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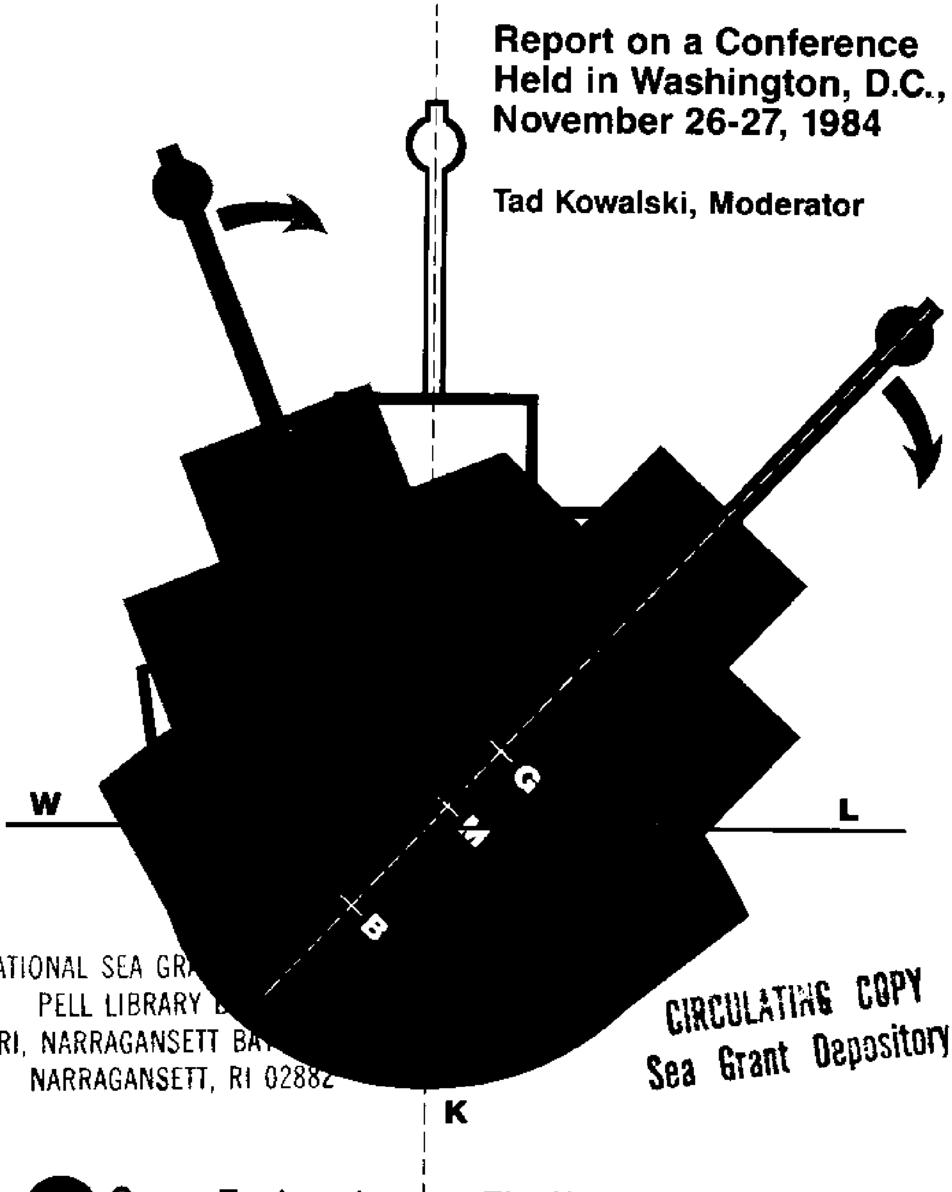
Fishing Vessel Safety Conference, 1984

Report on a Conference Held in Washington, D.C., November 26-27, 1984

Tad Kowalski, Moderator



Ocean Engineering
NOAA/Sea Grant

The University of Rhode Island
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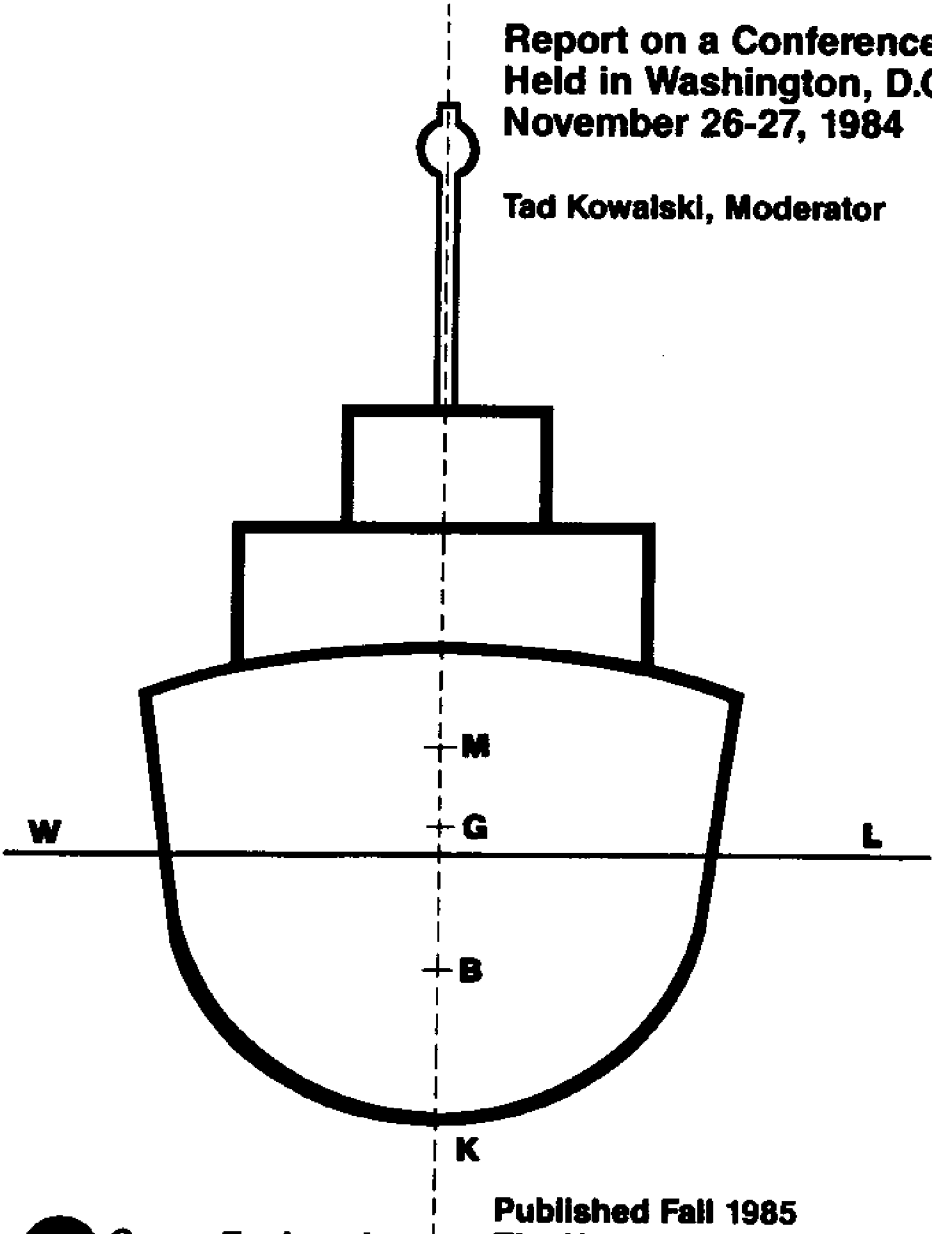

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OPENING REMARKS

Tad Kowalski, Moderator

This is the second annual meeting of the Fishing Vessel Safety Bureaus Association. I would like to express our thanks to the United States Coast Guard and the National Sea Grant College Program for providing the support and encouragement for our work. We are grateful to the Coast Guard for hosting this meeting.

Our objectives are the same as stated last year: "to coordinate and discuss fishing vessel safety research, disseminate our work to fishermen, and provide help to federal and other agencies so that their actions may reduce the various problems of fishing vessel safety."

Now I have the pleasure to introduce Admiral Gracey, Commandant of the Coast Guard, who graciously agreed to welcome participants to this conference and by his presence express the Coast Guard's great interest in fishing vessel safety.

INTRODUCTION

Admiral J.S. Gracey
U.S. Coast Guard

I would like to thank Dr. Kowalski for inviting me here today to talk to you on such an important matter as fishing vessel safety. I see from the cross-section of industry and government representatives here today that we all feel the same way; fishing vessel safety is important.

Fishing vessel safety is of great personal concern to me. This is one of the reasons why I recommended to the Secretary of Transportation that the Coast Guard develop fishing vessel safety initiatives. Let me briefly describe how we got there.

Earlier this year, the Secretary of Transportation established a transportation safety task force to look into non-highway-related areas where safety could be improved. We took a look and noted that fishing vessels have the poorest safety record. The loss rate for fishing vessels, based on vessel population, averaged about seven vessels per 1,000 vessels between 1970-1983. This is on the order of five times that of U.S. oceangoing cargo ships and three times that of U.S. oceangoing tankships. This loss rate equates to the highest vessel loss rate of any segment of the U.S. Merchant Marine. Fishing vessel casualties also result in an average loss of 87 lives annually. This annual death rate is seven times greater than the national average for all types of U.S. industry groups. Our 1983 casualty statistics reveal that although the number of vessel losses declined over the previous year, they were still above the average for the previous five years. In 1983, foundering, either through flooding or capsizing, accounted for 104 vessel losses, or 41 percent of the total. In 1983, there was a significant increase in the number of reported fatalities. Fatalities rose to 111, up from 72 in 1981 and 66 in 1982. (The increase is largely due to the greater number of deaths occurring in Alaskan waters. The most notable of these are the 14 deaths resulting from the losses of the fishing vessels Americus and Altair.) So you see, there is need for improvement.

Based upon what we found, we put together a program aimed at improving the safety record of this class vessel. In February I recommended to the Secretary a two-pronged approach to reducing the number of casualties: a voluntary vessel standards program and a mandated educational program. Because of input from industry and their willingness to assist in the development of our safety programs, I have just recently recommended to the Secretary that we pursue a safety awareness program aimed directly at the fishermen, using safety guides to convey the message instead of a mandatory educational program. The voluntary vessel standards program will continue as originally planned.

As you may be aware, Radm Lusk, chief of the Office of Merchant Marine Safety, established a task force to implement our safety initiatives. Since it was established, task force personnel have ha the opportunity to visit and solicit input from the fishing vessel safety centers located at the University of Rhode Island, Florida Institute of Technology, and the University of Washington at Seattle They have also discussed our safety initiatives with representatives from other government agencies such as NOAA/Sea Grant and the Nation l Marine Fisheries Service, and industry organizations such as the National Federation of Fishermen, Texas Shrimp Association, Pacific Seafood Association, North Pacific Vessel Owner's Association, National Council on Fishing Vessel Safety and Insurance, Tuna Boat Association, and insurance brokers, underwriters, and surveyors from all parts of the country. I am delighted to hear that our proposed safety initiatives have been well received by all interested parties. They are willing to work with us in developing voluntary standards and safety guides on a national level. A truly cooperative effort.

Of course the Coast Guard are not the only ones interested in fishing vessel safety. Industry at the local and regional level has taken the initiative to improve safety. I support and encourage these efforts. Meetings and conferences such as this gives the Coast Guard, other government agencies, and industry the opportunity to exchange ideas concerning areas of mutual concern.

The Coast Guard wants to be responsive to the needs of industry. For example, at last year's conference some items were left unresolved, one of which was providing a stability demonstration model for the established fishing vessel safety centers. I am pleased to say that we have taken the necessary steps to have two such models built. These models will be loaned to the fishing vessel safety centers at the Florida Institute of Technology and the University of Washington. They will be used in their ongoing safety seminars.

The time is right for industry and the government to pool resources and to pull together to improve the safety record of fishing vessels--a grass roots effort without government dictating what must be done. The benefits to be derived from such a cooperative effort are many. If the progam is properly developed and implemented, insurance rates should go down. The Coast Guard will spend less time on search and rescue efforts and casualty investigations, and fishermen will be able to increase revenue due to less time lost because of equipment malfunctions and the like. More importantly, however, less lives and property will be lost. Our success relies heavily upon the cooperation of all segments of industry and government. We must be willing to participate and assist where possible. Thank you.

IMPORTANCE OF FISHING VESSEL SAFETY: SEA GRANT VIEWPOINT

Ned Ostenso
Director, National Sea Grant College Program

It has been a year since many of you first met in Washington, D.C., to address the issue of fishing vessel safety. Since then, you met again in Washington in April and then in Florida in May for an international conference on the design and construction of commercial fishing vessels.

It is good to see the continuation of such meetings, which bring together the collective energies of individuals committed to reducing unnecessary hazards at sea. Lives are at stake, and it is encouraging to see more people involved in, and more attention focused on, improving vessel safety.

For over 11 years, the National Sea Grant College Program has been actively involved in fishing vessel safety through research, education, and Marine Advisory Services projects.

The National Office continues its position of endorsing worthwhile projects in vessel safety, funding research that is competitive with other local and regional Sea Grant needs. Research has been conducted in several areas, primarily vessel stability, vessel seakindliness, and vessel fuel efficiency.

Through our Marine Advisory Services division--or perhaps a better description would be our extension component--we encourage activities by marine extension personnel to help their constituencies to be sensitive to and aware of safety requirements.

Sea Grant support in this very important area has led to establishment of what we call fishing vessel safety centers. These are currently being operated through Sea Grant programs at the University of Washington, the University of Rhode Island, and the University of Florida and Florida Institute of Technology. These centers are helping to develop, at least on a regional basis, visibility for the importance of vessel safety efforts. You'll be hearing more about these centers from Bruce Adee, Tad Kowalski, and John Sainsbury shortly.

From the marine extension viewpoint, there are several other Sea Grant programs involved in vessel safety projects besides Florida, Rhode Island, and Washington. These include programs in Alaska, Maine, Massachusetts, Oregon, South Carolina, Virginia, and Texas, which have been active in conducting research and holding workshops on vessel safety. Philip Cahill, of the Virginia Sea Grant College Program, will be telling you more about a safety course in gear handling that he has been conducting, and Cliff Goudey, of MIT Sea Grant, has some news for you about a bulbous bow retrofit in fishing vessels.

One of the larger marine extension efforts currently under way is the Mariner Reporting Program, or MAREP, which is operated in conjunction with the National Weather Service. MAREP is designed to integrate marine users, especially commercial fishermen, into weather forecasting. Fishermen at sea call in weather observations back to their local port or a Sea Grant college radio station. Information from these individual reports is passed on to the regional National Weather Service forecasting office, where it is used to develop the next forecast. Sixteen coastal and Great Lakes states are now participating in MAREP.

We have also seen over the past year a growth in the number of publications being made available to the public and interested organizations. The newsletter of the National Concil of Fishing Vessel Safety and Insurance is keeping readers up-to-date on new developments and legislation in the field.

Insuring a vessel represents a major operating cost for today's commercial fisherman, but until recently the chances of his being able to understand exactly what he was paying for were remote. This situation has been improved with the issuance in 1984 of the booklet "A Commercial Fisherman's Guide to Marine Insurance and Law" by Dennis Nixon of the Rhode Island Sea Grant Program. Fishermen can now turn to this publication for information on how to maintain a safe and a profitable operation.

Dewayne Hollin of the Texas A & M Sea Grant Program will be talking to you later in the day about a user survey done of his 1982 publication "Safety at Sea: A Guide for Fishing Vessel Owners and Operators."

When we got together last November, I had said that I hoped for two things: a sharing of what we know and an understanding of what needs to be done and who is best able to do it. I think that we are well on our way. There is a spirit of cooperation here that needs to be nurtured. For its part, the National Sea Grant College Program remains committed to supporting work in this vital area of fishing vessel safety.

THE FISHING VESSEL SAFETY BUREAU AT THE UNIVERSITY OF RHODE ISLAND

Tad Kowalski
Professor, Department of Ocean Engineering

The University of Rhode Island Safety Bureau has been investigating the problem of the conversion of Gulf shrimp boats to New England draggers. There has been a substantial influx of Gulf shrimp boats into New England waters in the last few years because of the cheaper price of such boats.

Safety problems arise due to the top weight added in the conversion and to the more hostile environment of the North Atlantic waters. The additional top weight has to be compensated by ballast, resulting in a reduction of freeboard. This reduces the area under the GZ curve, decreasing the dynamic stability of the vessels.

The conversion is done, most of the time, according to the owner's wishes. No prior design is drawn up nor calculations of stability or strength made. The basis of conversion is the owner's or boatyard's experience and a feeling of what is or looks right. The conversion is done one step at a time, mostly by trial and error, to achieve the desired trim. No check on the propulsive efficiency of the changes is made.

The Safety Bureau arranged to follow one such conversion and kept a check on the stability of the boat. The study included:

1) inclining experiment prior to the start of the conversion
2) monitoring weight of equipment and structure removal and addition
3) inclining experiment after the completion of the conversion
4) taking the offsets of the hull in a drydock.

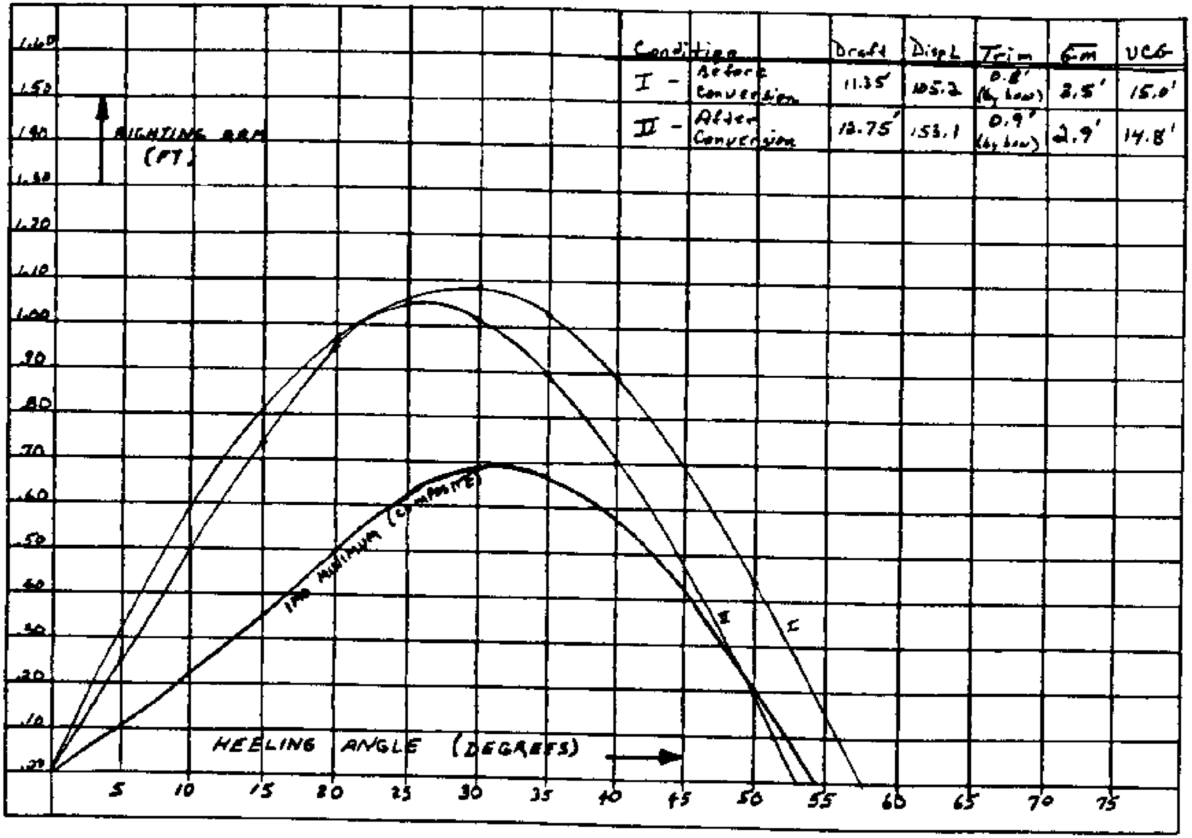
Figure 1 shows the resultant GZ curves together with the minimum recommended IMO curve. It shows that the stability of the converted vessel satisfies the minimum IMO curve. The angle of vanishing stability was, however, reduced by about five degrees. This is the result of reduced freeboard. The changes in displacement, draft, trim, and GM are shown in Figure 1 for conditions before and after the conversion.

The major weight changes included the following:

added weights	
steel plates for rubbing strake at the stern	5,300 lbs.
towing winches (2 @ 2,300)	4,600 lbs.
doors (2 @ 1,600)	3,200 lbs.
net drums, nets, and lines	12,000 lbs.
deck non-slip tiles	3,200 lbs.
concrete ballast	12,000 lbs.
ice in fish tanks at departure	30,000 lbs.
removed weights	
small winch and motor	300 lbs.
ice maker	750 lbs.

URI FISHING VESSEL STABILITY BUREAU

VESSEL'S NAME: SHRIMPER TO DRAGGER CONVERSION
DATE: 4/84



Condition		Draft	Displ.	Trim	$\overline{GM}$	VCG
I -	Before Conversion	11.35'	105.2	0.8' (by bow)	2.5'	15.0'
II -	After Conversion	12.75'	153.1	0.9' (by bow)	2.9'	14.8'

COMMENTS

Piché: As a fishing vessel loads up at sea, the angle of maximum righting arm will stay the same--that is, about 25 degrees--but the range of stability will drop rapidly to about 40 degrees or less. It is important to have all loading conditions investigated. The condition at departure may give the operator a false sense of security. An investigation should look at the worst possible actions the fisherman can take with his equipment and assess the stability implications of these actions.

Adee: The Gulf shrimp boats have lower L/B and B/T ratios than comparable boats, and therefore their transverse stability is inherently lower.

THE FISHING VESSEL SAFETY BUREAU AT THE UNIVERSITY OF WASHINGTON

Bruce H. Adee
Director, Ocean Engineering Program

First let me say that a Fishing Industry Safety and Health Conference which will be held in Seattle on December 14 is being put together by industry for the industry.

The University of Washington Fishing Vessel Safety Bureau has two major ongoing projects: the reconstruction of capsizing scenarios and model testing of radio-controlled capsize models. From this work, we have learned several things. Vessels that capsize are generally overloaded, with low freeboard and low range of stability. They have high initial GMs, with maximums occurring as low as 10-15°. Initial stiffness gives a false sense of security. Most vessels are found to be well short of IMO guidelines. Previous inclining data cannot be extrapolated, even among sister ships. A deadweight survey is a requirement, as a minimum, for vessels in a class.

There may be a change in stability with vessels over time. Ships with light ship weight of approximately 200 tons show growth of 30 tons over the years. Conversions for other fisheries are treated as mechanical changes, without regard for stability changes.

Operations practices are critical. Vessels have traveled for four to five hours and then turned and capsized. Fishermen on the West Coast often turn stern to seas and need to learn not to do that. In head seas they will not capsize.

A mathematical theory has been developed for the action of water-on-deck. Ships may be getting water on deck as soon as they reach a 10° roll.

In general, full power and hard-over rudder are used to try to avoid capsize. These tend to aggravate capsize. A better tactic is to cut power and move rudder amidships. Some captains have claimed that their vessels capsized when the autopilot failed hard-over, even though they were "properly loaded." We are investigating the possibility of capsize even though the IMO criteria are met. If the rudder is shifted violently, capsize may occur, especially when free surface effect is present.

Some salmon fishery processors are offering a price bonus if fish are landed in chilled water rather than ice. Some small vessels are putting the largest tanks possible in their holds, without regard for any stability effect.

COMMENTS

Johnson: A number of casualties occur with stern into sea--is this common practice?

Piché: A number of publications recommend that if you get into trouble, run with the seas.

Cahill: Most fishermen run with the seas only while eating. In trouble, they will try to head into the sea. One problem is that autopilot is not synchronized with sea conditions and can make a wrong turn.

Harrison: There is a rule for anti-cyclonic storms in the Northern Hemisphere--put the storm on the starboard quarter and in that way work away from it.

THE FISHING VESSEL SAFETY BUREAU AT THE FLORIDA INSTITUTE OF TECHNOLOGY

John C. Sainsbury
Professor, Department of Ocean Engineering

There has been some interesting research on a scallop vessel tha capsized while coming into harbor. This research was funded by Florida Sea Grant. The master's thesis that describes the analysis done on the scallop vessel was published in SNAME South East Section. The study noted that, given the price of fuel, fuel loads are low, an on arrival ships will be at very low fuel. When vessels are at sea, outriggers are down. Some ships have come in, raised the outriggers, and capsized. Others have capsized in a turn, or run aground and los enough stability to capsize. Documentation of the analysis is in the published paper, but programs are available on Apple Computer. They are in the public domain and will be provided if one sends four blank disks.

The funding from Sea Grant for the Vessel Safety Bureau is ending. FIT is forming a Fisheries Engineering program which will continue the vessel safety work.

LIABILITY ISSUES INVOLVED IN THE OPERATION OF UNIVERSITY FISHING VESSEL SAFETY BUREAUS

Dennis W. Nixon
Assistant Professor of Marine Affairs, University of Rhode Island

Nicholas Trott Long
General Counsel, University of Rhode Island

(Paper submitted by Nixon and Long; presented at the conference by Nixon)

The subject of fishing vessel safety historically has not received significant attention from the academic community. Since 1982, however, three institutions, the University of Rhode Isand, the University of Washington, and the Florida Institute of Technology, have begun to explore this area with support from the National Sea Grant Program.

This will be a review of some critical liability issues inherent in the operation of a university-sponsored fishing vessel safety bureau. They are examined in two stages. First are the questions of liability arising out of the nature of the services performed. That is, liability problems inherent in the professions of marine surveying and naval architecture. Second are the special legal concerns related to institutional liability for the acts of its employees and others "acting on its behalf."

Last year, 111 lives and 242 vessels were lost in fishing accidents. On a per capita basis, commercial fishing is seven times more hazardous than shoreside industrial work. The U.S. Coast Guard Fishing Vessel Safety Initiative may improve matters, but it cannot succeed without a broad base of research support. The university safety bureaus can and should contribute their expertise to provide the information the industry needs to operate more safely. Some risk is always present when professional opinions are rendered on a subject as complex as vessel stability, but, when prudently managed, those risks are not more serious than the others which universities routinely assume.

First, let us deal with liability of marine surveyors and naval architects. The legal responsibility of a marine surveyor or naval architect can be stated quite simply: it is the obligation to use due care in performing his professional tasks. It can also be stated in terms of an obligation to perform professionally at a level equal to or above that of the generally accepted standards of performance in the industry. Failure to meet this responsibility is called negligence. In determining whether a person has used due care, a court will look to what is customary and usual in the practice of surveying. Important evidence of what is customary and usual can be found in published design guidelines and standards generally accepted as valid by the industry. Regarding fishing vessels, relevant guidelines would include the minimum recommendations for fishing vessels given in the Coast Guard pamphlet NVC 3-76 and the IMO publication Resolution A.168/ES IV. If there is a substantial deviation from good surveying practice, and if an accident is a direct result of a defect not revealed in the survey which would have been revealed but for the deviation, the damages caused will be chargeable to the surveyor. The word "damages," in this sense, is a legal term of art. It represents an effort by a court to arrive at a dollar value for everything, from lost fishing time to loss of life, which occurs as a result of the negligence in question.

What kind of negligence can lead to liability? In the case of Krohnert v. Yacht Systems Hawaii, 664 P.2d 738 (Hawaii App. 1983), a surveyor inspected a wooden sailing vessel for a prospective purchaser and found no major problems. Shortly thereafter, the new owner of the vessel began experiencing some difficulties with the boat and had it surveyed again. The later inspection revealed that most of the underwater planks and frames were rotten, most of the iron fastenings were corroded away, and some frames were so soft they could be broken by hand. The court held that the first surveyor was negligent in not finding the defects, and the surveyor had to pay damages equal to the differences between the purchase price of the vessel and its salvage value.

A recent case from the federal court in California illustrates how the principles of negligence are applicable to naval architects and vessel stability. Dillingham Tug & Barge v. Collier Carbon and Chemical, 548 F.Supp. 691 (N.D. Cal. 1981), involved the sinking of a barge being towed from Texas to Oregon. It had been recently modified, and the naval architecture firm of Nickum and Spaulding had been retained to calculate the barge's seakeeping ability after its modifications. The Salvage Association of London was then hired to check the work of Nickum and Spaulding and perform its own survey. Despite these precautions, the vessel foundered and the owner brought suit. The court found both surveyors negligent. Nickum and Spaulding made errors in their calculations and failed to advise the barge owner that their work was incomplete. The Salvage Association was liable because it didn't catch Nickum and Spaulding's errors.

Both Nickum and Spaulding and the Salvage Association are respected as organizations with substantial experience in naval architecture and marine engineering. Hence, even the best firms can make serious and costly mistakes. The lesson is simple: when calculating the stability of vessels headed offshore, there is little margin for error.

Some surveyors and naval architects have attempted to use disclaimers or exculpatory contract clauses in an effort to protect themselves from liability. These efforts have been largely unsuccessful. In the Dillingham case, the following "fine print" was part of the contract:

> The Salvage Association London believes that the surveyor appointed by them is fully competent to carry out this survey but the resultant certificate will be issued on the express condition that neither the Salvage Association London nor the surveyor shall in any circumstances be responsible

> or liable to any person for any act or omission, default or negligence of the surveyor in the conduct of the survey or the contents of the certificate or for any situation or event which may occur subsequent to this issue of the certificate.

The court ruled the clause contrary to public policy and refused to enforce it. It cited the Supreme Court, which observed in Bisso v. Inland Water Corp., 349 U.S. 85, 75 S.Ct. 629, 99 L.Ed. 911 (1955), that exculpatory clauses are inherently suspect and should be invalidated when necessary to discourage negligence or to protect those in need of goods or services from being overreached by others who have grossly unequal bargaining power.

A similar disclaimer was examined by the court in Great American Insurance Company v. Bureau Veritas, 388 F.Supp. 999 (S.D.N.Y. 1972). Bureau Veritas is a well-known classification society, which develops construction standards for vessels and then inspects the vessels on a periodic basis throughout their working life. Their standard disclaimer read:

> The Bureau Veritas declines any responsibility for errors of judgment, mistakes or negligence which may be committed by its technical or administrative staff or by its agents.

The court threw out the clause on the grounds that it was too broad and contrary to public policy.

The Krohnert decision, discussed earlier, is one of the few modern cases in which an exculpatory clause was, at least in theory, upheld. It read:

> This report is issued subject to the condition that it is understood and agreed that neither their office nor any surveyor or any employee thereof is under any circumstances whatsoever to be held responsible in any way for any error in judgment, default or negligence nor for any inaccuracy, omission, misrepresentation or misstatement in this report and that the use of this report shall be construed to be an acceptance of foregoing conditions.

The surveyor argued that where the parties are of equal bargaining power and the language of the clause is clear and unambiguous, an exculpatory clause should be upheld. The court agreed in principle but reached the same result as the other decisions by finding that the clause was not enforceable in this case. The court ruled that for an exculpatory clause to be enforced it must be shown that the parties clearly and unequivocally agreed to the disclaimer with knowledge of its content. Since the surveyor made no mention of an exculpatory clause prior to doing the survey, the court ruled that the surveyor failed to meet his burden of showing that the boat owner clearly and unequivocally agreed to the disclaimer.

The Krohnert case provides guidance on how a disclaimer might provide some protection. Instead of being placed as fine print at the bottom of a survey report, the disclaimer should be one of the first things in the report and should be in bold print. A signed acknowledgment of the disclaimer would obviously be helpful as well. Although such clauses are generally disfavored by the courts, they may still provide some protection under the right circumstances when rendering stability and safety reports. Since it is the attempt to avoid responsibility for one's negligence which offends most courts, it is wise not to try it at all. Rather, the disclaimer should focus on the limits of the service offered, emphasizing that the opinion to be rendered is only that. If the opinion will be based on only a partial survey, that should be noted, and if the service is to be rendered primarily by persons in training, such as graduate students, that should be noted as well.

Second, there is liability of university employees in fishing vessel safety bureaus. Three additional legal concepts are to be considered if the marine surveyors and naval architects discussed above are also state university employees: they are indemnity, respondeat superior, and sovereign immunity.

The most important of the three for the employee is the doctrine of indemnity. This doctrine provides that an employer agrees to assume all costs of defending a lawsuit brought against the employee so long as the employee was acting within the scope of his employment at the time the allegedly negligent act was committed. At the University of Rhode Island, the policy of indemnity for employees is very broad and comprehensive.

A closely related doctrine is that of respondeat superior, or "let the master answer." Because the person bringing the lawsuit will recognize that the institution has the "deep pockets," he will most likely sue the institution as well as the individual employee. The doctrine says that the master is responsible for the acts of his servants, and the modern parallel is the employer and employee. Indeed, the rationale for many indemnification policies is the understanding on the part of the employer that the institution will be sued in any event under the respondeat superior doctrine and that by agreeing to indemnify their employees they can require that the employee will cooperate in the defense of the case.

The concept of sovereign immunity derives from the divine right of kings. Since the sovereign was incapable of doing any wrong, there would be no point in holding a trial which could only--as a matter of law--confirm that fact. Somehow this notion survived the establishment of our nation and its constitution, and remains alive, though in ill health, around the country today. In Florida the legislature has abrogated the doctrine to the point of admitting that the state could be wrong, but only to the amount of $100,000 per person and $200,000 per incident. Rhode Island, no doubt reflecting its relative poverty, has legislated a potential acknowledgment of fault up to the amount of $50,000. However, at least one federal judge in Rhode Island has ruled that the University of Rhode Island is not a part of the State for the purposes of sovereign immunity (Vanlaarhoven vs. Newman, 564 F.Supp. 145 [D.R.I. 1983]). The State of Washington simply got rid of this nonsense some time ago.

To conclude, a university employee performing safety evaluations on fishing vessels, like anyone else performing a professional service, will be found negligent if he fails to use due care in the performance of his responsibilities. Exculpatory clauses, which seek to contract away responsibility for negligence, are viewed with extreme disfavor by most courts. Clearly worded disclaimers, however, can have a positive impact in limiting liability if they fairly outline what and what not the other party is getting for the fee paid.

Where negligence is proven, and causation exists between the negligence and the incident for which damages are claimed, the university employee acting within the scope of his duties is not without protection. Respondeat superior and indemnity will likely free the employee of individual liability, and sovereign immunity may limit the liability of the institution.

There can be substantial liability associated with the operation of a university fishing vessel safety bureau. But, with adherence to industry standards, proper training, and proper supervision of personnel, these risks do not represent an unreasonable burden on operations and should not deter the further development of the fishing vessel safety bureau concept.

U.S. COAST GUARD FISHING VESSEL SAFETY INITIATIVES

Captain Gordon Piché
U.S. Coast Guard

Good afternoon, I am Captain Gordon Piché, the Coast Guard's Fishing Vessel Safety Initiatives Team Manager.

The Coast Guard's Office of Merchant Marine Safety in its "Fiscal Year 1987-91 Commercial Vessel Safety Operating Program Plan" proposed a goal to reduce the number of uninspected commercial fishing vessel casualties by not less that 10 percent by 1991 without a net increase in the current level of overall resources. This goal was later proposed to the Department of Transportation Safety Task Foce for a departmental safety initiative. The basic concept of the initiative was endorsed by the Secretary of Transportation.

The need for such a program is suggested by the casualty statistics:

- Vessel losses averaged over 250 per year between 1981 and 1983, which is a jump from the ten years previous, where losses ranged between 150 and 200 vessels each year.

- Fishing vessel loss rates are five to seven times that of U.S. oceangoing cargo ships. Lloyd's Register of Shipping lists 24 U.S. commercial vessels as lost during 1983; 15 of these were fishing vessels and only 2 were cargo vessels. The remainder were towboats, with one drillship.

- The casualty death rate for fishermen is seven times the national average for 11 industry groups (twice that for miners). In 1983, the number of accident-related deaths jumped to 111 from 66 in 1982 and 72 in 1981. In the ten-year period from 1970 to 1980, accident-related deaths averaged 103 per year.

Tony Hart will fully review the Coast Guard casualty statistics in his presentation.

This recent increase in deaths and vessel losses has created what has been termed the "insurance crisis" in the U.S. commercial fishing fleet. The Office of Merchant Marine Safety established a small team to study the problem and is developing a suggested voluntary program for commercial fishing vessel standards and personnel safety awareness and education.

The team is involving the fishing vessel community to the fullest extent possible. We have visited New England, Florida, the Gulf, Washington, and Alaska in addition to the Washington, D.C., area, as well as interest groups and government agencies. Team members have discussed the proposed program and solicited input, advice, and recommendations from fishermen's associations, NOAA/Sea Grant fishing vessel safety centers, fishing vessel designers and builders, marine surveyors, insurance/underwriter groups, the National Marine Fisheries Service, NOAA marine advisory services, our own district and field units, and many of you sitting in this room. We are trying to reach anyone who has an interest in fishing vessel safety. This contact is being made early in the development of the program.

A first cut at what the vessel standards should address has already been given. The standards would probably be published as a navigation and vessel inspection circular (NVIC). They would be aimed at the designer, builder, modifier, etc., and be technical in nature. They would be used in those areas where the Coast Guard has the expertise and a history of published standards (fire protection, navigation, life saving). Where we traditionally adopt other agency standards (hull construction, machinery, etc.), those standards would be identified and recommended. The one gray area is stability. Much information and many criteria have been generated on the subject, but the truth of the matter is there is no handy-dandy formula for fishing vessels of the size and hull form prevalent throughout the U.S. fishing industry. We are of the opinion that something is better than nothing, so we will take our best cut at a stability assessment procedure and emphasize the limitation of it. Bob Letourneau will discuss some aspects of small-vessel stability that the Coast Guard is tackling.

The safety awareness/crew education part of the program is aimed directly at the fishermen. We envision producing a safety guide, or a series of these guides, which parallel the topics in the vessel standards but are presented in a way which the man on the boat can use. The guides would be mostly pictures and diagrams depicting safety considerations with just a few words to clarify and emphasize the topic. Distribution of the guides will be key to the effectiveness of the program. The districts and local units, through their various contacts as well as the fishing vessel safety centers, NOAA marine advisory programs, fishermen's associations, and underwriters and surveyors, can circulate the guides and encourage their use. We are now working with the North Pacific Fishing Vessel Owner's Association to explore the feasibility of combining efforts and resources in developing and publishing safety guides.

Further, we will encourage the fishing vessel safety centers and other private institutions to use the safety guides as the outline for a formal course that could be offered to fishermen either as one- or two-week residential workshops or in night classes. The safety guides would then become the course notes that the fisherman takes back to his vessel.

We were informally considering the desirability of legislation to require the person in charge of navigation or control of any fishing vessel between 50 and 200 gross tons to complete a formal safety course approved by the Coast Guard.

Based on what has been learned from the various meetings, we have recommended to the Commandant to remove any mandatory requirements from the Coast Guard Safety Initiatives. As you heard this morning, he has accepted our recommendation and is forwarding it on to the Secretary of Transportation. Pursuing mandatory personnel certification would lead to opposition from industry and possibly other government agencies. The focus of attention and industry efforts would shift from one of cooperation to one of resistance. The excellent working relationship that the group has developed with fishing vessel interests would be lost. However, many of the people contacted expressed the need or desirability for a mandated safety program. The United Kingdom is one country that fully regulates its fishing industry, using as a basis the Intergovernmental Maritime Organization (IMO) of the United Nations 1977 Convention. They have found that fishing vessel casualties have not decreased. The industry view there, which is also applicable to the United States is, and I quote:

> Legislation for safety tends to take things out of the fishermen's hands. If a fisherman has his boat surveyed and has to spend a considerable amount of money to bring it up to standard, then at the end of the day he gets a piece of paper which can be interpreted as saying that his boat is safe. This means that he is likely to fish harder and push the boat closer to the limits and inevitably sooner or later disaster will strike.
>
> Legislation takes the responsibility for safety away from the fisherman. He may be less concerned over maintenance, which is the key to long-term safety, but, perhaps more important, he doesn't have the right attitude towards safety, which is what really counts in the long run. Most casualties come about through taking risks, perhaps in not replacing worn equipment or in not stowing the catch properly, and it is only the right attitude of mind which will reduce the risk taking.
>
> Legislation gives a false sense of security. If a vessel has passed a survey, the inference is that it is safe. Nothing is further from the truth, and a great amount of safety is in the hands of the person driving the boat. The facts speak for themselves. Since the introduction of safety rules in Britain for fishing boats, fishing boat casualties have risen despite a decrease in the size of the fleet. This is despite the fact that the rules were officially described as the greatest advance in fishing boat safety when they were first introduced.
>
> Fishing boat safety will only improve if the right climate is created for fishing. The fisherman is attacked on all sides by legislation, governing where he can fish, how he can fish, what he can fish, and the type of boat he can use. This is not the right climate for safety. It puts too much pressure on the fisherman.
>
> A much more constructive approach is needed. In addition to creating the right climate for fishing, there is a need to demonstrate that safe fishing can be profitable fishing, that time spent on maintenance is worthwhile. To a certain extent, safety can be improved by education, but there must be a strong element of logic in this. Fishermen are not fools and safety must be shown to make sense.

I think this best states the case for a wholly voluntary program that fishermen and their associates have helped define.

COMMENTS

Nixon: The philosophy is interesting, but I have to ask if casualties would have increased even more if the regulations had not been in place. The fishermen from the United Kingdom were operating old boats under great economic pressure at the time of legislation. Without legislation, they may have had even greater losses.

O'Sullivan: Economic pressures are preventing maintenance, and the number of vessels have doubled. Statistics are clouded because so many more boats and vessels are at sea. As fishermen are pressed harder, accidents may greatly increase without legislation. A major problem in insurance is the P & I, because fishermen are covered under the Jones Act and there is no cap, no maximum on losses which can be claimed. Most Virginia operators would accept a reasonable inspection program if it could be combined with insurance relief.

Lassen: But I think the initiative belongs with the fleet.

Harrison: There is the problem of human error. Operators don't know enough basics of navigation to take care of themselves. Too many vessels are independently owned--there are 400 in Gloucester. Hairdressers and plumbers are licensed. The captain of a million-dollar vessel, with up to 17 on board who may not be U.S. citizens, goes to Georges Bank in the winter--the only requirement is that the captain have U.S. citizenship.

CASUALTY UPDATE FOR DOCUMENTED FISHING VESSELS IN 1983

Lieutenant Commander Tony E. Hart
U.S. Coast Guard

This report updates a May 1984 analysis of casualties to documented fishing vessels to include 1983 casualties.

There were 242 documented fishing vessels reported to have been lost in 1983. This represents a decline from the 250 vessels lost in 1981 and the 270 vessels lost in 1982. However, losses for 1983 were still above the average of 203 vessels lost in the previous five-year period (1978-1982). Expressing 1983 losses in terms of loss rates based on vessel population, 7.3 vessels were lost for every 1,000 documented fishing vessels. This compares to the 8.2 loss rate for 1982. The loss rate for fishing vessels remains the highest of any segment of the American fleet.

One hundred and two, or 42 percent of the losses, were the result of flooding or capsizing of the vessel. An additional 64 vessels, or 26 percent of the total, were due to fires or explosions.

Table 1. Documented Fishing Vessel Losses During 1983 by Nature of Casualty.

Nature of Casualty	Losses
Collision	29
Fires and Explosion	64
Groundings	24
Flooding, Capsizing	102
Material Failure	19
Weather Damage	1
Other	3

The 1983 losses are shown in Table 2 by gross tonnage. Sixty percent of the losses were to vessels of less than 50 gross tons, although the number of vessels in this size range account for approximately 77 percent of the total vessel population. While the number of vessels in the range of 50 to 200 gross tons account for about 22 percent of the total fleet, almost 40 percent of the losses fell within this tonnage range. Only one vessel over 200 gross tons was reported to have been lost in 1983. This was the 331-gross-ton Elsinore, which took water into the engine spaces and sank off California.

Table 2. Losses of Documented Fishing Vessels During 1983 by Gross Tonnage.

Vessel Size	Losses
Less than 10 Gross Tons	28
10-19	50
20-29	30
30-39	14
40-49	23
50-59	16
60-69	11
70-79	10
80-89	14
90-99	16
100-149	20
150-199	9
200-299	0
300 Gross Tons and Above	1

Losses for 1983 were also broken down geographically by the Coast Guard district in which they occurred. The greatest number of losses, 49, was in the Gulf of Mexico. Alaskan fisheries accounted for the next highest number with 44 losses.

Table 3. Documented Fishing Vessel Losses During 1983 by Location of Casualty.

CG District	Collision	Fires and Explosion	Groundings	Flooding Capsizing	Material Failure	Weather Damage	Other
01	3	7	2	13	0	0	0
03	2	0	1	5	0	0	0
05	1	2	1	5	1	1	0
07**	2	10	4	9	4	0	0
08	9	13	3	19	3	0	2
11	1	2	0	8	2	0	1
12	3	4	3	11	3	0	0
13	5	7	5	11	2	0	0
14	0	1	1	0	0	0	0
17	3	17	4	18	2	0	0
Atlantic(Gen)	0	1	0	0	1	0	0
Pacific (Gen)	0	0	0	3	0	0	0

** 7th District losses occurring in Atlantic. Losses in Gulf included in the 8th District.

While the total number of vessels lost in 1983 declined, the number of vessels reporting damages increased. In 1982, 725 vessels were reported damaged. In 1983, 921 vessels reported damages, an increase of 27 percent. Equipment or material failure accounted for 453 of the reports, or 49 percent of the total. Groundings were the next kind of casualty with 152 reports.

Table 4. Documented Fishing Vessels Reporting Damages During 1983.

Nature of Casualty	Damages
Collision	95
Fires And Explosion	57
Groundings	152
Flooding, Capsizing	141
Material Failure	453
Weather Damage	8
Other	15

The 111 deaths reported in 1983 were a substantial increase over the 72 deaths in 1981 and the 66 deaths in 1982. Seventy-one of the total 83 deaths associated with a casualty to the vessel were the result of flooding or capsizing. Twenty-eight deaths were the result of accidents on board a vessel. Of these, 21 were due to falls overboard.

The higher loss of life is partly attributable to the increase in fatalities in the Alaskan fisheries. Thirty-six persons were reported to have been lost in Alaska during 1983, compared to 20 in 1981 and 14 in 1982. Fourteen of these deaths were the result of the Americus and Altair losses.

STABILITY INVESTIGATIONS

Lieutenant Commander Robert Letourneau
U.S. Coast Guard

In developing voluntary standards for fishing vessels, the area most open to question is stability. The main reason for this is that no stability criteria exist which can be applied to all fishing vessels due to the variety of hull forms and equipment used in different geographic locations in the country.

Many designers today use the IMO criteria to evaluate the stability of fishing vessels. These criteria were developed for fishing vessels while in transit to and from their fishing zones. They do not consider the effect of overturning forces from fishing gear. A second shortcoming is that the Coast Guard considers them valid only for vessels greater than 100 feet in length. The majority of U.S. fishing vessels are less than 100 feet long. To serve the needs of the U.S. industry, the requirements must be suitably increased to provide an equivalent level of safety. To date, no one has proposed how to modify the criteria to do this. Another problem with these criteria is that they may not provide adequate stability for smaller fishing vessels in the light condition. This became evident following the investigation of several capsizings of fishing vessels which met the IMO criteria while in the light condition. Finally, the icing criteria are suspect because of the lack of "rate of icing" data on ice accumulation (how many inches/hour in certain icing conditions).

Other criteria used by foreign countries have similar limitations. They may apply only a minimum GM criterion, which does not give the entire picture of stability, or they may only apply to selected vessel types. Where does this leave us in developing a voluntary stability standard? The answer for now is to present the most complete criteria that we can while calling attention to the limitations such as length, loading, etc.

We are actively studying currently applied standards for fishing vessel stability to determine those most appropriate for voluntary application to U.S. fishing vessels. We recognize this is not a final solution but rather an interim measure while more extensive research is conducted to identify significant factors in preventing capsizings. We intend to update the criteria continually as research results become available.

Another project the Coast Guard is interested in is the stability computer. These devices are touted by their manufacturers as being highly effective in reducing stability-related casualties because they alarm the Master when the stability of his vessel decreases. These devices measure the roll period of the ship over a statistically determined number of rolls and then calculate initial stability based on the equation:

$$GM = \left(\frac{CB}{T}\right)^2, \text{ where } B \text{ is the maximum beam}$$

T is the period roll

C=0.42 to 0.45 (empirically derived).

The stability computer may prove to be a real benefit in preventing capsizings or it may lull the Master into a false sense of security. To use the computer, fishing vessel owners must do an inclining test and stability analysis before the input information can be entered to use the computer. This by itself may reduce casualties caused by undocumented modifications. However, there are still several potential fatal flaws which must be examined more closely. These are:

a) The period of rolling is a function of both the ship's natural period of roll and the period of waves. A ship rolling in still water is in free oscillation; its period of roll is the natural period of roll of the ship. A ship rolling in waves of exact uniformity and regular period is subject to nearly regular periodic wave impulses. In this condition, the ship is in forced oscillation and will eventually assume a period of roll identical to that of the waves. On the other hand, a ship rolling in irregular waves where the impulses are not fairly regular has a tendency to revert to its own period of roll. The overall result is that the period of roll of a ship is a combination of the ship's own natural period of roll and the period of waves producing the rolling moment where the period of the waves is generally the more predominant.
b) The coefficient C must be determined for each vessel. C may also vary with the sea conditions.
c) These devices measure only GM, which is not the only indicator of a vessel's intact stability. (However, this may alert the Master to relative changes in his vessel's stability.)

The Coast Guard will begin an evaluation of a commercial stability computer early next year using the teaching staff and facilities of the U.S. Coast Guard Academy. The primary tasks will be to answer the following questions:

a) Does the stability computer measure what it says it measures? How does the stability computer distinguish between the response due to the forcing function of the waves and the natural period of roll of the ship?
b) If the stability computer does measure the period of roll, can it quantify the stability of the vessel on the basis of motions? Can acceptable limits of uncertainty be set on an automatic stability evaluation based on the length of the vessel and the wave length?

Results are expected late next year.

COMMENTS

Harrison: Before we can get them to buy stability computers, we have to get them to use and maintain bilge alarms.
Letourneau: We also need to present stability data in an understandable format.
Adee: Inclining will give value for C, but is usually done in a light loading condition and may vary considerably.
Piché: Also, IMO criteria do not apply to U.S. vessels.
Harrison: The education level of the fleet is extremely poor. Many can't read--any language! And it is these folks who are the casualties.
Johnson: There are two problems. One, to develop criteria that everyone can agree on, and, two, develop a method of implementation that the fisherman can apply in everyday operation.
Adee: Alaskan vessels that capsized had a stability booklet on board, or were aware of it.

A SAFETY CERTIFICATION COURSE IN GEAR HANDLING FOR REDUCED INSURANCE RATES

Philip Cahill
Commercial Fisheries Gear Spcialist, Virginia Sea Grant College Program, Virginia Institute of Marine Science

I represent the Virginia Sea Grant Marine Advisory Program at the Virginia Institute of Marine Science. I am present at this meeting to inform you of a fishing vessel safety course that we are developing for the mid-Atlantic fishing fleet. This course is our response to the current nationwide problem in fishing vessel safety and the resultant negative impact on fishing vessel insurance. Because of the current high incidence of fishing vessel sinkings, capsizings, gear-induced injuries and mortalities, insurance underwriters have been reluctant to remain in the market. The economics of the situation have caused them to respond with both cancellations and increased premiums. This has been particularly true of P & I coverages; rates have doubled and in some cases tripled over the last six months. These increases are in part responsible for some fleets and owners not being able to meet debt obligations. Some action has to be taken to alleviate these conditions if we want to see continued growth in our fishing industry. Personally, I do not feel that there is any one all-encompassing answer. Traditionally, the fishing industry has been characterized by independence and individualism. Because of this, the industry has been slow in evolving coordinated internal mechanisms to control problems.

Recently, I visited the U.S. Coast Guard RTC Center in Yorktown, Virginia, to solicit Coast Guard assistance. Specifically, I wanted to recruit personnel and use portions of their safety programs as components of a course on fishing vessel safety. While I was there I was able to interact with a number of their safety course advisers, who had a myriad of opinions on fishing vessel safety. One opinion consistently mentioned was that the fishing industry is one of the last maritime industries that is not subject to some form of external regulations regarding safety and working conditions. One officer stated that, given the present record of sinkings and casualties, it was only a matter of time before some type of external inspection or policing would occur.

What, then, can Sea Grant's role be? Dr. Ned Ostenso in his welcoming remarks to the 1983 conference stated, "Clearly, Sea Grant is not going to go into the vessel inspection business. And probably we are better off supporting some of the 'soft' sciences like training, education, economic incentives, insurance incentives, and so forth that might lead to greater vessel safety."

My own boss Bill DuPaul likes to say, "We can't arrest you and we can't give you any money." These prudent philosophies assist us in determining procedure and policy as we define our role and establish programs to meet this challenge.

We are fortunate that within the Sea Grant system we have various programs and informed personnel that can be coordinated to form the foundation of a comprehensive fishing vessel safety course. For example, The University of Rhode Island safety bureau is already actively working in the area of vessel stability, and the University of Washington Sea Grant Program has for years sponsored programs through their Fishing Vessel Safety Center.

The Virginia Sea Grant Program is drawing on these and other resources as we develop and implement a standardized "Fishing Vessel Safety Course." This course will initially be run as a pilot program in conjunction with Wells Scallop Company of Seaford, Virginia, the industry partner. The Wells fleet of eleven 85-foot to 90-foot St. Augustine trawlers was chosen because these vessels are representative of the mid-Atlantic fishing fleet and because they are engaged in the scallop fishery, which has a higher incidence of injuries than even draggers. Working closely with Bill Wells and Bob O'Sullivan of the Flagship Group of Norfolk, Virginia, we decided to create a comprehensive safety course and focus it particularly on safety problems related to gear and winch injuries. By doing so, we felt that we could track the program and document any reductions in injuries for the insurance industry. Over the last 16 months, crew members on Wells vessels have experienced 29 casualties, none of which has resulted in loss of life. To date, these 29 casualties have resulted in settlements of $200,000 for the five or six which have been settled. Of these injuries, 55 percent have been the result of slipping or falling on deck, 35 percent are winch-related, and the remaining 10 percent fall into the "Act of God" category. It was obvious to us that there was a strong potential for significantly improving the safety of the crew members by introducing improved winch-operating procedures.

Gear- and winch-related safety is just one of the important areas of concern. We designed the course to be broad enough to cover most of the casualties and perils that commonly occur on fishing vessels. The course will include, but not be limited to, the following: (1) procedures for safe winch and gear handling; (2) fire-fighting techniques; (3) search-and-rescue coordination training; (4) hypothermia and cold water survival training; (5) emergency medical training; and (6) vessel stability seminars.

The course will consist of two six-hour sessions which will be designed to certify the qualifying participants for a potential automatic reduction or rebate in P & I premiums of up to 10 percent. By utilizing films, existing programs, publications, and, above all, hands-on training as the learning mechanisms, we anticipate positive results.

To date, we have established a relationship with the Coast Guard and are coordinating two aspects of the course with them: a search-and-rescue component that will feature a helicopter, and a safety information program. Proper procedures for gear and winch handling will be filmed on board during simulated periods of hauling and setting. Captains who have had the best safety records in the Wells fleet have been chosen to illustrate the right and wrong procedures. A certified EMT instructor will provide basic first aid training, concentrating primarily on the most common fishing vessel injuries. The Sea Grant Program at VIMS will offer a course in hypothermia and cold water survival, and we see a need to incorporate some of the fine work other programs have done in this field. The fire-fighting component will focus on recognizing the source of a fire, identifying the combustible material, and methods of extinguishing these different materials. This will be in the form of a hands-on training session that will be filmed. Vessel stability is one of the biggest problems confronting us today, not only in the mid-Atlantic but in New England and Alaska. Hopefully, we can establish today what direction this part of the course should take.

I don't feel that this course is a panacea, but is rather a response by responsible parties to attempt corrective action. However, if this project can document that it has caused any reduction in casualties, then I feel that the course can be tailored to respond to the specific needs of various regions and/or fisheries. William Wells III, of Wells Scallop Company, is making participation in the course mandatory for all of his captains and crew, as well as for any new employees, before they can set foot on a vessel. Mr. Wells has stated that "the insurance companies might not grant us a rebate, but a course like this might enable us to stay in business."

COMMENTS

Nixon: Basic safety issues are important. Why put tile on the decks of boats? Research should be put into the basic issues.

Harrison: Gloucester had 35 losses from 1980 to 1984. Many were suspicious. Insurance companies canceled insurance and the losses stopped. Some policies are now being re-instated, with deductibles of $1,500 upped to $5,000, to as much as $20,000. Total losses are to be reimbursed at 75 percent of value.

O'Sullivan: The American offshore fisherman pays $1,950 times 7 for a P & I policy. His Canadian counterpart pays $750 per year for hull and P & I. Their catches must compete equally on the world market. Lawyers meet boats at the pier with brochures spelling out rights under the Jones Act.

RESULTS GENERATED BY FISHING VESSEL SAFETY PUBLICATION IN THE TEXAS COMMERCIAL FISHING INDUSTRY

Dewayne Hollin
Marine Business Management Specialist, Marine Advisory Service,
Texas A & M University Sea Grant Program

(Submitted in writing; not presented)

Between January 1980 and May 1982, the Marine Advisory Service at Texas A & M University did a great deal of work developing a guide primarily to help Texas commercial shrimpers establish an industry-wide safety program. The Texas Shrimp Association participated extensively in reviewing and evaluating material for the guide. Also, marine insurance company claims and safety department personnel, marine surveyors, and many marine industry safety professionals contributed large amounts of experience, support, and energy to the project. The end result was the Sea Grant publication, "Safety at Sea, A Guide for Fishing Vessel Owners and Operators," which has been provided to each of you.

Both the Texas Shrimp Association and Sea Grant realized that as the number of fishing vessels and vessel accidents increased in the Gulf of Mexico, so did the need for each vessel operator to have some type of safety program. Many of the losses--both loss of property in the form of fishing vessels and equipment and loss of life--could be avoided if vessel owners and operators established and used safety programs. The central problem was to develop a safety guide that would generally meet the needs of most commercial shrimpers in a form that was easy to use and understand.

"Safety at Sea" is designed to provide fishing vessel owners and operators with guidelines to improve their individual safety programs. It includes information about the prevention of accidents, safety inspections, safety rules for crew members, accident reporting procedures, accident investigation, and safety training. It gives sample forms to be used in collecting safety-related data and even includes a section on how to survive at sea after vessel abandonment.

Because of the diversity of fishing operations in the Texas commercial fishing industry, no ready-made safety package can fill the needs of all operators. While "Safety at Sea" guidelines form a sound basis for organizing an effective safety program, other program guidelines may meet fishing industry and individual needs just as effectively. The suggestions listed in the publication can, however, be used to supplement other procedures and safety programs in the marine work environment.

The shrimping industry recognized that insurance companies could not sustain the 150 percent to 170 percent loss ratios in fishing boat hull and P & I insurance. The industry was convinced it was rapidly becoming uninsurable at any affordable level. Accidents covered by the Jones Act and case law on definition of a seaworthy vessel, as well as subtle or even direct encouragement by plaintiffs' attorneys, were principal causes of many physical injury cases being filed.

"Safety at Sea" provides help to the industry by identifying potential safety hazards through a system of organized vessel inspection checklists and reporting forms. It also helps the industry avoid recurrence of accidents by determining cause through records developed with accident-reporting forms and follow-up accident investigation procedures. Forms in "Safety at Sea" cover personal injury reports for vessel captains and crew members which record and properly document specific details of an accident immediately after the accident occurs. In many cases, this could prevent potential lawsuits.

Since late 1982, more than 2,400 copies of "Safety at Sea" have been distributed by insurance companies, trade associations, and individual request to the commercial fishing industry. More than 300 copies are now aboard Texas Shrimp Association member vessels.

Although no fishing vessel accident statistics are available for this distribution period, the Texas Shrimp Association estimates some improvement in the number of reported accidents by its membership. While a drop in reported accidents would be a very positive sign for the industry and a positive result for "Safety at Sea," most industry people feel the publication has aided the industry more by (1) creating a greater awareness of safety hazards on fishing vessels; (2) providing methods to reduce these hazards; and (3) providing better accident-reporting procedures when an accident does occur.

By having a better awareness of how safety programs are organized and implemented, commercial fishing vessel owners and operators can establish effective safety policies, maintain better accident records, and conduct productive accident investigations. Another benefit would be the overall reduction in fraudulent physical injury case filings, a result of better accident report documentation by vessel owners and operators.

Just as there is little doubt fishing vessel owners will continue to face enormous risks for accidents occurring on board vessels, there is also little doubt that the only way to prevent substantial loss is through more effective safety programs. Safety problems do not go away when they are ignored--they get worse. The most constructive way to deal with these problems is to identify them (much like the safety hazards identified in "Safety at Sea") and develop steps to eliminate or reduce their effects. "Safety at Sea" helps the industry by providing controls and procedures in the form of safety program guidelines. The degree to which the commercial fishing industry benefits from using these guidelines depends on the vessel owners and operators.

LEGAL DEVELOPMENTS REGARDING SAFETY OF FISHING VESSELS

James P. Walsh
Lawyer, Washington, D.C.

The theory is that the vessel captain and owner take care of the crew and are responsible for them, almost without exception. The number of cases and settlements is up. The plaintiff normally asks for remedy and cure, claiming negligence under the Jones Act. Insurance companies recognize that juries are partial to the injured party, and will initiate settlement discussions. A good guide is "Commercial Fisherman's Guide to Marine Insurance and Law" by Dennis Nixon of the University of Rhode Island.

As insurance companies leave the business, owners and captains are becoming self-insured.

Whenever a case goes to court, the aim of the plaintiff is to find the "deep pocket." One approach is to look for product liability--from the manufacturer, the designer, the surveyor, the shipyard. This broadens the possibility of finding someone who can pay. In some cases, the government is sued in the hope of getting greater compensation.

Legislative action is possible. The House Merchant Marine and Fisheries Committee has been stirred by the drilling rig disasters. There is interest in increasing the safety requirements (for instance, cold water survival suits). This is offset by economic concern for the fishing industry, and the cost impact of legislation which may not result in a significant improvement in safety.

The House of Representatives has come up with a revision of the U.S. shipping code. The revision includes a bill to establish and set limits of liability. It also defines unseaworthiness and financial responsibility ($600,000 per crewman) with a maximum value. This is also a step toward regulation of the marine insurance industry, which may not be acceptable.

IN-SITU STABILITY MEASUREMENT OF FISHING VESSELS

John A. Tylawsky
Marine Consultant, New Haven, Connecticut

(Prepared paper presented as a handout at the conference)

The evaluation of small vessel stability by the marine surveyor in the field is, at best, subjective. A detailed study is not practical and in many cases impossible. The required data is often not available, or never existed. The lines plans, table of offsets, and displacement curves may have been long since lost or never originally prepared.

A common criterion used in determining how safe a vessel is, stablity-wise, is GM, or metacentric height. This is a measure of the vessel's ability to resist small heeling moments.

Unfortunately, vessels with large GMs often have poor stability characteristics at large heeling angles. A better source of stability information is an evaluation of the vessel's righting arm (GZ) versus the angle of inclination. A plot of GZ versus angle of inclination is commonly referred to as the "statical stability curve."

The statical stability curve has several useful features in the evaluation of stability. Figure 1 shows two statical stability curves (A and B) for vessels A and B. Curve C is a plot of the righting arm curve using $GZ = GM \sin\theta$.

At a small angle of heel, curves A, B, and C show approximately the same values for righting arm. However, the direction of the righting arm curve near the origin determines whether the vessel will develop a positive righting arm when the GM is reduced.

The righting arm curve for vessel A shows that the vessel will heel to a small angle beyond which a positive righting arm will result in limiting the heel angle.

Vessel B, however, will capsize with a diminishing metacentric height.

It is clear that if GM was used to evaluate vessels A and B, it would be impossible to predict their stability at large angles of heel. It could have resulted in loss of life due to capsizing for the men aboard vessel B.

Although metacentric height may be positive at the time of survey, it is possible and common for a condition of negative GM to develop gradually over time. This may be due to a reduction in consumables, weight removals or additions, increased free surface, or through the accumulation of topside ice.

With vessel A, there would be some warning that a serious stability condition was evolving due to a gradual increase in roll period.

On the other hand, the men aboard vessel B would not detect a change in roll period while alongside the pier or while in still

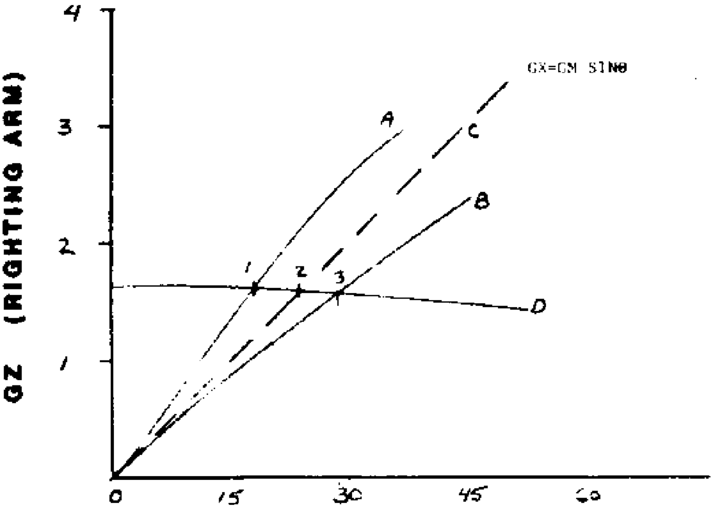


FIGURE 1
ANGLE OF INCLINATION

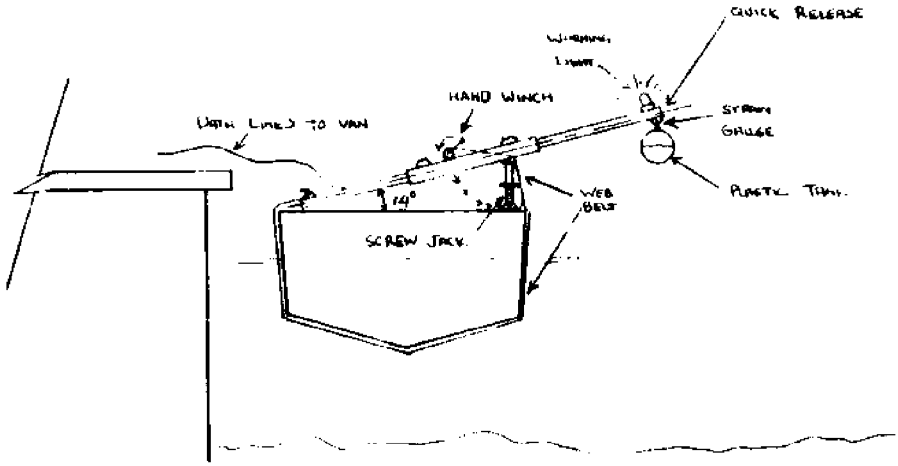


FIGURE 2
POSSIBLE BOOM ARRANGEMENT

water. The dangerous stability condition would only be apparent when the vessel was experiencing heavy rolling conditions.

The statical stability curve is also useful in estimating dynamic stability characteristics. The residual dynamic stability is represented by the area above the heeling arm curve (curve D) and below the righting arm curve (curve A or B).

Point 1 represents the angle of heel at which vessel A would roll with the applied heeling moment. Likewise, point 3 represents that limiting angle of heel for vessel B. It is obvious that using the assumption that $GZ = GM \sin\theta$ at large heel angles would result in useless information regarding maximum roll with applied moments.

The excess of the righting arm over the heeling arm is also important because it provides a means of determining the safety margin for other upsetting forces such as wave energy and shows the allowable margin of experimental and computing error in calculating GZ.

A Case Study

Lundgren and Storch in "Small Fish Boat Stability: A Case Study" (1), remind us that there is no criteria to determine whether a "small" vessel is stable or unstable ("small" being a vessel less than 79 feet, O.A.). They go on to conduct an analysis of a small fishing vessel (27 feet, L.O.A.) using a "poor man's" inclining experiment.

Their procedure consisted of hanging weights from the vessel's trolling poles and determining the heel angles from photographs of the vessel taken from shore. What is important about this procedure is that it proved that, even considering the crudeness of the "poor man's" inclining experiment, the data obtained was valuable in predicting the vessel's stability characteristics.

The conclusions that the authors reached were:

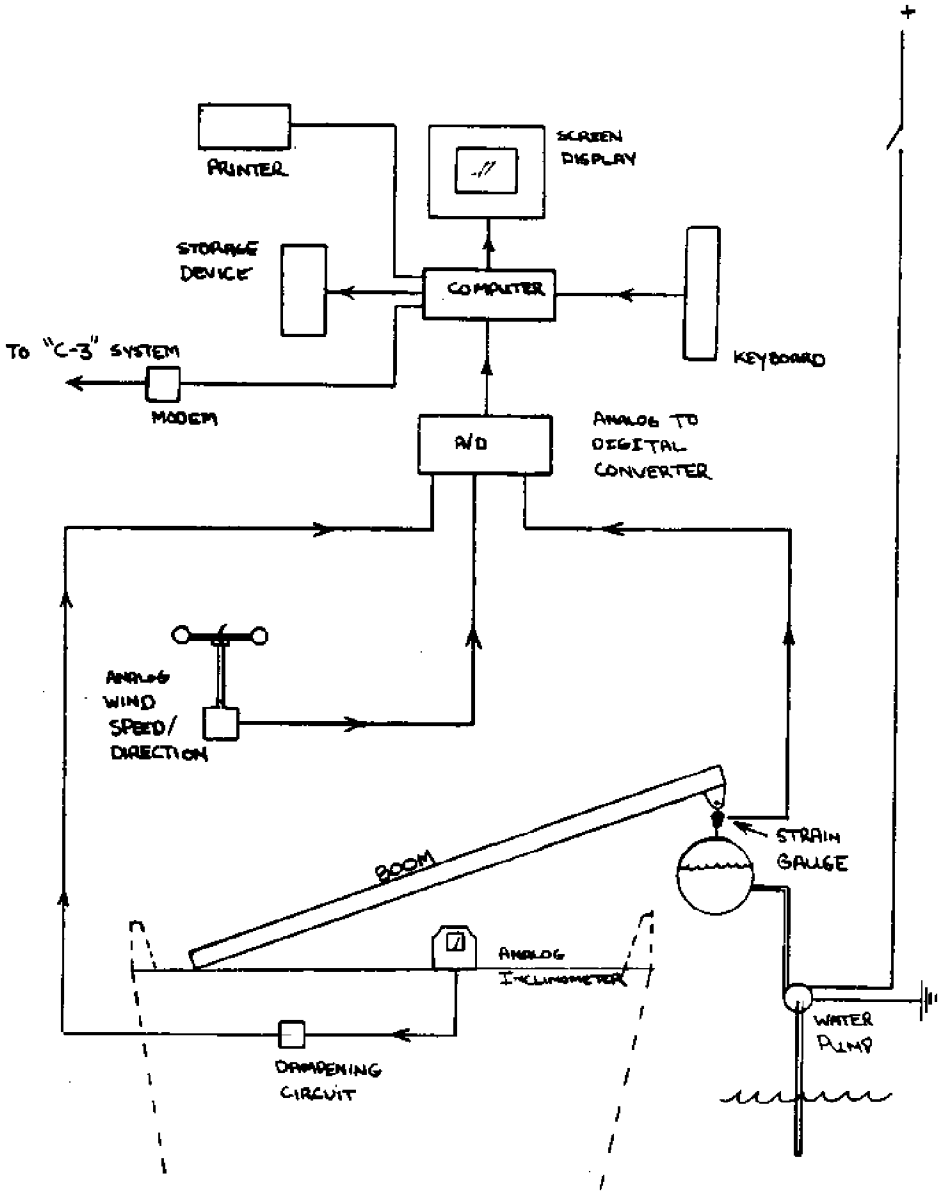
1) Stability analysis of commercial fish boats is important.
2) Even crude inclinings can provide useful stability information.
3) After initial inclining, roll period can be useful to determine small changes in GM.
4) Initial GM is not a good indicator of stability.
5) IMO criteria are a good guideline for vessels under 79 feet, L.O.A., for now.
6) Good seamanship and vessel behavior in following seas is more important for smaller vessels, stability-wise.
7) Large steel vessels and vessels with tanks should be carefully inclined.
8) For small vessels, the principal cause of poor stability is inadequate waterplane moment of inertia ratio to displacement.
9) Increased freeboard and higher down-flooding angles could improve small vessel stability.
10) Some stability knowledge is better than none at all.

In-Situ Stability Measurement

Lundgren and Storch proved that even crude inclining experiments could provide life-saving stability information. The problem then arises of what system can be used to incline the vessel and collect the necessary information.

As you know, the current approach is to simulate either wind heeling moments or passenger heeling moments by placing weights

SCHEMATIC DIAGRAM OF BOOM TYPE SYSTEM



off-center aboard the vessel. However, several problems arise. In many cases, the required moment cannot be simulated by adding additional weights without excessive immersion of the vessel requiring compensation and introducing error. When dealing with small fishing vessels, where the vessel's beam is about 10 feet, a miscalculation of the center of gravity of the weights by as little as 4 inches could easily result in a 7 percent or more error in applied heeling moment (with a similar 7 percent error in righting arm). In many cases, sandbags are used, and an estimation of their respective centers of gravity as well as their combined centers of gravity, considering the slightly variable spacing, could easily result in such an error. Further, the inclining experiments are limited to vessels that are easily accessible, since the required weights can be 1,000 to 2,000 pounds of sand or more.

The required weight can be estimated using the following equation:

$$w = \frac{GM * W \tan \theta}{d}$$

where:

- w = required weight (pounds)
- GM = approximate matacentric height
- W = displacement of vessel (pounds)
- θ = required heeling angle
- d = moment arm

Clearly, the need exists for a device that can be used to incline such a vessel, gather the stability information, and reduce the procedural errors resulting from the large applied weights and the calculation of moment arm. The problem exists to develop a device that can be easily transported by two men, that is adaptable to a wide variety of vessel configurations (i.e., flush deck, cockpit, well deck, etc.), that is independent of the vessel power, and that can safely and efficiently be used to gather stability information.

Figure 2 shows a proposed "portable inclining boom" that would meet these criteria. The boom design would probably be an "aluminum extension ladder truss" fitted with a plastic water tank at the outboard end. The boom would be placed athwartships and secured around the vessel with a web type "belly band." A screw-type jack leg would be provided to achieve the necessary angle to prevent immersion of the water bag during inclining. An aluminum "spread footing" mat could also be provided to distribute the force of the jack screw leg on vessels with marginal deck strength.

The inclining experiment would begin with the operator starting a small battery-operated water pump that would supply seawater to the plastic water tank located at the end of the boom and used to create the desired heeling moment. A strain gauge at the water tank connection to the boom would monitor applied weight, while an analog inclinometer aboard the vessel would measure angle of heel. A wind speed and direction indicator would also collect data about wind direction and force that might influence the results of the experiment.

The analog signals would be sent to an analog to digital converter and then to a microcomputer. The computer screen displays would be identical to the current "Small Passenger Vessel Stability Test" form CG-4006 (2). A graphics pad would also allow the inspector to input the vessel profile for sail area calculations.

The results of the inclining experiment could be used to provide a field report of statical stability, compare the data to IMO criteria for larger vessels, or the data could be transferred to the office data base via modem (such as the C-3 system used by the U.S. Coast Guard).

Upon completion of the experiment, the boom would be retracted for transport and placed on conventional ladder racks on a car, truck, or van. Because of its light weight, it could also be easily shipped to various locations using commercial delivery companies (such as UPS) or even transported by helicopter or other light aircraft.

Advantages

1) Procedural errors are reduced or eliminated because the experiment would be completely automated (i.e., erroneous data associated with incorrect estimate of weight, moment arms, etc.).
2) A high degree of technical skill is not required to conduct the experiment, as the system would be "menu-driven" and "user-friendly."
3) The system would be light-weight and easily set up, reducing time and cost.
4) The system could be easily transported to relatively inaccessible locations.
5) The system can be purchased by fishing cooperatives and other groups for periodic monitoring of stability. Because of transportability, a large number of groups could share one unit.
6) The data can be easily transferred to a larger data base for future analysis (i.e., statistical studies of stability characteristics and vessel configuration). This information could also be made available to designers and others.

References

1. Lundgren and Storch. "Small Fish Boat Stability: A Case Study." Marine Technology, Volume 21, Number 4, October 1984, pp. 364-369.

2. United States Coast Guard. "Small Passenger Vessel Stability Test Procedure." Form CG-4006.

3. United States Coast Guard. "Navigation and Vessel Inspection Circular No. 3-76, Stability of Fishing Vessels."

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5. Society of Naval Architects and Marine Engineers. "Principals of Naval Architecture." S.N.A.M.E., 1977.

COMMENTS

Johnson: Initial GZ curve is not a sufficient measure of stability, since loading conditions vary. Also, problems occur after 14°, which is still in the range of stability.

Chatterton: Inclining uses fixed weight, the known distance above the keel. This proposed method uses variable weight, variable distance above the keel, and there must be a correction. Also, there must be a calibration procedure built in to verify the measurements.

Piché: Loading conditions may not change shape of curve, but range will definitely change drastically. This could be misleading to the operator. Also, Pacific crab boats--sister ships--were found to be grossly different. It would be difficult to build a data base for "similar hull types."

Goudy: The primary function of an inclining experiment is to determine or verify the location of the vessel's center of gravity. When subsequently combined with the hydrostatic properties of the hull geometry, the stability of the vessel can be predicted.

The vertical distance between the center of gravity and the metacenter is the metacentric height. This value can be used to establish the slope of the righting-arm curve at small angles of heel. Mr. Tylawsky's technique could be used to determine whether the righting-arm curve is convex or concave at small to moderate angles of heel. This fact, however, can be predicted by an experienced naval architect based on hull shape; particularly topside flare.

Knowledge of the righting arm at small to moderate angles often has little bearing on the range of positive stability or the maximum GZ. It would be ill advised to draw conclusions about the stability of a vessel without an analysis of the hull form. I appreciate the fact that many of the vessels over which there are stability concerns do not have lines drawings or cannot conveniently be hauled to derive them. The proposed method is no alternative.

The technique reported by Storch may, however, have merit, since he suggests using the vessel's own rigging to heel the vessel. Since the strength of rigging is usually commensurate with the size and displacement of the hull, it can usually be used to heel the vessel to large angles when connected to the pier or another vessel. Only if the vessel is heeled to an angle well beyond that of maximum GZ can some indication of stability for that particular loading be obtained. Whether this extreme heeling can be done safely is another issue.

NATIONAL COUNCIL OF FISHING VESSEL SAFETY AND INSURANCE ACTIVITIES

Thor J. Lassen
Executive Secretary of the Council and Representative of the National Fisheries Institute

The National Council of Fishing Vessel Safety was originally formed in Washington State. It includes representatives from the various fisheries, and representatives from the Marine Index Bureau and the insurance companies. Funding in 1982 through the Saltonstall-Kennedy Program established a computer-based safety analysis program, using the Marine Index Bureau. Research shows that almost all problems are human-related.

Some of the problems identified are: a) no measure of fishing vessel performance; b) no standardized designs and layouts; c) no basis for equipment selection; d) poor or no use of protective equipment--guards, etc.; e) no clearinghouse for information.

Recommendations include a 90-day cooling-off period during which owners, injured parties, and insurance companies get together, before any attorneys can enter the case.

Fishery management plans have to allow for bad weahter days so that a fisherman is not exposed to weather hazards to remain solvent.

Problems that are recognized by Congress include: a) vessels are uninspected; b) marine insurance is unregulated; c) there appears to be a unique opportunity to defraud; d) there is no limit to amount of claims; e) all monetary disputes are settled in court; f) there is no requirement for fishing vessels to be insured; g) there is no existing standards for insurance to avoid ommissions; h) PHS hospitals have closed--no more free care for fishermen; i) attorneys have recognized a bonanza; j) existing law is extremely complex.

SELECTION OF A MARINE CONSULTANT

Desmond Connolly
Independent Marine Services, Inc., Buzzards Bay, Massachusetts, and Member of the National Association of Marine Surveyors (NAMS)

A marine surveyor is someone who looks at a vessel for its intended use. There are no standards for marine consultants or surveyors, outside of the state of Rhode Island, which licenses all professions. To be a surveyor requires a knowledge of losses and insurance.

NAMS has been in business for about 25 years. They have established qualifications, including the requisite that one-half of the previous five years of experience be spent full time in surveying. The association is now international, with about 400 members, some of whom resist new membership because of competition.

NAMS is open to anyone qualified--anyone who can pass a multiple-choice test and show they meet the experience requirement.

NAMS publishes an index of marine surveyors, and is looking at a recertification process. The Society of Marine Consultants, in New York, publishes a list of people and categories of expertise.

P & I FISHING VESSEL INSURANCE, 1984

Jim Harrison
Maritime Adjusters, Inc., New Bedford, Massachusetts

When I received a call a few weeks ago from Dr. Kowalski, he asked if I was planning to attend this year's meeting of the Fishing Vessel Safety Conference. I said, "Yes--barring any emergencies." Dr. Kowalski said, "Good, I'll put you down for a 10-minute presentation--now, what will you present?" Since a hot item at that time was the "35 Suspicious Sinkings of Gloucester Fishing Vessels," I told Tad that I would discuss that item, since I had investigated and handled at least 10 of those losses for marine underwriters.

However, in the meantime, I thought it would be more relevant to a fishing vessel safety conference to research our F/V Casualty Log and compile the statistics on vessel casualties for the five-year period 1980 through 1984, to date. So I did compile the statistics, and computed the rate of occurrence of each type of casualty. I have listed the named casualties in descending order, from those most often occurring to those least occurring. I then prepared a few observations, opinions, and recommendations.

Well, about two weeks ago I received a letter from URI. It was the agenda for this meeting. I turned to page 2 and said, "Great, the usual inflation--my 10 minutes has mushroomed to 30 minutes, but worst of all, there is an odd entry next to my name, 'P & I Fishing Vessel Insurance, 1984.'" Well, I know there is an easy way out--since I'm not a licensed insurance broker, I'll give that topic a very wide berth and stick with "Fishing Vessel Casualties, 1980-1984; Statistics, Observations, and Recommendations." The rest of the entry is correct--I am Jim Harrison and I am employed by Maritime Adjusters in New Bedford, Massachusetts.

Our function is to handle all types of marine claims and to conduct marine surveys for various marine insurance companies and, periodically, vessel owners. Our principal function relates to commercial fishing vessels and fishermen. We handle about 350 personal injuries, illness, and death claims per year. Our principal function relates to commercial fishing vessels and fishermen. We also handle about 100 fishing vessel casualty claims per year. Commercial fishing vessel claims comprise about 75 to 85 percent of our work.

Besides commercial fishing vessel claims, we:

a) conduct about 35 to 50 condition surveys on fishing vessels, tugs, barges, and ferries
b) conduct tug and barge on-hire and off-hire surveys
c) handle personal injury claims on passengers and crew members of the Woods Hole/Martha's Vineyard and Nantucket Steamship Authority. They have five large passenger-and-vehicle ferries.

d) handle personal injury claims for passengers and crew members of the Hi-Line ferry fleet, which operates between Cape Cod and the islands of Martha's Vineyard and Nantucket.

However, since fishing vessel safety and insurance is the order of the day, I'll atttempt to restrict my remarks and statistics to commercial fishing vessels only. As I'd mentioned earlier, at Maritime Adjusters we handle an average of 450 fishing vessel claims per year. This average is taken from the last five-year period, 1980-1984, to date. We have six marine claims adjusters. Four of these specialize in handling the personnel-type claims; that is, injury, illness, and death, which are named perils in the P & I (Protection and Indemnity) insurance policy.

The other three marine claims adjusters and myself handle all of the vessel casualty claims and surveys. Dave Burns and I are both marine surveyors and both marine engineers. Dave's background is with the Coast Guard, while mine is with the Navy. Briefly, let's take a look at the insurance carried by fishing vessel owners:

Hull Insurance
P & I Insurance
War Risk Insurance
Pollution Insurance

Now, what do these policies provide to the fishing vessel owners?

Pollution Insurance: generally, the costs associated with oil spill control, containment, and clean-up; also, liability associated with damage to property, such as the mess that oils make to the sides of other vessels.

War Risk Insurance: the policy names damages caused by war, rebellion, insurrection, Surprisals, Enemies, Pirates, Rovers, Taking at Sea, Arrest, Restraint and Detainment of all Kings, Princes, etc. Very venerable terms, having their origin in the named perils claim in the Lloyds form, which dates back to the early seventeen-hundreds.

However, what does all this eloquent wording provide today's fishing vessel? First, there is our very important named peril--Malicious Acts--also from early eighteenth-century England. So, if you are not bilingual, Malicious Acts gives needed protection in case of arson or vandalism, as we Colonials call it. Further, in the event an unexploded torpedo, mine, depth charge, or projectile is brought to the surface in a vessel's nets or scallop dredges and explodes, causing damage to vessel and crew, then the insured is protected by his War Risk Insurance.

Hull Insurance: this policy protects the insured from certain named perils which cause damage to his vessel and to its gear. In case of a collision and the insured is liable, then it extends to the damages suffered by the other vessel.

P & I (Protection and Indemnity) Insurance: a liability insurance, basically, and by far the most important--compensation and medical expenses for injury, illness, or death of any member of the crew. P & I also provides coverage to the insured vessel in case the vessel

	Avg/Yr.	Total	Avg. Per Yr.	'80	'81	'82	'83	'84
Collision w/floating object		103	20.6	29	31	22	28	13
Material failures (machinery/other gear) Crew negligence or latent defect		80	16	15	16	22	13	14
Collisions		63	12.6	12	15	11	15	10
Both vessels underway		29	5.8	9	8	6	2	4
1 vessel moored		34	6.8	3	7	5	13	6
Resulting in sinking		3	0.6	1	1	1	0	0
Flooding		45	9	15	10	5	10	5
" w/sinking at sea	36/7.2	26	5.2	9	5	4	6	2
" w/sinking in port		10	2	3	1	1	3	2
" w/o sinking in port	9/1.8	5	1	2	1	0	1	1
" w/o sinking at sea		4	0.8	1	3	0	0	0
Groundings		40	8	14	12	9	1	4
Fire		39	7.8	9	9	5	6	10
" w/sinking at sea	13/2.6	9	1.8	1	0	2	2	4
" w/sinking in port		4	0.8	2	1	1	0	0
" w/o sinking at sea	26/5.2	17	3.4	3	5	2	3	4
" w/o sinking in port		9	1.8	3	3	0	1	2
Collision w/fixed object (Mostly damage to object)		28	5.6	10	8	1	3	6
Heavy damage		23	4.6	12	3	3	4	1
Assailing thieves		20	4	9	1	4	1	5
Malicious acts		7	1.4	0	2	1	4	0
Removal of wreck		5	2.8	1	1	1	1	1
Lightning damage		5	1	4	1	0	0	0
Oil spills		5	2.8	2	1	1	1	0
Capsizing		2	0.4	0	0	0	1	1

causes damage to other property, such as piers, floats, marine railways, buildings, properly marked fixed fishing gear, damage to moored vessels by wake, and so on. Also very important, P & I insurance covers expenses involved in the removal of the wreck of the insured vessel where the removal is required by law.

Now, something you have all been waiting for, the statistics on fishing vessel casualties: the annual or five-year totals, the rate of occurrence of named casualties, the relative standing of the named casualty from "occurring most" down to "occurring least."

So, in looking at these statistics, what do we learn?

Well, I see seven glaring inadequacies:

1) the absence of training
2) the absence of safety education
3) the absence of periodic safety inspection
4) the absence of periodic condition surveys
5) the absence of posted safety precautions
6) the absence of first-aid training
7) the absence of accident prevention programs.

A few of the statistics that we looked over cannot really be controlled by owners or captains, such as: latent defects and lightning damage. However, they amount to 9 per year, or 9 percent. All the rest can be controlled by some legislation, indoctrination, and/or training. The federal government must establish requirements and standards for licensing captains and for conducting safety inspections and condition surveys. The fishing industry itself must take advantage of the wealth of information which is already available pertaining to safety, vessel operation, and training. Further, inexpensive and reliable safety equipment is available. Examples are:

1) exposure suits
2) EPIRBS
3) Coast Guard-approved life jackets
4) Coast Guard-approved fire extinguishers
5) well-equipped life rafts
6) emergency signaling devices (flares), etc.

However, the equipment must not only be procured, it must be maintained, periodically inspected and serviced. But while we are proposing all this, we must ask the question: "What are owners, captains, and fishermen doing for themselves?"

When all is said and done, and given the hazardous nature of commercial fishing, it is the unsafe acts of fishermen themselves, plus the unsafe conditions existing on fishing vessels, that cause personal injury, death, and damage to the vessel itself or other property. So, we are inclined to ask again: "What are the owners, captains, and crew members doing for themselves?"

Safety equipment and devices are available. Outstanding publications are available, some of them free. Just to mention three of them:

1) "Safety at Sea," a guide for fishing vessel owners and operators, from Sea Grant, Texas A & M. Free!

2) "Fisherman's Digest," from the First Coast Guard District. Free!

3) Dick Allen's "Atlantic Fisherman's Handbook," only $12.95. In Chapter V, he has 48 pages devoted solely to safety, and for those who ignore Chapter V, he has 18 pages in Capter VI devoted to first aid.

So again--all of this, the equipment and the literature, is left to the conscience of the vessel's owner, captain, and crew members. It is available, but they themselves must make use of it.

COMMENTS

Goudey: I found the data presented by Mr. Harrison to be most interesting, particularly regarding the relative unimportance of capsizing in New England vessel losses. I hope a similar analysis of data will be performed on personal injury records to reveal what tasks or equipment are most hazardous.

I am curious whether there is anything about the variety of vessels handled by Maritime Adjusters that is untypical of the rest of the New England fleet. Can we, in other words, assume this data is based on a random sample?

LOSS CONTROL PERSPECTIVE ON FISHING VESSEL SAFETY

Michael P. Taylor and Kim MacCartney
INA Loss Control Services, Inc., CIGNA

INA Loss Control Services evaluates risk for INA and Aetna, using a group of about 50 marine surveyors. Fishing vessels are becoming a smaller part of the marine insurance business.

Underwriters want to know if a vessel is suitable for operations. Since the industry is unregulated, the insurance companies are requiring safety equipment, and are providing some rebates for safety equipment. They look carefully at area and times and periods of operation. Crew age, physical condition, and training are considered. Instructions have to be posted. INA issues a check-off list and other instructional materials with a policy. Underwriters are favoring fleet operations, where it is easier to control risks and losses. INA has developed an eight-point inventory to evaluate fleet operations:

1) Management and administration--who has responsibility for maintainance and loss control?
2) Are written policies and procedures prepared for emergency situations, personnel hiring, etc?
3) What is the management selection and training policy? What are the promotion qualifications?
4) Is there a formal inspection program, an in-house and external inspection/review?
5) Are there employee selection and training criteria?
6) Is there a means of written accident input from an employee, including recommendations?
7) What are the equipment selection and maintenance policies? Is equipment selection appropriate to operating area?
8) Who provides safety promotion and publications?

An INA technical department in Philadelphia sets up training programs for vessel operators.

SMALL VESSEL CAPSIZING RESEARCH

Howard A. Chatterton
Hydromechanics Laboratory, U.S. Naval Academy

The U.S. Naval Academy Hydromechanics Laboratory has been involved in capsizing research for about the last three years. This presentation will provide a short description of our facilities, a review of three major research efforts related to capsizing, and a discussion of where we are, and where we hope to go with this program.

The Naval Academy is located about 25 miles east of Washington, and has an undergraduate student body of approximately 4,500 men and women. The undergraduate point is important. The primary purpose of our laboratory is to support the academic program. We have no graduate students to assist with research, although individual midshipmen do credible, graduate-level research as part of their program of studies. The engineering program took a giant step forward in 1975, with the opening of a new engineering studies complex known as Rickover Hall. Extensive laboratory facilities were included in the building program, and the one we are concerned with is the Hydromechanics Laboratory (NAHL).

The major NAHL facilities include:

- a ship model towing tank, 120 feet long, 8 feet wide, and 5 feet deep, equipped with a double flap wavemaker
- a ship model towing tank 380 feet long, 26 feet wide, and 16 feet deep, also equipped with a double flap wavemaker
- a circulating water channel with a 16-inch-square test section

We are fortunate in having excellent support activities. A computer-aided design and interactive graphics facility gives us the ability to design marine vehicles and provides the input for numerically controlled model cutting. A shop facility within Rickover Hall produces quality models in a variety of materials. Instrumentation systems include the use of lasers for mapping flow fields, both in the water channel and in other laboratory facilities such as wind tunnels. Our own laboratory has a dedicated computer system for data reduction and analysis.

The views expressed herein are those of the author and do not necessarily reflect those of the U.S. Naval Academy or the Department of the Navy.

Stability demonstrations have been carried out in a 20-foot tank known as the Ballast Tank. We have equipped the tank with a ring which places a pure moment at the center of gravity of a model up to 20 feet in length. This allows the measurement of righting arms through 180 degrees, with the vessel free to trim. It is handy for evaluating vessels with unusual geometry or with other characteristics which cannot be handled by contemporary computer programs. We have also devised some outfitting assemblies which cannot be handled by contemporary computer programs. We have also devised some outfitting assemblies which can be easily and cheaply duplicated by any of the safety centers, and we would be happy to provide sketches and photos to anyone interested.

The first of three major stability efforts was the measurement of the 180-degree righting-arms of the Coast Guard's 41-foot utility boat. Several configurations of inflatable bags were evaluated to determine which would be capable of righting the boat if it were capsized (this boat is not self-righting). We did find one configuration which resulted in very low inverted stability, and it was reasonable to assume that in rough weather the boat could not stay inverted. I will discuss this further on in the presentation.

The second major effort came as a result of the 1979 Fastnet race, which resulted in 5 capsizings, 15 fatalities, and 19 abandonments. USNA crews and boats were involved in that race, fortunately without mishap. A joint Society of Naval Architects and Marine Engineers--U.S. Yacht Racing Union (SNAME/USYRU) project to investigate yacht capsizing resulted. Our lab staff developed a technique to combine waves of varying length into a single, repeatable breaking wave. This is an application of basic physics, but the ability to change wave height and move the breaking point around in the tank for photographic analysis is a real technical achievement.

A set of two-dimensional models was built to study the effect on capsize of:

- length-beam ratio
- freeboard
- vertical center of gravity
- roll moment of inertia
- keel (for yachts)
- model location relative to the wave

The results are reported in "Sailing Yacht Capsizing" (Reference 1). Some 1,150 runs were made. When these data are analyzed using multiple linear regression techniques, the most significant factors are the roll moment of inertia and wave height. We are planning tests to try to isolate other factors which appeared significant in data plots but did not appear to be significant in the statistical analysis. The USYRU is now developing guidelines for offshore racers, in which they identify meteorological conditions likely to lead to breaking waves, and suggested analysis of boat capabilities based on an analysis of righting-arm curves. The analysis recognizes the potential for capsize, and compares the upright and inverted stability of a yacht as an indication of a yacht's ability to right itself, assuming it is in rough seas.

Our third major test series involved evaluating the capsize characteristics of the USCG 44-foot motor lifeboat, a self-righting vessel. The problem here was to evaluate whether or not a large, low, rub rail contributed to capsize. The technique was to move the model toward the breaking wave, at set intervals, with and without the lower rub rail. Statistically, we could see no difference, but while we were set up, we put the 41-foot utility boat into the tank. We found that wave heights that capsized the boats in reality did, when modeled in the tank, capsize the models and vice versa. That was encouraging. We also got a surprise when we put the utility boat with its buoyance bags beam-to-waves. Instead of righting itself, the boat "weather-vaned" into the sea, and became very stable in the capsized position. The lesson I see here is that the righting-arm curve analysis can be misleading, and it is dangerous to evaluate a dynamic problem using the techniques of statics.

Where we are now:

1) We can model a boat or ship dynamically, and place it in a repeatable breaking wave.
2) We can get a rough idea of limiting wave heights for survival of a given craft at a given loading condition.

Where we are headed:

The techniques described are time-consuming and expensive. We are trying to develop the means of evaluating one boat configuration against another for capsize survival and to provide guidance for designers. In addition, we would like to be able to evaluate loading conditions to provide guidance to operators. The only way to do this economically is to build a computer simulation of capsizing and validate it with the model experiments. We have some long-range support for this effort from the Coast Guard's Naval Engineering Division, Boat Branch.

How far have we gotten?

The first step has been a literature search to avoid duplication of effort. A number of studies have been done, notably in Europe and Japan. They confirm the validity of the Froude scaling we have been using in the model experiments, and provide some pieces for the computer model. We know that the model will include at least the following elements:

1) Definition of the wave profile. We currently synthesize a breaking wave by adding up waves of different frequency. We have to look at the characteristics of those waves in comparison with the operating environment.
2) Calculation of the hydrostatic response. This requires calculation of the forces on the craft as the wave shape changes beneath it. British attempts to develop mathematical models of capsize have shown that, even though capsize is a very fast event, these forces play a significant role.
3) Water velocity effects. These are the forces brought about by orbital velocity of the wave. Their contribution is unknown.
4) Wave impact loads. Some wave load data is available, and for this part of the model we must also look at the effects of water on deck.

5) Tripping effects. The wave forces on the hull impart a sideways velocity to the vessel, with a resulting tendency to roll away from the wave.
6) The dynamic characteristics of the vessel. The inertial properties of the vessel are unquestionably important to the evaluation. We are going to have to look for opportunities to collect and catalog such basic data as hull form parameters, inclining data, and roll period for all types of vessels in order to begin making estimates of the dynamic properties.

This is obviously a long-term venture. It will be a major milestone when we get to the point where we can make relative measures of survivability between vessels.

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RESISTANCE AND SEAKEEPING RESPONSE OF BULBOUS BOW RETROFITS ON FISHING VESSELS

Cliff Goudey
Center for Fisheries Engineering Research, MIT Sea Grant College Program

The experimental study of bulbous bow retrofits on fishing vessels is an area of current research at MIT. It is being performed for a thesis by graduate student Angelos Heliotis as part of a broad program of research being conducted by the Center for Fisheries Engineering Research.

Before describing some preliminary technical findings, an introduction to the Center is in order. The Center for Fisheries Engineering Research was organized in 1982 as part of the MIT's efforts related to the fishing industry.

The brief brochure being handed out describes the variety of projects in which we are presently engaged. Also described are the test facilities available for engineering research both at MIT and at the Navy's research facilities in Bethesda, Maryland.

An important aspect of the Center is its responsiveness to the needs and interests of the New England fishing industry. This is accomplished through an active advisory committee made up of industry members representing a wide range of interests. This committee is used to identify existing problems, evaluate project ideas, and review progress.

Most of the projects in which we are now engaged relate to improving the efficiency or productivity of vessels and trawling gear. No specific project deals with safety alone; however, each project includes a phase dealing with the safety implications of the problem and the solutions being studied.

The bulbous bow project is a good example of this. Its primary goals relate to the efficiency of fishing vessel hulls and motions in head seas. Reduction of motion has an impact on both livability and safety. Further, modification of hull forms can have implications on stability and maneuverability.

The project was begun this summer and has been supported by the Sea Grant Program, the Canadian Department of Fisheries and Oceans, and by the U.S. Coast Guard through the loan of two trawler models. The work is still in progress; however, I can speak today on some preliminary results this group may find interesting.

We have been studying the effects of retrofit bulbs of various diameters and protrusion. Bulb sizes of 10, 20, and 30 percent of the immersed midship section area are being used. The longitudinal length of the bulb is also varied, from just at the forward perpendicular to 1.5 diameters ahead in .5 diameter increments. In most cases, the bulbs are located as deep as possible without extending below an extension of the keel line. Calm water testing includes a total of 12 different combinations for each model.

Calm water tests have been completed on two models: a 76-foot single-chine hull and a 119-foot double-chine hull, both Gilbert designs. The construction of a third model, a 164-foot round-bilged Canadian design, will be completed soon.

Seakeeping tests will determine the motion response of the hulls in regular head seas of wave lengths between 0.5 and 3.0 of the waterline length. These tests will be performed on both bare hulls, and the best retrofit for each design will be based on resistance performance.

Reduction in pitch is expected, since this is the primary reason bulbous bow installation has become a common part of converting West Coast crabbers to trawlers. Reports of owners, designers, and ship yards have confirmed these benefits; however, there has been little documentation of it, and information on resistance effects is not available. The design of these "seakeeping" bulbs has evolved without guidance from appropriate model tests. It is this void that our present work is meant to fill.

The principal function of a ship's bulb is to generate a wave of comparable magnitude but opposite phase to the hull's bow wave. These waves tend to cancel each other, reducing significantly the wave-making portion of the ship's resistance. This phenomenon is obviously most useful on displacement hulls driven at high speed/length ratios.

There is a common suspicion that only large ships can benefit from bulbous bows. While it is true that bulbs are ubiquitous on merchant ships, tankers, and naval vessels, their scarcity on fishing vessels is primarily due to the absence of design guidance appropriate to today's fishing hulls. The range of hull forms for which test results are available does not include the stubby, hard-chined vessels that have evolved in the U.S. fisheries.

The results to date reveal some interesting trends. The bulb sizes that appear optimal are larger than are found on conventional ships. As shown in the accompanying graph, of the combinations tested the 20 percent bulb has superior performance. These are graphs of the best length for each bulb diameter.

In each case, the bulb is detrimental at lower speeds. This is due to either ineffective wave cancellation or added skin friction resistance, or both. It can be seen that the 20 percent bulb reduces the resistance at speeds over 6.5 knots. At the normal steaming speeds, between 9 and 11 knots, the resistance is reduced by 20 to 25 percent.

The apparent penalty at lower speeds is relatively unimportant because of the low horsepower requirements. In addition, the seakeeping benefits may more than make up for any loss through improved working conditions and higher propeller efficiencies.

The safety implications of this work are twofold. Reduced vessel motions should have a positive impact on crew productivity, with less fatigue and risk of injury. On the other hand, the bulbs can have a negative influence on stability unless they are kept ballasted. Using the bulbs for fuel or freshwater tankage would be ill advised, since when empty the low-slung buoyancy would present an upsetting moment.

Our testing and analysis should be completed in the next couple of months. I will place the attendees of this conference on the distribution of project reports.

The end results of our tests will be guidelines for the optimum size of bulb based on hull characteristics and expressed as a percentage of the midship section area. Bulb size will therefore be customized to each vessel under consideration.

Opportunities for the manufacture of standard bulb retrofits may exist; however, the shapes being considered can easily be fabricated by most boat yards. The hemispherical caps of these bulbs are economically obtainable from steel suppliers as end caps for pressure tanks. To some extent, bulb size may be based on the exact diameter of available hemispheres.

The concept of using fiberglass as a material for the retrofit bulbs would probably be appropriate and cost-effective only on fiberglass vessels. The potential, therefore, is somewhat limited, especially in New England, where the majority of fiberglass vessels are planing or semi-displacement.

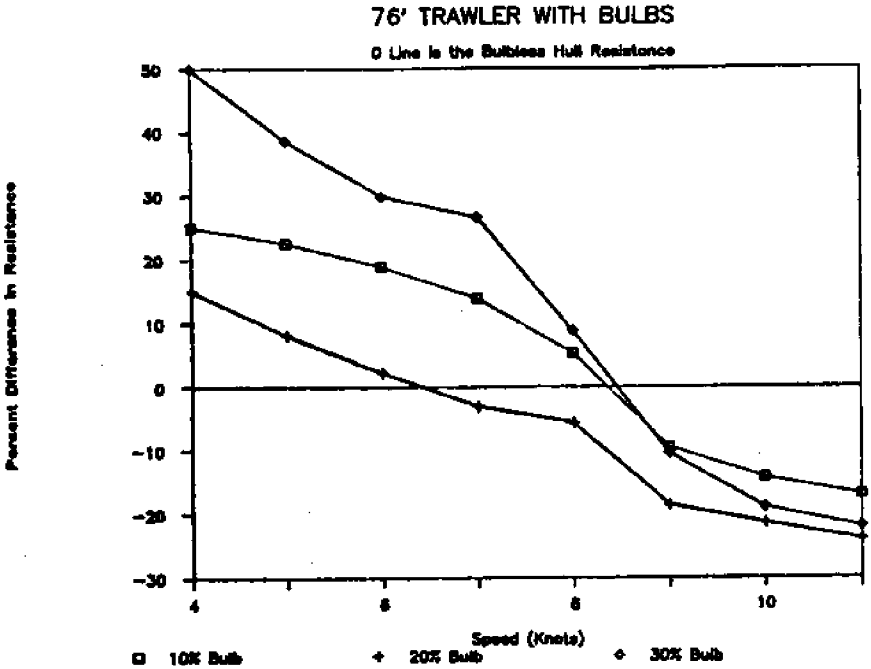

Figure 1. The resistance effects of bulbous bow retrofits.

MARINE INDEX BUREAU'S COMMERCIAL FISHING SAFETY PROGRAM

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(Submitted in writing for inclusion in these proceedings)

Description of Project

The high rate of casualties and high cost of vessel insurance in the fishing industry are of great concern to the entire U.S. commercial fishing community. Many remedies have been proposed and considered. But, first, a comprehensive examination of the accidents and injuries is necessary to serve as a base for improvement. The Marine Index Bureau (MIB) initiated a study under contract to the National Council of Fishing Vessel Safety and Insurance (NCFVSI) to determine the feasibility of compiling and analyzing fishing vessel casualty data. A pilot survey was undertaken to gather data from many sources. Preliminary analysis was conducted to determine the significant factors which contribute to fishing casualties and injuries. These factors were examined as possible contributors or correlations of the frequency of specific casualties and, where reported, of related costs.

The pilot study was successfully completed. A computerized system for receiving, processing, and analyzing data was established. Specially designed report forms were created and widely distributed by MIB to all possible sources of casualty data. All regions of the United States responded to the pilot survey, indicating that industry recognized the need for a central data bank of casualty and injury information to serve as a base for improving the safety of fishing operations and preserving lives of fishermen. This supports one of the major conclusions--that there is a definite need for a centralized data bank on fishing vessel casualties and crew injuries.

Based on responses from the survey, and from comments noted at various conferences and meetings held over the past two years, it is clear that there is an interest in building a data base for fishing vessel casualties. The lack of reliable information in this area continually creates problems in terms of interpreting fishing casualties. Without this data base there is no clear direction that can be pursued in resolving the current problems associated with fishing vessel safety and the high cost and lack of availability of vessel insurance.

Using this data base, the frequency, types, and causes of all previous accidents could be analyzed to determine the significant factors that contribute to commercial fishing casualties and personnel injuries. The data on crew injuries should help to insure that insurance costs are equitably assessed according to the level of risk. By identifying problem areas and making recommendations for improving vessel safety, the MIB program will help reduce accident losses.

The Data Bank

In 1978, the National Council of Fishing Vessel Safety and Insurance was organized by concerned individuals and associations representing all major sectors of the U.S. seafood industry. Although the NCFVSI's membership varied geographically, covering the entire United States, and professionally, ranging from insurance companies to fishery associations, all recognized the need to address the issue of fishing vessel safety.

In 1982, the NCFVSI began a project with the Marine Index Bureau to carry out a pilot survey on establishing a fishing vessel accident-reporting system. Founded in 1937, the Marine Index Bureau operates a system of receiving casualty data and providing a depository of such data for the U.S. maritime industry as an aid to industry safety, health, and accident-prevention programs. There are presently over 7 million records in the MIB data bank.

Goals of the Project

The American commercial fishing industry is currently facing drastic marine insurance problems. Fishing vessel damage and sinkings along with costly personal injury settlements have caused P & I and hull insurance premiums to become prohibitively expensive. The result is inadequate coverage or no insurance at all.

Higher insurance costs contribute to increased prices of seafood products and lower demand in the market place, ultimately leaving the commercial fishermen and fleet owners and operators with falling seafood sales and rising insurance costs.

Vessel casualty and personal injury information disseminated to the fishing and insurance industries through NCFVSI newsletters, special reports, and trade publications serves as a useful aid in analyzing the principal types and causes of reported incidents. Understanding and targeting problem areas can lead to:

- avoiding unnecessary recurrence of work-related accidents
- improved safety records
- lower insurance costs for fishermen
- reduction in the number of fatalities and in the pain and suffering of fishermen

The Commercial Fishing Vessel Safety Program can help achieve these goals.

The following is an evaluation of the reporting system, as set up by the Marine Index Bureau:

PROJECT EVALUATION

APPLICATION OF MIB/NCFVSI COMMERCIAL FISHING ACCIDENT REPORTING SYSTEM

REPORT TO MIB

Fishing Vessel Owner/Operators, Insurance Companies, etc., report vessel casualties and personnel injuries to MIB. Information is entered into MIB Data Bank.

IDENTIFY PROBLEMS

Based on reported information, identify and correlate frequent commercial fishing accidents/injuries and their principal causes.

SUGGEST AND IMPLEMENT REMEDIES

Industry suggests and implements remedies to solve recognized problems.

IMPROVES SAFETY-REDUCED ACCIDENT LOSSES

Improved commercial fishing safety records lead to lower risks and losses for Insurance Companies.

FISHERMEN PAY LOWER INSURANCE PREMIUMS

COMMERCIAL FISHING OPERATING COSTS ARE DECREASED

STABLE AND REASONABLE PRICES FOR SEAFOOD PRODUCTS

INCREASED DEMAND FOR SEAFOOD PRODUCTS

The impact of savings realized by lower costs cannot fail to reflect on all areas of the fishing industry. Lower operating costs mean lower prices; lower prices invite higher consumer demand. Finally, the U.S. commercial fishing industry will be competitive with its counterparts throughout the world.

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