LIABILITY AVOIDANCE IN SHIP DESIGN AND CONSTRUCTION

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Introduction

There is, in the title of this presentation, "Liability Avoidance in Ship Design and Construction," an implicit assumption which is central to this paper. That assumption is that liability occurs and re-occurs in ship design and construction, and that it is desirable to avoid such liability.

It appears to be a rare designer or shipyard that has successfully avoided being engaged in a lawsuit testing their potential liability for their design or construction efforts in the maritime field. Several firms have, however, successfully knocked back those attempts to pin liability on them, but not without significant cost. The most successful counter-attacks to alleged liability undoubtedly stem from considerable preparation and forethought by firms at the time of contracting to undertake their design or construction efforts, and by well-planned contract management throughout the rendering of those efforts.

This presentation will examine the basis of some of the more common forms of potential liability facing marine designers and shipbuilders; and will offer suggestions which may be helpful in avoiding -- or at least minimizing -- potential liabilities.

The reason why the possibility of liability exposure cannot be avoided with certainty is that we are in a very litigious society, where a party injured -- according to that party's own definition of injury -- rapidly becomes a party seeking a "deep pocket" to compensate him for that injury.

In order to deal effectively with liability avoidance, one must understand the causes of liability and the way allegations of it are phrased. Moreover, it is important that recognition be given to the difference in standards employed by engineers and courts. What an engineer sees as adequately safe and proper design, or suitably cost-effective safety measures, will not necessarily be that which a court (judge and/or jury) will consider to be adequate, proper and safe. Since the final outcome of the exposure to liability is decided in the arena of the courtroom and not a design office, it is the interpretations and definitions utilized by the court that must be considered valid, or at least considered useful in developing liability avoidance programs.

The perspective taken in this presentation is that of an engineering consultant, not an attorney. Also, this presentation recognizes the fact that, in contrast to many liability cases involving consumer goods (generally small in size, for which the engineering aspects are easily documented), ships are generally unique, one-off designs that are among the most complex mechanical items produced.

Thus it would be irrational to suggest that liability avoidance programs for the maritime industry should be similar to those for the consumer goods industries. It should be borne in mind, however, that certain areas of liability -- especially products liability -- is a creation of the consumer goods industry

which has overflowed into the transportation industries.

Forms of potential liabilities

An article in the November 1978 issue of *Electronic Products* magazine states the commonly encountered legal theory of liability:

> "In the case of negligence, the plaintiff must prove a company was negligent in the design and/or manufacture of the product which caused injury to the plaintiff. This can be very hard to do because the plaintiff has very little idea of what went on within the company that could have caused the product to be defective.
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> "The strict liability theory greatly simplifies the plaintiff's job. Under strict liability, all the plaintiff has to show is that the product has a defect and that he was injured as a result of defect. He doesn't have to show that the defect was a result of negligence."

Thus one can see that the primary origins of potential liability are either negligence or strict liability. For engineering and design work, the negligence aspect is the concern; whereas for the construction of the vessel, strict liability is the focal point.

The consulting experience of our firm tends to indicate that the last part of that description of negligence is not always valid. We have found it to be not very hard to support attorneys alleging negligence on the part of designers and shipyards because (perhaps from our particular background and expertise) we do have a good idea of what went on within the designing companies or shipyards that could have caused the product to be defective.

No large engineering firm operates without numerous memoranda, technical notes, design notes and correspondence, in addition to the basic design drawings. Since American law permits a "discovery" in litigation, a plaintiff can usually examine the records. Through the examination of those records, experienced engineering consultants assisting an attorney can closely reconstruct the probable design development process which the plaintiff alleges to have caused the product to be defective.

This, in turn, raises the question of whether a design/engineering firm should maintain its files, or perhaps should "sanitize" its files after the work is done. Some attorneys and others do not feel comfortable with the concept of maintaining the files.

Others do not feel comfortable with the purging of files. I feel quite strongly, however, that on balance, maintaining the files will be the most effective defense, especially if the files include "defensive engineering", as discussed below.

Regarding the strict liability theory, it appears that the concept of strict liability is a case-developed one (that is, not legislatively mandated). Thus it has all the impact of any law or any regulations that could possibly hinder the economic well-being of engineering manufacturers and designers. Judicial law is, in fact, probably more imaginative and more

responsive to plaintiffs than any regulations could hope to be.

The strict liability concept is applied in product liability cases. The October 1978 issue of *Product Liability Trends* discusses the problem of defining a "defective product" in the following manner.

> "Few issues in product liability cases have caused more problems for U.S. courts than definition of the term defect, particularly in design defect cases where the allegation is strict liability.
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> "Two State Supreme Courts that have always been at the leading edge of product liability law, California and New Jersey, in decisions this year have tried to put some of the confusion in design defect cases to rest by clarifying what it means to call something a design defect for liability purposes ...
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> "The California case was *Barker vs. Lull Engineering Company*. The plaintiff in *Barker* was injured while operating a high-lift loader at a construction site . He claimed that the accident was the result of the loader's defective design. The manufacturers, however, claimed that the plaintiff misused the product. Experts on both sides sharply disagreed on the issue of design defect.
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> "In the court's view a product is defective in design if either one or the other of the following occurs: (1) the plaintiff proves that the product failed to perform as safely as an ordinary consumer would expect when used in the intended or reasonably foreseeable manner; or (2) the plaintiff proves that the product's design proximately caused his injury and the defendant fails to prove, in light of the relevant factors, that on balance the benefits of the challenged design outweigh the risk of danger inherent in such design.
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> "In weighing the benefits of the product against the risk, the jury may consider among other relevant factors, the gravity of danger posed by the challenged design, the mechanical feasibility of a safer alternative design; the financial cost of an improved design; and the adverse consequences of the product to the consumer that would result from an alternative design."

The judge in *Barker vs. Lull Engineering Company* is quoted in the June 1978 issue of *Insurance Adjuster*. He said "Design, to be defective, need not be unreasonably dangerous and need not be used as intended, as long as use of the product is a reasonably foreseeable use (including accidents and misuse)".

It cannot be emphasized too strongly that the burden of proof rests on the defending manufacturer and designers, and not on the plaintiff in a product liability suit. It need not be shown that the manufacturer or designer was negligent or that they gave only cursory attention to safety. Instead, the plaintiff merely has to demonstrate that the injury resulted due to some characteristic of the product's design.

<u>Origins of Potential Liability</u>

Suppose a hydraulic pump for the steering gear of a ship fails, causing an accident. The person injured as a result of that accident will most likely file suit against the pump manufacturer as well as the shipyard that built the ship. Why should the shipyard be held liable, since that item was supplied to it, and since the shipyard did not even specify the particular pump, but rather that it was specified by the owner's naval architect? The answer to this in the maritime field comes from a 1946 U.S. Supreme Court decision in a case known as *Sieracki vs. Seas Shipping Company*. In his chapter of the book *Maritime Product Liability*, James Wheeler states:

> "In that case, a longshoreman was injured by a defective shackle aboard a ship owned by Seas. Constructed by Bethlehem Steel, the vessel was 18 months old at the time the shackle broke in Philadelphia.
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> The longshoreman was seriously injured. In the *Sieracki* case, the Supreme Court... said that Bethlehem Steel was responsible for the failure of the shackle even though it had purchased the shackle from an outside source. Bethlehem's responsibility was based on the ... doctrine that an assembler or manufacturer was responsible for its finished product. The result is essentially a species of liability without fault."

That illustrates one potential origin of liability to which shipyards are exposed -- defective equipment supplied by a sub-contractor.

Let us consider another potential form of liability exposure. Suppose a shipyard writes purchase order specifications calling for a pump having a shaft manufactured from materials suitable for a salt water environment. The manufacturer replies with a proposed specification for a shaft utilizing stainless 416.

Several years after the ship has been built, incorporating that stainless 416 shaft, the shaft fails, causing an accident. The shipyard goes back over its purchase order specifications and contests the selection of the 416 as suitable for salt water service. The shipyard could even bring out strong indication that the 416 was inappropriate, and some other grade of stainless would have been acceptable.

The acceptance of the improper pump shaft probably originated in the purchasing department. Inadequate or imprecise purchase specifications were perhaps followed by improper examination of the equipment specifications and of warranty clauses provided by the supplier. A good explanation for this occurrence is given in the February 1978 issue of *Product Liability Digest*, in which a presentation by Walter Erlenbach of Taussig Associates to the Iowa Manufacturers Association was recorded:

> "In our 25 years of experience as an independent metallurgical testing laboratory, and as expert witnesses for clients involved in product liability suits, we find that one of the most expedient and simple methods of reducing product liability claims is to

ensure that the materials that the company receives for manufacturing and production are actually the materials they ordered or specified -- this is commonly called incoming materials inspection.

"Our courtroom experience includes specific instances where the manufacturers did not check the received material as to its certification or specification and, as a result of consequent product failure, the company was involved in a liability action. Even if the material may have been proper and suitable for its intended use, [lack of an incoming materials inspection still] places the company in a weak position to defend its action. The relatively inexpensive procedure of checking materials against certification and purchase order requirements can result in considerable savings in potential liability cost."

Thus we have identified another potential origin of liability to be the imprecise purchase order specifications and insufficient care in accepting the manufacturer's response to them.

As another example of a potential origin of liability exposure, consider this example of a common outfitting specification for a tanker, which has occasionally proven inadequate. Tankers are required to be fitted with lifelines of 1500 lbs breaking strength.

Occasionally the lifelines have been used to lift crew members up out of tanks. Regrettably, sometimes they have been used by pulling the lines over the edge of the tank coaming, leading to a failure of the lifeline due to the sharp edge of the coaming. In the event an injury occurs due to the failure of the lifeline when it is hauled over the edge of the tank coaming, who is responsible?. .. The vessel owners?. .. The vessel builder?. .. or the vessel designer? In any case, what price would have been incurred to prevent injury to the crew member who was being hauled up but then fell to the bottom when the lifeline parted for lack of an A-frame with suitable pulley?

This brief example illustrates that one origin of potential liability is reliance on regulatory safety standards as the limit of necessary equipment and operational capabilities. The play-off of cost vs. safety will be discussed in a later section.

Another form of potential liability rests with ship repairers who experience the need to repair equipment as the result of accidents. In *Maritime Product Liability*, James Wheeler gives an example which tends to set the stage for product liability of ship repairers who do not adequately utilize their particular knowledge to benefit ship owners.

"Another extreme example of liability ... that has evolved from land law is rather frightening. It is the theory that an underwriter -- an insurer-- can be responsible... for personal injury for failing to advise a manufacturer or an assembler or a repairman of a knowledge of a defect which had been gleaned through the underwriter's own investigations of other accidents. The application of

> this rule would result in underwriters being compelled to disclose all of their previous investigations of every case concerning a similar product. This would result in underwriters being liable if they knew or should have known that their knowledge, if imparted to somebody else, could have prevented an injury."

There appears to be an analogy between the role of the underwriter discussed by Mr. Wheeler, above, and the role of the repair yard. The repair yard is presumably expert at providing guidance to vessel owners as to what systems need additional maintenance or overhaul or parts replacement. Though knowledgeable that certain types of systems need regular maintenance, the yard may not have been specifically requested by the owner to provide that maintenance. Today repair yards may have a burden to advise the owner of the potential consequences if such maintenance is not performed. This is, of course, a new burden on ship repairers. Nevertheless, my interpretation of developments in parallel, court-tested situations indicates that such a burden will be ultimately unavoidable as the quest for safer operations continues to increase.

Similarly, if the repair yard discovers any deficiencies during the conduct of previously authorized work, those deficiencies should be brought to the attention of the owner. This then shifts the burden of the decision to deal or not to deal with that problem from the repair yard to the vessel owner. Without that action by the repair yard, if the problem later becomes part of a lawsuit, the repair yard may be found partially or wholly responsible.

Safety vs. Cost and Standards

Most engineers should be familiar with the "Pinto" case, correctly known as *Grimshaw vs. Ford Motor Company*, involving a fire resulting from a Pinto automobile being struck from the rear by another car. During the discovery phase of the lawsuit, a memorandum within the Ford Motor Company surfaced, in which Ford's play-off between the cost of alternative fuel tank design and the safety of the existing design was described. On the cost side of the 'equation', Ford developed a cost per unit of about $11 for an improved gas tank safety item to be used on 12.5 million cars and trucks, for a total cost to Ford of about $137 million.

On the benefit side of the 'equation', Ford estimated the savings of approximately 180 lives (at $200,000 each) and the elimination of 180 burn injuries (at $67,000 each) for a total of $49.5 million benefit. Thus the cost of the modification outweighed the benefits; so Ford did not undertake the improved tank design. (*Product Liability Digest*, March 1978). That analysis apparently represented the automobile manufacturer's concept of a play-off between cost and safety.

Undoubtedly, after the lawsuit, the manufacturer has a different concept of what constitutes a proper play-off of cost versus safety. Perhaps if Ford had "sanitized" its files, that memo would never have arisen. In that case, however, Ford would never have been able to demonstrate that it had indeed considered safer designs and had rejected them on the ba-

sis of some other cost benefit analysis. The problem here was that Ford's estimation of the proper form of cost-benefit analysis was not acceptable to the court.

There is often an attempt to use, as a shield against liability, the fact that a design incorporates common industry practices and complies with recognized safety standards. Neither of those shields are very secure in their placement. Coast Guard, ABS, ASME and other standards are developed to ensure reasonable protection. But courts have recognized that such a standard doesn't consider all possible forms of accidents or possible foreseeable misuses of equipment. In *Electronic Products Magazine* (November 1978), four safety experts address the use of standards as a liability shield; and all dismiss its potential to act as a liability shield.

Mr. A. Kanode, Product Safety Administrator for Hewlett/Packard states that a standard "is simply a general statement on a particular type of product that specifies some of the potentially hazardous things in the construction and use of the product."

Mr. B. Card, Product Safety Coordinator for FMC states that "while safety standards are important, they really represent only 'brownie points' when you get into court. This can be tough for the design engineer to accept or understand because the designer knows that he has worked hard to meet a particular standard, or maybe even a number of standards; and then he discovers he must go far beyond practices given in the safety standards to protect the users against misuse and abuse."

Richard Nute, Corporate Safety Product Engineer for Tektronix says that safety standards represent "a compromise in judgment which doesn't guarantee you one thing in terms of whether someone will be ultimately injured by a product. All you can say is that they represent something which is achievable."

Lastly, Warren Stanton, Manager of Engineering Services for Racal-Dana Instruments, summing up the legal ramifications of adherence to safety standards states that "they can't keep you off the hook in a suit, but they can reduce the amount of damages you get stuck for, because the money handed out in a lawsuit is a function of the jury's attitude. If you've done your best to make the thing safe, they won't hit you as hard."

There are numerous other examples one can recite to illustrate the fact that existing design/engineering procedures are inadequate in face of the attitude displayed by courts and for operation within our litigious society. Clearly, an engineer's concept of what is adequately safe is repeatedly being found inadequate according to judicial proceedings. Moreover, using 'standards' as a means to determine the adequacy of safety features incorporated in a design has been found insufficient.

Defensive Engineering

Based on the foregoing, it appears that the first element appropriate for developing liability avoidance programs in ship design and construction is the education of the designers and constructors to the potential liabilities that may arise

from (i) their forms of work and (ii) from the illustrations of how the courts have re-defined "adequately safe" requirements.

Simply put, design engineers are not taught to think defensively. In fact, there is a serious question as to whether engineers are taught to think about safety instead of just about function and sometimes about cost. Nevertheless, in view of the considerable litigation that naval architects, marine engineers, shipbuilders and ship repairers are finding on their doorsteps, their engineering staff must be taught to think defensively. Following an accident, can their design practices stand up to the test of a court proceeding in front of a jury?

The focal point, then, for a liability avoidance program in ship design and construction is the use of defensive engineering and defensive design. This means analyzing alternatives to proposed design steps, and then assessing and documenting the relative safety, cost, functionability and repairability of the alternatives--prior to making a design decision.

In the design of a ship, there are far too many items to be considered as carefully and thoughtfully as good defensive engineering requires. So how do you pick and choose what items need to be considered?

Perhaps the most appropriate starting point for identifying those design features which should be subjected to defensive engineering is experience within the industry. Identifying vessel-disabling product failures or injury-causing operational failures, or where Coast Guard and ABS take particular care in specifying acceptable practice, those are indicators of previously identified sensitive areas. Then engineers must work beyond those specifications or standards given by ABS and USCG, and design defensively--documenting the relative safety, cost, functionability and repairability of the alternatives, and then clearly spelling out the basis for the design decision.

Who has responsibility to perform that defensive engineering? Answer: everyone-- at least to the extent of ensuring it is performed over an adequate range of design items. This includes the ship owner, the owner's naval architect, the shipyard, and its subcontracting naval architects who produce working drawings as well. Also, the in-place foremen of the shipyard work force, as well as the owner's construction supervisors, will be able to identify potential sources of equipment failures, inoperability or injury.

Defensive engineering can be strengthened by a shipyard contract which could enable the shipyard and the construction representatives to undertake modifications to enhance the safety of the vessel without going back to the owner's home office for approval. While this generally can be regarded as a change-order procedure, under the name of safety, it should be more readily accomplishable and more easily justified to ensure it is fulfilled. Perhaps such a change order could be made automatic if the Coast Guard representative or the ABS representative agree that it will enhance the safety of the vessel.

There is ample opportunity for each party to require that other parties undertake defensive engineering and defensive design. The cost of doing so will be negligible if included at the outset of contract development. For example, the contract between the shipyard and the yard's naval architects could require that the naval architect advise the yard of each area identified during the course of design that may be capable of improved safety through added design effort. Similarly, the owner could require his naval architect to identify such areas during the course of development of contracts, plans as well as during the construction supervision phase. Also, the contracts between vessel owner and shipyard could be augmented by a provision requiring the shipyard to advise the owner of possible added safety measures, obtainable through defensive engineering.

As for the component suppliers, any warranty given by the supplier could be predicated on receiving feedback from the purchaser as to the use and maintenance of the supplied equipment. This enables the component supplier to have a more thorough knowledge of the on-going use and life of his product. Then, as in the aircraft industry, component manufacturers could send notices to the users for suggested overhauls, modifications, or withdrawals from service of that particular piece of equipment.

The last question to be answered is: can defensive engineering be applied? The short answer is: Of course. It takes a re-education of the draftsmen of all the contracts as well as the contract administrators of all parties. Yes, it will certainly add to the cost of contracting, the cost of doing business and the cost of acquiring the vessel. But if it permeates all aspects of contract management, that cost will be small.

Is it worth it? Ask your underwriters. Ask your accountant, who keeps separate tabs on the amount of time that your engineering staff spends preparing for litigation. Ask the head of your legal division, who constantly requires increases in his budget for legal defenses. Ask the president of your firm who sees the imbalance between the legal division budget (high) and the engineering and production department budget (low) , noting which one produces a profit and which one doesn't.

Lastly, ask the head of the shipyard's or the design firm's insurance office the cost of purchasing adequate insurance coverage against design negligence and product liability. This should also include an examination of the amounts which are deductible for each occurrence. Although the costs of the basic insurance premiums may be a small percentage of total gross sales, they represent a large part of profit. Moreover, the deductible amounts and the legal defense costs come directly from the profit of the yard since those cost do not in any way increase the profitability of the organization.

In summary, the cost of undertaking defensive engineering and defensive design does not represent a significant additional cost in the design and construction process. Rather, it represents a transfer of budget from the

overhead legal division costs to the profit-making design division. It also results in the freeing of design staff from participation in defensive litigation, enabling them to pursue more effectively their profit-making activities.