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THE LIABILITY OF THE ELECTRONIC CHARTMAKER FOR NEGLIGENT CHARTING

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This is an update of a paper presented by Mr. Obloy at the 5th Biennial International Symposium of the Hydrographic Society (HYDRO 86), Southampton, England, 16-18 December 1986.

Abstract

This paper examines the current state of the law affecting the liability of the nautical chartmaker and engages in 'informed speculation' concerning the probable changes the electronic chart may bring to influence the nature and scope of this liability. Although the governments of the maritime community are likely to be the biggest producers of electronic databases and influence the nature of digital navigational information, the private sector will also be extensively involved in development, manufacture, and dissemination of electronic charts and related digital products. Recognizing how dynamic this new era of digital information is, this paper will only begin to define the parameters of the liability of the private sector and highlight the differences between governmental and private liability in the information age.

INTRODUCTION

> *With the current dynamic nature of the global economy and the need to use our resources in the most efficient manner to promote commerce, the Nation's attention is again being focused on the need for highly accurate and up-to-date marine and coastal information in digital form for nautical charts to support both safe and efficient navigation and maritime resource exploitation.*
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[1] Remarks contained in the Foreword of: *Report of the NOS-CEDD Digital Charting Data Users Workshop*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Charting and Geodetic Services, and International Hydrographic Organization, Committee on Exchange of Digital Data (2-3 April 1985).

We have entered the era of 'digital data.' Some have said we are 'mesmerized by the digit.' Maybe this is the case, but everyday experience demonstrates that digital data is rapidly becoming the most important format of exchanging and using information since the development of the written word. One needs only look as far as the explosive growth of the personal home computer: it is used to play games (these 'games' include very realistic simulations of airplane flight including graphics depicting the various gauges in the cockpit, weapons control in the case of combat aircraft, scenery and even skills associated with landing on an aircraft carrier or navigating a supertanker![2]), teach reading, writing and create graphics, create and manipulate databases, telecommunicate, balance the home budget, etc.; the power to do at home what had been the province of 'main frame' computers a few short years ago.

What makes digital data unique is that not only can it be used to convey information in many forms, but it can also be used to complete tasks. Digital data used to display or describe features on the earth's surface is also an integral part of the navigation systems of the most sophisticated weapons as well as simulators[3]. As Captain Hayes observed, we are entering into a new and exciting time for chartmakers. The versatility of digital data will not only affect navigation but will touch every aspect of the chart-making process: gathering, assessing, interpreting, depicting and disseminating navigational information. We are now beginning to see digital data used to reproduce a traditional paper chart on a video screen, systems which integrate radar and other electronic data emanating from gear on board as well as from shore points, and no doubt soon we will see as commonplace things capabilities that automatically update electronic charts through such means as near realtime Notice to Mariners updates[4] and positioning information from satellites to give the navigator the most complete picture of the environment around him. Indeed, a totally integrated system to aid the Master of a ship is on the horizon, and many varied uses of

[2] VALDEZ is a simulation of supertanker navigation in the Prince Williams Sound area of Alaska. It contains a detailed analysis of ship response characteristics, as well as a model of tidal patterns in the Sound. Navigation is aided by a variable range radar display which shows the land masses and other traffic (ships and icebergs). A unique feature of this simulation is the 256 × 256 element map employed. Sections of this map are peeked at using the radar display. This description of VALDEZ was taken from the DYNACOMP Catalog No. 30, P.O. Box 18129, Rochester, New York 14618, USA.

[3] 'For example the cruise missile is guided primarily by a terrain matching system. Whether launched from land, sea or air, the cruise missile initially utilizes inertial guidance, then, after making a landfall, turns to low-altitude terrain contour matching guidance. An on-board radar altimeter takes readings at predetermined checkpoints along the route, compares this data with an on-board computer map, and corrects the missile's course as required, for extremely accurate targeting.' *Mapping the Earth in Bits and Bytes,* Defense 85, May 1985, Wilkinson Jr., E.A., Rear Admiral, USN, Director, Defense Mapping Agency. This article also discusses the many other weapons systems currently using digital mapping data, such as the Pershing II and Firefinder, and ground hugging aircraft like the A-10.

[4] The Defense Mapping Agency has been operating a digital Notice to Mariners system called the 'Automated Notice to Mariners System' since 1975 and has made it available to interested users since 1982. *Automation Yields Instant Access to Navigational Information,* Inside Marine Microcomputers, March/April 1987. This system gives mariners chart corrections, warnings of navigational hazards such as icebergs, military and gunnery exercises, dredging operations, wrecks and malfunctioning aids, lists of navigational lights and oil-rig locations — and information about incidents of piracy and terrorism around the world. Users may access the data base via INMARSAT and modems. *U.S. file carries piracy alerts,* Soundings Marine, October 1986

digital navigational or positioning systems are being introduced almost daily.[5] New skills will be necessary to harness this 'brave new world.' This paper will provide a framework for discussions enabling decision makers to understand any new exposure to potentially costly lawsuits the digital era may bring and put the liability of the electronic chartmaker, whether government or private, into some perspective.

LEGAL FRAMEWORK

> *The case has been instanced ... and referred to by my brother Denning of a marine hydrographer who carelessly omits to indicate on his map the existence of a reef. The Captain of the 'Queen Mary', in reliance on the map and having no opportunity of checking it by reference to any other map, steers her on the unsuspected rocks, and she becomes a total loss. Is the unfortunate cartographer to be liable to her owners in negligence for some millions of pounds of damages? If so, people will, in the future, think twice before making maps. Cartography would become an ultra-hazardous occupation.*
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> Asquith, L.J.[6]

As we now know, the cartographer can be liable for negligent charting. [7] From the users' perspective this may seem quite reasonable since they are required to have these navigational aids aboard in order for the ship to be considered seaworthy.[8] While no individual cartographer has been sued, the government or private producer of the cartographic products alleged to be erroneous, by whom the cartographer was employed, has. The Defense Mapping Agency (DMA) has defended lawsuits concerning charts, publications and radio broadcasts and its civilian sister agency, the National Oceanic and Atmospheric Administration (NOAA) and the Federal Aviation Administration (FAA), have likewise been accorded the opportunity to defend themselves against claims of

[5] Hammer, John L., III, Captain USN, *The Electronic Chart — It's On Our Doorstep,* Sea Technology, Mar. 1984, pp. 10-15. The article describes integrated navigation systems then under development. Among them is the U.S. Coast Guard's Command Display and Control System (COMDAC) which is an integrated navigation, collision avoidance and tracking system which displays an electronic chart on a cathode ray tube. This chart provides generalized features such as shorelines, danger bearings, channels and buoys. A system using compact discs is Lasr Plot Inc.'s LaserNav 20/20. Commercial systems are beginning to proliferate. 'The Air Force is developing systems to display digital maps in cockpits, as well as digital based training simulators. There's potential for terrain contour matching navigation systems-such as now used in cruise missile guidance —being placed in cockpits for low-level flight operations.' *Charting a World of All-Digital Maps,* Defense 88, March/April 1988, Maj. Gen., Robert F. Durkin, USAF, Director, Defense Mapping Agency.

[6] Candler v. Crane Christmas & Co. (1951) 2 K.B. 164, 1 All England Law Reports 426, 441. (Accountants not liable for negligent misrepresentation in that they owed no duty of care to plaintiffs in preparing accounts and giving their certificate).

[7] De Bardeleben Marine Corp v. United States, 451 F.2d 140 (1971).

[8] The Maria, 91 F.2d 819 (4th Cir. 1937).

negligent charting.[9] Not much has been left untouched. The integration and use of the electronic chart and complementary systems such as satellite positioning information will not end the realities of legal liability.

Issue

The question deserving consideration is whether, and if so, how, will digital navigational systems, such as the electronic chart, change or modify current navigating practices which may cause casualties resulting in lawsuits against the chartmaker or the system designer and manufacturer? [10] When one understands this, then informed decisions can be made to either correct that which may give rise to findings of liability, or resign oneself to the inevitable lawsuit, secure in the knowledge that all that was reasonable has been done to prevent negligence and produce the best possible product.

The professionalism of the chartmaker is the major factor in the ultimate quality of a chart. But for the dedication of the people that design, plan, produce and distribute navigational aids, many more lawsuits would be the rule rather than the exception. This professional pride is exemplified by the reluctance of the chart producers (quite correctly in this author's view) to place 'warnings' or 'disclaimers' on their charts in attempts to avoid liability except when required in limited circumstances to put mariners on notice of hazards to navigation. [11]

Conventional Navigational Aids

The need for accurate products to insure safety of navigation is codified in U.S. Law. [12] In discharging the responsibility to insure safety of navigation,

[9] Empire Transport Inc. v. United States [DMA], 524 F.2d 1 (2nd Cir. 1975); United States Lines Inc. v. United States [DMA], No. 79 Civ. 4209 (S.D.N.Y., May 12, 1983); Rappenecker v. United States [DMA], 509 F. Supp,. 1024 (N.D. Cal. 1980); Southern Natural Gas Company v. United States [NOAA], 711 F.2d 1251 (5th Cir. 1983); Southern Natural Gas Company v. Zapata Haynie Corporation and the United States [NOAA], No. 82-1777, E.D. La., July 29, 1983. Murray v. U.S., 327 F. Supp. 835; 463 F.2d 208 (10th Cir. 1971)(U.S. found negligent in publishing and disseminating aeronautical charts and information falsely indicating that runway lighting was available throughout the night without request.)

[10] 'One of the first operational applications of digital mapping techniques is aboard the Navy's high-speed Patrol Hydrofoil, Missile-class ships. An on-board computer matches digitized navigational charts with the ship's radar on a video display to provide real-time information on inshore coastal features, hazards to navigation, and navigational aids. The ship's radar return is automatically superimposed over the Defense Mapping Agency digital chart to permit safe operation at very high speeds. The system, known as the Hydrofoil Collision and Tracking System, also tracks, prioritizes, and computes collision avoidance data for up to 45 contacts, all related to the true position of the ship .... Then, when approaching harbour, the craft drops down off its hydrofoils and, on its hull, navigates as any other ship. At this time, the on-board computer switches from the digital chart and reads standard Defense Mapping Agency paper navigational charts, again superimposing the chart with the ship's radar on a video display.' *Mapping the Earth in Bits and Bytes,* Defense 85, May 1985, Wilkinson, JR., E.A., Rear Admiral, USN, Director, Defense Mapping Agency, p. 21.

[11] TROOP, Peter M., *The Legal Liability of the Chartmaker,* International Hydrographic Review, Monaco, LXII(1), January 1985. Mr. TROOP recounts the following exchange at p. 120: 'In 1965, the author raised with the then Dominion Hydrographer, N.G. Grey, the possibility of the CHS putting a cautionary note on the charts to the effect that Her Majesty does not assume any responsibility for any errors or omissions that may exist on the chart. Mr. Grey expressed the opinion that such a note would be a retrograde step, greatly lowering our prestige, and not be in conformation with the policy of other major Hydrographic Offices or of the International Hydrographic Bureau.'

[12] 10 U.S.C. 2791-94; 44 U.S.C. 1336 [Nautical charting]; 49 U.S.C. 1301, 1348(b)(3) [Aeronautical charting].

many interests converge on the chartmaker shaping the products. The Government's liability is one which is probably the least important. Governments cannot be sued unless they have consented to be. This is an important legal concept known as 'sovereign immunity.' Generally, it can be stated that the United States has waived its sovereign immunity in many situations. Although there is a plethora of statutes covering many areas of U.S. governmental activity in which the government has consented to be sued, the Federal Torts Claims Act (FTCA)[13] and the Suits in Admiralty Act (SAA)[14] are the primary statutes providing the jurisdictional basis for lawsuits in navigational chart cases.[15] There is an important distinction between the two. The FTCA provides an explicit statutory exception for *discretionary functions* of the government. The SAA has no such exception explicitly stated. The importance of this exception in limiting liability of the chartmaker will be explained later. Fortunately, many decisions of the U.S. courts have incorporated the exception into the SAA. [16].

It is widely accepted in U.S. jurisprudence that the SAA is indeed the statute which provides the jurisdictional basis to a U.S. District Court sitting in admiralty to entertain complaints alleging negligence on the part of the U.S. chartmaker. There is an exception to this accepted principle in the case of the Defense Mapping Agency (DMA). This exception is hidden in the decision of the court in the case of the stranding of PIONEER COMMANDER.[17] Following an extensive trial, which included for the first time admission into evidence of a computer simulation of the stranding, the court ruled in DMA's favor. In a rather unusual set of Findings of Fact and Conclusions of Law, the court also ruled that the United States was immune from the suit because the SAA had not waived sovereign immunity for charting prepared by DMA of international or foreign waters. [18]

[13] 28 U.S.C. 1346(b) and 2671, *et seq.*

[14] 46 U.S.C. 741-752.

[15] De Bardeleben Marine Corp. v. United States, 451 F.2d 140(1971). In the United Kingdom, a lawsuit would be brought pursuant to the Crown Proceedings Act of 1947, 10 & 11 Geo. 6 c. 44; and in Canada pursuant to the Crown Liability Act, 1952-53, c. 30, s. 1. *See also*, Warewick Shipping Ltd v. Her Majesty the Queen, 2 F.C. 147 (1982), *affd* 48 NM.R. 378 (1983)(Although a chart was misleading, the Crown was not liable for the stranding of the GOLDEN ROBIN because no duty of care was owed to individual mariners nor did their master or pilot rely on the chart). For a detailed discussion of the facts and law as it pertains to the stranding of the GOLDEN ROBIN, *see, The Charting and Safekeeping of Oceans and Waterways: Legal Implications,* Dalhousie Law Journal 578.

[16] Williams v. United States, 581 F. Supp. 847 (S.D. Ga. 1983), *affd*, 747 F.2d 700 (11th Cir. 1984); Canadian Transport Co. v. United States, 663 F. 2d 1081 (D.C. Cir 1980). *See also*, Rappenecker v. United States, 509 F. Supp. 1024 (N.D. Cal. 1980)(United States could not be held liable for failure to warn a private cargo vessel, the MAYAGUEZ, of the threat of seizure by Cambodian gunboats). This case is an excellent illustration of the 'discretionary function' exception to the waiver of sovereign immunity incorporated into the SAA by judicial decision. The plaintiffs argued that the failure of the U.S. to issue a 'Special Warning' before the seizure of the MAYAGUEZ was negligence. The Court found the decision whether to issue a 'Special Warning' was a political one arrived at after deliberations at high levels of government. Therefore, it was by its very nature *discretionary*. In Baird v. United States, 653 F.2d 437 (10th Cir. 1981), an aeronautical charting case where it was alleged that the government permitted ambiguous symbols on a Sectional Chart resulting in a crash of a Piper Seneca killing two passengers, the government was found exempt from liability based on a finding that the 'discretionary exemption' applied. The government had decided to leave to the pilot '... the responsibility of further inquiry for details from other sources available to him.' Wolf, *Legally Speaking*, AOPA Pilot, February 1982.

[17] United States Lines Inc. v. United States, No. 79 Civ. 4209 (S.D.N.Y., May 12, 1983).

[18] *Id.*

Standards of Liability

Whether the chartmaker is to be found liable in any given situation is dependent on essentially two legal theories: (1) negligence, i.e., where there are definite errors in navigational aids; or (2) products liability, i.e., where the product may accurately portray information but its design was defective. The former is one most readers are familiar with. The latter is a rather new concept, not yet applied to the nautical chart producer but developing in the aeronautical charting arena. There are significant differences between these two legal theories, very important to the government and the private sector for different but compelling reasons. The United States Government has not consented to be sued for defective products and may only be sued for negligence.[19] The private chartmaker on the other hand faces lawsuits grounded on both theories. [20]

Negligence

Although seemingly elementary, the Government cannot be found liable when a nautical chart accurately depicts information.[21] Similarly, the United States was found not to be liable for failing to chart an underwater obstruction in its Sailing Directions and Notice to Mariners when the obstructions were unknown and not readily ascertainable at the time the publications were produced. [22] However, what constitutes *accurate* can be problematic. For example, the United States was found liable in a case where the chart noted a 'ferry cable' but failed to disclose a hazardous condition, known to the Coast Guard, that the cable became suspended above the water when the ferry was in operation. [23]

The analysis for finding one 'negligent' can be summarized as follows:

a. Did the chartmaker have a duty to the injured party?

b. Did the chartmaker breach that duty?

c. Did the injured party rely on the chart to his detriment?

d. Was the breach of the duty the proximate cause of the injury?[24]

[19] Dalehite v. United States, 346 U.S. 15 (1953).

[20] For a general discussion of the liability of a private aeronautical chartmaker under either theory of legal liability, *see* McCowan, *IFR — The Liability of the Chartmaker*, 44 J. Air L. & Comm. 375 (1979). See also Brocklesby v. Jeppesen, 753 F.2d 794 (9th Cir. 1985); and Saloomy v. Jeppesen, 707 F. 2d 671 (2nd Cir. 1983).

[21] Mango v. Corros, 630 F.2d 224 (4th Cir. 1980) (Government not liable for death caused by collision with a properly marked and charted dike).

[22] Empire Transport, Inc. v. United States, 524 F.2d 1 (2nd Cir. 1975).

[23] Doyle v. United States, 441 F. Supp. 701 (D. S.C. 1977). (U.S. found liable for wrongful death when taught ferry cable could not be seen and plaintiff's boat struck the cable and severed the top of his head).

[24] The liability of the governments of Canada and the United Kingdom for negligent charting are likewise bottomed on these elements. *See, The Legal Liability of the Chartmaker*, Peter M. TROOP, note 13 *supra*; and P.K., Mukherjee, *The Charting and Safekeeping of Oceans and Waterways: Legal Implications*, The Dalhousie Law Journal 578.

To avoid a lengthy discussion on negligence let's just examine a few cases beginning with De Bardeleben v. United States,[25] which will illustrate the legal principles outlined above.

In De Bardeleben, the United States was sued for damages resulting when an anchor on a barge ruptured a natural gas pipeline in Tampa Bay causing property damage to the tug and barges, and personal injury to a mate. The nautical chart on board did not depict the subject pipeline. Although the chart bore the authorized stamp 'Corrected through Notice to Mariners No. 29 ...' (the government conceded this marking was a misrepresentation) it had not been so corrected. Had it been, the pipeline would have been added by hand correction as a result of the Notice to Mariners. While noting that the United States must utilize 'due care' in the preparation of charts, it discharged this responsibility when it issued the correcting Notice to Mariners. That is, the court found that the obligation of the Government ceases at the time in which a prudent shipowner-navigator would have received the Notice to Mariners advising of the publication of a revised chart correctly portraying the condition in question. The United States breached no duty because the Notice to Mariners had announced the publication of new and correct charts, and the mariner had the duty to read it and insure that the charts on board the tug had been properly corrected, irrespective of the erroneous government marking on it.

In the case where the chart may indeed be in error, a showing that it was relied on and the error in the chart was the proximate cause of the damage is necessary to establish liability. The following case illustrates this principle.

"An Untoward Turn — 'We done bought that pier' "[26]

The tug NAVIGATOR and the barge OCEAN CITIES failed to navigate successfully the Chasevilel Turn in the Trout River Cut range on the St. John's River. A shoal on the left ascending side of the river was marked by the U.S. Coast Guard Buoy 69. Although the Coast Guard was negligent in failing to detect and correct the dislocation of Buoy 69, in the absence of any substantial evidence that the person navigating the vessel knew of, or in any way relied on the buoy's charted position in navigating the vessel, dislocation of the buoy was not a cause in fact of the collision between the vessel and pier, and, therefore, the Government was not liable.[27]

A final illustrative example is the case of the stranding of the PIONEER COMMANDER. The PIONEER COMMANDER left Bremerhaven for Bayonne, New Jersey and stranded on the Clettack Skerry in the Pentland Firth on August 17, 1977. The owners of the ship used the United States alleging that an error in

[25] De Bardeleben Marine Corp. v. United States, 451 F.2d 140 (1971).

[26] Captain Giles testifying in the trial of the lawsuit Inter-Cities Navigation Corporation v. United States, 608 F. 2d 1079 (5th Cir. 1979): '... I realized that we wasn't going to make the turn; the barge was swinging a little bit but I knew we wasn't going to make that turn without hitting that pier, and I told My. Rakyta that we had done bought that pier.' p. 1080, Fn. No. 1

[27] *Id.* The court also found that there was no evidence that the chart which was in error was even aboard the vessel.

DMA's Light List, describing the Pentland Skerries Light, caused the stranding. Although the description of the light in DMA Pub. 114 accurately described a group flash, the characteristics were very wrong.[28] However, the court ruled that the ship was unseaworthy, had been negligently navigated and that the error in DMA's publication was not the proximate cause of the stranding.

So we can see that pointing to errors of the chart maker is not substitute for prudent navigation even when it is shown that errors were in fact contained in government products. Proving an error is but one step in the lengthy and often complex litigation of claims involving negligent charting. There is no reason to assume that these basic principles will in any material way change when navigators begin to rely on electronic charts.[29] It is this author's view that integrated digital navigational systems, with near real-time updates to navigational aids such as, the Defense Mapping Agency's Automated Notice to Mariners System, will make proof of *proximate cause* much more difficult. Integrated digital systems will make *prudent navigation* easier, thus shifting further the responsibility from the chartmaker to the navigator. For example, the errors alleged to have caused the stranding of the PIONEER COMMANDER, the error in DMA's Pub. 114 List of Lights, would have been readily ascertainable to the navigator. The integration of radar, depictions of the characteristics of the light itself as reproduced on the video display, together with the charted locations of the lights, would have immediately alerted the navigator that something was not quite right. Couple that with satellite positioning and the shift of responsibility of the navigator for detecting errors and prudently navigating becomes obvious. Similarly, the error in the marking on the chart in De Bardeleben, would not be an issue either because the system would have automatically updated the chart or flashed a warning as to the inconsistency between the Notices to Mariner and the chart. Of course, how helpful these systems are in reality is dependent on design and use.

The legal standard of the *reasonable and prudent navigator* will change. Likewise, the definition of what is a *seaworthy* ship will change. How and to what degree will have to be left to future litigation. However, it seems clear that the ship owner will have to equip the ship with some minimal digital capability and the navigator will necessarily be required to understand the full capability of the integrated system much as he is required to know how to manually integrate conventional sources of information. The defense premised on 'I didn't know the computer could do that,' 'but the paper chart showed,' or 'the computer costs too damn much' will fail.

[28] *The United States List of Lights and Fog Signals for the British Isles, English Channel and North Sea*, Pub. 114, 1976 Edition, described the light as follows:

> 'flash 0.4 second — eclipse 0.1 second
> flash 0.4 second — eclipse 0.1 second
> flash 0.4 second — eclipse 28.6 seconds.'

The Northern Lighthouse Board, United Kingdom, said the light's actual characteristics have remained the same since 1958 at:

> 'flash 0.4 second — eclipse 5.6 seconds
> flash 0.4 second — eclipse 5.6 seconds
> flash 0.4 second — eclipse 17.6 seconds.'

[29] This conclusion is shared by P.K. Mukherjee, L.L.B., Canadian Hydrographic Office, as reported in *The Canadian Hydrographers Association and The Hydrographic Society (U.S. Branch) Proceedings of Joint Workshop*, Dartmouth, Nova Scotia, Canada. April 19, 1985 (p. 21).

While no integrated digital system is widely used, we are beginning to enter that grey area of when it will become an essential tool to navigation such that a failure to have one would constitute negligence or render a ship unseaworthy. Sooner than many may care to admit, we will find ourselves in the situation similar to that of the owners of the T.J. HOOPER where in 1932, despite the absence of statutes, regulations, or even custom as to radio receiving sets, the court found the vessel unseaworthy for lack of one.[30]

Products Liability: Private Producer Beware

The term *products liability* is the name given the legal principle that *strict liability* may be imposed on: ' One who sells any product in a defective condition....'[31]

Why be concerned about *products liability* if you are a private producer?[32] There are two very compelling reasons: One, the manufacturer of the product may bear some or all of the liability; two, the product may be accurate yet still be determined to be defective and thus visit legal responsibility upon the manufacturer, distributor, and seller jointly or severally for injuries sustained in the use of the product.[33]

Liability may be found even where the product was accurate as to its content, but defective for some other reason. This is the single most significant legal consequence of a finding that a chart or other aid to navigation is a product. The traditional defense that the chart correctly portrayed the information provided by the government may not be sufficient to avoid liability if, for instance, it is shown that its design, i.e., scale, graphics, symbology, etc., misled the navigator.

[30] The T.J. Hooper, 2nd Cir. 1932, 60 F.2d 737, *certiorari denied*, Eastern Transportation Co. v. Northern Barge Corp., 287 U.S. 662, 536 S. Ct. 220, 77 L.Ed. 571 (1932)(Two barges had been lost in a storm and the tugs and their tows might have sought shelter in time had they received weather reports by radio).

[31] *See* RESTATMENT (SECOND) OF TORTS Sect. 402A (1965):

> 'Special Liability of Seller of Product for Physical Harm to User or Consumer
>
> (1) One who sells any product in a defective condition unreasonably dangerous to the user is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if
>
> (a) the seller is engaged in the business of selling such a product; and
>
> (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold ...'

[32] While current legal opinion is that the United States can not be found liable on a products liability theory, *(See* note 21, *supra,* and accompanying text) no case against the Government for negligent charting on this theory has been litigated. *But see.* Brocklesby v. Jeppesen & Co., 767 F.2d 1288 (9th Cir. 1985) where the court found the instrument approach chart produced by Jeppesen in accordance with U.S. specifications to be defective, that the chart was a 'product' and thus found Jeppesen strictly liable for the deaths and injuries from an airplane crash. The damages were finally assessed to be over $12,000,000.00. The court noted, however, that the publisher had a right to seek tort law indemnification from the United States.

[33] Aetna Casualty and Surety Co. v. Jeppesen & Co., 642 F.2d 339 (9th Cir. 1981); Saloomey v. Jeppesen & Co., 707 F.2d 671 (2nd Cir. 1983)(Jeppesen found strictly liable for its mass produced navigational chart erroneously indicating that airport had full instrument landing system on the basis that the chart was a 'product' under products liability law).

Unfortunately this is not a mere exercise in speculation. The full impact of a finding of *strict* or *products liability* was dramatically demonstrated in the case Brocklesby v. Jeppesen & Co., 767 F.2d 1288 (9th Cir. 1985), involving a private manufacturer of aeronautical products.

On September 8, 1973, an aircraft crashed into a mountain near Cold Bay Alaska, killing all six crew members and destroying the aircraft and its contents. The private producer of the charts used, Jeppesen and Company, and the United States as a supplier of information used on the chart, were sued by the survivors of the six dead crewman.

The Jeppesen approach charts *graphically* depicted the instrument approach procedures for an airport as that procedure had been promulgated by the United States Federal Aviation Administration (FAA). The procedure included all pertinent aspects of the approach such as directional headings, distances, minimum altitudes, turns, radio frequencies, etc. The specifications prescribed were set forth by the FAA in tabular form. Jeppesen acquired this FAA form and portrayed the information on a graphic approach chart.

The court held that Jeppesen was *strictly liable* for injuries caused by the *defective product* [aeronautical instrument approach chart], because a change in scale between charts would not be readily apparent to the pilot.

This case is sobering to say the least. The impact on Jeppesen was so great that a new law was passed to provide indemnification by the United States should this occur in the future.[34]

ELECTRONIC NAVIGATIONAL AIDS

> *Electronic charts will be a part of a sophisticated navigation and bridge management system on board major vessels involved in international shipping. Coastal operators will be prime users when it can be shown that integrated radar and electronic charts can improve the efficiency of their operation while increasing safety. The large number of coastal recreational boaters will want integrated navigation systems because they will simplify navigation and increase safety.*
>
> Neil Anderson
> Canadian Hydrographic Service[35]

[34] 'Aeronautical Charts and Maps. Sec. 1118 .... the United States Government shall enter into agreements to indemnify any person who publishes a chart or map for use in aeronautics from any claim, or portion of a claim, which arises out of such person's depiction on such chart or map of any defective or deficient flight procedure or airway, if such flight procedure or airway was:

(1) promulgated by the Federal Aviation Administration; (2) accurately depicted on such chart or map; and (3) not obviously defective or deficient.' Sec. 328, P.L. 99-190, Dec. 19, 1985.

An interesting article in the April 28, 1986 issue of the *Legal Times* newspaper reported a strong dissent from the Department of Justice to enactment of this law in a letter to the Director, Office of Management and Budget, Executive Office of the President of the United States: '... Put simply, this seemingly innocuous provision could make the United States partly or wholly liable for any aviation accident ... directly or indirectly attributable to an FAA promulgated flight procedure or airway. Such liability could involve the United States in hundreds of lawsuits annually...' One can only guess whether a like statute for the private nautical chart producer is likely to be passed.

[35] Remarks contained in the Foreword of: *Proceedings of Joint Workshop 'The Electronic Chart,'* The Canadian Hydrographers Association and Hydrographic Society (U.S. Branch), April 19, 1985.

The *electronic chart* (EC) is but only one of the navigational aids currently in existence or planned for conversion into a digital format.[36] The electronic chart will show chart data in digital form or as a photographic image. Navigation will be carried out using it to plan a track, determine the ship's position, and plot the track made good.[38] The Automated Notice to Mariners System (ANMS) in use now is another example of digital navigational information. The most exciting and challenging prospect is the total integration of electronic navigational data and related systems now in use and planned for the future.[39]

Electronic Chart Display Systems

The electronic chart is still very much in the developmental stage. The uncertainty of the technology, coupled with the problems of establishing standardized formats for the databases, and hardware and software systems that manipulate the databases, will continue to affect the development of the electronic chart . Though the international maritime community is still defining its specifications, development of the electronic chart is proceeding apace by both private and governmental developers as a *digital equivalent* of the conventional paper chart to be used alone or as part of an integrated system.[40]

The advantage of the electronic chart seems to lie in its ability to improve on conventional products in two ways. One, it can be designed to show selected features, unclutter an oftentimes cluttered chart, while also presenting navigational aids, such as lights, in their true characteristic rather than relying on the description in a publication or the annotation on a chart. Two, integrated with radar, collision avoidance systems and satellite positioning, it will greatly assist the navigator by providing a dynamic or near real-time capability unknown with today's static conventional paper products.

An added potential benefit would lie in the possibility of automatically updating charts using transmitted Automated Notice to Mariners System data. It is not inconceivable that, rather than performing this critical activity in the current labor-intensive way, it could be performed regularly, accurately and automatically. By having appropriate programs and telecommunications gear, the transmitted ANMS information would be captured, stored and then used to update the appro-

[36] The Director of the International Hydrographic Bureau, Captain James E. Ayres, USN (Ret.), summarized the current situation in a letter to the Secretary-General, International Maritime Organization: 'Industry is forging ahead in this field, with equipments to meet both public and private sector requirements already operational or in an advanced state of development.' IHB S3/8151, January 10, 1985; Annex A, IHB Circular Letter 33/1985.

[37] *id*

[38] *See,* note 6, *supra.*

[39] *See,* notes 7 and 12, *supra,* and accompanying text.

[40] As recently as January 1986, maritime nations recognized the inevitability of the electronic chart but expressed the view that for now it must only be accepted as a supplement to the current paper products. *International Hydrographic Organization Circular Letter 1/1986,* January 15, 1986, IHB File No. S3/8151. *See* also, notes 6 and 11, *supra.* The latest version of the International Hydrographic Organization's (IHO) Special Publication No. 52, Annex, *Updating the Electronic Chart,* was circulated for comment early in 1989, IHO Circular Letter 50/1988.

priate file (electronic chart) without human intervention. Imagine being freed from the vagaries of the postal services![41]

Both capabilities have the potential to increase safety and improve the economics of shipping. These very capabilities will change the standards of liability as it currently exists regarding negligent charting, safe navigation, and vessel seaworthiness, and indeed raise new and interesting legal issues.

We will next examine how the electronic chart described above fits into current legal standards and how they may be changed or affected.

The Electronic Chart and Conventional Legal Standards

The electronic chart will not eliminate the basic legal standards concerning the liability for negligent charting. The manufacturer/supplier of the database(s) required to reproduce the chart accurately will be held to the same duty as currently exists. That is, when the chart is displayed, assuming simply that a conventional chart is reproduced on a cathode ray tube (CRT), the supplier/maker of the database which was used to generate that presentation will be under at least the same duties as currently apply to paper products regarding timeliness and accuracy. However, how that responsibility is discharged or even recognized that it has been, and at what point in time, is very intriguing. Will a simple certification by the manufacturer suffice? Probably not. How then will the user satisfy himself that the database is accurate? Will the manufacturer be willing to simply provide the database as it currently supplies charts without any requirement that the user acknowledge at the time it is transferred that it is accurate and accept responsibility for its accuracy?

The problem is the difference in the media. A paper chart is fixed as to its contents when it is printed. Any changes by the user are obvious. Such will probably not be the case with electronic databases. Their very nature subjects them to changes, both intentional and unintentional, by user manipulation, or simply by the infamous problem of computers: 'The BUG.'

The first and most obvious need is governmental regulation. There are regulations which require the navigator to have certain navigational aids aboard.[42] How should the electronic chart be addressed in these regulations? It does not appear that the *status quo* will suffice. Recognition of the difference in digital information must be addressed. At a minimum, date/time stamping of the file (EC) as to Notice to Mariners updates should be required in addition to identifying, in some fashion, the actual electronic chart used to navigate at various times during a voyage and certainly upon approaching harbour.

Copyright is also a potential problem. Currently, international agreements among the maritime community permit governments to reproduce charts. A technique employed to insure that the charts utilizing copyrighted information are

[41] In re S/T TEXACO NORTH DAKOTA, 570 F. Supp. 1272 (E.D. La 1983).

[42] Title 32 Code Fed. Reg. 164.33 (U.S.A.), requires that all vessels have the most recent, available and currently corrected copy of both the DMA Notice to Mariners and the Local Coast Guard Notice to Mariners.

not inadvertently reproduced without permission is to include a note indicating what parts are copyrighted. How this information will be identified, segregated and noted so that unauthorized reproduction by the manufacturer does not occur is a challenge. The fundamental question of whether governments should copyright the data will need to be reviewed. Since private producers must obtain permission from the copyright holding country to reproduce the database, there is a potential that private exploitation of electronic charting may be stifled.

Intriguing manufacturing questions and their related impact on liability are raised. For example, despite the professionalism and care that goes into producing a chart, inaccurate information is sometimes inadvertently portrayed. Often it is of a nature that is susceptible to human error in the editing process. These are discovered after the chart has been printed and is in distribution. Courts have not yet intervened in the chart-making process, but such may not be the case in a digital era.

For example, if error checking routines could be established to find what otherwise would not have been discovered by current standards, no doubt a court will find that a failure to do so is negligence. Similarly, the duty placed on the navigator will likely change with these new capabilities.

To illustrate, recall the facts in the case of the SS PIONEER COMMANDER.[43] The navigator of the vessel alleged that the error in the Light List describing Pentland Skerries light misled him. However, the light's description in the publication was patently wrong as you can imagine when you attempt to envision how it would actually appear on the horizon if it were flashing in accordance with the description:

flash 0.4 second — eclipse 0.1 second
flash 0.4 second — eclipse 0.1 second
flash 0.4 second — eclipse 28.6 seconds

If the eye could discern that a flash occurred between an eclipse of only 0.1 second, the light would probably look like a pulse rather than a group flash. If the ship were using an electronic chart capable of reproducing the light characteristics the navigator would have been alerted immediately to his mistake. Either the chart would have flashed a warning that the light is non-standard, or when attempting to display it, the chart would either display its strange characteristics, literally, or warn that it did not have the capability to display such an odd flashing light. Such an error checking routine at the time of producing the publication/EC/database could have also detected the error in much the same manner by checking the characteristic against a standardized data set of group flashing lights. It is clear, that if either capability existed for use by the producer or user of the electronic chart, the obvious error in the characteristics of the light as described by Pub. 114 would have been flagged.

One thing is for certain, courts will continue to require that the database be kept accurate. An interesting question is when and by whom? How will the standards change pertaining to updating on-board databases? Certainly the

[43] United States Lines Inc. v. United States, No. 79 Civ. 4209 (S.D.N.Y., May 12, 1983). *See*, note 30 and accompanying text.

manufacturer will be required to distribute a database accurate as of a certain point in time and will be required to update it through the Notice to Mariners or a similar vehicle. The liability for accurate charting will remain the same, but will currency standards remain the same? Probably not.

The mariner may be required to have the capability to receive electronically transmitted Notice to Mariners in order to keep the databases as accurate as possible. Concomitantly, it seems the pressure on the hydrographic administrations to speed up incorporation of new correcting information in the database will grow. If you add to the system a capability to permit users to link-up with the electronic database through telecommunications, and transmit notice of new hazards, a new dimension in time is added to the liability equation. Situations such as were presented in the case of *In re* S/T TEXACO NORTH DAKOTA[44] could have been avoided.

The TEXACO NORTH DAKOTA struck a partially built Chevron oil and gas platform in the Gulf of Mexico. The navigating officers of the vessel did not have onboard the 8th Coast Guard District Local Notice to Mariners which would have alerted them to the platform. Since the vessel had not been put on the mailing list for the local Coast Guard Notice to Mariners, it did not have the most recent correction when it set sail nor did it receive them when it docked at an interim destination. The court held that the tanker owner failed in its duty to maintain an adequate system for updating of navigational charts. The evidence supported a finding that this negligence attributed to the collision.

The capability to receive navigational information through telecommunications cuts the umbilical cord of the mail services with the potential of preventing disasters such as the TEXACO NORTH DAKOTA. For example, the Lykes Steamship Company uses software to download and retain ANMS data. They estimate that use of the ANMS in this fashion allows them to get corrections to their vessels two to three weeks sooner than they normally arrive in printed form from DMA[45]

The use of digital information in admiralty litigation has already occurred. In the trial of the SS PIONEER COMMANDER[46] a video tape of a computer simulation of the stranding was introduced into evidence. The parties agreed to reproduce the events leading to the stranding by using the Computer Aided Operations Research Facility (CAORF) of the National Maritime Research Center, Kings Point, New York. [47] In so doing it was necessary to generate simulated radar scenes, bottom soundings and horizon scenes.

The simulated bridge consisted of a wheelhouse 20 feet wide and 14 feet deep. The equipment on the CAORF bridge was similar to that normally available in the merchant fleet and responds with realistically duplicated time

[44] 570 F. Supp. 1272 (E.D. La. 1983), 1985 A.M.C. 1650.

[45] *See, Automation Yields Instant Access to Navigational Information, Fn. 6, supra.*

[46] *See* notes 19, 30 and accompanying text.

[47] The CAORF is a sophisticated ship-manoeuvering simulator operated by the U.S. Maritime Administration for controlled research into man-ship-environment problems. The major subsystems are: wheelhouse, central data processor, image generator, radar signal generator, control station and human factors stations.

delays and accuracy. The arrangement consisted of a contemporary bridge design containing among other things two radars capable of both relative and true motion presentations, collision avoidance systems, and a digital fathometer. For fear of stating the obvious, if the simulated information could have been 'real data' recovered from the data stored onboard the vessel in its electronic database, the video would not have been that of a 'simulation' but more accurately a replay, like an instant replay in a sports contest. Such a capability is not new, it exists in the 'black boxes' or flight recorders used in the aviation industry. The 'black box' will soon be an integral part of ships also if Lloyd's Register of Shipping has its way.[48]

Resort to the 'black box' for evidentiary purposes in litigations of any kind where navigation is an issue is obvious. Of course, some international standard needs to be set as to time and type of information that must be recorded, and recorded in such a manner that it cannot be tampered with. This technology would permit increased training opportunities through the use of computer simulations of 'real' navigational problems encountered.

Unique Issues of Liability in the Information Age

The entrance on the scene of the electronic chart and other digital systems thrusts the producer, distributor and seller into the information age. This will affect every aspect of liability faced in the era of navigation by conventional means.

The system designers of hardware and software will be subject to liability. They will have to insure that the hardware, processor, data storage, etc. actually assist in prudent navigation, not hinder it. For example, is the video display, of an appropriate resolution and type, mono or color, size, etc., to insure that the information in the database is properly displayed. Many other issues arise: whether a capability to produce a 'hard copy' should be included; system characteristics such as how extensive should the error handling capabilities of the software/hardware be; how user-friendly should the system be; how extensive should the user manuals be? These are questions which must be answered. It is probably safe to assume that no matter what the answer, when a disaster occurs, someone will allege that it was the wrong one.

The owner's duty to maintain a seaworthy vessel will be affected. A decision point will come as to when and to what degree these new systems should be placed on board ship. One can only hope that this will come through industry initiative and not at some point prior to general acceptance or regulatory requirement to do so, in much the same manner as what occurred in the case of the T. J. HOOPER.[49]

Thirdly, the private producer of the electronic chart's legal exposure will be subject to the growing body of law involving products or 'information' liability.

[48] *'Black Box' for ships unveiled,* THE INDEPENDENT, London, October 2, 1987.

[49] *See,* note 32, *supra.*

This aspect of liability has something for everyone involved:

> Say a company develops a pharmacy computer system ... Every time a druggist fills a prescription, he types the requested drugs into a database that keeps track of improper drug interactions and that is designed to provide the druggist with information on which drugs shouldn't be prescribed with other drugs. But suppose something goes wrong and, as a result, a lethal drug interaction goes undetected ... the prescription is filled, the consumer takes it home, and becomes paralyzed for the rest of his life. Who will get sued? ... Everyone ... A savvy attorney will go to the pharmacy, will go to the computer manufacturer, will go to the software developer, will go to the person who gave advice on the design of the software ... everyone will get a piece or, as is most likely, lose a piece of the action.[50]

As the above hypothesis demonstrates, it seems clear that all the parties involved in producing and providing the electronic chart will be sued when something goes wrong, primarily because it is most likely going to be very difficult to decide where the error actually occurred and who is at fault.

When systems allow the user to pick and choose the features to be displayed, scales at which it will be displayed, etc., new definitions of what constitutes a reasonable and prudent navigator will develop. Thought should be given to defining the limits of data manipulation that should be allowed the user. Of course, this has the seeds of its own undoing. If you limit the user, and he has a disaster that later is determined to have been avoidable if he had had the ability to manipulate the data in a certain way, liability may result. However, the best defense for the government is one that is based upon conscious decisions. This would be construed as a *discretionary decision* excusing the government from a finding of negligence so long as accurate data is not denied the user as a result of that decision.

Complicating matters is the extreme flexibility of digital data and the probable competition in the private sector to produce 'the system'. For example, providers of systems that either modify what is currently the conventional standard describing what must be portrayed, or allow the user to do so, run the risk of finding themselves in the same position that Jeppesen did in the BROCKELSBY case. The information may be accurate but how it was displayed was in error and resulted in a finding that the chart was a defective product. Liability for defects could extend to the software routines as well.[51] Only time and actual litigation will define the parameters of liability.

A final issue is worth raising. In the interim period there is a need to articulate standards for using the electronic chart. While it is clear that the mari-

[50] *Liability in the Information Age,* InfoWorld, August 18, 1986, p. 37-38.

[51] See, Liability Case Against Lotus Raises Fears in Industry, InfoWorld, July 28, 1986.

time community has stated that the electronic chart is not now the primary tool for navigation, certain rules and standards should be established beyond that. It is possible that a maritime disaster will occur and a question will arise as to whether there was negligent navigation (or whether the ship was even seaworthy?) where the navigator relied on the erroneous paper chart when resorting to the EC and its capabilities to integrate with other systems would have averted the disaster. Well reasoned regulatory guidance is necessary. Leaving it to the courts may be a simple way out but the consequences in having them act as regulator may be less than desirable. Fortunately, preliminary performance standards for the electronic chart have been agreed to and final standards should be effective in 1993.[52] Is this mere speculation? In 1986, yes, today, no.

Grounding of the HOOP op ZEGEN

On November 27, 1987, the fishing vessel, HOOP op ZEGEN ran aground on one of the Banjard sandbanks.[53] The skipper had aboard an electronic chart and integrated navigation system. He entered his course into the system without resort to paper charts because he viewed them as 'old fashioned,' then merely insured his actual course tracked with it. He set the chart for a scale of 1:100,000. What the system did not take into account was the depth over the length of his course. No automatic warning of any kind notified him to use a larger scale chart or of the problem of his intended course: he was likely to run aground! As the board of inquiry noted, '... each manufacturer [of an electronic chart] has been able to decide what will appear on the screen; this provides no guarantee that a complete, updated chart can be presented in an acceptable manner'.[54] Whether a design that does not provide some minimal warnings or 'sanity checks' on user choices is defective, is open for debate. However, one of the observations of the Maritime Board of Inquiry in the HOOP op ZEGEN case was that international operational standards '... for an acceptable electronic chart system: [should include] a warning signal if a chart is shown underscale or overscale and its use constitutes a danger to navigation.'[55] Depending on the damages sustained, had this occured in U.S. waters, a suit on a theory of products liability against the manufacturer of the electronic chart system would most probably have been filed. The apparent system design deficiency present in this case: not prompting the user to use the appropriate scale chart, is strikingly similar to the *defective product* in the BROCKELSBY case discussed earlier.

[52] *Smooth Sailing for Electronic Charts*, SEA TECHNOLOGY, March 1989.

[53] Verdict No. 27, The Maritime Board of Inquiry, Netherlands State Paper No. 178, Wednesday, 14 Sept. 1988, The Hague, Netherlands.

[54] *Id.*, at p. 5.

[55] *Id.*, at p. 6

CONCLUSION

The electronic chart will not eliminate nor unduly exacerbate the current standard of liability for negligent chartmaking, but it will change it. While it appears that certain types of errors will be less likely to occur, new causes of action will arise, probably involving new parties heretofore unfamiliar with negligent charting, such as software designers and computer systems analysts. The manufacturers should approach the task of providing an electronic chart with one objective: to place in the hands of the navigator the best possible cost effective system, using as a model the skills and attitudes toward safety of navigation that have been the hallmarks of the traditional chartmakers.

The bottom line on whether the electronic chart will indeed be a boon to safety of navigation rests, as has been the case throughout history, on the dedication and professionalism (in the case of the private producer, adequate liability insurance) of the producers of navigational aids.