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LONGSHORE SAFETY IN THE 70's

By JULIUS STERN
Welfare Officer, Local 10, International Longshoremen's & Warehousing Union, San Francisco, Calif.

May I extend my personal appreciation and that of the ILWU for having the privilege of participating in this most worthwhile conference. A conference of this magnitude, and the caliber of leadership, not only makes it possible to receive singular items of information, but can, also present challenging new perspectives and new horizons for all present. The International Longshoremen's and Warehousemen's Union has a background of progressive action for the betterment of human values and an active program of accident prevention from the humanitarian point of view. Since the acceptance of the principle of collective bargaining in maritime unions, safety and prevention of accidents has been a major item of discussion in all our negotiations. Under the Association of Waterfront Employees and at the request of the unions as far back as 1929, the work of drawing up a Marine Safety Code was delegated to representatives of shipping companies, delegates from waterfront employers, and longshoremen representing all major ports of the Pacific Coast.

This code was adopted at special meetings of the Pacific Coast Marine Safety Code Committee held in San Francisco on August 2, 1929, and remained as a voluntary code until 1946 when, in the Return to Work Agreement, the P.C.M.S.C., as it became known, was then made a part of the longshore contract between the Waterfront Employers Association and the ILWU. Between 1946 and 1948, an in-depth study was made of working conditions, and the results of these findings revised the existing code which was put into effect as the 1949 Revision of the PCMSC.

Again, in the 1966-1971 agreement, the PCMSC was revised for the purpose of updating the code to reflect the needs of a more modern and changing industry.

We certainly cannot review all of our accomplishments over the past years, nor can we review our disappointments. There have been too many. Over the years, the one fact that stands out clearly is that if we relent in our efforts toward achieving safety on the job, the accident rate goes up. If we continuously push hard to achieve safety awareness, the number of injuries goes down.

We are, today, in the maritime industry, confronted with a multitude of changes. We originated the agreement to modernize—the outgrowth of which has given us more "izes:" "container-ize" — "jumbo-ize" — "mechanize" — "Unitize" — all boiled down mean higher, faster and bigger. Along with these modernized phases of operation come "modernized hazards to life and limb." With the bigger, the higher and the faster, the worker must become "quicker," "smarter," and "alerter."

To compete in the world's shipping trade, minimal in port time is essential to the shipping companies. Hence, we must increase the tonnage per working hour. All of this can be accomplished with bigger machinery of greater capacity, but too little thought in design improvement is given to the basics of coordinating the movements of men with the motion of weight. Certain basic safety devices are built into the construction of weight moving equipment, such as warning bells on traveling cranes, capacity markings on booms, and the like; but what we need are fail safe devices when safe stresses are exceeded, so the equipment or handling devices stop in operation. What we need is for the same concern to be given to protection as is given to production. We in the labor movement are constantly told these protective devices are costly and unnecessary. We in labor believe this theory is a twisted economical concept for any business firm to avoid a rigorous accident prevention program.

During our period of modernizing the shipping industry, design and construction of huge weight handling equipment was and is priority; Methods of lashing or securing loads or containers are secondary. How this will be safely achieved is the last consideration.

First, we must recognize that accident prevention in the longshoring industry is unique, due to the vast difference between this industry and other industries. While many of them involve material handling, none have the complexity of materials nor the methods and differences in environment of work places. It is the accepted rule that management controls the accident prevention programs in all other industries; the policy is established by the general manager through his own channels down to line supervisors. In our industry, we have no single general manager but many employers, all of whom are in competition with each other for business. Therefore, establishment of policy and the carrying out of the program for safety must be left to many persons with entirely different viewpoints on the subject.

Another aspect which should be mentioned is that, due to the wide variety of commodities handled, each employer is dependent on what his company principally works with and develops his own approach to the problems confronting him.

Other industries have employees under control of one supervisor or foreman, and these employees know what his expectations and policies are. On the waterfront, a longshoreman may work for as many as five different bosses every week, and even for five different companies.

With the longshore industry, every vessel is different, and every sling load of cargo at the hatches presents a different set of circumstances to be coped with. Longshoremen can never get wholly familiar with one operation before a new operation commences. Then, compound this confusion with the fact that every different company has their own ideas on how to best handle a specific commodity.

While, as stated earlier, we can look back on progress in achieving improved conditions, we have not achieved outstanding results in reducing accidents. In the ever changing era of modernization, we are faced with new problems and hazards which are resulting in far more serious injuries than in the past. Danger, hazard, and high accident rates have been too long a natural occupational development in this maritime industry.

In the past ten years, the Federal government has done much to improve the hazardous conditions through inspection and legislation. Still, government intervention cannot be effective on its own. The industry itself must take an active part and concern itself with building in safety along with the design and development of the new equipment.

For the most part, a ships' cargo handling equipment is used to move cargo and may involve use of derricks or cranes of conventional or unconventional design. This brings about another problem—the safety of this equipment must lie with the ship, and when dealing with ships of all nationalities, each working under a different governmental safety code, uniformity is impossible.

While the International Labor Organization did establish minimum standards for the inspection and maintenance of ship's cargo handling equipment, there are many and varied opinions of what is acceptable as minimum.

Certainly not all ships can be thoroughly inspected by surveyors on a regular recurring basis. We recognize that we must rely on ship's crews to perform careful maintenance and replacement of worn equipment; however, you can readily see why the stevedore accepting work involving use of heavy lifting machinery must be alert to watch for the telltale signs of weakness or impending failure, and so the longshoremen, too, must be alert to watch out for these dangers.

Like every labor organization, our work force grows and changes. Old timers retire; new young men replace them but cannot come into the industry with the wisdom that comes from experience.

In past years (and still, to a large extent), the older and more experienced longshoremen passed on to the new comers their know-how and precautions, but with the changing methods and the introduction of mechanization in cargo handling, new systems must be learned as they are developed. Also in this ever rapidly changing age of plastic and synthetics, science is introducing new materials and compounds. Exotic chemicals, I am told, are being produced at the rate of about forty new products a day. All of these, before much is known of their potential, must be shipped from one location to another, and materials handling is our business.

We have seen some very strange and very scarey evolutions take place in the holds of ships when a drum, bag, or sack of cargo bearing a long, unpronouncable name breaks open and its contents spill out.

To cope with these problems we must realize the need for training and education on how to avoid contamination, the injuries resulting from inhalation, and systemic poisoning from contact, all of which can seriously maim or cripple our people.

Our union has gone completely into pre-training programs for safety and injury avoidance. In 1963 ILWU Resolution 86 was introduced. All locals on the Pacific Coast have adopted by popular vote a mandatory safety training program of between 12 and 18 hours for all new men entering the industry. Our B-class men, on first registering, are assigned to training programs conducted by the U. S. Bureau of Labor Standards, the Pacific Maritime Association, the State of California Division of Industrial Safety, and union officials. Subject matter taught and literature provided results in their knowledge of injury avoidance from falls on ladders to handling chemicals and rigging gear—actually, 14 separate subjects are taught. Longer, more in depth training has been given our union officials. In addition our Stewards Council, comprised of a number of experienced longshoremen designated for each gang, are constantly alert as to the hazards of the work and the compliance of the safety codes.

The locals each publish a weekly bulletin which carries pertinent information of requirements of the Pacific Coast Marine Safety Code as well as requirements of the Bureau of Labor Standards' Safety and Health Regulations.

To date the 3,000 plus members of the ILWU have taken this safety training as part of fulfilling their requirements to become a union member. This time spent in safety training is a requirment the men fulfill on their own time; there is no pay or compensation provided for completing this safety training. We are justly proud of our membership for this achievement and we expect to cite an improved accident rate as a result of this training.

Recent governmental regulations require that the stevedore company ascertain if any hazardous cargoes are to be loaded and to inform the longshoremen of the nature of the hazard. With some training behind them it is much less of a problem to persuade men to wear respirators and protective clothing when they are aware of the dangers involved.

With a little safety training and a continuing program of safety awareness, it is becoming simpler to persuade men to use proper care in moving, lifting, lowering, stacking, and sorting cargoes. More important, the industry as a whole is realizing that increased safety and increased production go hand in hand. We have our gripes about certain trends of management which we consider unsafe to our members. So does management have certain complaints about unsafe acts of our members.

To cope with this area of disagreement we have a joint accident prevention committee in each of our locals. Equal numbers of delegates from the union and representatives of management meet on a monthly basis. Complaints are voiced and the action required by either side is taken and reported at the next meeting. These are all positive approaches toward the reduction of accidents.

Proposals are currently under consideration to be enacted into Federal statutes, such as having load sensing devices on cranes to warn operators of dangerous stresses on the cranes, and more stringent requirements on the proper labeling and marking of dangerous chemicals. These are the modern approaches to combat the new hazards brought about by the mechanization of waterfront operations.

As has been the motto of our union since its founding: "An injury to one is an injury to all—and with dedicated continuing effort we hope to prevent that injury."

INDEPENDENT STEVEDORE'S APPROACH TO SAFETY

By CHRISTOPHER C. MORTON
Vice Pres., Operations, The Cleveland Stevedore Co., Cleveland, Ohio

Outside of the effective control of the operations of the longshoremen working for him, there is no more difficult task facing the individual stevedore than an effective safety program. The individual stevedore has all but faded from the waterfront, and the companies that survive have grown to such proportions that they have been acquired or merged into larger industrial concerns and, in a sense, lost much of their uniqueness. This has made the job of the individual stevedore just that much tougher.

Outside of bare labor costs, the next biggest hurdle for the stevedore has been the high cost of insurance along with the damaging exposure from third party suits, resulting from his catastrophic entanglement with the Jones Act. So, it is obvious that the stevedore must do more than just an adequate job in providing his employees with a safe place to work. Not only must the stevedore take pot-luck with the ship he is provided to work with, the nomination of which he has no say in, but in most ports the people he must work the ship with are, more or less, recommended to him by a union hiring hall or a string piece. It is a brave stevedore indeed who will refuse his ready-made place to work and work force.

Approximately 30 seconds after he starts to work, he is faced with an aggravated union steward informing him that unless he makes a 20 year old vessel ship-shape immediately, his men are not going to be working that day. If, at this point, he should refuse to load the ship because the ship's owner has not done his maintenance or has left an untidy situation from the previous port, there are four or five hungry stevedore companies in the wings just waiting for the opportunity to take advantage of his predicament.

What occurs next is what each of us face everyday—it is called "stevedoring." That is the split second, vitally important decision as to how to placate the union steward, unload the ship at something less than cost, and get everybody off without a lost time injury. This decision normally is made by an under paid, over worked, and much maligned individual called a foreman—a foreman who normally, through excessive hours at sea himself has figured out that the sea is good for fish and he will take his chances with the land sharks on the shore. If he had known what was in store for him, he would almost certainly still be sailing. It is here that the thin red line between profit and loss is drawn and implemented. There is no question in my mind that the key to a safe stevedore operation starts with, and ultimately ends with, the ship's foreman. Of course, management, and I mean top management, must recognize his problem and not only provide him with good equipment and ample pay, but also the knowledge that they are behind him in every-way to achieve a safe, and thereby successful, stevedore operation.

Top management must sooner or later come to the conclusion that there never was a safety program yet that was successfully carried out that did not cost money—money in the terms of the best equipment available and a top rate preventive maintenance program. Money in the terms of special safety equipment provided free of charge to the employees, such as hard hats and safety shoes. Money in the sense of incentives to gang leaders, dock foremen and, of course, a compensatory wage to the foreman himself.

In addition, an active campaign must be carried out utilizing full co-operation of the U. S. Department of Labor's training service and constant reviews of violations and accident frequency tables, as provided by the Federal government. Safety signs and slogans, as well as adequate enforcement of No Smoking areas. Protective guards on all fork trucks and cranes must not only be installed and maintained, but also pointed out at frequent intervals.

We in the Great Lakes in general, and The Cleveland Stevedore Company in particular, have come up with a small and concise condensation of the U. S. Department

of Labor's safety regulations for the longshoring industry. This booklet is given to longshoremen when the season begins in hopes that throughout the season they might digest some of the basic safety principles in a condensed form. In addition, most ports have in their labor agreement provisions for a joint safety committee whose function it will be to establish port-wide rules to cover specific operations. In most cases this is done with the help of the U. S. Department of Labor, U. S. Coast Guard, and the various local fire departments.

There is something unique in the nature of a longshoreman who will bring his observance of several pieces of dunnage on deck to a port-wide work stoppage, and yet the next day the same individual will work a 12 hour day under an unlocked beam. This is something that has always plagued waterfront employers in their search for safety.

Also, we in the Great Lakes have felt it vital to establish workable rapport with the local investigating representative of the U. S. Department of Labor. We have seen all types. Our basic feeling is that if the U. S. Department of Labor inspector comes on our ship and does not give us a ticket for an unlocked beam or failure to take a carbon monoxide reading where two fork trucks are working in deep tanks, he is not doing anybody a favor. We feel that these violations should be promptly issued and followed up with corrective action if the individual involved does not respond. On the other hand, we do not expect to be needlessly harassed with petty and inappropriate violations not directly effecting our work. These can normally be taken care of with a word to the foreman or superintendent and in good time be corrected with no danger to the gang. In all fairness to the Department of Labor, over the years we have been blessed with dedicated and reasonable people who, we felt, have helped us immeasurably in our quest for safety. However, some day I would like to see the Department of Labor start issuing violations for unsafe acts to the individuals involved and in this way, I think, the true responsibility will be better apportioned than is now the case.

We have been utilizing a special slide program produced by the U. S. Department of Labor in co-operation with M.A.C.H.S.C. Some ports are having one member of the committee go through the port unannounced with a camera, and at a subsequent safety meeting show slides with the workers themselves shown in sometimes embarrassing positions and circumstances.

Many ports have also used a small publication which is put on board the vessel and is a further condensation for the mate of the vessel so that he can be in compliance with those conditions over which he has control prior to the vessel commencing work. This is normally done through the vessel's agent, and, we feel, has been helpful in Cleveland in eliminating many of the conditions which accumulate in previous ports and are left to the last stevedore down the line to eliminate.

Finally, we have urged our union to accept their responsibility in a three point program that, we feel, is their responsibility and duty to their union brothers: (1) acquaintance with the safety code in the interest of safety alone and to resist the temptation of using safety as a club to ram some unrelated work condition down an employer's throat, under the guise of safety; (2) recognize, avoid, and discourage careless and reckless work practices of individuals who are risking injury not only to themselves but to others; (3) an alertness to safety hazards along with a prompt report to their immediate superior in such instances where these hazards cannot be eliminated by their own actions. If the union will do these three things and the employer will provide the tools in a safe working condition, then safety can be achieved and the stevedore foreman can be effective in not only a safe operation, but a profitable one.

EXPERIENCES IN LONGSHORE SAFETY TRAINING

By DONALD E. MacKENZIE
District Supervisor, U. S. Dept. of Labor, Norfolk, Va.

In a recent newscast Coco, the clown, said: "Circus days are over for clowns; we can no longer be funny. If you're funny today, legally, you will drive yourself out of business." He continued, "If I throw a bucket of shredded paper into the audience and a piece gets into someone's eye, the circus is held liable. If I run up into the audience and sit on someone's knee and they have a heart attack, the circus is held liable." "In plainer words, liability has had a major effect on the fun or laughs I can create." We have become, throughout the last twenty years, so legal conscious that it has destroyed to some extent the ability to laugh at, laugh with, or laugh for.

Our social values have changed. It was not so many years ago that if you had a slight rear-end collision with your private automobile, you would jump out, offer the other party $20 to take the dent out, and leave. Today, do this and I can guarantee you will be getting sued for whiplash, broken back, or cracked rectum a month later. Our society has changed; with it, our social values. These same people whose social values have changed work and play with you, for you, and are you. If this were not true, I'm sure you would not be carrying workmen's compensation policies, homeowners' policies, extra territorial policies, etc. I can't remember my father worrying about the height of a fence around his house and whether he should insure it. I can remember him saying, "Get the hell off there!" That was enough.

We have changed in our whole social outlook. But, yet, we persist in not changing in our work practices. We stick to the adage, "This is the way I learned; I can't understand why Joe can't learn the same way." When you learned, you could afford to make mistakes. Today, because of changing values, which in many ways are good and signs of progress, you can't afford mistakes, and the only way to escape these mistakes is through proper training. I will go a little bit further and say you can keep making mistakes and let your costs rise and eventually drive yourself from the competitive market; or you can sit back, take a good hard look at yourself, and say, "I'm going to do something about it," or, "What can I do about it?" You can justify yourself and make all types of excuses and say, "I didn't do it that way; why does Joe?" But I don't think the stevedoring industry is that large that you're going to change the entire United States society or reverse the social changes that have taken place within the society. You had better start thinking, "What can I do about my segment of United States industry to make it competitive or healthy?" and when you decide this you will find one of the fastest and most economical ways is through proper training and communications. When I say training and communications as one and the same, that's all training is: proper communications.

If you think for one minute that you can take a man or group of men and train them in a specific area and consider the job is then done and your safety problems are licked, you have another think coming. Training is a continuing process and consists of semi-formal classroom study followed by continued on-the-job instruction or application and then periodic returns to the classroom. Let's remember, a large percentage of what is taught is already known by the class. The big thing the instructor is doing is making people re-think; or, better still, remember or refresh their thinking. Remember also that a very small percentage of anything taught is retained. The human brain is not capable of storing to that degree. Who remembers the poem *Barbara Fritchie*, or the poem, *Midnight Ride of Paul Revere?* Yet, the average person had to recite these during his high school days. In fact, because we don't recite the pledge of allegiance as often as we used to, I find people throughout our nation are forgetting that! I highlight this area to demonstrate that retention of information, including safety, is only accomplished by periodic training.

Now, let us get into the mechanics of stevedore training—who should have it, and why; and I must start out by saying your training had better be total to be effective or to prevent the broken link in the chain.

The first group we had better start with is top management—presidents, vice presidents, managers, and superintendents. I don't think we have to go into the technical area with this group but mainly create an understanding of what safety is, what part it plays in production, and the economic factors involved. Also, to get across to them that all the training we may do will be to no avail unless they support it and back up statements with acts. There's not much sense for instance, in the instructor spending time with employees, going through carbon monoxide testing and proper ventilation procedures, if management doesn't insist that it be done. It would be a waste of money and his time. There wouldn't be much sense to the instructor spending time on the how or why of rigging safety nets while working on benched-up cargos if the foreman can come back and say, "I didn't have a safety net handy so I proceeded without one" and management accepts this as an excuse. That's the time when you have to back up the program and find out why he didn't have the net handy. Was it his fault for not preplanning? Was it the gear man's fault because he didn't deliver? Or, was it *your* fault because it was never supplied? If you in top management don't follow through, again, training is a waste of your money and the instructor's time.

You can imagine my dismay at one location to find gangs standing by every morning for fifteen minutes until a net was placed under a gangway, whether it needed one or *not*. All I could say to myself was, the money being thrown away by management not training their foremen to know which gangways should be protected by nets and why. Many times this was the difference between profit and loss for the day's operation. They must have a fairy godmother someplace.

During this management training it should be spelled out which of the following costs of stevedoring are competitive features and which are not: acquisition costs, material costs, labor costs, supervisory costs, and insurance costs.

Acquisition Costs: Paper work, salesmen's salaries, entertainment, etc. Whether you entertain at a church supper or a night club, at the end of a given period of time you have expended in dollars just about the same as your competitor to get or retain the business.

Material Costs: Possibly you believe you have a sharp purchasing agent. Your competitor thinks the same; and where your man may get a break with Allis and Chalmers, your competitor may get a break with Townotor. At any rate, to stay in the business today, you have to have forklifts, bridles, nets, hooks, shackles, etc., and you are all expending the same dollar content over a given period of time. It's not a competitive item.

Labor: It's a known fact labor cost is the same in dollar content, whether you work Boston, New York, Chicago, Norfolk, etc. It's not a competitive item.

Supervisory Costs: Now we get into a competitive cost, because if your supervisor has super-vision, as his name denotes, he sees things others don't. He knows the game and the tricks involved with any number of commodities, so that he can produce better than your competitor and thereby bring higher profits. When your profits are higher, this gives you the edge on the next go-around. This is known as the competitive spirit, or the American way of life.

Insurance: Or, direct and indirect costs of an accident or injury. This has a tremendous bearing on supervisory costs because if this supervisor has super-vision, he's seeing the accident before it happens and eliminating it by good work practices within the given production system, thereby reducing your direct or indirect costs of production. I believe you all recognize this when you receive your workmen's compensation insurance bill, whether you're on manual rate or the debit side or credit side, and I believe you recognize that this is a competitive cost. It can determine whether you get the business or not and, once you get the business, whether you can make a profit from it or not.

This carries us into the next group, who should be subjected to training and the reasons why; namely, superintendents and ships' foremen. Any foreman or superintendent who thinks he does need training isn't worth his salt; so, expect resistance when you get to

this area. This guy worked his way up from the bottom, and the main reason he holds his present position is he could get others to produce for him. He feels, and should feel, that he knows the job better than anyone else. However, in the rush of our daily work, little or no time has been spent with this man indoctrinating him into good business practices, the economics of the business, and the total responsibility of his job. Oh, he can recite tonnage figures, and he can show you that he can discharge or load more tonnage than any man that walks the waterfront. But in most cases, he can't tell you whether he made economical tonnage or expensive tonnage. We just haven't indoctrinated people this way on the waterfront.

In this respect, we are behind the majority of American industry. This is very easily determined during routine inspections when safety practice is brought to the foreman's attention. The first thing you hear is, "What jerk thought that one up?" "For cripes' sake, what's coming next?" When you take time to explain the economics of building safety in as the job progresses and how it can't possibly cost extra if you do it this way, his immediate reaction is, "Another one of those far-out S.O.B.'s telling me what or how I should do it." Don't blame him, he's reflecting what he has been taught: get the tonnage and get the ship out; not, get the tonnage economically and the ship out economically.

During this group's training, concentration must be placed on the technical factors of stevedoring as these men are giving direction. However, we are being unjust in our training if we can't explode each technical factor into an economic factor. Take for example, the regulations for stevedoring as a base. There is not one regulation within the book that cannot be interpreted into dollars and cents, and unless the foreman is made aware of this through proper training and communications, he will always look at safety as something that slowed him down or caused him troubles, even though it may have been of a temporary nature that he more than gained back throughout the day. He should be able to interpret safety as a dollar value that makes him look good in the boss's eye; that, because he did "such and such" at 8:00 A.M. that took five minutes, he gained one hour throughout the next eight; got his tonnage and more, and there were no sideline expenses of injuries or damage to cargo. Until this type of training and re-training is accomplished, I doubt whether you're going to move the frequency or severity rate down much further. In plainer words, along with safety, we must teach good business. They are one and the same.

Now, let's get into the next phase of training—hatch foremen and gangway men; the great, unused potential. If you miss training these men, I know you will not reduce frequency or severity and, consequently, costs. This group acts as the fingers of the hand; the ship's foreman being the hand. Unless the hatch foreman can act when he sees the need arising, and unless the hatch foreman can readily recognize the unsafe factor in order to act, he's going to take the ship's foreman to oblivion with him and, consequently, you. The hatch foreman knows the potentialities of the men in his gang better than anyone else. He takes the gang off the corner in the morning and it's his duty to return them at night. He has more to lose than anyone in this struggle for safety. The quality of his gang can suffer, his pocketbook suffers, his self-esteem suffers.

We don't utilize him and he wants to be utilized. Certainly, when five gangs are rigging in the morning, the ship's foreman can't be every place at once. Certainly, when five forklifts are working in five holds, the ship's foreman can't be taking tests at all holds or rigging proper ventilation at all holds. If he is, I can guarantee you you're losing production. The hatch foreman can only be doing it if he's trained to do it. There's no reason why a gang should be standing by for a safety net until the ship's foreman is contacted and one ordered. If the hatch foreman or gangwayman is trained, he knows the reasons why and for a safety net and will in all likelihood have one in his gearbox, or anticipate when he will need one and have it ready when needed. We underestimate what this group can and will do for us. They, again, reflect the top man's thinking, and if the top man has not been imbued with the economics of safety and the need for training to achieve safety, believe me, it has not filtered down. This is the reason I hear the retort from ships' foremen: "Cripes, Mac, I can't be everyplace at once." As part and parcel of safety training and dove-tailed all through it should be

responsibilities and authority and their delegation.

The last group we mention is the group that are suffering the accidents. This is also through lack of training, and when it comes right down to the nitty-gritty, this group can do the most regarding reduction of accidents. That's Joe! The man in the hold or the slinger—that guy you can't load a ship without, and do we underestimate this guy! He's in the thick of it, knows what's wrong or knows what's coming up that's going to be wrong. Many times, he doesn't dare to change it, and many times doesn't know how to change it, and many times is not aware that he can change it. But, still he knows it's wrong, instinctively or otherwise. If we can get to him, recite the instances, make him aware and reawaken what he already instinctively knows through work practices, he goes home in one piece with his rightful day's pay, to return again. The hatch foreman goes home with his self-esteem and his full gang, to return again. The ship's foreman has worked his tonnage economically which guarantees return work, and top management sits back with their rightful profit and lower insurance costs, ready to charge out for bigger and better contracts.

Somebody else has gained here also; the instructor, during the training process. Because, by his listening, he has picked up unbelievable conditions that are creating accidents or will cause accidents. Yes! From guys like Joe. He can utilize this information with other groups. This is the purpose of safety training. Everybody should and must profit. We are not teaching anything new; we are refreshing people's memories to what they already knew and forgot.

The next question may well be, "Sounds good, but where do I get the cash to train the waterfront?" I'm going to say this: $79,000 is the cost of one accident regarding carbon monoxide that I'm aware of, and there have been many before and many after. That $79,000 would give 9,875 men two hours' training in carbon monoxide control, testing, and ventilation; hopefully, eradicating the problem. Because of lack of training in production safety techniques, there are many delays and accidents, not necessarily injuries, that can be readily converted to dollar figures. I can't see how you can not afford it.

During the last five years we have had a revolution in the marine industry. During this period we have purchased sophisticated equipment; cranes, fifth wheels, ships, boxes, lifting gear, etc. What have we done to sophisticate the man to his surroundings? Not too much, I'm afraid. We are still working trial and error. Our types of accidents are changing, our downtimes are much more costly, but we persist in carrying on the thoughts of years ago. That's the way I learned, why can't Joe learn the same way? I don't believe there's a man who would say to the average man on the street, "Go ahead, take my Cadillac for the day." But, many times we do this with much more expensive equipment throughout the normal work day. I question the wisdom and with it I question the costs, and with that I question how long we will last.

Training is the answer. Let's revert back to the three "E's" of safety: education, engineering, and enforcement. Proper training will lick the education and engineering, and, hopefully, education and engineering will lick the enforcement.

Let's take a look at how safety training should be applied. Once again, I must tell you, "Don't underestimate your longshoremen." Don't be afraid to discuss dollar content. He's much more aware than you believe. He's aware that the dollar he takes home is generated from the amount of work you get, and he also knows that the amount of work you get depends on his ability to work economically. He also knows there is a constant competition for contracts within a port, and from port to port. He is well aware that your insurance costs can be the difference of whether or not he is gainfully employed. He has his pride and self esteem. If you don't believe this, stand on the corner some morning during shape and listen. Joe's gang can tell you how Jim's gang made out the previous day; what he made for tonnage, who got hurt, and where the foolish or nonproductive moves were made. If you don't include him in your training and planning, if you don't include him in your communications, you are being unfair to him, which will show up in devious ways. You are also being remiss in your duties to your principals in not getting the most from what you've got, caused by lack of communications. He's as much a part of the team of production as the loftiest executive—more so; you depend on him to produce. The job of any executive is to surround himself with people who can produce, and these can only produce if they have the tools of knowledge to produce with. One of the largest tools of knowledge in our particular game is safety, because it is a major competitive cost.

What's wrong with spelling it out and leveling? Take, for example, hatch beams not moved back far enough. Sure, it's dangerous, and the winch driver can hit them coming out of the hold, possibly damaging bridles, cargo, or even dislodging the hatch beam by shearing pins off.

I don't think that's quite impressive enough. I don't think it's quite the selling job that will leave a lasting impression so that it will not be repeated. We must get to those concerned (and this is everybody). We can show and explain, that, by taking approximately five minutes during opening up to remove another hatch beam and set of boards, throughout the next eight hours of work the winch driver doesn't have to slow down as he's coming out or going in (and he does this instinctively!) Everytime he slows down he forces the entire gang to slow down with him, so your cost must be figured on the entire gang. If you lose 30 seconds a draft by this slowdown, it is costing 7½ minutes per hour, or 60 minutes per eight-hour day. With a 21-man gang, this little venture is costing 1,260 man-minutes, or $84 and, worse still, the accident exposure never was eliminated. So, the slowdown stands the chance of being much worse, and the costs could be much more. Magnify this cost on a five-gang ship and you're running close to $500 per day, plus five-times the exposure. The cost of doing the job correctly in the morning and eliminating exposure besides, would have been 105 man-minutes, at a cost of less than seven dollars.

When we train for safety in this manner and include it as part and parcel of production, we will start to cut into the accident rate. That's good business. What is the cost of not clearing the work area of tripping hazards throughout the day? What happens, cost-wise, when we don't stow hatch beams, pontoons, etc. properly and the gangwayman or signalman has to slow down, as he doesn't have a clear walkway, or, worse still, decides he's not going to walk the load because of obstructions? What happens, cost-wise, when the gang knocks off for fifteen minutes so the carbon monoxide content gets down to a workable level, all because someone didn't plan in the A.M. and rig his blowers correctly? Let us keep in mind that the gang works in a unit and the failure of one man effects 21.

You can't afford not to train now, with gang cost doubling, because Paceco crane cost is approximately the same as gang cost. Preparation is all the more important. What it amounts to, instead of having "Double the flavor, double the fun," you have "Double the trouble, and you're under the gun." With the fast turn-around of container ships on unit basis, you no longer have the opportunity to recover lost time. You did when working break bulk cargo for three days' time, you may have lost on the first day, you had the opportunity to recover on the second and third day. Our industry has changed and will be changing. We must change with it or suffer. Proper training could be the answer.

Let's talk to the man; he wants to hear you, and, if you're sincere, don't underestimate what he can and will do for you. That's good business.

SAFE LOCKING PROCEDURES

By JAMES A. PETERSEN
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The St. Louis District is one of the smallest of 42 districts within the Corps of Engineers. However, because of its location we feel that it is extremely important to the inland waterway system. The St. Louis District is responsible for obtaining and maintaining a navigation channel in the Mississippi River from Cairo, Illinois, 300 miles upstream to Saverton, Missouri, and likewise the lower 80 miles of the Illinois River from Grafton, Illinois to La Grange, Illinois. We maintain the channel below St.

Louis by using regulating works (stone dikes and revetment) and by dredging. Above St. Louis we maintain our channel by the use of navigational locks and dams.

We are responsible for operating and maintaining four locks and dams. Lock and Dam 24 at Clarksville, Mo. (Mississippi River mile 273) was placed into operation in March, 1940. It has one lock which is 110 feet x 600 feet. Next downstream is Lock and Dam 25 at Winfield, Missouri (Mississippi River mile 241) which was completed in May, 1939 and has one 110 foot x 600 foot lock. Our busiest lock is Lock and Dam 26 at Alton, Illinois (Mississippi River mile 203). The Alton lock was completed in May, 1938 and has two locks. The main lock is 110 feet x 600 feet, which is the same as Lock and Dam 24 and 25, and it has an auxiliary lock which is 110 feet x 360 feet. We are now involved in preconstruction planning to replace this structure with a new modern lock just downstream from the present location. This should be completed about 1980. Lock 27, located in the Chain of Rocks Canal, adjacent to Granite City, Illinois (Mississippi River mile 185) is our newest and most modern lock. It was completed in February, 1953 and has two locks, the main lock being 110 feet x 1,200 feet and an auxiliary 110 feet x 600 feet.

Since first going into operation at Lock and Dam 26 in May 1938, and up until last week, we have had 245 reportable accidents at all our locks and dams. Cost to repair the damage to the government structures was $784,000, or an average of $3,200 per accident. Section 14 and 16 of the River and Harbor Act of 1899 places the liabilities of the accidents on the offender.

I have not been able to identify any specific trend in these accidents, with the exception that as the number of lockages increase, so does the number of accidents. A graph of number of accidents versus years looks like the profile of the Grand Teton Mountains. It appears that the years divisible by five are bad years; 1960-1965, etc. 1969 was our worst year, with 23 accidents, a 55 per cent increase over any previous year, and a 64 per cent increase over 1968.

Both 1968 and 1969 had approximately the same number of lockages: 32,000. To date in 1970 we have had 18 accidents. If the pace continues, we should have an accident experience record similar to 1969, with a slight increase in the number of lockages.

Average damage to Government structures per accident—$3,200—is only a small part of the total cost of these accidents. Other items of cost that should be included are:

1. Repair of the damage to the barge or towboat, drydocking, hiring of additional towboat or emergency unloading equipment, loss of cargo, loss of earning power, and increased insurance premiums.

2. Another cost that should be noted is the cost to the marine industry as a whole if the damage is sufficient to the lock or dam to require the structure to be closed. There is no good time to close a lock for repairs. If one of the locks in the St. Louis District is closed for any 12-hour period we begin to stack up traffic, and towboats that are waiting aren't earning any money for their owners. During the ice jams last January we had telegrams and calls from as far away as New York and Italy.

3. A third and final item of cost is the administrative cost to report, analyze, negotiate, and settle the accident claims. This is a hidden cost to both the government and the firm having the accident. I'm convinced that many of the larger firms have the same amount of red tape in their administrations as is often criticized in the government.

In discussing safe locking procedures and accidents with the personnel on our locks and with some of the people from industry, the causes of most accidents can be attributed to one of three basic elements.

The first is equipment. You must have proper equipment of sufficient power to handle what you are pushing in all situations. The safe capability of each boat should be determined by barge line management for every river condition: normal pool, open river, or ice. Once these capabilities are established, the boat shouldn't be allowed to take any additional barges. Each boat is different. There are good 3,200 hp boats and just plain 3,200 hp boats. The capability of each of your vessels must be well known to all pilots, dispatchers, and managers of your company.

Equipment must be properly maintained. The money saved in skimping on maintenance can be quickly expended in an accident when the cost is figured as I explained earlier. The slow response of an engine to reverse, or a rudder too slow to turn due to improper maintenance can cause real problems. I have seen the statement of pilots on accident reports many times "I threw it into reverse, but it just wouldn't stop." Ultimately, the boat stopped, but not until it hit a gate or a bullnose or something else.

The second basic element in safe locking is having trained, experienced personnel on your boats, and likewise for us on the lock wall. This is perhaps the most critical area in the whole program. Every barge line official with whom I have spoken in the last four years has indicated the problem of getting and keeping good towboat crews, pilots, engineers, mates, and deckhands.

In solving this problem, perhaps part of the answer lies in the formal school approach, such as is being established at Helena, Arkansas. I am part of a committee of navigation people working with the Junior College District in St. Louis trying to establish courses for pilots and engineers. I have heard that similar schools are being considered in other parts of the country.

The navigation industry as a whole must put on an extensive public relations recruiting program to lure additional people to work on the river. I keep emphasizing to all the people whom I interview for jobs on our vessels that I don't believe there is a more lucrative career field for a fellow with basic intelligence and a desire to get ahead than the marine industry.

As for the persons presently in the industry, don't push them too fast. Be sure a pilot is truly capable of handling the vessel before you let him take charge. The actions of one unqualified or inexperienced pilot or mate could bring disaster to your company and to the whole inland waterway system. Practice the Golden Rule: Be honest with other companies in personnel qualification referrals as you would have them be unto you.

The third basic element in the cause of accidents is a hybrid. It actually could have been covered as part of the other two items. It is recognizing and allowing for the effects of natural phenomena or conditions. Have boats that can properly maneuver and personnel trained in how to handle a tow approaching a lock with the dam at open river and an outdraft condition existing. The same holds true on windy days and when there is ice in the river. The boat and crew must master the situation.

In the St. Louis District we have several natural phenomena problems which we have solved by the construction of the deflection situation at Lock and Dam 24 was partially solved by the construction of the deflection dike. A similar, but not as critical, problem exists at Lock and Dam 25. The January ice problem at Lock and Dam 26 is a continuing problem with no ready solution. The wind and lack of guidewalls at Lock 27 will be solved shortly. We go out for bids for guidewalls next year.

In regard to problems in the area I solicit your help. Let's communicate. If you or your crews have a particular problem or complaint, let me or the locknasters know about it. It is my belief, and I stress this with people who work for me, that we and the marine industry are partners. The locks and dams were built to serve the best interest of the public. If you have problems with navigating the St. Louis District, let us know, and if you have any recommended solution, pass that along, too.

The sharp rise in the number of accidents at our facilities during the increasingly heavy use is a matter of great concern to us, as well as to you, the user. The cost of these accidents extends far beyond just the cost of repair to the structures. As I see it, the essential elements in eliminating these accidents are:

1. Management officials must know the capabilities of their vessels and operate within this capacity at all times.

2. Follow good maintenance practices on the vessel to prevent malfunction at a critical time.

3. Hire the most competent people. Use of unqualified or inexperienced personnel will lead to trouble.

4. Be aware of the inherent danger at each facility due to elements of weather or the natural conditions or the stream.

KNOW YOUR LINES

By WILLIAM HAGENBUCH
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The use of rope is attended by certain hazards which cannot be met completely by prior engineering or any mechanical means, but only by the vigilance of an intelligent, responsible user.

The first step in analyzing these hazards is to recognize two distinct categories in the application of rope. The first category is active service uses such as lifting and towing. These uses are characterized by the fact that the individuals (or workmen, or crews) who handle the rope are themselves the principal persons subjected to any hazards from rope failure.

All other uses are lumped together in the second category, transitive uses. These uses are transitive in the sense that any hazard is passed on to someone who had no part in the creation of the hazard. This category would include standing rigging, concealed applications, recreational uses, etc. In these transitive uses, the involvement of a second party, sometimes an innocent bystander, creates an entirely different situation and calls for different precautions in the safe use of rope.

Having established two categories of rope use, I now would like to develop two principal requirements for safe use in each category. Here we must distinguish between engineering requirements and supervisory requirements. Engineering is simply the matching of rope properties (size, type, safety factor, etc.) to the anticipated application. Supervision, then, should provide the assurance that anticipated conditions and/or rope properties do not change to adversely affect safety. Also, supervision would include the assignment of responsibility for this function.

In this paper we will emphasize supervisory requirements, in contrast to engineering requirements, for several reasons:

1. Practically all rope failure accidents are caused by inadequate supervision rather than poor engineering or original product defect.

2. The need for vigilant supervision is not as obvious as is the engineering required in the selection of size and type of rope and the rigging arrangements.

3. The supervisory function has been ignored in most treatments of rope applications, not to mention the safety manuals.

4. The rope user (or his agent, or principal) is largely and of necessity on his own with respect to the supervisory function. Conversely, the rope user is deluged with published data and outside expertise in resolving the engineering factors.

Active Service Uses

Supervisory Requirements

Active service requires, by definition, the presence of workmen who are in a position to observe prevailing conditions, including changes in the application as well as changes in the condition of the rope. One of these men should be given the responsibility for determining whether or not prevailing conditions are safe. The responsible man should have received appropriate instruction regarding safe practices and knowledge of the anticipated conditions (on which the rope selection was predicated). He should also be given authority to alter or stop the operation as the situation may warrant. When the individual responsible for rope safety departs the site, the work should be stopped immediately, unless he imparts the essential instructions, responsibility, and authority to another person remaining on the site.

Senior supervisors, consultants, experts, etc. should refrain from accepting responsibility for rope safety during visits to a job site. Instead, they should confine themselves to advising, instructing, and educating the workmen in authority, on the site. It should be noted that the experienced rope user can easily visualize many situations which would be highly hazardous, but he cannot anticipate or evaluate all actual hazards as they occur on any particular job unless he is continuously present. Thus, the man who is not present is not in a position to accept responsibility for rope safety, nor should he attempt to deprive the man on the job of the authority he needs to assure safe operations.

Before the last man who might reasonably be expected to assume responsibility for rope safety departs the job site, work should be discontinued and he should choose one of the following actions: (1) remove rope to storage; (2) remove load from the rope and secure it to avoid the appearance of an attractive hazard, and to prevent it's being damaged; (3) notify his supervisor (or legally liable rope owner) of the prevailing situation, including specific mention of hazards and appropriate precautions.

Engineering Requirements:

Published data on safe working loads (or breaking strengths and safety factors) apply to active service uses unless otherwise stated. These working loads are intended to provide adequate safety for life, limb and valuable property in well defined active service applications. This would exclude both impact loads and long sustained loads, and situations where the rope has been damaged.

However, they would include the usual environmental conditions, which are typically limited to the extremes for human exposure with normal winter and/or summer clothing.

Higher working loads may be justified in some instances where the following conditions are met:

(1) danger to life, limb, and valuable property is negligible;

(2) application conditions can be and are in fact more carefully controlled;

(3) severely limited service life is acceptable. Under such circumstances, the higher loads should be determined and authorized only by a responsible, informed person on the job. Outside experts, management supervisors, consultants, etc. should limit themselves to educating the man on the job, but they are not in a position to name higher working loads for jobs which they cannot keep under continuous personal surveillance.

Lower working loads are generally justified only by economic considerations, such as use of an oversize rope for extended service life or use of an oversize rope because it is on hand or quickly available. Conversely, a lower working load for a given rope rigging (or the substitution of larger size rope of the same type in same rig) is seldom an effective method to compensate for unusual conditions. For example, a large rope will cut or burn or melt or rot almost as quickly as a small rope. For increased safety under unusual conditions, considerations should be given to other types of fiber rope, chain, wire rope, or even non-flexible structures.

Data on safe working loads or safety factors may be obtained from the rope manufacturers, and for the more common types of rope they are published by the Cordage Institute, the U. S. government, various safety organizations, and in numerous engineering handbooks. It is worth noting that the same safety factor is not recommended for all types of rope. For instance, most U. S. sources recommend a safety factor of 5 for manila rope, 6 for polypropylene and 9 for nylon and polyester. In addition, it should be pointed out that factors which further decrease safe working loads must be considered for most types of rigging, including slings, hitches, and especially simple knots.

For instance, the difference in safety factor means that it is unsafe to substitute a small synthetic rope for a large manila rope on the basis of the two having the same ultimate strength. Does this seem strange to you? To convince you, I wish I were prepared to demonstrate how easy it is to cut a small diameter nylon rope when it is under considerable tension. Anther demonstration I like to give scout troops who come through our plant is to have each scout tie his best knot. Then, when we test the knot we find a considerable variation, but seldom do any knots have half the strength of a good splice—and you would be surprised how many kinds of knots pull apart without breaking the rope, especially in some types of synthetics.

Transitive Uses

Transitive applications, though they are many and varied, have one feature in common: continual surveillance by an informed responsible individual is impractical, if not impossible. In view of this circumstance, special attention must be given to the supervisory requirements for safe use.

Supervisory requirements

The property owner who is legally liable must accept a high degree of personal and moral responsibility for the overall safety of the rope use. This involves at least five functions:

1. Obtaining competent advice on the engineering of the original rope installation, including especially any limitations, and as-

suring himself that these limitations are realistic for the particular applications.

2. Making sure that the design of the rope installation is faithfully executed.

3. Posting notices of limitations when appropriate.

4. Keeping informed of all activities which bear on the rope installation, being alert for activities which may exceed the limitations. (Exposure to chemicals, high temperatures, and even severe weathering would be illustrative of these activities.)

5. Inspecting the rope periodically for signs of abuse as well as normal wear.

The owner's responsibility for these functions may be delegated to an agent or employee who is more intimately associated with the rope use than is the owner. Conversely, the responsibility cannot be transferred to a more remote level, such as a contractor or supplier.

Detailed engineering requirements for transitive rope uses would be too lengthy to incorporate in this guide. However, they generally fall into two categories:

1. Those which are technically complicated, though they may not appear so to the layman. This would include static applications which are left under sustained loads for long periods (two days or longer); impact loading, where the stretch of a fiber rope is used to stop (or start) a load relatively quickly (these applications involve acceleration forces equal to or greater than the dead weight of the load); concealed applications (such as elevator ropes) where rope wear or abuse are not normally visible, and certainly not apparent to those whose safety may be jeopardized. When any substantial hazard may be involved in these applications, expert advice is indispensable.

2. Applications which may seem trivial except that they involve children and/or incompetents who cannot be expected to exercise mature judgment. For example—playground swings. In these applications the working loads should be reduced to 50% or less of the working loads recommended for active service uses in commerce and industry.

GENERAL DYNAMICS BIO-ENVIRONMENTAL HEALTH CONTROL CENTER

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The threat to our environment, as evidenced by the precipitous rise we are seeing in the consumption of natural resources, plus the degradation of what remains by the dumping of wastes, is all too personal for us to ignore. The threat is to our aesthetic senses, our health, and even our very existence.

Thus we, as private industry and members of organizations such as the National Safety Council, cannot be against efforts to conserve and enhance our environment any more than we can be against any other program that is designed to preserve health and promote longevity. Our responsibilities in industry for positive action are quite clear. First, we are major contributors to environmental pollution. Second, since we have been recognized leaders of technological advances and problem solving, we are looked to for solutions. Third, since much of our business is of public contract origin, we are closely tied to all aspects of public legislation and should be example-setters from the standpoint of good practices. Finally, pollution control is an item of major personal concern which demands corrective action by all responsible citizens.

Environmental pollution has been described, in a recent piece of proposed Federal legislation, as that condition resulting from the presence of chemical, physical, or biological elements or agents which (1) adversely affect human health or welfare, (2) unfavorably alter ecological balances of importance to human life, (3) affect other species of importance to man, or (4) degrade the utility of the environment for aesthetic and recreational purposes. The reduction of environmental pollution requires consideration of the use and treatment of air, water, and land, and includes the abatement of noise, the proper management of solid waste, radiant energy, and radioactive materials, as well as the control of other pollutants.

Beyond this statement, which, in effect, really has only reference to the maintenance of the status quo, is the concept of environmental enhancement.

At General Dynamics, we have long been concerned that the environment in which our people work and live shall be as safe and aesthetically acceptable as we can make it for their well-being. We also have this same concern for the inhabitants of communities in which our operations are located.

Environmental control has been a costly item in our past budgets and will continue to be so. In the past decade, our capital costs for air and water pollution control items alone have exceeded 8 million dollars. Operating expenses have taken another 3.2 million dollars. Forecasts for the current decade indicate that these two items will exceed 38 million dollars.

Control of activities of this proportion require well thought out plans. Thus, in March 1968 a corporate industrial pollution committee was established to formalize major pollution control objectives. From this evolved the Bioenvironmental Health Control Center which was established at the Fort Worth operations of our Convair Aerospace Division in August 1969. This center was charged with the task of providing technical information and know-how in the areas of air, water, noise, and thermal pollution control, occupational health and safety, and all other facets of environmental hygiene.

In essence, it was given the charter to assess the problem, recommend solutions, and then participate in the development of get-well plans and establishment of priorities. The design and implementation of required fixes remained the task of facility engineering, and both functions were made subservient to sound financial planning.

Before going into a detailed description of the Center, I would like to emphasize that we visualize air and water pollution as merely one facet of a much larger subject; namely, that of man's relationship to his entire physical environment. It makes little difference if we are considering the confined area of his immediate work space or that of the entire community he lives in. Further, it makes little difference whether we speak of it in terms of health, safety, or environmental control.

It was for this reason that it seemed proper for us to establish a single activity to survey and monitor the entire subject area. Additionally, such a center would provide a major assist in developing a corporate-wide systematic approach in arriving at solutions.

From a historical standpoint, it may interest you to know that the name "bioenvironmental" was first coined by the U.S. Air Force about ten years ago. It is a contraction of the words biology and environment and connotes the relationship of living things to their surroundings. This same connotation, we feel, provides an excellent description of the mission we have assigned to the center; hence, the similarity of names.

To place General Dynamics' objectives in proper perspective regarding our concern for the world we live in and yet be practical, four guiding principles were established to provide a framework and basis for Center activities. We wanted to protect the health of our employes, to comply with all laws and regulations, to be a good neighbor, and to make a profit.

Pressures to activate the Center came from many areas. Those of most immediate concern were: first, almost every material, chemical, alloy, and process utilized in our business brings with it environmental considerations. Second, new experimental data has caused a lowering of permissible exposure levels of environmental variables that we previously considered safe. Third, stringent new Federal, state, and local pieces of legislation had been enacted or were in the offing. Many of which were confusing and, at times, even in conflict, making compliance complex, difficult, and costly.

Consequently, as a first order of business, the Center was requested to develop a capability that would enable them to assess our industrial activities, materials, and processes from an environmental standpoint. Further, to be capable of instrumenting and quantifying environmental variables and to

have knowledge concerning available means to control them. Additionally, Center personnel were to become thoroughly conversant with existing and proposed safety, health, and environmental practices, standards, and laws.

In the accomplishment of the above, an excellent technical library and reference file has been put together. The organization has thus become our centralized repository of information and "know-how" for health legislation and standards; air and water pollution; air and water sampling techniques, testing, and monitoring equipment; waste treatment and disposal methods; environmental control technology, such as filters, scrubbers, and collectors; personnel protection equipment; sanitation; relative toxicities of chemicals; health aspects of new processes; noise, lasers, microwaves, radiation, etc. In addition, it provides a source point for information concerning the location of the many diverse corporate resources which have environmental control capabilities; as well as those available from outside consulting organizations.

From a standpoint of instrumentation and equipment, the Center maintains a capability to detect, analyze, and/or monitor environmental pollutants such as fumes, vapors, dusts, mists, and gases. This includes physical characteristics of the environment such as noise, illumination, radiation, temperature, humidity, and vibration. By coordinating efforts with our various chemical and process control laboratories, a full range of other qualitative and quantitative capabilities are also available. Similar capability is available for evaluating safety devices and personal protective equipment. Because of the one-site nature of many of the problems requiring evaluation, much of the laboratory gear is portable.

The personnel resources of the center consist of an administrator, industrial hygienists, health physicists, technicians, and other company personnel who perform as consultants on an "as needed" basis. Representative consultant talents include occupational medicine, aerospace medicine, industrial safety, legal biology, chemistry, physics, and metallurgy.

Utilizing this talent and equipment, the Center is now assisting our divisions and subsidiaries in a number of ways. For example, by providing fast answers to basic questions; accomplishment of literature surveys and advising on specific problems; by providing men and equipment to evaluate specific problems; and by conducting scheduled comprehensive industrial hygiene and environmental pollution surveys. These are low cost services available to any group that requests them. The findings and comments go to the requestor for his use, thus obviating the connotation of a police or inspection organization.

In addition to these services, new processes or chemicals under consideration for use or purchase are reviewed; areas requiring research are defined; personnel are furnished to serve on committees; and active participation is maintained in the proceedings of technical organizations such as industrial hygiene associations, health physics societies, air and water pollution control and waste disposal associations.

Long range plans provide for the periodic publication of an environmental health and safety newsletter; development of operating standards, manuals, training aids, and handbooks on health and safety; research of specific problems involving lab tests; investigation of related cost savings and trade-off concepts; and encouragement of contracts to study health, safety, and pollution problems.

Since its inception, most of the Center's energies have been directed towards the accomplishment of a corporate-wide industrial hygiene and environmental survey, the purpose being to establish base-line reference points of where we are, where we have to go, how long will it take to get there, and how much will it cost.

Our Surface Shipbuilding Division at Quincy, Massachusetts and the Electric Boat Division at Groton, Conn. were two of the early operational locations surveyed. To give you some idea of what these surveys entail, a brief review of the survey team's modus operandi may be of interest.

Initial action was the distribution of a corporate executive memorandum to all division managers outlining our position concerning environmental control, the reasons for the survey, the results desired, and a request that the survey team be provided their full cooperation. The team was then scheduled to look at like industries located in the same general geographical area.

In the case of Quincy and Electric Boat, a four man team and equipment from the Center was put together. On arrival, both personnel and equipment augmentations were provided by the host division. Their subsequent survey activities utilized the better part of two weeks. This time element might have been longer except for the fact that much base-line information was already available and merely required updating and compilation.

Of prime concern was a review of our operations as they related to Federal, State, and local requirements. Thus, in the case of air pollution, emphasis was placed on an assessment of sulfur dioxide, suspended particulate matter sources, and airborne levels. Similar attention was also given to hydrocarbons, carbon monoxide, and photo-chemical oxidants.

Regarding water pollution, a review of the local water shed and drainage systems was accomplished, evaluating both point discharges and surface water runoffs. Analytical tests included those for coliform bacteria, pH, total organic carbons, biological oxygen demand, and chemical oxygen demand.

Micro-environmental surveys of the immediate work place environment were similar to those accomplished as part of our industrial hygiene program. They included analysis of atmospheric contaminants for lead, cadmium, zinc, beryllium, asbestos, polymers, solvents, carbon monoxide, etc. Again, source points, control methods, and existing levels were evaluated.

From the standpoint of physical agents, noise, illumination, ionizing, radiation, and lasers were included.

To round out the overall assessment of base-line conditions, rest rooms, food service facilities, and general yard sanitation measures were also evaluated.

Although a number of items were found at both yards that needed further attention, no major heretofore unidentified trouble spots were detected. Those requiring our immediate concern included better methods for the disposition of chemical wastes and more aggressive noise control programs, each of which is now receiving local and corporate attention.

Of greatest value was the fact that for the first time we had a single document that described conditions as they existed in finite terms. Our follow-on action includes condensation of this material with similar type status reports from all other operating locations. Proper corrective actions needed are then proposed and priorities for implementation established.

Hopefully, intelligent and practical interpretations of new laws and regulations will allow us to progress with this approach in a sane and orderly manner.

In conclusion, the Center belongs to each of our divisions and subsidiaries. Its usefulness depends on the use made of it by management and their health and safety personnel. It has been in operation now for slightly over a year. During this time, we have accomplished detailed air, water, and industrial hygiene surveys of over three-fourths of our manufacturing locations and work environments involving nearly 80,000 employees.

Returns have not been spectacular from the standpoint of discovering heretofore unknown problems. They have, however, been invaluable in quantifying the problems and describing them in finite measurements that design engineers can work against in coming up with solutions. To date, the solutions do not appear to be technically impossible, but are costly and time consuming.

As we see it, we still have a long way to go before we reach an optimum relationship with our environment. In fact, we never expect to reach a complete end point.

Environmental health safety and pollution control are part of an evolving technology. New hazards are constantly being introduced and new and more efficient control methods discovered. Each, in turn, require new evaluation selection and implementation. Even more importantly, there will always be a constant requirement for review and enforcement of existing control techniques and procedures. Consequently, we see a continuing and growing need for the centralized bioenvironmental health control center we have established.

U.S. SHIPBUILDING AND NATIONAL SAFETY

By EDWIN M. HOOD
President, Shipbuilders Council of America, Washington, D. C.

To a nation virtually surrounded by water, as the United States is, the seas—the oceans—have a three-fold purpose. They constitute a moat with which to deter the aggressive purposes of unfriendly or even friendly powers. They provide a conveyor belt for the transport of essential commodities and products. And they represent a resource of infinite proportions in terms of foodstuff and minerals yet to be tapped.

The common denominator, in each of these three areas, is ships. But ships without supporting shipyards are like butter without bread. U.S. sea power encompasses not only merchant and naval ships, but also shipbuilding and ship repairing capabilities, as well as the industrial and manpower vigor of America. By manpower, let me assure you, I have in mind men and women skilled and unskilled, blue collar and white collar, professional and administrative disciplines, plus the promise of the future; our young people.

Any fair assessment of history suggests that a balanced industrial base, including shipbuilding, ship repair and ship component capabilities, is no less important to effective sea power than are the naval and merchant fleets themselves. History also suggests that the nation which builds the ships, carries the cargoes, collects the revenues therefrom, and keeps the sea lanes open for commerce has generally been internationally influential and economically affluent.

Without adequate sea power, as I have here echoed the definition of experts, our country could not long survive as a republic, as a bastion of freedom. Without adequate sea power, you and I would have little reason to discuss interpretations of safety regulations or allied topics as they concern the marine industry.

In a crazy-quilt sort of way, our country, throughout most of the past two decades, has had available what can only be described as a marginal degree of sea power. Use of the adjective "adequate" to imply sufficiency under all possible conditions of world turmoil and serenity would be stretching a point. The vital interests of the United States have been served by naval forces, part old and part new, and by maritime services, mostly old and minimally new.

New ships have not been ordered in sufficient numbers to overcome the high degree of obsolescence which has afflicted both the naval and maritime fleets. As a consequence, more than half of our Navy and nearly three-quarters of the American merchant marine are today made up of vessels 20 years of age and older.

Even more incredibly, the United States, the world's leading trading nation, has suffered the humiliation of its own merchant marine carrying less than seven per cent of its own trade and commerce. The balance has been moved in ships flying foreign flags. Ships of other nations have brought to our shores better than 90 per cent of those critical minerals and metals without which our industrial and military enterprises could not exist, and without which our national safety would be gravely endangered.

The responsibilities of the U.S. Navy, by the force of world events, have been expanded. Yet, budgetary strictures of recent times have compelled a decrease in the size of our naval forces. New ships plus World War II vessels, suitably upgraded, have been and are at this moment the mainstay of our Navy. During the past two decades, these ships, their armament, and their crews have made possible the preeminence of American strength on the oceans.

But, the United States has been slowly and perceptibly losing its total sea power initiative. Partial obsolescence, diminishing numbers, and reliance on foreign flag shipping contribute to this loss of momentum.

More sensitive, however, has been the rapid emergence of the Soviet Union as a sea power of impressive dimensions. Though the United States is considered by experts to possess a navy of unsurpassed capabilities, those same experts predict that the Russians will shortly be in a position to challenge, in an effective way, the supremacy of American sea power. Those same experts forecast that the Soviet merchant marine, within the next two years, will surpass the U.S. flag merchant marine in both numbers and tonnage. With seemingly equal determination, the Russians are exploiting, to their own advantage, the developing spectrum of opportunities associated with oceanography and marine sciences.

It is therefore important that the changing balance between American and Soviet sea power and all that it foretells for free people everywhere be given the widest possible recognition. The national safety of the United States is at issue. The equanimity of the world is in balance. A contest for supremacy on the seas, and thus a contest for the minds of men and women everywhere, is involved. Control of strategic waters and sea lanes, and thus control of the flow of vital trade and commerce, is at stake.

More than 80 per cent of the Russian merchant marine is less than 20 years of age, and 90 per cent of the Russian navy is less than 10 years old. Compared with the high level of obsolescence in our maritime and naval fleets, previously mentioned, these modernity indices suggest that the shipbuilding programs of the Soviets have received high priorities in the allocation of fiscal, production, and manpower resources.

The output of intensive ship construction efforts, started in the mid-1950's, has made it possible for Soviet sea power to expand around the globe—in the Mediterranean, in the Caribbean, in the South Atlantic, in the Indian Ocean, and elsewhere. This spreading reach reflects the political, economic, foreign policy, and psychological objectives of the communist regime. Its motivations are both military and mercantile.

By the end of this year, for example, the number of nuclear-powered submarines in the Russian navy will be equal to those in the United States fleet. And, in the next four years, U.S. shipyards will deliver only 20 additional atomic subs, while it is estimated Russian yards will deliver 60, plus a number of diesel submarines which are no longer ordered by our navy. Many of the submarines in the Red fleet are, or will be, capable of launching missiles at our industrial and population centers, and the safety deterrent is our Polaris/Poseidon forces of 41 nuclear-powered submarines.

The employment of the Soviet merchant marine as a commercial tool has multipled over the past decade. New and modern merchant ships, flying the emblem of the "hammer and sickle," have been moving into established trade routes and creating new trade patterns. The occupants of the Kremlin in Moscow, in the words of our Chief of Naval Operations, "are clearly willing to undercut freight rates in order to achieve political and economic leverages in the developing nations; financial profit is clearly secondary to their political motives in this regard."

With this kind of motivation in mind, one can hardly feel secure with the news that ships of the Russian merchant marine will shortly call at U.S. ports on the West Coast on a regular basis. According to press accounts, no American shipping interests opposed the application for this service at rates as much as 47 per cent below those offered by steamship conferences but comparable with those of some independent operators in the same Far East to U.S. trade.

It has become increasingly evident that the Soviets have come to recognize the importance of the seas to their grand design of world domination and the sea power initiative has been slowly and perceptibly shifting from Washington to Moscow. Whereas politicians of yesteryears have tended to downgrade the steady buildup of Russian ocean strength, the present occupant of The White House in Washington has been more positive and more constructive in his reaction.

President Nixon refuses to abdicate our maritime position to the Soviet Union. Only last week he signed into law the Merchant Marine Act of 1970 which incorporates his blueprint for the restoration of the United States as a first-rate maritime power. Under this landmark legislation, as many as 300 new, modern, efficient U.S. flag merchant vessels could be built in American shipyards over the next 10 years.

This maritime fleet of the 1970's would correct the errors and omissions of the past. It will be structured to carry 30 per cent, not seven per cent, of our nation's trade and commerce by volume. It is intended to serve the national interest by making available sufficient shipping services to ensure that the needs for security, survival, and safety of our great nation can always be met by ships under our own flag and under our own jurisdiction.

To be sure, the results of this renewed effort will not be seen for another several years, and a similar blueprint for U.S. naval

sufficiency to meet the Russian threat on the oceans is still in the making. But, the important point is that a beginning has been made, a beginning toward reversal of a trend which has brought our total sea power capability to the precipitous brink of being swamped by the Russians.

The task of neutralizing this situation, in very large measure, rests with the shipyards of America. For until new ships are built and delivered, the deficiences in our nation's arsenal of sea power resources will not be remedied.

To complete these remarks, it remains only to be said—and repeated—the private sector of the U.S. shipyard industry has today the manpower, facilities, capacity, and capabilities to undertake much more work than is presently at hand. The industry is prepared to expand facilities as market potentials materialize. It has an excellent manpower base which can likewise be expanded as market conditions require. The industry is fully confident of its ability to meet the challenge of expanded merchant and naval building programs now in the process of development and stands ready to cooperate with the Congress, the Administration, the naval services, and the shipowning and ship operating communities in measures to strengthen the full spectrum of U.S. sea power resources.

A MARINE ACCIDENT PREVENTION PROGRAM

By SIDNEY G. VASS
Safety Director, Marine Transport Lines, Inc., New York, N. Y.

Marine Transport Lines owns and operates an extensive fleet of ocean-going ships, both in the worldwide and coastwise trades, totaling approximately 1,641,799 D.W.T. This tonnage comprises 14 bulk cargo, 22 tankers, and 18 specialized vessels. The ships are manned by American, Chinese, British, and Spanish crews. The specialized vessels consist of multiple grade chemical ships; one presently being built at Ingalls Shipyard will be capable of transporting up to 33 different products at a time; others transporting anhydrous ammonia at —28°F., liquid sulphur at 275°F., and tetraethyl lead, which can cause lead poisoning from breathing the vapors or liquid absorption through the skin. Incidentally, the latter has no known antidote. These specialized vessels have, of course, many built-in safety devices and particular operating instructions specific to their needs.

The chemical ships, as a group, have the best safety record and the lowest accident frequency rate in the fleet. Because the source of seamen is identical for all ships, one must assume that they exercise a greater degree of caution in an environment where safety is practiced as part of the normal job routine.

Marine Transport Lines' loss prevention is based on 10 basic and essential procedures: indoctrination of crew members, instruction of supervisory personnel, development of rules, inspections and observations, accident reporting procedures, accident investigation procedures, recording and analysis of accident data, reporting of progress, administration of the program, and coordination by loss prevention (directing).

1. *Indoctrination of Crew Members*

This is the very first step in an effective loss prevention program. When a seaman joins a vessel, his department head gives him one of our "Welcome Aboard" safety pamphlets printed in the language used aboard the vessel—English, Spanish, or Chinese. Not only is this an appropriate greeting to a new employee but, as it contains many safety tips, it will serve as a knowledgeable reminder to him for the entire voyage. We are particularly anxious to convey to all new employees our sincere interest in their safety and welfare. Department heads are instructed to take a few minutes to explain the safety feature of our loss prevention program regarding any particular safety item pertaining to the vessel, as well as instructing him to report immediately any unsafe condition.

On the inside page of the leaflet alongside the safety tips, (made out to the company's initials) is a slogan which states: "Men who

are properly trained will stay healthier and live longer." Backing this us, directly under the sign "Obey Safety Rules" on the first page, is a sentence stating: "If you are uncertain how a job should be done, ask your department head." All too often we have found that accidents have occurred to crew members time and time again due to a lack of knowledge of a particular job: consequently, by informing a seaman ahead of time we hope to eliminate this cause.

The last page of the leaflet contains an "Accident Sequence Chart" which outlines, with examples, four steps of an accident from the Reason Why to the Undesired Results of the Injury Damage Loss. By this chart we hope to encourage the shipboard supervisory staff to eliminate the reason for an accident on the spot immediately after an occurrence, rather than to indulge in lengthy correspondence with the home office and consequently wait a number of weeks before taking action.

2. *Instruction of Supervisory Personnel*

As operators of ships, we are indeed fortunate that our supervisory personnel are licensed to serve in their various capacities by such bodies as the U.S.C.G., as this provides us with a competent person for each position. However, over the years it has been shown by the large number of losses experienced by property damage to ships, as well as personnel injuries, that additional training and instruction are required to control these losses.

Many of these instructions are of a reminder nature or tailored to the company's needs, but others give information on the latest government requirements, or upgrade existing practices to keep up with our increasingly complex technological advances. This entails many forms and varies from vessel to vessel, depending on its type and class. However, each ship is supplied with a company safety manual which is prefaced with a statement of policy. Here are a few sentences from the policy which explain the objectives of our safety program rather well:

"The safety policy of Marine Transport Lines is to eliminate unwanted, unplanned occurrences which can result in personal injury, loss or damage to equipment, cargo, vessels and premises. These occurrences are often harmful to the well being of our employees and interrupt the orderly performance of work aboard the vessels and shore facilities.

"The safety of our employees and others aboard the vessels is as always our primary objective and worthy of first consideration. Our second objective is to reduce waste, loss or damage of equipment, cargo damage, and delays produced by accidents."

Other instructions are issued in the form of government publications, such as the U.S.C.G. fire fighting booklet, reference books, or our Shipboard Port Emergency Directory, which is a standard form and is designed to provide the necessary information on a particular port. Contained in the form are instructions on what to do in case of a shipboard fire or other emergency. The latter includes the correct procedures to follow in obtaining the telephone numbers of the local agent, police, ambulance service, nearest hospital, etc. Vessels are instructed to post this directive in two conspicuous places aboard ship. Other instructions and general information on loss prevention are also distributed to the ship in our Safety *Newsletter* or by general letters.

In our opinion, the need for a radar refresher training course is made very evident by the continued large number of collisions taking place between vessels fitted with radar and from the findings of the courts from investigation of these collisions, which invariably revealed that the incorrect use of radar, including non-plotting or incorrect plotting of targets, was a contributing factor. The 168th Annual Report of the Liverpool Underwriters Association shows that for vessels of the world merchant fleet of 500 gross tons and upwards, 1,624 ships were partially damaged and 21 were total losses as a result of collisions in 1969.

While all these collisions cannot be attributed to the misuse of radar, a significant number can, and if this is coupled to the portion of the 903 strandings reported in 1969, which resulted from incorrect radar use, the losses remain tremendous.

The shipboard radar refresher training course is in the form of a book entitled *Marine Radar and How to Use It*, and a monthly radar newsletter, both of which we at Marine Transport Lines intend to give to each Master and desk officer aboard our ships to obtain the widest coverage possible.

The book is written in a manner easily understandable to seamen, and will be multi-

colored to aid in describing the plotting system and diagrams. The text color and the portion of the diagram to which it refers are always the same, and the diagrams are arranged so that there is never a need to turn pages ahead or back to make reference to them, thus simplifying the normal task of correlation between text and diagrams. Among the contents of the book are the legalities of radar, which includes sections on "Must You Use Radar," "Clear Weather Use of Radar," "Must Radar Be Kept in Good Repair," "Must you Plot," "Radar and Speed In Fog," etc. Other chapters deal with how radar functions, collision avoidance, harbor radar operations, to plot or not. The latter describes all the different plotting methods so that the reader can choose the one he is familiar with, as well as being aware of the other methods.

The monthly *Newsletter*, as its name implies, will be basically radar oriented, but other subjects of interest will be included. One of the main reasons for the *Newsletter*, aside from its being a vehicle to present updated information on radar and other navigation aids, will be to maintain the initial appeal provided by the book and to generate new interest in the subject matter with those who may warm up to the program more slowly than most.

A separate company, called Operational Radar Service Publications, has been formed to handle publication, and of course the program will be made available to all steamship companies, as part of its success will be due to maximum exposure. Steamship companies should combine to perform needed services.

3. *Development of Rules*

Loss prevention and the safe operation of systems and equipment is a part of every ship's operation manual. Its practice or lack of practice is evident on every job either by a trouble-free operation or by personnel accidents or down time of machinery.

Like most companies, we try to develop correct procedures before an accident or injury/damage loss results, but many rules are developed on the job from the experience gained by the men actually performing the work. We find this operational job analysis is invaluable, especially aboard new vessels or those with new equipment, where crew members' innovations play a major part in the formation of needed proper procedures. Most of us are familiar with the rules developed for lifeboat drill and their value is obvious, but it is also preferable to have rules and safety checklists for the operation of such machinery as grinders, lathes, pumps, etc., as well as for performing such tasks as chipping, mooring the vessel, etc., and we at Marine Transport Lines try to cover these areas.

4. *Inspections and Observations*

Inspections and observations to detect unsafe shipboard conditions or unsafe practices by crew members are a prerequisite of a conscientious captain, department head, or watchkeeper, and a significant part of our loss prevention program is devoted towards backing up and encouraging these procedures. We strongly urge that, whenever possible, any deficiencies found are eliminated immediately, and a crew member performing in an unsafe manner stopped and the correct method demonstrated before he is allowed to continue. Other hazards requiring shipyard work or requisitioning of equipment are eliminated as soon as possible. The safety director and other shore staff personnel also conduct shipboard safety inspections, and this provides an effective check on a ship's practical performance.

5, 6. *Accident Reporting Procedures* and *Accident Investigation Procedures*

After an accident, the insurance department requires certain data for their records, and also, if necessary, to process hospital and maintenance claims or any other payments that can be incurred after an injury. Of course, from a loss prevention viewpoint, we are primarily interested in the prevention of future accidents as a result of the same conditions.

By combining the two we have increased the quality of the data received from the ships and have also reduced the amount of paper work involved. The ships are required to report every accident regardless of whether any injury is sustained. The department head or the supervisor in charge is required to investigate an accident immediately after its occurrence, if possible in the presence of the person involved, so that corrective action can be implemented immediately. The officer conducting the investigation completes the following questions contained in the form: (1) What was injured person doing at time of accident, including equipment involved? (2) What unplanned occurrence caused injury? (3) What did injured person do or fail to do which caused accident? (4) What is being done to prevent a repetition of this accident?

The application of this method benefits all parties by publicizing the particular hazard among employees, helping to determine facts for cases involving legal liability, but most significantly helps to prevent re-occurrences by establishing a cause, so that similar accidents may be prevented by mechanical improvement, better supervision, or employee training.

7. *Recording and Analysis of Accident Data*

Shipboard accidents are recorded under definite cause and agency data so that any trends are revealed. An analysis of this accident data is reviewed and sent to the vessels monthly. Marsh & McLennan, our brokers, record a similar but more detailed accident analysis in booklet form for us on an annual basis. Besides noting any trends and the frequency of occurrences, selected outstanding accident causes for preferred attention are contained in their recommendations.

All this information is reviewed and acted upon, but experience has proved that the most effective way to reduce accidents is to concentrate on one phase of the accident problem at a time rather than attempting to stop all accidents at once.

This analysis revealed, among other items, that a number of serious and costly accidents were occurring during mooring operations. After consideration of the facts, the company adopted a mooring line policy. We are now replacing mooring lines with polypropolene/polyester line and all rope stoppers will be made from polyester. By the use of this type of line, together with appropriate instructions in their use, we hope to greatly reduce the frequency of mooring line accidents.

8. *Reporting of Progress*

This title speaks for itself, but it is important to keep management fully informed on a regular basis of progress in loss prevention. A realistic yardstick should be adopted as a base, so that factual information can be provided.

9. *Administration of Program*

Like all programs, we feel it is essential to have a full time administrator for a company loss prevention program. Basically he must help management solve two principal problems—how to substitute safe practices for unsafe practices of employees, and how to remove physical hazards. Safety is a part in all company operations and tremendous savings are possible by a well administered program.

10. *Coordination by Loss Prevention*

In our company this takes the form of a management safety control committee comprised of a member of each department, with the exception of accounting. This committee meets once per month and reviews all aspects of safety, whether of an engineering, purchasing, operating or personnel nature. On board our vessels, monthly safety meetings are held; written minutes are kept and a copy sent to me. We attempt to convey to our masters that physical conditions aboard ship are only responsible for a small percentage of our accidents.

Out of the three most expensive items in operating a ship—fuel, wages, and insurance —only the latter is directly controlled by a company, as the former two are usually the same for each operator of ships under the same national registration.

Insurance premium rates are known to vary widely between steamship companies, and this variation is a direct reflection of the effectiveness of their safety program. Hull and P&I claims will be used in negotiations on future insurance premiums and, while inflation and all company claims collectively will, no doubt, cause a rise in the rates, an effective company loss prevention program will keep these increases to a minimum.

SAFETY
AN EXCHANGE OF IDEAS

By CAPTAIN R. P. WALKER
U.S. Fleet, Texaco, Inc., Port Arthur, Texas

We commence with the premise that safety is an exchange of ideas. If you will, an effluence of information influencing people to attain desired results. As with all premises, this one needs to be developed, and we propose to do this by constructing first a hypothesis and then indicating how this translates into programs. The exchange of ideas has several levels.

First, but not necessarily the most important, is that of exchanging of ideas among management people such as we do at the National Safety Congress. Second, the exchange of ideas among our own people on the same level within our own organizations. Third, and probably the most important, the exchange of ideas among the levels within our organization.

As this paper develops, we do not propose to set forth an ideal safety program, as we question whether there is such an animal; but it is hoped that before we finish, there will be sufficient guidelines for a skeleton from which anyone could develop a program from the approach that we verbalize. When I say verbalize, I also mean that many of the thoughts and premises translated into active programs are known by most of us, but in the exchange of ideas in safety, it is well that we vocalize and reinforce our thinking. We should put to test our premises so that as the years pass we become more astute and flexible and have greater understanding as to what safety is all about.

As we talk about safety, we are continually aware that it is not a separate function within an organization but rather an integrated aspect of operations. It is pulled to the side and emphasized because it is important. Because not only does it make a meaningful contribution to production but, more importantly, it carries with it a moral obligation to avoid human suffering.

We also are saying that safety programs are not mechanical because they deal with people, and we quickly add that this does not mean they are Machiavellian because they deal with people. With this thought, we will attempt to explore with you some of the premises and their development.

We also believe that the average individual seeks involvement and responsibility and has a desire to make a meaningful contribution to whatever activity in which he may be involved. It is also believed that each individual is capable of self-direction and self-control and does not necessarily need pushing and "whipping" in order to move forward.

In moving forward, the question arises, "Does our safety program move forward?"

Have we exerted the self-direction and self-control in our programs that will enable us to progress as rapidly as our people can? Or, do we hang on the programs that have long proved they are no longer worthwhile or no longer motivate or that need revision, just so long as we can say we have some sort of program?

In other words, are we loyal to an old program called safety for no apparent reason?

One of the measuring gauges used in determining how modern our safety program is, is how we are managing it; whether by past experience, immediate expectations, or by pressures. If these pressures and expectations are coming from outside the program, we feel that little value is being delivered to the program itself. This approach of "continually whipping" it into shape generally means we grasp for straws to build the semblance of a safety program.

It is believed that a program must be people-oriented and dedicated to meaningful goals. Will it continue to deliver the results whether there is a safety engineer around or not? Parenthetically, a program that always requires a safety engineer around, is not a safety program. What we are saying is that safety must be built into one's operations so it is impossible for supervisors to think of an operation without automatically having thought "safety." This means a fully integrated position where safety is both consciously and subconsciously considered in performing a job. Getting the job done is no longer enough.

What we need is a total concern for the people involved with the realization that most people truly have a need and a desire to contribute, to be self-directed, to get involved, and to make a meaningful contribution.

The "seat of the pants" approach to safety is like "seat of the pants" flying. There is not much need for it any more, and one doesn't go far or fast. One's program has to be systematic. It should be carefully and professionally planned with certain intuition and regard for people.

This approach calls for developing long-range as well as short-range strategies and applying management techniques, research, and quantitative decision making. The manager must be concerned with the task and with his people so that he integrates them with their work, thus assisting them in utilizing the proper techniques. This may call for training, education and, sometimes, replacement of people. One must frown on placing too much reliance on good intentions rather than on knowledge and rational approaches. But, we also say there must be objective concerns tempered with the humanistic approaches.

As we said earlier, it is the effluence of information that influences people to achieve the desired result. That means that we not only examine the style and behavior of those who may be reporting to us but also our own style, behavior, and patterns of communication.

In communicating we know that words are only part of the story.

Communication has been defined as "behavior that results in an exchange of meaning." Words, even word inflections, facial expressions, bulletin board notices, and staff meetings are all examples of behavior which transmits feelings, facts, and ideas to someone else. Communication processes often result in communication misfires or misunderstanding because:

(1) the behavior of the sender is not clear or
(2) the receiver in some fashion distorts or misinterprets the sender's signal or transmission.

Therefore, the basic definition of communications does not specify "good" or "bad"; rather, it indicates that any transmission that results in an exchange of meaning is communication.

The more critical question then is, "What is effective communication?" Our first assumption might well be that an effective communication is one that is understood. However, it must go beyond that, for in the final analysis effective communication is that which results in positive action in line with the needs of the situation. This suggests that the sender and receiver need to do more than give and receive instructions. They must clarify purposes and situational needs. In complex situations there may be a need for a careful examination of alternative goals, and the possible consequences of a given course of action.

The safety-minded manager must influence his subordinates and associates in building positive action. Often the integration of conflicting viewpoints requires two-way influence with an opportunity for persons involved to change their own viewpoint as a result of influence from others or to influence others to change part or all of their viewpoint. Words, ideas, facts, and feelings are communicated to others in order to influence behavior, to produce understanding, acceptance and positive action.

Now, we might ask, what does this have to do with our safety program, our people, and plans?

In developing safety programs, we cannot use pressure if we are not totally familiar with the problems. The supervisor who is attempting to instill a new or stronger safety approach needs to have quite a few facts about the people involved—their experience, point of view and feelings—before he begins to try to control the situation. In the "old days" when there were few jobs around, people could often be treated in a very direct way, given orders, told what to do, and if they didn't like it they could be fired. There were always other people to take their place. In today's mobile labor market we have changed our philosophy toward employees. We know if the supervisor or company "controlled" an individual we still would not have control of the individual's motives, feelings and attitudes. If the employee feels he is being bossed around, he

may find very quiet and subtle ways of resisting. Psychologists tell us that this is passive resistance. The employee slows down his effort and does as little as possible or perhaps actually engages in work stoppages if he feels over-controlled and over-dominated.

In almost any situation we need the ideas of others, we need their commitment and motivation. We cannot operate unilaterally if we wish to build team work and understanding between management and our people.

Sounds good, just like out of the textbook. How does one translate into practice? In the program that I am familiar with, the exchange of ideas takes place on several levels. Formally; attending safety congress; meeting with our officers ashore; and finally, meeting aboard ship. One can readily see that these three types of meetings fulfill the need of cross-fertilization of ideas and permit them to be treated at the various levels.

In this paper one will not find an outline on how to hold a meeting or how a safety meeting should be conducted. Yet, most organizations will undoubtedly find a necessity to conduct instructional meetings on how to have a successful safety meeting.

We must continually reinforce within the minds of all the people that safety is a continuing thing, not just at meetings. This can be illustrated by a bump cap.

During the past six months the bump cap has become popular with our people. Previously, we had tried to persuade our men to wear safety helmets We found the bump hat to be lightweight and more practical on deck. We decided to give the hat out on request only, where previously we had put a supply of helmets aboard each ship. Before two months expired, we were requested out of supply. Our men have received it very favorably with little or no pressure on our part. The requests keep pouring in. The hat serves several purposes—it stops cut heads and is a constant symbol of safety.

This single happening illustrates the need for pressure for safety to come from within. On deck, they now wear the bump cap—they wouldn't wear safety helmets.

Interpretation and persuasion are being added to information and entertainment, which have been the traditional twin objectives of communications. Where controversy is concerned we sometimes fail to voice effective communication to our people. Too, often we communicate on controversy in about the same tone, words, and style that lawyers would use in a Supreme Court brief. The opposite extreme of pitching a message at about the third grade level is also common. Both of these practices reflect a lack of understanding of the employee. Our communication will be wholly ineffective if listeners interpret it as talking down to them.

This problem can be avoided by permitting any member of the ship to chair a safety meeting, so long as he does a conscientious job.

Your business and mine are changing. Growth, diversification, and increasing competition are constantly forcing alterations in methods or structures. Whatever the goal, the hoped-for-benefits of change are seldom fully realized. Many factors contribute to the difficulties of making changes. They included the structure of the plan, communications, and systems. But the greatest single factor is that the people who make the decision to change do not realize that an organization consists of people whose capacities, psychological make-up, personal goals, informal relationships, and value systems must be taken into account. A fully integrated change must take place adapting safety strategies, policies, and relationships to this continual change.

Any proposed change that is to succeed must begin with a full examination of our past program and an analysis of our future goals and objectives. One may wish to appoint a team of people not connected with safety to study and evaluate the program already in existence and, hopefully, discover new ways, fresh ideas that otherwise would never have been developed.

To achieve any goal in safety requires paying a price. It would be unrealistic to design a plan which required a price higher than management is willing to pay. The amount of money spent is not a gauge of a successful program.

A continual state of flux will bring out new ideas to develop the excellent performance we will expect from our officers and crews. We achieved success when we took a senior master mariner and made him a safety inspector for two years. We benefited from the exchange of ideas that followed his placement ashore.

It is essential that management be prepared to do what it must in order to make a program a success. If management does not carry out its part, resistance and inertia down the line will increase. In such cases it is better never to have undertaken change.

In planning change we must be sure that all the processes on which a safety system depends are aligned to conform to a new plan. It is important that procedures for planning and the measurement of results be immediately aligned to conform with the new structure.

A frequent remark, when change is suggested is, "You can't act now because the time isn't right." Even if the time isn't right, change is often resisted because we may upset people's feelings. The fact is that changes in procedures to benefit safety programs must change people's habits if they are going to succeed. Changes for the better improve morale.

Officer conferences are frequently held to discuss problems, suggest changes, and evaluate reactions. Officer consultations encourage change and a better understanding of management's objectives.

Among the pressures opposing change in safety are human attitudes, one or all of which are almost always present when people fail to alter their habits: they do not know what is expected of them; they do not know it is important; they do not know how to change; and they feel psychologically threatened.

These pressures can be reduced by: (1) presenting a safety program in a way that wins understanding and acceptance—this is the process of communication and persuasion; (2) helping people change habits, respond with new skills and attitudes; (3) establish confidence in safety.

But change is difficult and considerable pressure is usually necessary to get people to break deeply ingrained habits and develop proper safe ones. Training slides that are educational as well as those that are humorous help communicate our safety message. They can break the ice in many areas and accomplish a meaningful purpose.

But discipline—pressure for change—is also required: uncompromising insistence that people do what they are expected to. This is reinforced by consistent use of rewards and penalties to attain high safety standards. We try to reward those that attain the proper safety performance.

Safety triangles were purchased for crew members of vessels that went through a calendar year without a lost time accident. The triangle is used to warn motorists of impending danger ahead. The award is a safety item and does several things, the most important to reinforce the idea of safety.

No matter how well our safety plans are introduced, there is still a big gap between understanding and action. Application of the learning theory can contribute a great deal to effecting the desired changes fully, quickly and smoothly. Psychologists tell us that learning has four elements: drives, cues, responses, and rewards (or future rewards).

Learning typically requires repetitive action over a period of time until new safe habits are formed. If we wish to speed this learning process, we must analyze our plans in terms of each of these elements.

What new ways of doing things does our safety program require?

What actions or events are likely to cue the proper response?

How can the proper response be rewarded in terms of factors that appeal to self-interest of the individual or group such as through incentives, or recognition?

Do we know what safe habits we require?

Have we created the proper opportunities to practice safety?

Learning the proper safety habits can be greatly improved if ways can be developed to determine whether people are responding correctly. The importance of this is demonstrated by research conducted by a corporation which developed some interesting methods for recording everything that took place in a work situation. The results were shown to the participants who were able to analyze their own mistakes and figure out the proper approach to the work. As a result, the productivity of the group rose to three times what it had been in the past.

One can attempt to duplicate this practice through inspections and accident investigations within the group. Also, one can use a study group that is not connected with safety.

The findings and information are then fed into the system.

Getting our people involved so that they don't merely acquire an intellectual understanding and acceptance is a challenge which we must rise to with new motivation. By involving outside people, our people become more deeply involved. People, both ashore and afloat, tell people outside the company how they expect the job to be done safely. These people include pilots, contractors, tugboat crews, and anyone who has business with the vessel. Getting people involved ensures contribution to new plans and new safety programs. After all, safety is an exchange of ideas.

A MASTER LOOKS AT SAFETY TRAINING

By CAPTAIN OSCAR H. GRONWALL
Master S/S McKee Sons, American Steamship Co., Buffalo, N. Y.

Aboard ships we have problems different from those faced in a permanently situated factory, but we try to instill the same safety thinking and safety habits as the shoreside programs.

"As long as there are ships, there will be accidents" is a phrase I have heard many times over in the 35 years I have been sailing on the Great Lakes. This is a truism repeated by attorneys, investigating officers, and sympathizing fellow members in the shipping industry. From the larger amounts of insurance coverage carried and the retaining of legal representatives on a permanent basis, we can gather that the shipowners are believers, too. I have also been involved in accidents as a victim, as a witness, and as the one who has to make out the reports for our office and the U. S. Coast Guard.

An observation on the subject was made in the 5th Century B.C. by Thucydides, a Greek philosopher, who observed that, "A collision at sea can ruin your entire day." This can be translated to "An accident of any kind aboard ship can ruin your entire day and possibly many following days," whether it be to the vessel itself or any member of the crew.

From the planning stage to the completed construction of a vessel, safety is uppermost in the thoughts of the architects, the builders, and the many technical professional societies with which the U.S. Coast Guard participates in generating meaningful standards. The National Safety Council, I am happy to say, is one of these groups. The Coast Guard also consults with many trade association and industry groups in connection with its merchant marine safety program for ship and equipment construction.

Through the cooperation of these groups and their regulations, we are assured of the latest technological and mechanical advances in material, machinery, electrical systems, lifesaving appliances, cargo gear, and safeguards against explosion and fire. Constant checking and testing as construction goes on ensure that the component parts and systems of the vessel are in order, so that when ready to sail it is a safe ship.

Once in service, regular inspections are conducted by the U. S. Coast Guard to note any unsafe conditions which may have occurred and recommend remedies. Corrections must be made before the vessel is given its certificate and permission to sail. When underway during the season, the equipment aboard ship is checked regularly for any possible defects by the vessel officers.

Programs for safe navigation of the vessels on the Great Lakes are continually being checked for improvement through the cooperation of the Lake Carriers' Association, the Maritime Safety Committee, the International Shipmasters' Association, and the U. S. Coast Guard. The excellent safety record of the Great Lakes vessels in the heavy traffic of these confined waters is taken for granted by so many, but it is the result of concerted effort of these groups and the individual vessel officers and is worthy of commendation.

Our vessels are equipped with the latest aids to navigation as improvements are made, and it would be impossible to estimate how

many casualties have been averted by the proper use of radar, the gyro compass, direction finders, and the excellent radiotelephone communications system in use on the Great Lakes. The recent installation of bow thrust equipment on our ships has drastically increased safe performance during close maneuvering in port and around docks.

So we find that safety is built into the vessel and its component parts, and safety is provided for in the rules for navigation of the vessel and in equipment placed aboard to aid in navigation. This leaves us with safety aboard the vessel in daily procedure, or personal injury, as our never-ending problem.

Figures gathered and tabulated from insurance investigations show that almost 90 per cent of the accidents aboard ship were caused by persons committing unsafe acts, and about 10 per cent were caused mainly by the existence of unsafe conditions. Corrections can be made to the material factors, but the individual crew member is still the one we have to reach to improve our record.

Aboard ship there is a place for everything, and when in place it can be clamped, battened, lashed down, or stowed away securely. The one completely unattached, continuing moving part which can't be kept secured in a specific place is the seaman. Each and every crew member is a potential casualty looking for a place to happen as soon as he leaves his bed or bunk.

Therefore, we must impress every individual to be safety minded. With the continuing turnover in personnel, this is a continuous job from fitout in March through layup in December.

Being ships, there are some hazards which have been with us a long time, and which will continue to be with us. Among these hazards are open hatches, open gratings, ladders, moving parts in unloading equipment, cargo spillage on deck, cables, and the unknown conditions on the docks we have to make.

Each year we try to combat these with safety meetings, weekly drills, safety inspections, posters and literature, and safety equipment. Through each of these mediums we hope to reach the crew members and try to make them safety conscious. However, daily examples and reminders by the officers and veteran employees who have developed safety habits can do more to impress the other crew members than those impersonal factors.

Safety becomes a personal and individual objective. A little effort exerted in routine jobs to show the safe and proper way may be a big saving in lost time and pain to a fellow worker. An accident results when something is done contrary to the correct way of doing it. How much better for all concerned if an accident can be prevented or avoided, rather than remedied after it has taken place.

Bulk freighter fleets on the Great Lakes have shown that with stress on safety an exceptional record can be made. These fleets are to be congratulated for their fine programs and deserve the awards earned. Many ships in these fleets have gone through full seasons without a lost time accident. There is time between ports on these vessels to activate a good program.

Because of our unloading equipment and the necessary components for handling this, we have more potential hazards aboard than the bulk freighters. Also, in our self unloader fleet, our vessels are in port almost every day in the process of either loading or unloading, and the runs between ports sometimes cover only a few hours. This can be evidenced by the fact that in a sailing season of about 250 days, we will have about 120 loads in and out of the vessel. My own vessel averages 14 to 15 loads a month. Sometimes we will be making three docks a day, and our crews are working both during the loading and unloading processes. This is not an excuse for having more accidents than the other types of vessels. It is merely a statement of fact about the different nature of our business and points out why we must try harder. There is no extended enroute time for implementing a special program.

It is necessary to apply our safety messages as a constant factor in the regular working time during our schedule. New men have to be shown by example and instructed on the job in safety measures. The veteran seamen have to overcome the complacency that comes about when things are going smoothly. The minute there is a lapse and someone gets careless, an accident can take place.

We must be sure there is understanding of what is being done at all times. A lack

of understanding, a lack of communication, ignorance, improper attitude, and error in judgment all lead to the same possible casualties.

Fire and boat drills are conducted aboard ship once a week. This is the time when the men become acquainted with the types of extinguishers, oxygen masks, and other safety equipment we have aboard and learn how to use them. They are checked on their duties as designated on their station cards and further instructed in the proper methods of using the lifeboats, life rafts, and other equipment in the event of a disaster. A recent influx of alien seamen has uncovered another problem, the inability to read or understand English, therefore not knowing what the Station Card means. This calls for further instruction and special treatment by the officers and fellow seamen, for that man's performance of his duties in an emergency might at some time be vital to all. Unfortunately, these things are not learned as quickly as such things as "overtime" and "coffee time"; therefore, again it calls for more effort on our part.

Once a month a safety meeting is scheduled aboard ship. Any unsafe conditions or practices in each department are brought up for discussion and remedies are sought. At the same time many of the old safety measures are reread into the minutes of the meeting, as another constant reminder that safety is each man's responsibility. Every attempt is made to make each man use common good sense to help eliminate accidents. Accident is an ugly word. There is nothing pleasant that can be associated with it in this business. The ideal situation would be if the efforts of safety programs could eliminate the word, but such will never be the case.

We want to have safety conscious crews. We want them to make full use of the safety gear we provide, such as hard hats and work jackets. Proper attire should be worn at all times while performing their duties.

It is stressed that when any such conditions or practices are noticed which may be considered unsafe they should be brought to the attention of the officer in charge immediately, not wait for the next scheduled monthly meeting. The safety meeting should be considered to be in session at all times in an effort to curb casualties.

Management is taking a more active role in recent years in promoting a safety program. A "Safety First" philosophy is being stressed throughout the fleet. Booklets, pamphlets, and attention getting posters are received regularly for distribution and display as a constant reminder that safety is an all time thought. Many of these are from this National Safety Council.

Safety consultants have been sent to our vessels for talks and demonstrations, or just to observe and report. Among these persons are an insurance company marine accident prevention expert and a fire-fighting expert. The first hand communication has a decided effect in promoting and imprinting safety in the minds of the seamen who are aboard at the time. Again, the constant turnover in personnel makes a weakness in the program.

All of these usages are well worth the effort and we are hopeful that they will prove effective and accomplish their objective in reaching the crew. We continually seek the prevention of accidents and hope to see a decline in these mishaps which can be attributed to human error, either in not knowing or being careless in the execution of a duty.

Pamphlets and posters, occasional visits from safety consultants, a weekly fire and boat drill, and a monthly safety meeting are not answers to an everyday problem, but they set the basis for our all out individual effort of safety thinking.

I have introduced no new solutions to our problems, and there is no panacea. I have merely restated our efforts to try and enforce safety thinking and good safety habits. Our attempts at safety training may be the same archaic methods that have been used for years against the same problems, but we try to update the approach to create a genuine desire for safety in each individual. Unless we can reach each crew member, the accidents will continue to happen through negligence, ignorance, bravado, or carelessness. We hope our efforts lead to safety prone people rather than those infamous ones known as "accident prone."

This would lead to a smoother operation aboard ship and fewer of those "spoiled days."

MARINE CASUALTIES— CAUSES AND PREVENTION

By CDR. JOHN S. LIPUSCEK, USCG
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In an analysis of vessel collisions, a major category of marine casualties, we consistently find the personnel element present; and hence feel that safety must be an integral part of any mariner's training. The three causal factors of collisions are: attempting to meet or pass without mutual agreement; failure to communicate with another vessel by available means; and other personnel fault.

The study of marine casualties provides us with invaluable information in identifying programs which should ultimately lead to legislation designed to make our navigable waterways safer. An example of this process is seen in our present proposals. Three bills currently pending in Congress deal with the unification of the rules of the road, required bridge-to-bridge radiotelephone communication, and towboat requirements. Each of these bills is important within itself, and each has an impact on one or more of the three causal factors of collisions mentioned earlier. The Coast Guard supports all three proposals.

What about accident prevention? Where does the solution lie? Is it in a licensing program for towboat operators? Does it lie in bridge-to-bridge radio communications to assure agreement in passing? Or, does it lie in the establishment of one set of rules for the prevention of collisions on all waters?

The significance of the pending legislative proposals as tools in reducing vessel casualties is best emphasized by looking at some recent disasters on the Mississippi River. While it is true that some problems are peculiar to the Mississippi, they nevertheless manifest themselves on all waterways in a variety of situations.

Unification of Rules of the Road

Here in the United States we have three separate sets of rules governing navigation on the Great Lakes, the Western Rivers, and other inland waters. Although these rules are similar, they nevertheless contain significant variations among themselves. Each set pointedly differs from the more recent International Rules. The design of H.R. 214 takes this into consideration, and therefore the rules contained in this bill conform to the International Rules. The only exception is the inclusion of special rules designed to meet local conditions where necessary.

Unification will also alleviate the division problem currently existing in the different rules. A mariner will only be required to have knowledge of one set of rules. My discussion deals with one facet of this problem.

The scene is a highly congested waterway that ranges some 200 miles between Baton Rouge and the Head of Passes on the Mississippi River. Recent years have seen an unprecedented growth in this area. Ever increasing amounts of hazardous materials are being shipped by water, and the vessels transporting them keep increasing in number, size, and speed. These increases further complicate matters because it is here, within this zone, that the deep draft ocean freighter meets the conventional river tow.

When the entire Mississippi River was governed by the Western Rivers Rules, which allow ascending and descending vessels to pass on either hand at the option of the downbound vessel, a custom was long judicially recognized that upbound vessels "took the points" and downbound vessels "took the bends." Recognition of the custom was easy, because there is no narrow channel rule on the Western Rivers; and the "head and head rule" was modified as to vessels ascending and descending to allow, as mentioned, the descending vessels to choose the mode of passing whatever the relative aspects of the vessels were on first sighting.

In 1948 the river below the Huey P. Long bridge was placed under the Inland Rules, which do have a narrow channel rule and do not have a special rule for vessels ascending and descending rivers as a qualification to the "head and head" rule.

The "Points and Bends Custom" is a necessity for many vessels in order to safely navigate the river. This is particularly apparent during times of high current velocity. A vessel using points and bends makes maximum use of the river current in this way. What happens is this: An ascending vessel comes up on the point or the inside of the bend. The current is at its weakest here and eddies flowing in the opposite direction often assist the vessel. A descending vessel entering a bend stays on the outer or bend side of the river. The flow of current tends to set a vessel across the river towards the bend; and with the following current a relatively high speed over the ground is realized, as well as an increased turning circle and increased difficulty in holding to the point. Assuming that half of the river bends are "bends to the right" and half are to the left, we are presented with a hazardous condition fifty per cent of the time if two approaching vessels are expected to accomplish a "normal" port to port passing. We can dramatically demonstrate the danger of collisions by showing a descending vessel approaching a bend to the right. If she is required to pass port to port she must hold to the point and attempt to overcome the forces of the current which are setting her across the river toward the bend and toward the ascending vessel, which is keeping to her side of the channel under Article 25 of the Inland Rules.

Under Western Rivers Rules vessels are permitted to pass starboard to starboard or port to port, providing they can do so safely. Article 25 of the Inland Rules, however, requires that "in a narrow channel every vessel shall, when it is safe and practicable, keep to that side of the fairway or midchannel which lies on the starboard side of such vessel." This in effect calls for vessels to normally pass port to port.

Confusion, therefore, does result when an ocean going freighter meets a river towboat pushing barges ahead in the area of New Orleans above and below the Huey P. Long bridge; because here lies the demarcation point of Western Rivers Rules and Inland Rules.

Rules for navigation in this area must reflect the common sense and good seamanship of the points and bends custom. This principle is recognized and allowed in the proposed revision of Article 25 of the existing *Inland Rules of the Road*. In the pending revision, vessels in narrow channels, proceeding with the current, will have the right of way and elect on which side to pass.

The following description of a collision between two vessels, taken from the record of the Marine Board of Investigation, will demonstrate the need for legislation on rules of the road unification. Incidentally, this casualty also indicates the value of bridge-to-bridge radiotelephone communication capability.

In April 1969 the New Orleans waterfront was the scene of an explosion and fire following a collision between the freighter *Union Faith* and the barge *IOC No. 7*, which was one of three loaded tank barges being pushed ahead by the tug *Warren J. Doucet*. The casualty occurred on a clear, dark night. At approximately 1730 it was found that the *Warren J. Doucet*, bound for Baton Rouge, could not make sufficient speed up the river to continue alone. The tow was turned around above the Harvey Canal about three miles above the Greater New Orleans Bridge at 1830. The vessel proceeded downstream at a speed of 4½ miles per hour, maintaining a course which favored the right descending bank. At approximately one-half mile above the Great New Orleans bridge the course was changed to cross the river toward the bridge abutment located nearer the left descending side.

At 1840 the *Union Faith* weighed anchor and departed the general anchorage about five miles below the Greater New Orleans bridge, bound for a dock three miles above the bridge. At 1855, in the vicinity of mile 93, the *Union Faith* agreed both by bridge-to-bridge radiotelephone and whistle signals to a starboard to starboard meeting with the downbound *SS President*. At this time, the *Union Faith* was making good about 10 miles per hour, favoring the right descending side in order to come up under Algiers Point. Before rounding Algiers Point, the *Union Faith* met and passed the *M/V Mama Lear* and tow starboard to starboard. After rounding Algiers Point, the *Union Faith* agreed by radiotelephone and whistle signals with the ferry *Crescent* and *M/V Sassafras* to a starboard to starboard meeting. The master of the *Sassafras* had called the master of the *M/V Toni Ann*, whose tow was about 1,000 feet astern, advising that the *Union Faith* would pass starboard to starboard if agreeable. The *Toni Ann* acknowledged and found this meeting agreeable. The *Toni Ann*, as she cleared the Greater New Orleans bridge, sighted the lights of the *Union Faith* coming around Algiers Point. After meeting the *Toni Ann*, the *Union Faith* altered course towards the left descending bank of the river. The radiotelephone possessed by the pilot on the *Union Faith* operated on channel 13, 156.65 MHz, and therefore was unable to communicate with the *Warren J. Doucet*, which had radiotelephone capabilities on frequency of 2,738 KHz. However, there are no regulations requiring bridge-to-bride radio communication capability. The lights of the *Union Faith* were first sighted at a distance of 1½ miles by the *Warren J. Doucet*. Shortly thereafter, the *Warren J. Doucet* blew a two blast signal for a starboard passing which was not answered. She then blew another two blast whistle signal while maintaining her course and speed across the river. No answer was heard. The collision occurred at about 1915 just upstream of the Greater New Orlean bridge. Twenty-five persons lost their lives in this collision, and the two vessels sank.

Bridge to Bridge Radiotelephone

Provisions for whistle signals have been in existence for a long period of time to show the intent of vessels when sailing on the inland waters of the United States. However, our statistics reveal that the failure to communicate and mutually agree upon the method of passing between vessels is one of the major factors contributing to collisions. Approximately one half of the vessels involved in collisions did not attempt to exchange whistle signals as required by national rules, thereby demonstrating personnel error in itself as a primary cause of collisions. The failure to arrive at an early passing agreement through whistle signals and voice radio inevitably results in the failure to make timely decisions which are essential if collisions are to be avoided.

There are three major problems associated with the use of and response to sound signals:

1. The failure to understand them.
2. The failure to hear or respond to them.
3. The failure to establish correctly the direction and nature of their source.

The noise level and wind velocity and direction will frequently create a sound barrier to persons on the bridge. However, it is difficult to understand the reasons for the failure to respond to signals when heard and understood.

Perhaps a reason for our current problems with whistle signals lies in the increased size and speed of ships entering inland waters. Coupled with periods of poor visibility, these increases make the effective use of whistles extremely difficult. To remedy this situation, legal requirements for direct radio communication between the pilot houses, or bridge-to-bridge radiotelephone, have been proposed in and are currently pending action by the Congress. These requirements are essential for safer navigation and, again, have the full support of the Coast Guard.

The collision previously described between the *Union Faith* and the tank barge *IOC No. 7*, being pushed ahead by the towing vessel *Warren J. Doucet*, showed the need for legislation covering unification of rules of the road as well as bridge-to-bridge radiotelephone. Another case which dramatically demonstrates the need for bridge-to-bridge radiotelephone legislation occurred during the early morning of 16 March 1968. Again, this was on the lower Mississippi River and involved the *SS African Star* and the barge *Intercity No. 11* (one of two loaded tank barges being pushed ahead by the towing vessel *Midwest Cities*, piloted, incidentally, by unlicensed personnel). According to the Marine Board convened to investigate this casualty, the tank barge was loaded with a cargo of highly volatile crude oil. As the vessels were closing prior to the collision, the upbound *M/V Midwest Cities* was directing her course at an angle across the river toward the left descending bank after passing Pointe a la Hache. The downbound *African Star* was about mid-river with the intention of conducting a starboard to starboard meeting situation. The pilot on the *African Star*, using his portable radiotelephone, attempted communication with the *Midwest Cities* prior to the collision. There was no response. Why was there no response? Simply because the radiotelephones on the two vessels were designed to operate on different frequencies; the *Midwest Cities* had 2, 738 KHz and the

African Star was designed for 156.65 MHz. Consequently, it was impossible for the two pilots to communicate by radio. The tank barge and the freighter collided and a fire and explosion ensued almost immediately on both vessels. Twenty-one persons aboard the *African Star* lost their lives. The tank barge burned and sank in the river. The fiercely burning oil ignited many secondary fires in combustible material on board the *African Star*. Shortly after the collision, the *African Star* backed out of the barge and was purposely beached on the right descending bank. Heroic members of the crew successfully fought the fire in an effort to prevent its spreading.

Captain Paul Ives, when chairman of the Bridge-to-Bridge Radio Committee of the American Pilots Association stated, "Our pilots will attest to the fact that single channel bridge-to-bridge radio will work indeed under all imaginable conditions of adverse weather and traffic density. It is not unusual to have a traffic situation involving ten or more vessels in sight of one another at any given time."

Captain Ives' comments were made with reference to the Delaware Bay and River where bridge-to-bridge radiotelephone communications have been in use since November 1, 1960. During the five years and ten months preceding the implementation of bridge-to-bride radio, there was an average of 1.27 collisions per month. The first few years after the use of bridge-to-bridge radiotelephone, collisions gradually dropped to an average of 0.91 per month. Later, during 1966 and 1967, the number of collisions dropped drastically to the figure of 0.23 per month. Our Philadelphia records show that for 1968 and 1969 not one collision occurred between vessels underway that were equipped and using radiotelephone communication. These outstanding results were achieved during that period of time when the Delaware River witnessed a large increase in tonnage as well as a greater number of vessels, carrying with it the inevitable potential for a higher collision rate area.

The advantage of bridge-to-bridge radiotelephone is quite obvious and reaches fruition when communication between pilots, reduced to the essentials, results in early agreement leading to positive and timely decisions.

Towboat Legislation

In September of 1961 the Coast Guard initiated a comprehensive study of towing vessel casualty statistics in an effort to determine whether the inspection of steam towing vessels and the licensing of their operating personnel should be extended to include diesel towing vessels. The study indicated that the inspection of all towing vessels and licensing of their personnel were essential in the interest of saving lives and property. The position has always been that it is inequitable for steam towing vessels to be subject to inspection and licensing whereas diesel vessels of the same type and size were exempt. Now statistical analysis of towing vessel casualties indicates a deficiency in safety due to the lack of qualified and properly trained towing vessel operators. The statistics have been updated each year, and each passing year reveals relatively little change in the basic comparisons. Personnel fault on the part of towing vessel operators was found to be a primary cause of towing vessel accidents. Therefore, we strongly support that aspect of a current House Bill, H.R. 13987, requiring persons in charge of a towing vessels direction and control to be federally licensed. We feel that such a licensing program would be a significant first step in reversing the casualty trend and that once the program is in effect, both the extent of its impact on maritime safety as well as any need for supplemental legislation can be more accurately assessed.

Three important lessons were learned from the previously discussed tragedies which reemphasize the need for unification of the rules of the road, bridge-to-bridge radiotelephone, and licensing of personnel operating towing vessels. The *African Star* and *Union Faith* were in collision with vessels directed and piloted by unlicensed personnel. There is no licensing requirement for personnel operating towing vessels similar in size and operation such as the *Midwest Cities* and *Warren J. Doucet*. In fact, the record of the Marine Board of Investigation revealed that the person in charge of the *Midwest Cities* at the time of the collision with the *African Star* had ability to read and write limited to little more than signing his name.

The recent sinking of a towing vessel in the Gulf of Alaska points out the potential need for inspection of certain categories of towing vessels. The *Intrepid*, towing an inspected sea going freight barge, was on a voyage from Seattle, Washington, to Whittier, Alaska. Three persons lost their lives when the vessel sank during a severe storm with seas reported to be 20 feet in height and winds in excess of 50 knots. The *Intrepid*, built in 1965, was an uninspected, welded steel, single screw, diesel propelled vessel of 199 gross tons. It was constructed and operated without any statutory requirements relative to plan-review and periodic inspection or drydocking. The vessel was not classed, but was in compliance with the 1930 Load Line Convention. There was no requirement for licensed personnel to be on board. Prior to her final voyage, the vessel was operated in Alaskan waters and had a history of hull fractures. The adequacy of repairs made to the hull are not known, as they were neither approved nor examined by the Coast Guard or a classification society. On the night of 19 February 1970 the *Intrepid* took an unusual roll to starboard, estimated to be sixty degrees, at about 2100 hours. The reason for the roll was never fully established; however, it was assumed to be the result of heavy weather. At about 2115 an attempt was made to haul in some of the tow wire; but because of the amount of water on the after deck, the crew was unable to reach the winch. Shortly afterward, an internal examination of the vessel was made to determine why the stern was riding so low in the water. It was found that the watertight door leading to the lazarette could not be opened because of the water in the lazarette. Pump suction was started on this compartment. Meanwhile, weather conditions worsened and the vessel's heading was brought around into the wind and sea. At approximately 2330 the *Intrepid* took another heavy roll to starboard. This roll, together with further submersion of the stern, allowed water to enter the engine room resulting in the loss of all power. The vessel started sinking by the stern and was totally immersed in 10 or 15 minutes. We believe that the flooding of the after compartment and the starboard ballast tank was caused by fractures in the underwater body. The sinking of the *Intrepid* possibly could have been prevented by timely and adequate inspection.

Conclusions

In summary, concerning the topics of passing methods, communication failure, and personnel fault, unification of the rules of the road would remove the confusion that exists on vessels passing from one rules of the road zone to another. The "narrow channel rule" under the Inland Rules and the "points and bends" customs would be compatible. Today, a vessel operating in the Gulf of Mexico could easily be faced with the problem of operating under three different sets of rules on the same day. I have shown earlier the dramatic effect bridge-to-bridge radiotelephone has on reducing vessel collisions in the Delaware Bay. What better way is there to lessen the occurrence of vessel collisions than establishing a positive, sure, and exact method of deciding how two vessels are to pass in inland waters? Bridge-to-bridge would not eliminate the requirements for whistle signals, but it would indeed provide an important tool to supplement the whistle, and one which is entirely compatible with radar.

Towboat legislation would provide licensing requirements for vessel operating personnel. If we were to construct a graph from our statistical studies of inland towing vessel casualties, it would reveal personnel fault as the major cause of such casualties. With regard to towing vessels operating on the high seas, our studies show vessel construction and maintenance deficiencies to be the major cause of casualties. Hence the Coast Guard's position that future legislation requiring inspection of certain categories of towboats may be required.

With each collision, the need for legislation in the areas of bridge-to-bridge radiotelephone, unified rules of the road, and towing vessels becomes even more urgent. These tragedies should convince us that unless preventive measures in the form of the legislation discussed are enacted, the same types of casualties will occur in greater numbers.

Is the safety of life and property worth the effort necessary to effect the passage of and then implement remedial legislation? I think it is.

IMCO—WHAT IT IS AND WHAT IT DOES

By CAPT. THOMAS W. POWERS, USCG
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In almost everything the Coast Guard does the key word is "Safety"—safety of life and property at sea, merchant marine safety, safety in recreational boating, safety in our ports and waterways.

Most aspects of our safety mission have an international flavor. For example, search and rescue activities often involve the life and property of foreign nationals. Our aids to navigation guide domestic as well as foreign shipping. Our enforcement of the maritime laws and treaties of the U. S. is felt by both citizens and non-citizens alike.

Historically, the oceans have served mankind as commercial highways. Even though in recent years the exploration of the seas has been greatly accelerated for purposes of science and exploitation of resources, transportation is still the primary use of the oceans, rivers, lakes and waterways of the world.

A large part of marine transportation is essentially an international undertaking. Ships of many nations sail in and out of our ports, and our ships are moving in and out of foreign ports. The safety of this vast maritime commerce cannot be left to what would be an enormous series of unrelated and unilateral standards. The need for coordination with others using the same waterways, harbors, and oceans is obvious.

This need led to the birth of IMCO—Intergovernmental Maritime Safety Consultative Organization. IMCO was conceived at an international conference in Geneva in 1948. Gestation was 10 years, for it took that long for a sufficient number of nations to ratify the IMCO convention. The Republic of Korea was the 21st nation to do so, and IMCO was born in 1958. There was thus brought into being an international, representative, responsive, viable, continuing body concerned with the whole field of safety of international sea transportation. Means were now provided for cooperation among governments on technical matters affecting international merchant shipping, with special emphasis on the safety of life at sea. Currently, seventy-one nations are now members. Practically all major maritime nations are represented. Even land locked countries like Switzerland belong. Some of the smaller countries in the organization are Maldives, Malta, and Kuwait.

One of the first tasks of IMCO was to conduct the 1960 Conference on the Safety of Life at Sea. This conference, which updated a similar 1948 conference, has now been adopted by 81 nations, including the U.S.

IMCO has three main bodies: the assembly, the council, and the maritime safety committee. There is also a secretariat of some seventy odd international civil servants who keep the organization functioning on a day to day basis.

The Assembly is the principal body, consisting of all of the members. It is the ultimate decision-making unit and meets every second year. However, an emergency session can be called at any time.

Eighteen of the member nations compose the Council, which usually meets twice a year. The council is primarily concerned with other than technical matters and acts as the housekeeping body of the organization. It does, however, review the work of lesser bodies. The council is formed from the following groups: The first group must consist of six nations from among those with the largest interest in providing international shipping service. Elected in 1969 were The United States, Japan, United Kingdom, Norway, Greece, and The Soviet Union. The next group of six is from the nations with the largest interest in international seaborne trade. Elected were Canada, France, Italy, Belgium, Germany and The Netherlands. The final grouping of six is from those nations not included in the two former categories but with special interest in maritime transport or navigation and whose election to the council will ensure the representation of all major geographic areas in the world. Elected were Brazil, India, The Malagasy Republic, Australia, Poland, and Ghana.

The Maritime Safety Committee (MSC), meeting twice a year, handles all matters of a technical nature for the organization. There are presently 16 member nations on the MSC.

The composition of the maritime safety committee is as follows: eight members are from nations representing the 10 largest shipowning states. Elected in 1969 were The United Kingdom, U. S., Japan, Norway, The Soviet Union, France, Greece, and Italy. Liberia and Germany were not elected from this category. Four members each must represent one of the following geographical areas: Africa, The Americas, Asia and Oceania, and Europe. Elected in 1969 were: Pakistan, United Arab Republic, Argentina, and Germany. The remaining four members must be from those nations not already otherwise represented on the committee. Elected in 1969 were Canada, The Netherlands, Sweden, and Spain.

By the way, Lloyds' *Register of Shipping* lists the U. S. Merchant ship tonnage as of 1 July 1969 as 19,550,394. We are in fifth place; however much of our tonnage is in the laid-up fleet. Liberia is first, with over 29 million gross tons. Nations in between are United Kingdom, Japan, and Norway in that order. As you can see, even though Liberia leads the world in tonnage she was not elected to membership to either the Council or the Maritime Safety Committee.

Under the MSC are the following 10 technical subcommittees, each meeting once or twice a year: subdivision and stability; fire protection; radiocommunications; marine pollution; cargoes and containers; carriage of dangerous goods; lifesaving appliances; safety of navigation; ship design and equipment; and fishing vessels.

The United States is a member of the Assembly, the Council and the Maritime Safety Committee, as well as each of the subcommittees. In fact, United States citizens chair two of the IMCO subcommittees.

As IMCO is an international body, all contacts between IMCO and the United States are made through the Department of State. To coordinate associated problems, the Department of State has formed and chairs a special group called the shipping coordinating committee. This committee, in turn, has standing committees to handle different types of problems. One such group is the Safety of Life At Sea or SOLAS subcommittee, chaired by the commandant of the Coast Guard. This group handles technical IMCO matters relating to maritime safety. Members of this subcommittee are from various government agencies and industry groups. The Lake Carriers' Association, the American Institute of Merchant Shipping, the American Petroleum Institute, as well as labor and management groups, are represented on the various committees, subcommittees, and working groups.

Although the Department of State has the prime responsibility to establish U. S. positions on international matters, it looks to the U. S. Coast Guard as the organization having the training, personnel, and technical knowledge in marine safety activities to assure effective United States participation in international discussions in this specialized field.

Members of the Coast Guard, therefore, act as alternate delegates and advisors to the IMCO Assembly and to the Council. The Coast Guard furnishes the chief delegate as well as advisors to the Maritime Safety Committee and to the various subcommittees.

I would like to review briefly some of the important areas with which IMCO has dealt and is dealing, to illustrate the scope and effect of this organization.

For many years, the United States has been advocating a higher degree of structural fire protection in international conventions for passenger vessels. After the loss of the *Lakonia* and 125 of its passengers in 1963, the loss of the *Yarmouth Castle* and 90 persons later, the United States proposed that the Maritime Safety committee of IMCO should make a special study of shipboard fire protection. A special meeting was held in 1966. The *Viking Princess* fire, which occurred just before the meeting, served to heighten the urgency of the problem. All of these vessels were of a non-U.S. flag.

Because of its complexity, the matter was separated into two steps, the first directed toward upgrading of existing passenger ships and the second to establishing standards for future construction.

At the conclusion of that meeting, the delegates agreed on various proposed amendments to the 1960 International Convention for the Safety of Life at Sea for existing passenger ships. These were submitted to an extraordinary session of the IMCO Assembly called for this specific purpose.

In November 1966 the IMCO Assembly unanimously approved the recommended amendments. The result will bring a higher degree of fire safety for existing passenger

vessels, upgrading many of those ships operating in the cruise trade from our ports.

The recommendations for amendments to the 1960 SOLAS convention for future passenger ships that emanated from these meetings were considered and adopted by the Maritime Safety Committee and Assembly meeting in 1967. These amendments will come into effect one year after acceptance by two-thirds of the contracting governments to the 1960 SOLAS convention. The United States has ratified these 1966 and 1967 amendments.

Marine pollution is a matter of intense national and international concern. On March 18, 1967, the *Torrey Canyon*, again of non-U.S. registry, a supertanker of over 120,000 deadweight tons capacity, foundered on The Seven Stones. These partially submerged rocks are in international waters off the southwest coast of England. The accident resulted in the spilling of thousands of tons of crude oil which was washed up on the beaches and harbors in the resort areas of Southwestern England and, subsequently, across the channel in France.

The incident and the extensive damage that resulted to the coasts and to wildlife focused worldwide attention on the need for measures to prevent future accidents of this nature, and to minimize ill effects if such accidents would re-occur. IMCO took special and immediate action. A whole series of preventive measures were recommended to governments. Some of the most significant ones were: the designations of sea lanes and prohibited areas, requirements for additional navigational aids, shore guidance for ships near land, testing of navigation equipment, officer and crew training, use of automatic pilots, international cooperation in connection with handling significant spillages of oil, and a strengthening of the international convention which seeks to prevent the pollution of the sea by oil.

One of the areas currently being investigated by IMCO is the question of tanker tank size. Roughly, this means what, if any, should be the maximum size tank permitted in an oil tanker, recognizing that if this tank is breached a given amount of pollution will result?

There are legal aspects involving marine pollution. In 1969 IMCO called an international conference, held in Brussels, dealing with such problems. The result of this conference was the adoption of two new conventions. (Of course, these conventions must be ratified by the various governments. Some have already done so.) The first deals with the right of a coastal state to take action to prevent pollution of its waters and shoreline in event of a vessel casualty occurring in international waters. The second convention deals with civil liability and will, when brought into force, ensure that funds are available for clean up and liability claims in case of casualties.

Future plans of IMCO call for a conference on the safety aspects of containers and a conference on revision of the international rules for prevention of collision at sea, both in 1972, and a conference on environmental pollution by ships in 1973. Waiting in the wings are international conferences on the revision of the rules governing the unberthed passenger trade and on fishing vessels.

In my mind, IMCO is playing and will continue to play an important role in the future of the entire shipping world. I believe our participation places us in an excellent position to improve the international posture of our merchant marine. The United States has taken an active part in this organization, and already we are achieving results which will be to our advantage. The safety of international shipping is constantly being improved.

I would now like to review some of the principal achievements of IMCO in its first decade. The first IMCO Assembly was held in 1959. In 1960 IMCO called an international convention to revise the safety of life at sea convention. The rules of the road were also revised at that time. In 1962 IMCO called a conference to update the International Convention on the Prevention of Pollution of the Sea by Oil. This convention was updated by IMCO's Assembly as recently as October 1969. IMCO produced an International Convention on Facilitation of Travel and Transport in 1965. Also that year, international agreements were reached on a new code of signals, on an international maritime dangerous goods code, and also a code on safe practices for bulk cargoes. In 1966 IMCO held a conference on loadlines and produced a convention. In 1966 and 1967 IMCO was engaged mainly in working on measures to produce fire protection safety measures on passenger ships. In 1969 IMCO produced a convention on tonnage measurement. In 1969 IMCO hosted a legal conference on marine pollution damage.

You can see that IMCO does useful work as far as the U.S. is concerned. Essentially, it comes to this: when we have an international problem, there exists an international forum where the matter can be thrashed out and concrete action taken. Most of the marine passenger trade and much of the cargo trade to and from our shores are carried in foreign flag vessels. Therefore, international cooperation in maritime safety is very much in our best interest.

In my view, IMCO will continue to grow and prosper and will continue to make a vital contribution to international maritime safety.

PREVENTION OF WATER POLLUTION BY MARINE TRANSPORTATION

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Although "ecology," "anti-pollution," and "environment" are the "in" phrases of today, they do not, in my opinion, change the basic fact that safety and anti-pollution measures are inseparable, and that anti-pollution measures are only an extension of what we desire to keep safe. The problem of containment of petroleum products or chemicals is the same whether you are concerned that it will escape and burn or escape and destroy the environment. Thus the Coast Guard has been and will continue to be a pollution control agency. The ecological concern of this country will only modify the current emphasis of our safety program.

I believe that the problem of water pollution is much more susceptible to an effective solution when placed in this safety perspective. Whether we like it or not, as safety experts we realize that we must accept some degree of risk, some degree of lack of safety in our everyday work, and in our lives. Your job and mine is to minimize this risk, to establish an acceptable level of risk. So, too, must we temper our approach to water pollution. In the words of the First Report of the President's Panel on Oil Spills, "Alternatives available to lessen the frequency and magnitude of oil spills do not include the complete abandonment of oil tankers or the total elimination of offshore oil operations."

With a presumption that marine transport of possible pollutants will continue to exist and will expand, what safety strategies exist? I would propose the following:

1. Provide a containment system which is unlikely to be breeched.

2. Eliminate all hazards to the containment system which have sufficient potential to breech it.

3. Limit the quantity of pollutant lost in the event of containment failure.

4. Limit the rate of loss of pollutant in the event of containment failure.

5. Provide a system external to the carrier to contain and clean-up any spill.

The above strategies as written are concerned with the product as stored aboard the transport. However, we must modify them and apply them also to the possible discharge of a pollutant as a result of product handling and transfer and routine vessel maintenance and operating procedures.

What is needed most then, is a method or system to evaluate these strategies, their substrategies, and the various combinations thereof to determine their impact and effectiveness on the pollution problem. The remainder of this presentation will be a discussion of these strategies, their application and value assessment.

I believe we will always need a clean-up capability. As long as people are involved in marine transport we will have spills. However, spill clean-up is attacking a symptom and not the cause. It is unfortunate that our society and particularly our research and development efforts are so hardware oriented. I suggest that we would be far better off if much of the efforts and funds of both gov-

ernment and industry were directed to prevent pollution rather than cleaning it up or developing better solvents and emulsifiers. This latter approach is akin to spending money on cemeteries rather than medical research because there'll be some tangible evidence of where the money went.

While I'm on the subject of people and spills, let's examine the old cliche that its just "human error." We must attack any accident prevention program (and spills are a form of accident) in a positive manner based upon the knowledge that man is fallible. In every human error accident there is a chain of events leading to the final act by a human. If any event in the sequence is eliminated, the accident does not occur in spite of the human failure. A foolproof system must be our design philosophy for, I submit, with the right set of events preceding an accident, anyone of us can be "the fool." With these criteria in mind let's examine the proposed strategies in more detail.

Provide a Containment System Which Is Not Likely to Be Breeched

The mere statement of this strategy concedes compromise is necessary. We cannot with current technology and within reasonable bounds maintain containment when two 300,000 ton tankers collide at 16 knots or break their backs upon the rocks. A total containment concept was used for the nuclear reactor on the *Savannah;* however, that design was assisted by a much smaller package to be contained.

A damage criterion is being developed by the Ship Design and Equipment Subcommittee of the Marine Safety Committee (MSC) of the Intergovernmental Maritime Consultative Organization (IMCO). This type of work must be done on an international basis since our waters are exposed to vessels of all nations. This criterion appears reasonable and only time will answer the question of its adequacy.

The joint effort of the Coast Guard and the chemical transportation industry to develop marine transportation standards for hazardous materials has resulted in a new Subchapter O of Title 46, more commonly, the Coast Guard Regulations. That section concerning unmanned barges has been published and that portion concerning manned vessels is soon to be published.

In these regulations are three types of hull design with varying degrees of damage resistance, Type I vessels being most damage resistant and Type III vessels the least. The Type I and II vessels require a double hull or independent tank such that the inner tank is a specified distance inboard of the outer hull. Although the distances presently specified approximate the tentative international standards for extent of damage, they do not in all cases meet the new international criteria. Once the international standard is in final form then our standards will be brought into line.

The present and proposed regulations, then, have in some way related hazard to degree of containment. To date only the very toxic (to humans or fish) and the very reactive have been assigned double hull type protection. We are faced with a decision on acceptable risk. Fast decisions placed a higher risk on the ecology than present day consideration might. Typical of this are petroleum products which are carried in single skin barges and ships. To my knowledge no one has ever justified this risk. A comprehensive study has not been done on the life cycle cost of using double hull construction rather than single hull construction. Unconfirmed reports I have received about one oil company, which built some large tankers with double bottom construction, are that many unexpected benefits occurred. With a flush bottom tank and a well type suction, one such benefit is that tank cleaning is greatly reduced and lost capacity due to sludge and residual cargo is eliminated. One adverse and unexpected result was the refinery complained to the producer on the poor quality of the crude because of the increased sand and dirt content.

A major side benefit of double hull construction is that it provides for clean ballast tanks and the elimination of the major contribution of slop oil and dirty ballast to water pollution. Although there are other alternatives to a better container, double hull construction is the only one receiving much attention at this time.

Eliminate all Hazards to the Containment System Which Have Sufficient Potential to Breech It

This strategy is, of course, the opposite of the first. In this strategy we propose to eliminate any possibility of collision, stranding, impact, weather damage, falling space ships, overpressurizing or overfilling, fire, dynamic loading, or fatigue. Again we are faced with lack of perfection. We cannot totally eliminate damage to the system, but we can reduce the probability that a damaging incident will occur. We can provide better navigation systems; we can provide better aids to navigation; we can provide vessel routing considering weather, channels, and traffic; we can provide better cargo handling, overflow, and pressure relief systems; and we can provide better training to the operating personnel. One interesting thought under this strategy is that we should have a few large vessels rather than many small ones and thereby reduce the probability of an accident.

Limit the Quantity of Pollutant Lost in the Event of Containment Failure

This strategy dictates many small vessels, many small tanks, available empty tanks or collapsible containers such that cargo from a leaking tank can be rapidly transferred, and one far out idea is cargo solidification. IMCO has the problem of tank size under consideration in conjunction with the expected damage criteria.

In relation to cargo handling, this strategy requires smaller loading hoses, lower transfer rates, and rapid response to the handling system to various conditions such as overfilling or line rupture.

Limit the Rate of Pollutant Loss

In regard to vessels this may be difficult to achieve. Two possible approaches would be a self-sealant type tank for small ruptures and a cargo coagulation process for larger ruptures. In regard to cargo handling, this is very similar to the previous strategy of lower handling rates and small inter-connections.

It should be apparent and not at all surprising from the above discussion that we are unable to use any one strategy to its fullest; rather we will use them all to some extent. How does one assess the pollution hazard and make a decision on which strategy and to what extent it should be employed? To answer this we must look to the complete pollution problem.

This procedure is to evaluate the intrinsic product hazard; consider the technology available to control the product prior to and after release; considering the quantities involved, assign an acceptable degree of risk which specifies the required preventive program; this in turn results in spills from which we establish our experience factor for re-evaluation. The fly in the ointment is that we haven't figured out an analytical or scientific way to do this.

The first part of the problem is specifying the hazard in some fashion so that products can be rated and equated. I would suggest that the hazard H be based upon the product's target or victim V, toxicity T, and persistency P. This might be expressed as:

$$H = f(VTP)$$

Values could be assigned to the parameters and a hazard rating arbitrarily (but with some scientific basis) assigned from the products score. For example:

V	T	P
people = A	none = Ø	>wk = W
fish & aquatic animals = B	mild = 1	<wk, >day = X
birds & plants = C	moderate = 2	
water supply = D	bad = 3	<day, >hr = Y
recreation & esthetic = E	extreme = 4	
		<hr = Z

Where A>B>C>D>E and W>X>Y>Z

Thus, for example, any product scoring greater than B3X for any victim or a total score for all victims greater than (A+B+C)2X would be in the highest hazard rating. The necessary number of ratings and their end points could be established to span the range of pollution.

The control evaluation is a straightforward evaluation of current technology. With this in hand, we must attempt to establish some degree of risk. The risk R as a function of parameters may be expressed as:

$$R = f(HQEUTMPa)$$

Where:

H = product hazard, previously established.

Q = quantity of product involved.

E = environmental conditions at the time and location of the spill. This would include temperature, stream flow characteristics, human population and aquatic life exposure.

U = water use. The water quality standards are based upon an assigned water usage.

T = time to detect or available to detect the product release and to begin some type of response.

M = mitigation factor, this accounts for any after spill action which ameliorates the pollution.

Pa = the probability of product release and based upon the preventive measures required.

With a conservative approach E, U, and M can be assumed to maximize the risk, thus limiting the problem to:

$$R = f(HQTPa)$$

At this point we have a choice of solutions. We can, based upon the hazard, assign a probability of spill and calculate a risk, or we can assign a risk and calculate the probability of spill. I would propose to use the latter and thus calculate the probability of spill or non-spill. I feel there is sufficient data available to estimate the probability of failure of the different strategies and thus determine our prevention program. I don't have a system to solve this problem, but I do believe this shows the logic our thinking should take and perhaps someone can suggest ways to define the parameters.

I have just recently been involved in an accelerated but extensive study of the general spill problem. To me, the most enlightening fact I learned was our nearly total ignorance of this problem. There is insufficient data available to pinpoint causes of spill pollution and to identify where our corrective efforts should be used. Perhaps one of the most significant actions to result from the Water Quality Improvement Act of 1970 will be the mandatory reporting of spills. This will enable us to get some handle on the real causes of their probable rate of occurrence. The consequences of a spill are not in all cases well established. Particularly, the long term effects of a spill require a great deal of study.

There are many products carried today which are unregulated, are probably routinely discharged to the waterways, and which constitute a long term ecological hazard. Recent examples are the Great Lake's area concern over mercury and DDT. The job of designating hazardous materials, i.e., those that are a pollution problem, has been assigned to the Department of Interior under the authority of the 1970 Water Quality Improvement Act. The *Evaluation of the Hazard of Bulk Water Transportation of Industrial Chemicals* done by the National Academy of Science for the Coast Guard is a good beginning. But it is only a beginning.

Our ability to clean-up or neutralize a spill is extremely limited. To date we have attacked only the problem of oil, which is relatively simple. Note that I said "relatively simple," because oil is easily visible, tends to separate from the water and retain its identity. You will see that oil is still a difficult problem, and we have not begun to reach a level where we can neglect prevention of a clean-up capability.

Finally, our tolerance or acceptance of pollution must be considered. At present, public indignation is high and political pressure dictates a very low tolerance level. However, man cannot live without modification of his environment ,and I suggest that our tolerance level must be established by a national scientific analysis and assignment of water usage. I believe some progress is being made by the government and the academic community in this respect. Zero defects is not possible.

Where, then, do we stand as far as progress is concerned in our efforts to curb pollution from marine transportation? I believe overall that the problem of pollution from marine cargoes is well in hand. Particularly with chemicals has a rational approach been made, primarily because the requirements either preceded or were developed concurrently with the establishment of the marine transportation mode of the product. Oil, however, has been shipped for sometime prior to our full awareness or concern for its pollutant properties. We need a formal rational approach to replace our past "seat of the pants" approach to the problem.

I said the pollution problem from cargoes is well in hand. Unfortunately, I cannot say the same for our daily marine operations. The Maryland State authorities feel their single largest routine source of oil on the Chesapeake is the waste oil and dirty bilge

pumpings of transient vessels. This is inexcusable.

The Water Quality Improvement Act of 1970 calls for the President to issue regulations for the prevention of oil pollution. This act also provides for a ten thousand dollar penalty for deliberate discharge of oil and a five thousand dollar penalty for failure to comply with the regulations. The Department of Interior has defined a harmful quantity of oil as any discharge which violates applicable water quality standards or causes a film or sheen upon or discoloration of the surface or shoreline, or causes a sludge or emulsion beneath the surface. With this definition and the above penalties, it seems assured that we will see some rather radical changes in our present system of handling shipboard waste oils, tank slops, and dirty bilges. The nation is no longer willing to provide free waste disposal to the marine industry. Waste disposal is a legitimate cost of business and the industry must recognize it as such.

CLEANUP AND CONTROL OF POLLUTING SPILLS IN THE MARITIME ENVIRONMENT

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In U.S. waters there may be as many as 10,000 polluting spills a year—ten of which are major spills. In addition, one spill of disastrous proportions can be expected on the average of every ten years. About half of these are oil spills, some three-quarters of which are estimated to be transportation-related. While many of these spills are relatively small, they are frequent and add up to an unacceptable level of pollution in our ports and waterways.

Thus, in addition to our preventive program, we must have a cure for the polluting spills that do occur. We must be able to limit the losses that these spills can cause to human health, natural beauty, wildlife, fisheries resources, recreational areas, private and public property, and other things that we value in the marine environment. To control such damages, quick action must be taken to confine the polluting substance to a small area and then to remove or somehow inactivate it.

First of all, effective response to pollution incidents requires careful advance planning. When a spill occurs, responsible officials must be ready to act immediately and decisively. The Federal government has been active in pollution contingency planning during the last few years. In anticipation of enactment of the Water Quality Improvement Act of 1970 and in response to a Presidential memorandum of June 1968, the Departments of Transportation, Interior, Defense, and Health, Education and Welfare and the Office of Emergency Preparedness signed an interagency agreement known as the National Multi-agency Oil and Hazardous Materials Pollution Contingency Plan. This agreement provided for a coordinated Federal response to a spill posing a substantial threat to public health and welfare. In June 1970 a new plan, based on the previous one, was published in order to meet the requirements of the Water Quality Improvement Act of 1970, which was passed last April. Under the new plan, the Coast Guard was assigned responsibility for furnishing or providing for on-scene commanders for spills on the high seas, coastal and contiguous zone waters, and coastal and Great Lakes port and harbor areas. This on-scene commander is responsible for the coordination of Federal response efforts at the scene. The plan also requires the Coast Guard to have equipment and trained personnel available in the above areas to take the necessary cleanup action when the responsible party is either unable or unwilling to respond adequately.

Unfortunately, present technology for cleaning up oil spills and other types of polluting spills is sadly inadequate. This fact has been most evident at major spills such

as the offshore oil well blowout at Santa Barbara, California, in January 1969, and the oil well incident off the Louisiana coast last February. It was most distressingly demonstrated in March 1967 when the supertanker *Torrey Canyon* ran aground off the southern coast of England, spilling 119,000 tons of crude oil into the sea. The desperate and largely futile efforts of the British and French to cope with this oil captured the attention and sympathy of people all over the world. Even for small oil spills, moreover, the cleanup methods that are now used are almost totally ineffective except in very calm and sheltered waters. Some commonly used methods such as dispersion of spilled oil with chemical detergents may even do more harm than good to the marine ecology. Finally, we know very little about how to cope with spills of the variety of chemical products which are now being shipped in bulk for the first time.

To provide an effective oil spill cleanup capability in the United States, the Coast Guard is now conducting an intensive $4,000,000 a year research program to develop new techniques and equipment. We plan to continue this research on a high priority basis for several years and to explore a wide variety of approaches to the oil spill cleanup problem.

We have placed emphasis initially on preventing spills from distressed tankers offshore and on preventing spilled oil from spreading out on the sea surface. An air-deliverable system for offloading oil and other potential pollutants from grounded or otherwise damaged tankers is an early product of our research program. The theory behind this system is that it is much easier to remove a ship's oil cargo before it spills than to try to clean up the same oil after it has spilled into the water. A prototype system has been built, and we are almost finished testing and refining it. The system consists of pumps, transfer hoses, and rubberized nylon bags for temporarily storing the oil. It is designed to be flown on short notice to the scene of an offshore tanker accident, dropped by parachute, and deployed by a specially trained Coast Guard pollution control team. A rapid response is possible because Coast Guard aircraft and other resources are kept at a high state of readiness at all times. The pumps and transfer hosing will be used to pump the oil from the vessel into the temporary containers before it spills into the water. The first operational system is scheduled to be ready for use in about one year.

The other problem that the Coast Guard is giving highest priority is that of preventing spilled oil from spreading on the water surface. Once oil has spilled into the water, it must be confined in as small an area as possible if cleanup measures are to be effective. If the oil is allowed to spread out over a large area, it is much harder to clean up and causes more damage. Many oil slick containment "booms" of "fences," as they are called, are now being sold commercially to oil companies and other potential users. Another method which is coming into use is the air bubble barrier, whirh creates surface currents by releasing air bubbles underwater. This device has the advantage of allowing vessels to pass freely through. Also, it can be permanently installed at an oil dock and instantly activated when a spill occurs.

Unfortunately, these products are effective only in very calm, sheltered waters where the water currents are very slow. In open waters, the action of the wind and waves washes the oil over and under these barriers, making them almost totally useless. None of the many commercial products tried at the Gulf of Mexico oil well incident last March were able to hold the oil slick against the forces of the sea. In view of the inadequacy of present technology, the Coast Guard has been conducting research on the problem for several years. We are now ready to begin construction of a prototype high seas oil slick barrier. If this prototype is successful, the Coast Guard hopes to have an operational version within a year. Eventually, the system may be packaged for delivery by Coast Guard aircraft to the scene of an oil spill. This feature will reduce our response time to a minimum.

After an oil slick has been confined to a limited area—or even if it has not been confined—there is the problem of recovering the oil or somehow treating it so as to make it less destructive. Many inventive methods of doing this have been proposed. Some of them are quite ingenious; so far, however, no single method has proved to be sufficiently promising to warrant a large investment by the Coast Guard. We are keeping an open mind and are funding research on many different approaches. Let me briefly mention some of the techniques which are being considered.

Chemical dispersion of oil is perhaps the most commonly used method of making an oil slick disappear from the water surface. Detergents and other chemicals can dissolve an oil slick so that it mixes with water and thus becomes less visible. Unfortunately, the oil can do more harm to fish and other marine life when it mixes with the water than when it remains on the surface. Also, the chemicals themselves are usually toxic to marine life. Chemical compounds which stick to oil and sink it to the bottom have similar disadvantages in that they bring the oil into contact with shellfish and other bottom life. They also tend to release the oil to the surface after a period of time. Because of these harmful side-effects, chemical dispersants and sinking agents often do more harm than good. Consequently, the Federal Water Quality Administration has published guidelines prohibiting use of these methods except under certain specified circumstances, such as when waterfowl or important shore areas are threatened by the oil. Dispersants may also be used if, in the judgment of the on-scene commander, there is a hazard to human life or limb or a substantial fire hazard which could be reduced by dispersing the oil.

Another approach is to absorb spilled oil with straw or some other plant fiber. Straw was used extensively at the Santa Barbara, California, oil well incident last year. Buoyant plastics and foams have also been tried, but straw seems to work best. This method has the advantage of not introducing the oil or any chemicals into the water below the surface. Its chief disadvantage is that recovering the absorbing material after it has soaked up the oil can be very costly and slow, especially if the slick has spread out over a large area.

When an oil slick has been confined and is thick enough, some of the oil can be removed simply by vacuuming the surface of the water. Septic tank cleaning trucks are often used for this purpose. As the slick becomes thinner, this method fails because large quantities of water are picked up along with the oil. Current oil-water separation techniques are not efficient enough to make this method practical under such circumstances.

Burning oil slicks on the water have been given considerable attention as a method of removing them. Special chemical agents have been developed by several companies to facilitate this process. Obviously, this method cannot be used in port areas where the fire might spread. In open waters, on the other hand, it can be very difficult to ignite an oil slick unless it is fairly thick and its more volatile components have not evaporated.

Biological degradation of oil slicks by special strains of bacteria or other micro-organisms is another area in which research is underway. As yet the feasibility of this method has not been determined, but it may be possible to accelerate the natural process by which oil decomposes in the water.

The Coast Guard is also concerned with the great number of hazardous substances other than oil which are increasingly being shipped in bulk quantities and which could cause serious pollution and safety hazards if spilled. Because of the variety of these chemicals and the scarcity of knowledge about some of them, it is difficult for non-specialists to know what to do when there is an accident involving one or more of them. We are now developing a solution to this problem. The National Pollution Response Center established by the National Pollution Contingency Plan and located in Coast Guard Headquarters will house a computerized information system which will be able to provide real-time technical guidance to personnel at the scene of a spill or a potential spill of oil or hazardous substance. Some type of rapid communication with a data blank at the center will be provided for Coast Guard units at major ports, Coast Guard district offices, and other users. By providing certain key information about a spill situation, such as the substance involved, the type of area threatened, weather conditions, and other parameters, an on-scene commander will be able to get instant information about the dangers involved and advice as to what action he should take. The information system will be developed and operated by the Coast Guard but will be available to other users. Developmental work on this system has just begun.

These, then, are some of the approaches to the "cure" for pollution by spills of oil and other substances. As the Coast Guard's research program progresses, we plan to

purchase the necessary equipment and materials and maintain them at locations where polluting spills are most common or could cause the most damage. Specially trained Coast Guard pollution control teams will stand ready to respond to any major incident. I am optimistic that with proper management and adequate funding American technology can rise to the challenge of controlling water pollution by oil.

ADDRESS

By ADMIRAL CHESTER R. BENDER
Commandant, U. S. Coast Guard, Washington, D. C.

The first year of this decade is rapidly coming to an end, and a report is indicated to bring you up-to-date on current Coast Guard matters and projects which are closely associated with marine safety. In general, we, as the Department of Transportation's marine arm, intend to continue to contribute our special knowledge to the support of a national transportation system, a safer fishing industry, and a more enjoyable and safer recreational boating fleet.

Our multi-mission capability to render service in marine safety, law inforcement, and marine science, while at the same time maintaining our ability to serve with the Navy in time of national emergency, is truly unique. It is this flexibility which gives the taxpayer great value for his dollar. So it is that our service, which has been historically dedicated to safety at sea, has in recent months acquired closely related duties concerning protection of the marine environment.

The Water Quality Improvement Act of 1970 provides for both prevention of and cure of water pollution problems caused by oil, other hazardous polluting substances, and vessel sewage. As will be emphasized later, our main aim is to prevent the pollution. However, we are prepared to cope with it and to minimize its effect should pollution occur. We also are prepared to proceed against polluters in Federal courts as circumstances warrant.

The Coast Guard, in coordination with other federal agencies, has assisted in development of a national contingency plan. This plan provides coordination of all federal response to a pollution incident in coastal waters through a Coast Guard on-scene commander. As part of the national plan, regional plans have been developed with regional response centers set up to respond to and monitor spills. Regional response teams monitor pollution problems and supervise containment and cleanup operations. All oil spill reports funnel into our national pollution response center in Washington.

Strike force teams are being organized and trained and air deliverable equipment is being developed in order to respond rapidly to a major spill in any location. A large portion of our research and development dollars is being spent in development of containment, recovery equipment, and special techniques.

Under the act, we are designated to study and to make recommendations for any needed additional legislation imposing liability for cost of removal of hazardous pollutants other than oil. This study is complete and has been submitted to the Secretary of Transportation. The Coast Guard is also required to promulgate regulations governing the design, construction, installation, and operation of marine sanitation devices. We have an active developmental program at this time.

Probably the marine safety matter of the most immediate concern to the Coast Guard is the enactment of the Administration's Ports and Waterways Safety Act of 1970, introduced in the present Congress and pending further action after recess. In his message on oil pollution, the President emphasized the growing danger to our marine environment posed by oil pollution from ships. In this connection he pointed out the large increase in the seaborne transport of oil and the large number of ship collisions involving tankers. The President outlined a number of

legislative and other actions being proposed to reduce the risks of water pollution from oil and other hazardous materials.

One of these proposals was the Ports and Waterways Safety Act of 1970. This Act would allow the Coast Guard to regulate vessel traffic, foreign flag vessels as well as American vessels, in the inland waters and territorial seas of the United States in order to minimize danger of collision and resultant pollution. It would also allow us to regulate the handling and storage of dangerous cargoes on the nation's waterfronts and to set up safety zones or other controlled access areas in or near U.S. harbors.

Most of you are aware that we can already do most of those things, but the present authority under which the Coast Guard carries out its port security program is pursuant to a delegation from the President under the Magnuson Act of 1950. That Act authorizes the President to make rules governing the movement, inspection and guarding of vessels, harbors, ports and waterfront facilities in the United States upon determining that our national security is endangered. In 1950 the emphasis was on sabotage prevention and port security operations were focused on this aspect.

The present need for port security has shifted from the sabotage aspect to that of port safety, including fire and pollution prevention.

The authority of the Coast Guard to prescribe or enforce regulations covering activities in U.S. harbors is circumscribed by the penalty procedures in the Magnuson Act. For example, the usual practice in enforcing safety regulations is to assess civil penalties. Regulations issued under the Magnuson Act, however, can be enforced only by criminal penalties. As a consequence, the punishment often doesn't fit the offense and enforcement is difficult.

The need for legislation is apparent. If we are to protect our waters and the ecology of our shoreline, as well as the port facility itself, it is evident that action must be taken to broaden the statutory area of concern and establish workable procedures. The non-defense aspects of port safety go far beyond the intended scope of the Magnuson Act and should be based upon permanent statutory authority specifically addressed to current needs.

The language of the Bill is written in broad, general terms. This was intentionally done, as we believe that a totally effective system should promote the safety of our water transportation and environmental quality of our ports, harbors and waterways. To accomplish these objectives, the Bill authorizes specific areas of regulatory action. In pursuing that action, the Coast Guard is, of course, bound to the provisions of the Administrative Procedures Act and will use the advice and recommendations of all interested parties.

Already, from the testimony of many interested groups and individuals, suggestions for improving and clarifying the language of the Bill have been noted and will certainly be considered. Most witnesses have supported the Bill but there are several who have expressed concern over the broad authority of the proposed legislation. To them I would emphasize that the Bill basically puts into permanent form our temporary authority exercised under the Magnuson Act. There are other features to the legislation, but none will change the traditional responsiveness of the Coast Guard to the needs of the maritime industry and the transportation community in general.

In his address to Congress in May of this year, the President also commented on the importance of harbor advisory radar systems. Such a radar system has been developed by the Coast Guard and is now operating successfully in the San Francisco Bay area. The system is designed to furnish pilots with surveillance data and traffic information by radio from a control center that will be manned 24 hours a day by Coast Guard surface traffic advisors.

As funds permit, our plans call for the establishment of the systems in Gulf and East Coast ports. We anticipate that these radar advisory systems will enable tankers and other vessels to move through congested areas with much less risk of collision and will make busy ports such as New York, Houston, and New Orleans safer than they are at present. At the same time, the threat of pollution from spilled cargoes will be much reduced.

The President also mentioned the increased use of air surveillance in the fight against water pollution. We know that much of the contamination of our coastal waters is due

to oil spills offshore. Many of these spills result from long standing practices which are nevertheless willful violations of laws which limit the discharge of oil within 50 miles of the coast. Such spills can be reduced by a cooperative industry combined with more stringent surveillance procedures.

Subject to budgetary restrictions, we plan to procure, as rapidly as possible, additional airplanes for offshore surveillance missions. To avoid the limitations of visual detection, our research and development program is concentrating on development of airborne all-weather sensors that can be used to detect spillage day or night. We hope to have these sensors operational and installed on surveillance aircraft within the next several years. We envision that within a few years there will be continuous air surveillance from Portland, Maine, to Miami on the Atlantic Coast, Seattle to San Diego on the Pacific Coast, the Gulf Coast, and the Great Lakes.

Another Coast Guard sponsored bill which we are watching with interest is the bill that would require the use of bridge-to-bridge radiotelephones on all vessels navigating in U.S. waters. This bill passed the House on 16 December 1969 and is presently awaiting Senate action subsequent to recess.

We believe this legislation will be a significant step toward the reduction of collisions. Many of our records of significant collision disasters have spoken to this need. Some of the more noteworthy marine casualties in which it was concluded that bridge-to-bridge radiotelephone communications might have prevented the collisions are the *Stockholm-Andrea Doria* collision in 1956, which cost 50 lives; the *Massachusetts-Alva Cope collision in* 1966, which cost 33 lives; the *African Star-Midwest Cities* collision in 1968, which took 21 lives; and the *Union Faith-Warrent J. Doucet* collision in 1969, which took 25 lives.

President Nixon further commented on the importance to safe navigation of this legislation in his address to Congress and urged prompt enactment. As those of you from the Great Lakes are well aware, bridge-to-bridge radio has been used in your area since 1934. The large ore carriers have demonstrated its effectiveness by maintaining one of the safest navigation records in the world. We hope that very soon the harbors of the United States will have a safety record equal to that of the Great Lakes through the provisions of this bill.

Because of the significant trend toward vessels of much greater tonnage, and in the light of continued collision incidents, the maritime nations of the world have agreed that the International Rules of the Road must be updated. An international conference has been called in 1972 for this purpose.

The Coast Guard, in close consultation with the U.S. maritime community, has been working for two years to develop the U.S. position for that conference. A questionnaire based on the preliminary work we have done so far is now being circulated to U.S. masters and deck officers. The tabulated information expected from this questionnaire will be used in firming up the U.S. position.

Although it is a little premature to prophesy what the final results of the international conference will be, the consensus is that there will be a strong push to modify the concept of "moderate speed" in fog to a term more relevant to present day ships. Much greater emphasis will be placed on the use of radar in all conditions of visibility and recognition will be given to the fact that deep draft ships are restricted in maneuvering ability outside the channel in many international waterways.

I would be remiss if I did not mention the status of the unification of U.S. Rules of the Road. As you know, for ten years the Coast Guard has sought to update and combine the inland, Great Lakes, and western rivers into a single set closely associated with present international rules. Although we can expect some further changes in this package, due to present work to amend the international rules, the Coast Guard is still very much interested in accomplishing more unification. We consider greater unification essential to optimum marine safety on American waterways and are eager to reconcile any parochial differences that arise. Although it may take another year or two, we feel the unified rules can come into force before the new international rules.

Another Coast Guard project had its beginning on the Great Lakes. For many years, vessels transiting the Great Lakes have used recommended course lines with marked success. It is only recently, however, that added sea lanes have been established at the entrances to our major coastal ports. During the past decade, over 50 sea lane systems have been established on the oceans of the world and have been approved by the International Maritime Consultative Organization. In U.S. waters we now have six traffic separation systems. We hope to see the next traffic separation system established for the approaches to Los Angeles/Long Beach Harbor later this year.

In closing, I would like to note that in all of these Coast Guard endeavors the progress that has been made was possible only because of the close cooperation and assistance of the members of this group in the maritime community.

The continual endeavor to improve marine safety must always be a joint effort of the Federal government and private industry. It goes without saying that the National Safety Council epitomizes this relationship.

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National Safety Council, Chicago, IL.

Respectfully,

Robert J. Marecek

Robert J. Marecek
Manager, Library

Marilyn P. Pettersen

"OFFICIAL SEAL"
MARILYN P. PETTERSEN
Notary Public, State of Illinois
My Commission Expires 10/26/03