onboard.* — Many decisions have indicated that there is an affirmative duty on the part of a vessel carrying properly functioning radar to use it when she is in or near an area of known reduced visibility.<sup>48</sup> Until recently, it was thought that this may be the only time that a vessel was required to use radar,<sup>49</sup> but several decisions indicate that the courts have expanded the times during which radar must be used to include certain situations where visibility is unlimited. One court has found the duty of a vessel to use radar breached where a mate on watch violated the starboard hand rule in a crossing sit-

44. 274 F.2d 469 (2d Cir. 1960).

45. 60 F.2d 737 (2d Cir. 1932), *cert. denied sub nom.* Eastern Transp. Co. v. Northern Barge Corp., 287 U.S. 662 (1932).

46. 213 F. Supp. 352 (D.C. Ore. 1962), *aff'd*, 327 F.2d 638 (9th Cir.), *cert. denied*, 377 U.S. 924 (1964).

47. 213 F. Supp. at 356.

48. *Afran Transp. Co. v. The Bergechief*, 274 F.2d 469 (2d Cir. 1960); *The Medford*, 65 F. Supp. 622 (E.D.N.Y. 1946); *The Esso Plymouth*, [1955] 1 Lloyd's List L.R. 429. See Note, 32 CORNELL L.Q. 570 (1947); Note, 33 VA. L. REV. 86 (1947).

49. See *Petition of United States*, 131 F. Supp. 712 (E.D. Va. 1955), *aff'd sub nom.* British Transp. Comm'n v. United States, 230 F.2d 139 (4th Cir. 1956), *aff'd*, 354 U.S. 129 (1957). See also Schmidt, *Radar and Marine Collisions Today*, 10 HASTINGS L.J. 71 (1958).



uation on a clear night,<sup>50</sup> while another court has held a vessel at fault for failing to use its radar to search for sudden squalls before leaving a dock.<sup>51</sup> A similar result was reached in the *Continental Oil* and *Placid Oil* cases where two vessels, proceeding in the Gulf of Mexico on clear, dark nights struck drilling platforms.<sup>52</sup> The courts placed great emphasis on the large number of drilling platforms in the area of the collisions and the unfamiliarity of the officers on watch with the particular locality.

In all of these decisions, the courts are, in reality, following the dictates of rule 29 which require vessel owners, masters, and crewmen to take any precautions that the ordinary practice of seamen, or the special circumstances, may require.<sup>53</sup> If the dictates of good seamanship would require radar to be used even though visibility is not reduced, the courts will also demand that its use be shown.

3. *Failure To Use Properly.* — A majority of courts are of the opinion that plotting is necessary to insure the proper and most effective use of a ship's radar.<sup>54</sup> There is no doubt that this supposition has validity in the ordinary situation, but there are certain circumstances in which a plot may be meaningless, and even dangerous to proper navigation. For example, in narrow winding rivers where vessels are constantly changing direction, relative ranges and bearings would be practically useless. Furthermore, in certain areas of the world, such as the English Channel, the number of targets on a radar screen can become so dense that a plot of every vessel would require an inordinate amount of time and would interfere with the other duties of the watch officer.<sup>55</sup> It is submitted that any dispute with regard to whether a plot should be maintained can only be answered by considering the entire circumstances of the case.

4. *Failure to Make Repairs to Existing Radar.* — There is a significant lack of cases dealing with the question of whether a vessel is required to make repairs to existing radar. In *Petition of the United States*, the court treated the problem in the following manner:

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

50. *United States v. S.S. Washington*, 241 F.2d 819 (4th Cir. 1957), *cert. denied*, 355 U.S. 817 (1957).

51. *Daniels v. Wienertor*, 1966 A.M.C. 817 (M.D. Fla. 1964).

52. *Placid Oil Co. v. S.S. Willowpool*, 214 F. Supp. 449 (E.D. Tex. 1963); *Continental Oil Co. v. M.S. Glenville*, 210 F. Supp. 865 (S.D. Tex. 1962).

53. Nothing in sections 1061-94 of this title shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper look-out, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

77 Stat. 208 (1963), 33 U.S.C. § 1091 (1964).

54. *Afran Transp. Co. v. The Bergechief*, 274 F.2d 469 (2d Cir. 1960); *Polaris S.S. Co. v. The T/S. Sandefjord*, 236 F.2d 270 (2d Cir. 1956), *cert. denied*, 352 U.S. 982 (1957).

55. The majority of merchant ships have only one watch officer who in addition to avoiding other vessels must continuously maintain the position of his own vessel and perform many other functions.

of repair. . . . Had it been in operation, the situation so urgently demanding its services, omission to use it would clearly have been negligence [*sic*]. 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.<sup>56</sup>

One commentator has suggested that the problem of repairs should be separated into two parts — a failure to make major repairs would not amount to negligence, while a failure to effect repairs of a routine nature which could be done by the crew would constitute negligence.<sup>57</sup> Perhaps the best solution would be to treat repairs in connection with the requirement of the "Good Seamanship Rule."<sup>58</sup> If a prudent navigator would have had the repairs made, it would be negligent to fail to make them, even though they amounted to major repairs. The opportunity for repairs at a particular port and the intended destination of the vessel upon leaving that port would be relevant factors to consider under this test.

#### IV. USE OF OTHER ELECTRONIC AIDS TO NAVIGATION

There has been little litigation arising out of the use of the other electronic aids to navigation. While many remarkable position-fixing devices have been invented in the past quarter of a century,<sup>59</sup> shipping companies are generally reluctant to acquire these new navigational aids if they can continue to operate efficiently by means of the standard sextant and azimuth circle. This is because the initial cost of these new devices is great, and substantial expenditures are required to keep them in repair. As ship speeds increase and the maritime industry becomes more automated, it is probable that the use of the new aids to navigation will greatly increase. As a consequence, many problems can be expected to arise in the future. A discussion of the bases of fault with regard to these new electronic devices is therefore relevant:

(a) *Fathometer or Echo Sounder.* — A fathometer is an instrument which determines the depth of water by measuring the time interval between the emission of a sonic or ultrasonic signal and the return of its echo from the bottom.<sup>60</sup> The fathometer's use as an anti-grounding device is obvious, since it enables the navigator to gauge the depth of water he is operating in at all times. Of equal importance is the fathometer's use as an aid in determining a vessel's position, which is accomplished by comparing the

56. *Petition of United States*, 131 F. Supp. 712, 717 (E.D. Va. 1955), *aff'd sub nom.* *British Transp. Comm'n v. United States*, 230 F.2d 139 (4th Cir. 1956), *aff'd*, 354 U.S. 129 (1957). Note, 8 STAN. L. REV. 273 (1956).

57. Healy, *Radar and the New Collision Regulations*, 37 TUL. L. REV. 621, 631 (1963).

58. The "Good Seamanship Rule" is another name for rule 29 cited *supra* note 53.

59. In addition to Loran and Radio Direction Finders, which are discussed *infra*, there are many more position-fixing devices, including Decca, Lorac, and Consol.

60. UNITED STATES NAVY HYDROGRAPHIC OFFICE, THE AMERICAN PRACTICAL NAVIGATOR 923 (1958).

depth shown on the indicator in the wheel house with the charted depth of the area. A fathometer or a mechanical deep-sea sounding machine is required in certain vessels by the Code of Federal Regulations.<sup>61</sup> Its absence on one of the specified vessels would therefore be a violation of a statutory rule, and evidence of unseaworthiness, since the vessel's appliances would be insufficient.<sup>62</sup> Several United States Coast Guard decisions<sup>63</sup> have held that failure to use the fathometer continuously when approaching land, paralleling shorelines, or making landfalls constitutes negligence.<sup>64</sup> But at least one American court<sup>65</sup> has held that there was no duty on the part of a shipowner to use the fathometer when navigating at night out of a dredged channel which was charted as being of sufficient depth.

(b) *Radio Direction Finder*. — The radio direction finder (R.D.F.) is radio receiving equipment which determines the direction of arrival of a signal by measuring the orientation of the wave front by means of a loop antenna.<sup>66</sup> This in turn gives a line of position which, when used in conjunction with one or more lines of position, gives the vessel's location. The use of this instrument on certain vessels is required by the Code of Federal Regulations.<sup>67</sup> Failure to use the radio direction finder was held to be a fault in *Rederiet for M/T Seven Skies v. The S/S North Dakota*.<sup>68</sup> It has also been held negligent for the master of a vessel to rely on R.D.F. bearings when he should have known that they might be affected by "land effect"<sup>69</sup> and "night effect."<sup>70</sup>

(c) *Radio Telephone and Loran*. — At present, no country requires vessels to be equipped with a radio telephone or Loran<sup>71</sup> by its statutory

61. 46 C.F.R. § 32.15-10 (1966).

62. For a discussion of unseaworthiness, see GILMORE & BLACK, ADMIRALTY § 6-38 (1957).

63. These decisions are contained in the Commandant's Appeal Decisions, which are appeals from cases before the Hearing Examiner of the United States Coast Guard. The cases are the result of Coast Guard investigations into marine casualties to determine whether revocation or suspension of seamen's papers or licenses is warranted. Although these cases have no bearing upon fault in civil actions before courts of law, they do indicate the Coast Guard opinion with regard to these matters and have a persuasive effect. For the statute authorizing these hearings, see 38 Stat. 894 (1915), 46 U.S.C. § 240 (1964); 62 Stat. 909 (1948), 46 U.S.C. § 240 (1964).

64. Commandant's Appeal Decisions No. 928 (1956); Commandant's Appeal Decisions No. 870 (1956).

65. *Reading Co. v. Pope & Talbot, Inc.*, 192 F. Supp. 663 (E.D. Pa. 1961), *aff'd*, 295 F.2d 40 (3d Cir. 1961).

66. UNITED STATES NAVY HYDROGRAPHIC OFFICE, THE AMERICAN PRACTICAL NAVIGATOR 313 (1958).

67. 46 C.F.R. § 32.15-25 (1966).

68. 242 F. Supp. 385 (S.D.N.Y. 1962), *aff'd*, 347 F.2d 507 (2d Cir. 1965).

69. This is the bending of the direction of the radio wave toward the land due to the fact that the land's conductivity is less than the water's. It normally occurs where the transmitter is located inland. UNITED STATES NAVY HYDROGRAPHIC OFFICE, THE AMERICAN PRACTICAL NAVIGATOR 313 (1958).

70. This is a general distortion of radio direction finder signals from one hour before to one-half hour after sunset or sunrise. *Id.* at 314. For a discussion of the situations in which the Coast Guard requires ship's officers to be aware of these limitations of Radio Direction Finders, see Commandant's Appeal Decisions No. 383 (1949).

71. Loran is a hyperbolic system of navigation by which lines of position are determined by measuring the difference in the time interval between reception of

law. It has been proposed, however, that certain vessels navigating the inland waters of the United States be required to carry radio telephones.<sup>72</sup> This proposal is grounded in the belief that a mandatory bridge-to-bridge telephone system is necessary to back up the required whistle signals, in order to prevent costly navigational errors. It should be noted that such a system, if used in conjunction with radar plotting, would help to indicate the future intention of the plotted vessel and cure one of the greatest difficulties of radar navigation.<sup>73</sup>

At least one case has held a vessel at fault for improperly using its radio telephone.<sup>74</sup> It is certain that if this view and the above rule is adopted, there will be many additional decisions rendered with regard to this instrument. It is quite likely that Loran will not be required on vessels for some time since other means of position finding, such as R.D.F. and sextants, can be easily and effectively utilized to accomplish the same result. In fact, a recent district court held that the failure to equip a vessel with Loran did not render it unseaworthy.<sup>75</sup>

#### V. CONCLUSION

The operation of a vessel on navigable waters requires a great deal of experience, training, and dedicated attention to duty in order to avoid collisions and groundings. As the number of ships continue to expand the sea lanes of the world, as speeds increase, and as ships become greater in size, the science of navigation will become more complex. It is important to recognize the fact that the wise navigator must use all the reliable aids available to him, and seek to understand their uses and limitations. Machines may reflect the science of navigation, but only a competent human can practice the art of navigation in the manner necessary to avoid needless casualties. The development of the rules regarding radar and the other electronic aids mentioned in this comment indicate how the courts of law will use the weight of judicial condemnation not only to encourage the rapid acquisition of these new devices, but also to insure their proper use by ship's officers.

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synchronized signals from transmitters located at two fixed points on shore. UNITED STATES NAVY HYDROGRAPHIC OFFICE, *THE AMERICAN PRACTICAL NAVIGATOR* 333 (1958).

72. See 22 PROCEEDINGS OF THE MERCHANT MARINE COUNCIL No. 9, at 200 (1965).

73. In this respect, a radar-calling device has been developed which enables a radar observer on one ship to alert his opposite number on another ship to the existence of a dangerous situation. The called observer and the caller can discuss the danger by radio-telephone and agree on appropriate maneuvers. 17 AM. JUR. *Proof of Facts* § 3 (1966).

74. *Reiss S.S. Co. v. United States Steel Corp.*, 245 F. Supp. 444 (N.D. Ohio 1965). In this case the vessel had announced over the radio telephone that she was at anchor when she was still underway.

75. *President of India v. West Coast S.S. Co.*, 213 F. Supp. 352 (D.C. Ore. 1962), *aff'd*, 327 F.2d 638 (9th Cir. 1964), *cert. denied*, 377 U.S. 924 (1964).