that were not battened down soon enough in some cases and not at all in other cases. The free water in the bilges reduced the stability further, the list became greater and the scuppers on the upper deck became immersed, bringing in more water. In addition, water came down the booby hatch on the weather deck. Forty-two hours after her departure from New York the first SOS was sent out. One hour later, the Captain reported that the ship had 32 degrees of list. Three hours after the report the ship went down. The loss of the ship was due to several things--inadequate freeboard, inadequate stability, open hatches, leaking discharge chutes, and heavy weather. The major causes were the lack of freeboard and stability. Had there been adequate freeboard and stability, the water entry would have been much less and it could have been kept under control. The large loss of life would have been prevented had the Captain called for help sooner. It was clear from the evidence that there was little hope of saving the ship six hours before the SOS was actually sent. If the message had been sent earlier, the rescue ships could have reached the VESTRIS before she went down. Another cause of the large loss of life was the attempt to lower the port boats filled with women and children. Due to the large list to starboard, the boats on the port side were very difficult to lower and when the ship went down three boats were either sunk or swamped. The boats on the starboard side, however, were successfully lowered and got away.

The loss of the VESTRIS was due primarily to inadequate freeboard and stability. From the standpoint of the 1929 Convention the ship just met the subdivision standards at a draft some 5 inches below that at which she was lost. It is not unreasonable to assume that even had the draft been 5 inches less the ship would probably have been lost since stability was a major factor and open hatches plus poor ship handling contributed their share to the result.

Stability is a factor that must be constantly guarded. In time of war, it becomes even more apparent. To the dangers of collision, grounding and storm, is added the danger of explosion from enemy attack. Whether in peace or in war, the importance of stability should be strongly emphasized, for a ship is a large investment, both in lives and in property, and the loss of a ship is a major disaster to any owner or nation.

Several attempts have been made in the past to develop mechanical devices for computing the stability of a ship. One instrument consisted of a profile of the ship drawn on a board. The board was pivoted at the ends and normally assumed a position in the vertical plane. Weights were hung at the various levels and positions fore and aft according to the loading of the ship. The pivot points could be adjusted up and down to obtain balance and from this the stability and trim could be determined. Another instrument employed the ship profile on a board in a horizontal plane. This board was supported on three legs attached to a scale somewhat similar to a bathroom scale. The board was loaded with weights and

readings taken for trim and stability from the scale. These instruments were not considered too satisfactory in a seaway because of the dynamic effects of ship motion.

During the last war many cargo ships were equipped with a device called the "Stabilogauge". This instrument has proved to be more successful than the other types. It has been issued to Naval auxiliary cargo types by the Bureau of ships. Reports from operating personnel have indicated that it is a useful, rapid and simple device for determining the ship's initial GM.

Subdivision and stability are the responsibility of the naval architect and builder. Damage control and stability are the responsibility of the operating people. The naval architect places the watertight divisional boundaries, both vertical and horizontal, in the most advantageous locations for limiting the extent of flooding and provides the best degree of stability consistent with other design requirements. These are things that are built into the ship and represent the ship's own ability to absorb the effects of flooding caused by damage. It might be called the ship's "built in" life insurance. It is the responsibility of the operating personnel to maintain the power of survival that has been built into the ship. Overloading the ship, lack of attention to doors and hatches, lack of attention to fire fighting equipment and procedures--all of these tend to reduce the ship's chances of survival when danger exists. A watertight subdivision bulkhead is only as good as the men who pass through its doors. If the men fail to close them when required, the bulkhead ceases to be a useful part of the ship's protection. Fire fighting equipment is not used very often. It is the type of equipment that may be called upon only once in the life of the ship, but at that one time it must perform its function successfully. Not only must the equipment be ready for use at a moment's notice, but the people who handle the equipment must also be ready. Regular training drills keep the crew at their best for an emergency and also serve as a means for checking equipment. Time is an essential element in most cases of flooding, damage and fire. The better trained are the men the quicker they will respond to the emergency.

The MORRO CASTLE in 1934 is noteworthy as one of the two cases that initiated Senate Report 184, the report which has had a major influence on American Ship construction during the past 14 years. The MORRO CASTLE was an outstanding example of loss by fire and demonstrated two important factors primarily responsible for the loss of a vessel--lack of discipline and combustible materials. In brief, the account of the disaster is as follows:

Sometime after 2:00 A.M., September 8,1934, a fire broke out in the writing room of B deck. When discovered at 2:45 A.M., the fire had gained considerable headway. At about the same time a fire started in No. 3 hold. Attempts to fight the fire and maintain discipline essential for safety of passengers were futile. Attempts to isolate the flames in the writing room which had not been cut off from the lounge by the fire door were so feeble

that the fire spread rapidly to the lounge. A lapse of ten minutes occurred between the discovery of the fire and the first attempt to call the watches below. Another five minutes passed before a general alarm was sounded and many of the passengers and crew later indicated that they did not hear the alarm. By 3:00 A.M. the fire had spread clear across the lounge and into the library. From that time on the fire was completely beyond control. The officers and seamen moved forward to safety while the passengers and stewards moved aft. An SOS was not sent out until between 3:25 and 3:30 A.M.--1½ hours later. At least six lifeboats were launched and safely reached shore, but these boats brought in very few passengers, most of the occupants being crew members.

The two outstanding facts contributing to the disaster were:

(a) Lack of discipline in the crew. The efforts of the officers and crew to prevent the rapid spread of the flames and the loss of life by drowning of passengers and crew, who jumped overboard in an effort to escape, were both inadequate and ineffective. An inspection by Bureau of Navigation personnel immediately after the fire revealed that not a single fire screen door on the ship was closed!

(b) Combustible materials in the construction and trim of passenger quarters. The MORRO CASTLE was a luxury liner in every respect, yet in that very luxury was the source of its destruction. The MORRO CASTLE demonstrates the vital necessity for disciplined well-trained crews capable of dealing effectively with a fire. It also demonstrates the hazard of combustible materials in ship construction.

An example of fire at sea diametrically opposite to that of the MORRO CASTLE is found in the dramatic case of the tanker AUSTRALIA the following year. At 5:45 P.M., December 22, 1935, out in the open Pacific 1275 miles West of Cape Mendocino, an explosion of inflammable vapor occurred in the aftermost tank, No. 10. A raging fire developed. There were several thousand gallons of gasoline and kerosene aboard. Only a cofferdam separated the tank which exploded and the diesel fuel oil bunker tank. Explosive gas pockets existed between beams under decks and in cargo and ballast piping communicating with other tanks. The danger of further explosions was imminent. In fact, a second explosion did occur half an hour after the first one. Every man was at his station and the engines stopped before the echo of the alarm had died away. Fire fighting apparatus was immediately put into use. Steam was turned into all cargo spaces. Streams of water were played on the deck to keep the temperature down, thus preventing vaporization of gases immediately below. Temperatures were taken of all other tanks to determine any spread of fire. An SOS was sent out and two lifeboats lowered and stocked with provisions in readiness for abandonment, if necessary. In two hours from the time of the explosion, the fire was under control and the ship in a reasonably

safe condition. The remaining kerosene was pumped overboard and the tanks and piping thoroughly flushed out with sea water. The engines were started up to get away from the kerosene coated sea. During the whole period of the fire the Captain held frequent consultations with his officers so that everyone would be completely informed on the status of the ship. After the fire the ship made the voyage to San Pedro and then up to San Francisco for survey.

This is an outstanding example of what a disciplined and well trained crew can do in an emergency. The crew obeyed orders to the letter and cooperated fully. Not a life was lost and the ship was brought safely to port from mid ocean.

Ship casualties are an ever present problem of the maritime service. Regardless of modern design and equipment, casualties still occur to ships. A comparison of the returns of the Liverpool Underwriters Association for November in four successive years indicate that there has not been a great variation in the number of casualties since the war. The casualty returns show that there were a total of 539 in 1946, 679 in 1947, 635 in 1948 and 624 in 1949. These casualties include machinery damage, weather damage, collisions, fires, explosions and founderings plus miscellaneous damage from various causes. The opportunity for reduction in casualties is as apparent today as it was yesterday and constant effort should be exerted to lower the score.

Damage control is a vital function of the operating characteristics in ships of the U. S. Navy. The great importance of damage control was realized at the outset of World War II and steps were taken to develop improved methods for controlling flooding and fires, for establishing the optimum resistance of the ship to damage by proper loading and for educating personnel in damage control procedures.

The value of damage control is indicated from an analysis of war damage reports. In one case the analysis of the reports of survivors established the fact that the loss of the ship was entirely attributable to progressive flooding. The important lesson demonstrated by this loss was that flooding boundaries must be quickly established and effectively maintained.

In another case, fire was responsible for the loss of the ship. The ship was a small one but in spite of that it would have survived damage to the hull if there had been no fires. For the particular damage incurred, watertight subdivision, stability characteristics and reserve buoyancy were all adequate. The ship was abandoned due to the fire. After being abandoned she was struck by several additional torpedoes, yet for all of that she did not sink immediately. When the durability of the ship is considered, it is unfortunate that fire should have been the cause of her loss.

All cases were not unfavorable. In one case twenty-two fires started during the engagement. Due to prompt action and good organization of fire fighting parties, all fires were quickly brought under control.

Another outstanding example is the case of a ship that was saved by beaching. The ship would undoubtedly have sunk after the first torpedo struck, if it had not been for the prompt, skillful, persistent efforts of the entire crew. Not only was the ship saved but also most of her cargo badly needed at the time. It was the combination of skill, promptness and persistence that saved the ship and cargo and enabled it to be put back into service later.

The Navy realized the importance of proper loading, of proper maintenance and of training in damage control. War experience confirmed its importance. Some ships were lost due to lack of proper procedures and training. Many were saved because of proper procedures and training. The Merchant Marine should profit from one of the great lessons of the war, namely that the survival of a ship depends upon:

(a) good subdivision and stability as built into the ship and
(b) proper equipment and well-trained crews.

Safety at sea is recognized as a national responsibility. The federal government exercises jurisdiction over the standards of ship construction and equipment for the purpose of safeguarding the safety of ships. It should also assume the jurisdiction and responsibility of damage control training for the men of the merchant fleet. The Navy has extensive training facilities for damage control. There are two main damage control schools, one in Philadelphia and one at San Francisco. In addition there are several Fleet Training Centers on each coast. In a paper before the Society of Naval Architects and Marine Engineers in 1949 it was suggested that the crews of our merchant ships be given fire fighting training at the Navy damage control schools. Actually, the damage control schools are authorized by the Secretary of the Navy to train civilian city fire department personnel. A number of these people have received training at the schools in the past. Recently, some 300 cadets from the Merchant Marine Academy at Kings Point, Long Island took the fire fighting course at the damage control school in Philadelphia. This is a commendable beginning, but in order to attain the maximum degree of effectiveness, there should be a broad program of damage control training covering stability and watertight integrity, as well as fire fighting. Furthermore, this program should include not only the merchant marine cadets, but the entire merchant fleet as well. Familiarity with the manifold problems of flooded compartments, damaged or plugged fire mains and pumps, shoring up structure, and plugging holes are necessary. While fire is the greatest source of danger, collision and damage are sufficiently important to warrant careful training of personnel. The realism achieved by the "Buttercup" training is particularly valuable since it drives home the problems encountered in a ship disaster. It

gives the men a better idea of what to expect and instills confidence in them. (Note: MSTS conducts such damage control training of merchant marine personnel).

A training program in damage control would pay dividends far in excess of its investment. Ships involve the safety of many people. In the larger passenger types the numbers may run into the thousands. The loss of a ship may mean the loss of thousands of lives. Proper equipment and proper action by the crew often can determine whether or not these lives will be lost. The search for improvements in safety for ships and the men who sail them cannot end. The ships of today are safer than those of yesterday. The subdivision is better, stability is larger, fire resistance is greater and navigational aids more accurate and penetrating. Yet, regardless of these facts, the sea is still a hazardous place on which to travel and when disaster does occur the best equipped ship with the best trained crew will stand the greatest chance of survival.

Section 7.10

SIGNIFICANT MARINE CASUALTIES OF THE PAST YEAR (1956)

(Condensed from a paper presented by Commander Robert F. Barber, USCG, at the Marine Section, National Safety Council)

I. INTRODUCTION.

The fiscal year ending June 30, 1956 was highly favorable from the standpoint of marine safety in that there were only 8 major casualties requiring Coast Guard Marine Boards of Investigation. In the preceding year there were 18 such major casualties. In addition to this encouraging trend in the number of major casualties, and more important, there was a considerable reduction in loss of life. Fifty-three lives were lost as a result of major marine casualties in fiscal 1956 as against 113 in 1955. However, of the 53 lives lost in the past year, 35 were lost in only 2 of the casualties. Excluding these 2 worst cases, the average number of persons who died in the remaining 6 cases was only 3, a truly remarkable record which fully reflects the efforts of responsible officials in the marine industry to make American vessels safe.

The 8 major casualties which did occur in the past year consisted of the foundering of a passenger-carrying sailing schooner, the MARVEL, with a loss of 14 lives; an explosion and fire which completely destroyed a tank vessel; the foundering of a C-3 freighter which had broken in two; a non-fatal explosion and fire in a tank vessel; a non-fatal but serious collision between 2 freighters on the Great Lakes; a collision between 2 freighters off the Pacific Coast; the foundering of an American fishing vessel off Mexico; and the foundering of a dredge under tow in the Great Lakes.

II. SALEM MARITIME FIRE.

This marine tragedy was enacted at the Cities Service Refinery Docks near Lake Charles, Louisiana on January 17, 1956. The war-built T-2 tanker SALEM MARITIME, lying peacefully at the terminal loading a mixed cargo of No. 2 heating oil, kerosene and gasoline, was transformed suddenly into a raging inferno, a molten steel pyre for 18 members of her crew and 3 terminal employees. Before this holocaust was finished, the SALEM MARITIME lay in ruins, a sunken hulk of a ship, 3 nearby tank barges were badly damaged, damage to the adjacent docks and shore property was estimated between $1,000,000 and $2,000,000 and 21 men were dead or dying.

Reconstruction of the exact circumstances of loading leading to the explosion, in order to deduce the cause of ignition, was extremely difficult since every member of the crew who had in any way been involved

in the loading operation was killed. However, the available evidence indicated that gasoline from No. 9 tanks was leaking through a defective bulkhead into No. 8 tank. When the loading of kerosene under pump pressure into No. 8 tanks was begun, it is certain that the turbulence and agitation thus caused generated considerable gasoline vapor in this tank. The limited available evidence indicated that there was a timely discovery of the gasoline leaks into No. 9 tanks and that the master decided not to load any kerosene in No. 8 port and starboard wing tanks. It is not clear whether this decision included No. 8 center tank. The time was 10:20 p.m.; 10,000 barrels of kerosene remained to be loaded. While it was being pumped in at a line pressure of not over 100 p.s.i. in the completing stages of No. 7 across or the first stages of No. 8 center tank, a terrific explosion took place. Flames spewed over the entire after end of the tanker and soon enveloped the vessel from end to end.

Flaming oil flowed over the water, transmitting fire to the three tank barges moored about 500 feet downstream and to the dock and cargo transfer equipment. Fire-fighting equipment was brought into action immediately but it was over 40 hours before all fire was extinguished. Of the 43 crewmen, 18 were ashore when the fire began. Of the 25 men aboard when the explosion occurred only 8 escaped alive from the vessel, the other 17 perishing in the flames. One man who made it safely ashore later died of severe burns. Three shoreside employees of the terminal received fatal burns. The deliverance of 3 men who were trapped by flames in the tanker's engine room was next-to-miraculous. Driven in desperation to the lower engine room to escape the terrible heat, they discovered fresh air somehow flowing in through a ventilator and were able to breath and exist here for four hours, although adjacent shell plates above the waterline were glowing red.

The most logical conclusion as to the source of ignition of this costly fire was static discharge on or near the surface of the kerosene, caused by splashing and turbulence and the presence of small amounts of water left over from Butterworthing, with gasoline vapor probably supplying most of the original explosive charge.

III. ESSO PATERSON EXPLOSION.

Another explosion in a T-2 tanker did extensive damage to the ship but, fortunately, took no lives. The ESSO PATERSON, built in 1942, was rent by a terrific blast on the evening of March 29, 1956, as she was being loaded at Baytown, Texas. The explosion originated in No. 8 port wing or No. 8 center tank, ripping out the weather deck and side plating, and structural parts. The bulkhead between No. 8 port and center tanks was found 100 feet from the ship. Excellent firefighting by the ship and the terminal confined fire damage to the immediate area. Studies of this casualty are not yet complete. However, it is apparent that the explosion occurred in a tank into which kerosene had begun to flow under pump pressure, which had contained gasoline on the last voyage, and which had not been gas freed although filled with salt water ballast prior to loading at Baytown.

The Coast Guard and the entire petroleum transportation industry have become increasingly concerned with the inherent hazards involved in handling kerosene and similar products, such as JP4 Jet Fuel, as evidenced by the two disastrous explosions in tank vessels this year and other similar explosions in recent years. The preliminary report of an oil industry committee now studying, at the request of the Coast Guard, the special hazards of loading and discharging kerosene and Jet Fuel indicates that additional precautions may be required. Although the study has not been completed, it would appear that a very real problem of static electricity discharge may exist on or near the surface of kerosene under certain conditions of turbulence and the presence of water. To avoid the possibility of the static discharge triggering an explosion, the committee suggested that any tank which previously contained a low flashpoint product should be gas freed or inerted before loading kerosene. In addition, contamination of kerosene with gasoline or other low-flash product should be avoided since contamination will probably result in greater explosive vapor generation during loading. More complete information on the avoidance of kerosene and Jet Fuel explosions and fires is to be expected during the coming year.

IV. WASHINGTON MAIL FOUNDERING.

A dramatic casualty involving the total loss of an 8,000-ton freighter in the Gulf of Alaska occurred on March 3, 1956. Happily there were no lives lost and no serious injuries. The SS WASHINGTON MAIL, a C-3 freight ship, built in 1945 at Pascagoula, Mississippi, was enroute to the Orient from Seattle with a full load of general cargo, including a deck load of lumber. At 1:15 p.m. on the 3rd of March, with the vessel steaming at 13 knots into a moderately rough head sea, a loud deep rumbling sound from the vicinity of No. 3 lower hold was heard accompanied by a distinct sagging amidships. Moments later, a fracture appeared completely across the weather deck directly along the after section of No. 3 hatch, and the vessel broke in two.

The bow section, with no persons on board, soon capsized and sank. The after section, with 51 crew members and 9 passengers on board, remained afloat for 8 hours, largely due to the commendable and energetic efforts of the officers and crew in controlling the damage and flooding. Every person on board safely abandoned the after half in the WASHINGTON MAIL's lifeboats and were taken on board the USNS Transport GENERAL FREEMAN about 1 hour before the derelict half sank. An emergency full-speed 65-mile run by the GENERAL FREEMAN after she picked up the initial distress call of the WASHINGTON MAIL was a large factor in this magnificent rescue at sea.

This was the first structural failure with serious consequences of a C-3-S-A2 type vessel in almost 13 years' operation of this class. As a result of a study by the Coast Guard and the American Bureau of Shipping based largely on the probable fractures which occurred on the WASHINGTON

MAIL, action has recently been taken to reenforce the upper part of the hull girder on all all-welded ships of the C-3 class by conversion to rounded hatch corners on hatches No. 2, 3, and 4 and by the installation of crack arrestors or riveted straps on the weather deck and the sheer strake abreast these 3 hatches.

V. LOSS OF A FISHING TRAWLER.

During May there occurred a casualty off the Western Coast of Mexico of a type which has plagued the West Coast for many years--the total loss of a fishing vessel. However, the stranding and breaking up of the 166-ton American wooden seiner WESTERN EXPLORER on May 14, 1956 on the shores of Socorro Island was unlike the normal pattern of fishing vessel accidents since 5 men were drowned. There were no mysterious elements involved. The WESTERN EXPLORER simply went ashore on a rocky coastline at 3:00 in the morning when the wind shifted and her anchor dragged undetected by the deck watch. Before aid from other fishing vessels in the vicinity could be rendered at daylight, the strand was a total wreck and 5 of her crew had perished in the surf. Had it not been for the foresightedness of the master in issuing life preservers to all hands immediately after the grounding, the loss of life would probably have been much greater.

VI. TWO SERIOUS COLLISIONS. During fiscal 1956 there were two major collision cases with heavy property loss in each.

A. In the first collision which happened at 2:18 a.m., May 14, 1956, on a clear dark night off Point Sur, California, the bow of the SS MARINE LEOPARD, a 10,600-ton C-4 freighter struck the starboard side of the small 39-year old lumber freighter HOWARD OLSON with such force that, within minutes, the bow section of the OLSON broke off and the stern section capsized and sank. In spite of heroic and strenuous efforts by the crew of the MARINE LEOPARD using two lifeboats to rescue survivors, and by the crew of the nearby steamer JOHN B. WATERMAN, 4 men from the HOWARD OLSON died in the water or after being picked up. The causes of this collision were as old as the history of collisions; uncertainty by the navigators of two vessels approaching each other on reciprocal courses at night as to the intentions of the other, reluctance to make a major course change well before a dangerous situation is generated, and, at the last moment, a decision by one to turn hard left instead of hard right. The failure of one vessel to blow whistle signals upon altering course to avoid collision as required by the International Rules of the Road was also a large contributing factor.

B. The second severe collision case was, happily, not attended by loss of life, but it did result in one of the most heavily-travelled waterways in the United States being blocked or partially blocked for 19 days by one vessel which sank within minutes of the accident. Upbound in the St. Clair River, Michigan about 40 miles above Detroit, on April 19, 1956,

the Great Lakes bulk freighter E. M. FORD was suddenenly confronted with a jammed steering engine with 5° left rudder and the downbound heavily-laden bulk freighter A. M. BYERS closing at a relative speed of 20 miles per hour about 1,000 feet away on the port bow! In spite of the competent and intelligent actions of the masters of both vessels during the next minute and a half, collision was inevitable, the bow of the FORD plowing head-on into the port bow of the BYERS. Sinking within 13 minutes, her collision bulkhead pierced, the BYERS rested on the bottom of the river partially blocking thetremendously important movement of Great Lakes freight until she was raised on the 8th of May. The jamming of the steering engine on the FORD was finally traced to two bolts connecting vital parts of the reciprocating steam steering engine--the bolts had backed out of a rapidly-moving eccentric arm, undetected. An $800,000 loss in vessel repairs alone traceable to two bolts worth less than $1.

VII. FOUNDERING OF A DREDGE.

A marine casualty of calamitous proportions occurred on Lake Michigan on May 23, 1956, when a 110-foot dredge capsized during a storm, drowning 9 men of her crew. The uninspected barge-type DREDGE No. 906 was under tow by the similarly uninspected 80-foot diesel towboat E. JAMES FUCIK. Foul weather had developed on the lake and the tug and tow were making for the safety of Milwaukee Harbor. Sea water entering the non-watertight hull of the dredge steadily decreased her buoyancy and stability to the point that, when a guy wire on her immense dredging boom parted and the boom and bucket swung heavily to one side, the dredge capsized and sank, casting her crew of 19 into the turbulent waters of Lake Michigan. There being no lifeboat or liferaft provided on the dredge, these men had only life preservers with which to struggle for life in the heavy seas. Only 10 of the 19 aboard survived. A particularly tragic element of this case was the lack of any positive means for the 19 desperate men on the dredge to communicate with the tug or the outside world and make their perilous plight known.

All in all, fiscal year 1956 was a bad year for dredges being transferred on seagoing voyages. On August 31, 1955, the 500-ton barge-type dredge FAIRLEE sank at sea while being towed from West Palm Beach to Venezuela by a modern seagoing diesel tug. Eighteen days later, the 344-ton barge-type dredge B-29 started to sink at sea while being towed from New Orleans to Venezuela by the same diesel tug. On this occasion the tug was able to tow the B-29 to the entrance of Tampa Bay before it capsized and sank in shallow water, where it was refloated a month later. On March 2, 1956, the 1500-ton dipper dredge HELLGATE sank at sea in the Pacific while being towed from Honolulu enroute to the Panama Canal and then to New Orleans. Fortunately there were no lives lost in any of these three sinkings although the financial loss was estimated at close to $2,000,000. A principal factor in these sinkings was the unsuitability of the dredges, designed for use in protected waters, to undergo the hazards and stresses of a sea voyage even though certain alterations and additions were made in each case to attempt to make them seaworthy for such a voyage. Early this year the Coast Guard instituted new measures to inspect and certificate such dredges and barges to insure, insofar as possible, that they are suitable to navigate open waters with safety.

Section 7.11

LESSON FROM CASUALTY-NAVIGATION

'Wrong-Way' T2: One for the Log

If a ship's compass were inaccurate by 111°, how long would it take for ship's personnel to discover the error? Ten minutes? One hour? One watch? A change of the watch?

A recent issue of the U. S. Coast Guard's *Proceedings of the Merchant Marine Council* recounted such a situation: A Merchant Marine ship left the Delaware River on what she thought was a trip to South America. She had gyro trouble. She ran aground on LONG ISLAND!—200 miles away from her dead reckoning position. Incredibly, a 111° error in the gyro compass repeater system had gone unnoticed over half a day through a complete cycle of three watches.

Proceedings spelled out the sequence of events of this maritime "wrong-way Corrigan" epic of errors: A new fully-manned T2 tanker clipped along at a steady 14 knots as she left the Delaware River and set a 118° course for South America.

Ten minutes after the correct course was set by gyro compass, the repeater system failed and the repeaters froze on 118°. Fifteen minutes later, the derangement corrected itself. The repeaters, however, were out of synchronization with the master gyro. Although the repeaters indicated a heading of 118°, the ship had swung left to a course of 007° true.

Three mates stood their watches during this leg of the trip. The error in course was not detected until too late: the vessel grounded.

There were plenty of clues during this 12-hour period that, if investigated, would have detected the error immediately. They were ignored. The presence of fishing craft "so far at sea" was not considered unusual. Nor had anyone noted the ship's failure to cross the Gulf Stream. The crossing would have been indicated by an increase in water temperature.

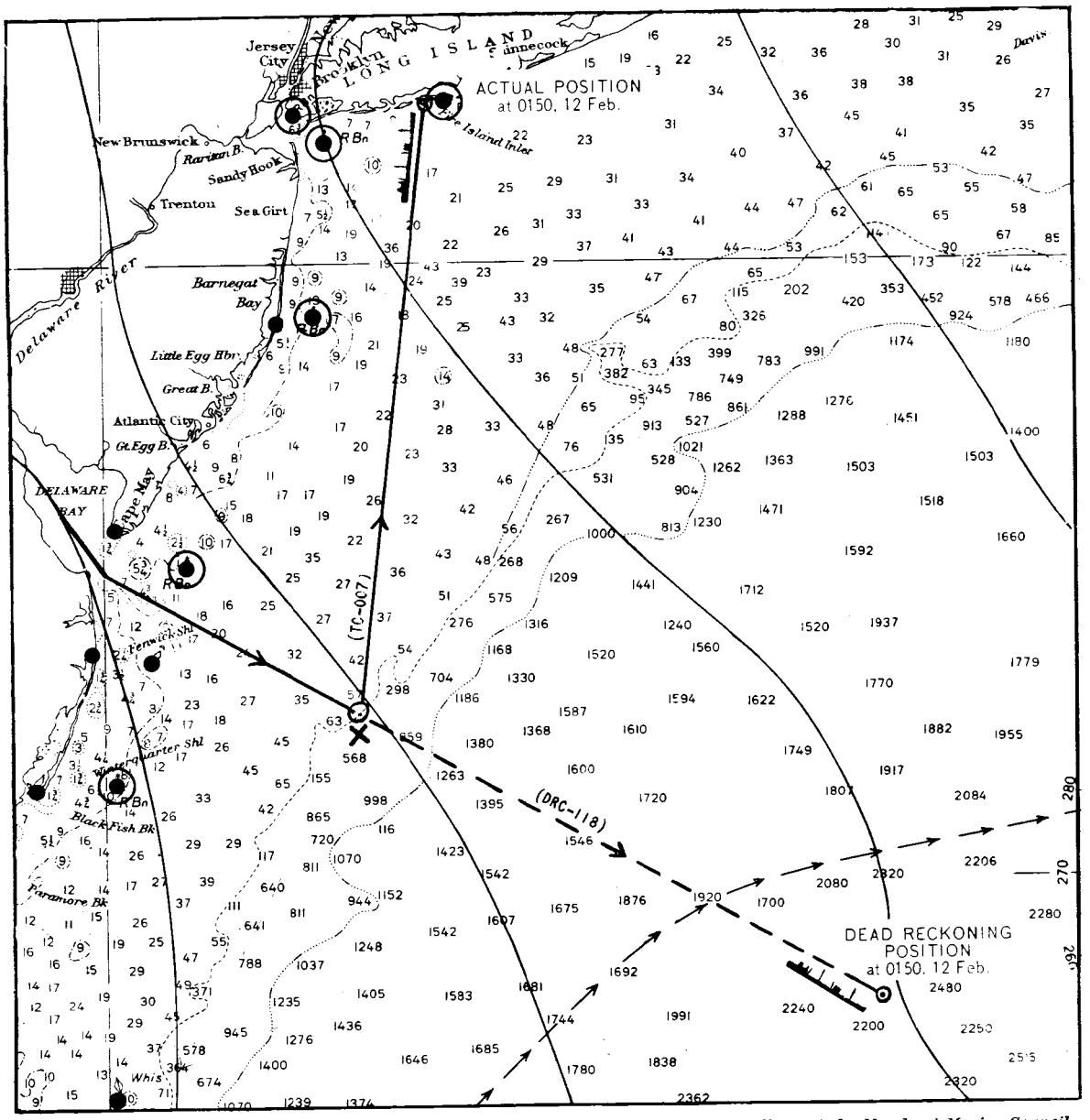
The wind, originally off the port bow, shifted radically but this fact also was ignored.

While in the area of the "Baltimore Canyon," use of the fathometer would have detected the depth variance from 50 to 500 fathoms. The radio direction finder was not used. The mates apparently made no comparison between the gyro and magnetic compasses.

This was not a case of a "green" master or inexperienced mates. The master had served "in command" for 25 of his 29 years with the company. The mates were making their second trip.

More details about this very unusual case can be found in the January 1957 issue of the *Proceedings of the Merchant Marine Council.*

See Chart on reverse side.



ACTUAL AND DEAD RECKONING COURSES OF THE TANKER. Chart furnished by *Proceedings of the Merchant Marine Council.*

Section 7.12

MASTER-PILOT RESPONSIBILITY

This case was distributed to all MSTS civil-service-manned ships under cover of a COMSTS NOTICE which directed masters and licensed deck officers to carefully review this case and to keep in mind that their responsibility for safe navigation does not cease with a pilot on board. It also appeared in the November 1957 issue of the MSTS Magazine.

MASTER PAYS FOR PILOT'S ERROR

The Coast Guard suspended a master's license for three months for his failure to relieve a Sandy Hook pilot in a collision situation in the New York Harbor. An additional three month suspension was also ordered on a probationary basis. This additional suspension was not imposed providing the master had no further navigation violations in the next year.

The accident occurred just after midnight on 11 February 1957, as ship A was proceeding seaward and ship B was entering the Upper Bay from the Kill van Kull. Ship B was proceeding from Newark to Weehawken, but the master and pilot aboard ship A thought ship B would turn south of St. George and head for sea. The crash occurred just off St. George, S.I., near Buoy #24 in the main channel. Ship B, struck on the port side amidships, caught fire and was so badly holed that she had to be beached on Red Hook Flats south of Governors Island.

At an inquiry before the Coast Guard hearing examiner, the pilot conceded that the handling of ship A had been imprudent and that he should have reduced speed when he first sighted ship B on his right. Under navigation rules, the ship approaching on the right is privileged. In this case, ship A was the "burdened" vessel, which means that it was her responsibility to give way.

Ship B had sounded three separate one-blast signals to indicate her course, but the men on the bridge of ship A testified they had heard no signal. The master of ship A was charged with negligence for failing to slow his ship and to take over from the pilot. According to navigation rules, the master of any ship is obliged to relieve the pilot taking his ship in or out of the harbor, if in the master's opinion the ship is not being properly navigated.

The foregoing stresses the advisability for masters of MSTS ships to follow strictly the provisions of article 7.4 of COMSTS INSTRUCTION 3120.2B which states that:

a. The master cannot legally surrender his navigational responsibilities to the pilot.

b. The pilot is merely an adviser to the master and his presence on board does not relieve the master or his subordinates of their continued responsibility for the safe navigation of the ship.

c. Masters are not authorized to surrender their navigational responsibilities during any period that a pilot is at the conn.

Section 7.13

COMBINED CASE INSTRUCTIONS, NAVPERS 10489

This training booklet is listed here because it contains valuable lessons from actual casualties. It is readily available in ships' training libraries or may be requisitioned under authorized publications allowances.

Combined Case Instructions contains 50 cases. This new pamphlet, NAVPERS 10489, combines ten new cases with the 40 cases which were published earlier in three parts as Case Instruction, NAVPERS 10882. References to Rules of the Road in the old cases have been updated to conform to the revised Rules of the Road. The majority of cases presented concern collisions and groundings; other cases cover such categories as capsizing, fire, seamanship, boiler casualties, and some administrative matters. The cases are condensations of actual casualties reported in records of courts of inquiry and boards of investigation.

The casualties presented were selected, not because they were sensational or even particularly damaging, but because they resulted from avoidable personnel failures. Each case makes some point or points which, if considered by others, may prevent the occurrence of a similar casualty in the future. A careful study and discussion of these cases will prevent repetition of such "human" failures.

Section 7.14

REFERENCE TO ADDITIONAL LESSONS FROM CASUALTIES

This is a reminder that additional new and timely lessons from casualties are readily available in various authorized publications aboard ship. It is urged that these be reviewed carefully as each of the publications listed below are received and that they be discussed during training sessions aboard ship.

Publications which contain lessons from casualties are:

Proceedings of the Merchant Marine Council, USCG, published monthly. The "Commandant's Action on Marine Boards of Investigation" comprises very practical lessons from casualties.

Naval Training Bulletin, NAVPERS 14900, published quarterly, contains excellent lessons from casualties under the heading "Davy Jones Locker". While these refer to casualties in commissioned ships, the principles apply equally to civilian-manned ships.

Bureau of Ships Journal, published monthly, frequently contains articles on casualties, particularly engineering casualties.

Section 7.15

Chronology of a Casualty

by Captain L. M. Thayer, USCG

The setting of this vignette is a court room in the United States of America, today. On the witness stand is a ship's officer. He is reciting to a group of much interested parties the details of what he did during the sixty minutes preceding a collision which is the subject of the hearing. He is attentive, polite. He speaks confidently, secure in his thought that his *job was well done, in spite of the collision. He is willing—even glad—to tell his story to this bunch of shoreside sailors, most of whom won't understand anyway. He watches counsel evenly, and shows no resentment over the interruptions which are made now and then to keep the inevitable record straight. He continues:*

Well, as I said, Sir, it was pretty foggy when I came on watch at 2000. We were blowing fog signals. Yes, Sir, we were still making 15 knots and we were on course 000 true. By the time I picked up this target on the scope, it was well shut down. Sir? That was 2300. I remember because I glanced at the clock just after I took the reading. At that time, she was about a point on my bow, and the range . . . Sir? It was my starboard bow.

Did I record the time?

No, but I remember that it was just after 2300.

No, Sir, I didn't take a true bearing of her. She was about a point on my starboard bow, and I didn't bother to take a true bearing. I would say she was between 10 and 12 degrees on the bow. And the range was about 10 miles.

No, Sir, I didn't record the bearing or the range, but I watched every few minutes. She seemed to be crowding me a little, and about 2310 I reported to the captain. By crowding I mean that she was changing bearing toward my bow as we were getting closer. The captain came into the wheelhouse in a few minutes.

Sir?

I'd say it was a minute or two before the captain came in. By that time, I'd say the bearing had come over toward my bow a couple of degrees. She was crowding me again.

No, I didn't check with the helmsman to see if she was on course. I could see that the bearing had come over a little.

I told the captain what had been going on, and after looking at the target for a couple of minutes, we came left a little.

Sir?

We steadied on course 355. It was a change of 5 degrees to port. The bearing opened up some after that change of course, and she was about a point and a half on my bow then.

At 2325 the bearing was about the same—a point and a half or so on the bow, and the range was 5.4 miles. The captain said give her some more room, so I came left again, and steadied up on 350. When we swung around, the bearing

This fictional, but not unlikely, account of a collision was prepared by Captain L. M. Thayer, USCG, Officer in Charge of Marine Inspection at Portland, Oregon. Author of various plotting articles and texts, including his latest—*Practical Radar Plotting*, Capt. Thayer's first plotting article in MSTS Magazine appeared in the June issue.

Collisions are distressing and heartbreaking. But even worse is the shameful knowledge of a deck officer that he could have avoided tangling with another ship if he had just kept on course.

drew aft again, but she soon seemed to come back left. That target was changing fast, and she kept crowding me. In about another 10 minutes, it was 2336.

Sir?

I know it was 2336 because the captain told me to note the times because we were getting too close. At 2336 the range was down to a little over 3 miles: 3.1 I think it was, and she was hanging there on my bow. She was a little over a point then.

No, sir, I didn't make any plot. You see, things were happening fast and you don't have time to take true bearings, exact times, and plot.

We changed course ten more degrees left, and rang her down to half. Half speed is 10 knots.

What did the bearing do then?

Well, Sir, the bearing was now about two and a half points on the bow. But it was pretty steady again. She must have changed course on me again!

Yes, Sir, we could see that this target was changing fast. We watched her close. The captain or I was at the radar at all times, and we also tried to pick her up through the fog. But we didn't see her. The bearing was still a little over two points, but it was not moving very fast, so we decided to watch her real close, and if she crowded any more, we would make another change to the left, and give her plenty of room.

Well, at 2355 we swung around to 330. The range was about a mile now, and this course change put her about three and a half points on the bow—maybe a little more. After we settled on the new course, I took another look at the scope. We were still closing, but the bearing seemed to be dropping aft. I went to the bridge windows and the captain stayed near the radar. In a few minutes—I don't know exactly how long, but it was only a short time—I saw her. She must have come around again, and hard, this time.

I hollered, "Full Left," and the captain put the telegraph full astern; but we hit her on the port quarter. She must have swung clear around on me.

Lights?

No, Sir, I didn't see any lights until it was too late. Yes, Sir, we had started to swing left, but I'd say we were on about 325 when we crashed. I didn't check it.

This is a fictitious but not fanciful account of a deck officer who was busy "using" his radar. He was obviously trying to avert danger, but he maneuvered into a collision, almost as though he had planned it carefully.

He made many errors: He did not take or record accurate information from his radar; he made note of the fact that the bearing was changing to the left as the range closed, but concluded, in error, that he should change course to the left to avoid being crowded; and, above all other errors, he did not make a plot of his ranges and bearings as he got them.

If he had read his radar accurately, recorded the data, and made a simple plot, he would have known, by the time he "came left a little" in the first place, that the target he was observing was a vessel on course 311 degrees true, at speed 5.6 knots; he would have known that if he made no change at all in either course or speed, the target would have passed 4 miles ahead; that the closest point of approach would have then been 1.4 miles on bearing 290 degrees true; and, if he decided to change course, for any reason, he should have altered to his right, and not left.

The plot would have taken no longer than 10 minutes (4 minutes after the first 3 readings were taken at intervals of 3 minutes) at which time the range between vessels was still 8 miles!

For the plot of this target which "was changing fast," see the June 1957 issue of MSTS Magazine.

Conclusion: Many collisions have occurred because ships' officers were too busy to plot; but none, of which I have knowledge, has occurred because the officers were too busy plotting.

Section 7.16

"A REVIEW OF CASUALTIES"

(Reprinted from Proceedings of the Merchant Marine Council, USCG, November 1958)

During fiscal 1958 there were but five major casualties requiring the convening of a Marine Board of Investigation. The first--and most serious--occurred on the night of August 27, 1957 when the American freighter SS MORMACSURF was downbound in the Rio de La Plata, enroute from Rosario to Buenos Aires. The upbound Argentine passenger vessel, CIUDAD DE BUENOS AIRES, attempted to cross the course of the American ship, was struck on her starboard side at almost a right angle and sank in 23 minutes. We do not know the number of passengers and crew aboard the Argentine ship; the MORMACSURF rescued 78 persons, local craft rescued numerous others, but between 75 and 80 drowned.

No personnel or survivors from the CIUDAD DE BUENOS AIRES were available for interrogation by the Board and efforts to obtain copies of the record of an investigation conducted by the Argentine authorities were unsuccessful. It was therefore impossible for the Board to determine what caused the passenger vessel to cross the bow of the freighter; similarly no information was obtainable as to the condition and accessibility of the lifesaving equipment or other facts which might have disclosed why so many lives were lost. Coast Guard Headquarters has since been informed that the Argentine newspaper La Prensa quoted survivors as stating that "many passengers and crew who lost their lives could have lived if ordinary and basic precautions had been adopted." "There was not enough lifesaving equipment aboard and such equipment as there was, was not in good working condition."

The Board found that the MORMACSURF was not at fault in this collision.

Dredge Sunk

The second major casualty, in chronological order, occurred on September 10, 1957 when the Army Engineers dredge WILLIAM T. ROSSELL sank in Coos Bay, Oregon, after being struck by the outbound Norwegian freighter THORSHALL. Four men aboard the dredge were lost. The report by the Marine Board of Investigation has been received and is under review at Headquarters. As is customary, the facts found and the final action of the Commandant will appear in the Proceedings of the Merchant Marine Council.

The third major casualty happened on October 8, 1957--fortunately without loss of life. The USNS MISSION SAN MIGUEL, a T-2 type tanker, owned by the U. S. Navy, civilian manned, and operated in the Military Sea Transportation Service, was bound from Guam to Seattle, Washington,

under USN sailing orders which included positions to be traversed along a track passing through the Hawaiian Archipelago about 23 miles south of Maro Reef. In the evening of October 8 while proceeding at full speed--about 15 knots--weather overcast with rain squalls, the vessel struck this reef. On October 10, all personnel were removed by other Navy ships without injury or loss of life, and the vessel--valued at $2,000,000--was abandoned as a total loss.

The Board concluded that the cause and extent of the casualty were directly attributable to certain errors by several officers with regard to the navigation of the vessel and an absence of damage control. Appropriate disciplinary action was taken against the licenses held by these officers.

The fourth major casualty hit home. Three Coast Guardsmen were killed on February 12, 1958 during a storm in the Galveston Entrance Channel. Visibility at the time was practically zero and somehow their 40-foot craft on harbor entrance patrol duty came into collision with a barge being towed on a hawser by a Mexican vessel. As these three were the only persons on board, we shall never know exactly how this happened.

The fifth, and last of the major casualties during fiscal 1958, was rather spectacular. Two seamen died and several others were seriously injured when the Swedish freighter NEBRASKA and the small American tanker EMPRESS BAY collided under Manhattan Bridge, New York, shortly after midnight on June 25. The fire which enveloped both vessels spread to the bridge. The tanker sank, and raw gasoline seeped to the surface creating a condition which threatened all waterfront installations for miles, including the Brooklyn Navy Yard. One fire boat was damaged through collision while fighting the fire, and in the excitement a veteran news photographer dropped dead.

The report of the Marine Board into this case has not been received at Headquarters as yet. The results will eventually appear in the Proceedings.

The statistical tabulations for fiscal 1958 on all marine casualties reported to the Coast Guard will be published in the Proceedings. Because of certain changes of method during the past year, it will be impossible to make a direct comparison with the figures in prior years. However, there has been no marked change; the number of vessel casualties continues to average about 150 per month, the personnel injury cases about 100 each month while the deaths from all causes will approximate 60 per month. The relationship between these last two averages is not consistent with that generally found, and it must be remembered that all deaths, of whatever cause, occurring on the Federal waters, high seas or in foreign ports on board or involving any American vessel--from a rowboat to an ocean liner--are defined as marine casualties and so recorded. This is not true of all personnel injuries; these are not required to be reported unless of sufficient seriousness to incapacitate the victim for over three days.

No Passenger Deaths

Once again a year has passed in which there were no deaths to passengers on any inspected American ship arising from a casualty to the ship or its equipment. In fact, during the year there were but two accidental deaths among passengers on our inspected vessels; one woman drowned in a swimming pool and a child fell down a ladder not intended for passenger use.

Other transportation industries publish statistics attesting to the safety of their operation. These figures, mentioning millions of passenger miles, are most impressive. It is presently impossible for the Coast Guard to furnish comparative figures because the classification "inspected vessel" includes not only the ocean-going passenger and freight ships, and the large ferry operations but also the small vessels of all types and sizes--even to cable drawn ferries of primitive construction--which have been inspected and certificated by the Coast Guard and on which no records are maintained as to the number of passengers carried or the miles run.

Since 1950 there have been only four instances when death of a passenger resulted from a casualty to an inspected vessel operating under the United States flag. This experience is a record which, in itself, is a commendation of the American maritime industry for providing the safest means of transportation ever devised since the ox cart.

At Coast Guard Headquarters those directly concerned with the review of marine casualties have great expectations of a new code system of accident classification, based upon the frequency experienced during the past five years. We believe it will furnish, with substantial accuracy, not only the statistical summations according to vessel class and service, waters, type of casualty, etc., but will also more specifically point up the causes of the accidents. The system is an adaptation of the American Standards Association code, with variations designed to illuminate the unique facets of the marine safety problem. In July we concluded our first full year of injury case coding under this system. It is expected that the results will be published in the Proceedings as these tabulations are completed. Certain facts which emerged during pilot run periods, when compared with statistical information from other sources--principally insurance companies--coincide to an encouraging degree.

Recreational Boating

In the pleasure boating field the number of fatal accidents has risen slightly from last year. Of the 375 boating deaths reported to, and investigated by, the Coast Guard, 170 (over 45 percent), resulted from capsizing. Of that number 123 drowned in the capsizing of outboard powered boats. For those interested in the grim statistics, a summation indicating the various causes of fatal accidents during recreational boating will be in the next issue of the Proceedings.

Although criminal recklessness is indicated as the primary cause in only two recreational boating casualties, there were 41 cases referred to the Department of Justice during the past year because of information obtained through investigations. In my opinion it would not be cruel and unusual punishment to compel those convicted of reckless operation of a boat to view the horribly mangled remains of a person chewed up by the propeller of a boat. We recently received close-up photographs of a skier who was killed this way, and I have personally investigated several such accidents. The last was of a young bride who fell asleep on the foredeck of a high-powered runabout which was towing her husband on skis. No one noticed that she had rolled overboard until the motor stalled with her leg wrapped around the propeller and shaft.

The primary purpose of casualty review is to assure as thorough an investigation as the circumstances would permit in order to see that all possible preventive or remedial action is taken. The secondary phase of the casualty review operation is the tabulation of accident statistics. More important than furnishing a background of facts for the promulgation of regulations, is the discovery of areas wherein there has been an increase of occurrences. This directs attention to the causes and compels effort toward their elimination.

Human Fault

One thing consistent in all statistics is that accidents caused by material failure are becoming increasingly rare; almost as rare as the "inevitable accident" or "act of God." Human fault, with varying degrees of culpability, is by far the cause of most casualties. In some cases the victim's only fault was his inexperience, but someone failed to instruct him in safe working methods. Young men, with but a few days or weeks on the job, are the most frequent victims in these circumstances. They are inclined to take chances; at that age the idea is strong that "it can't happen to me." It is a sad commentary that, of all young men who die in America between the ages of 15 and 25, over 65 percent are killed in accidents. With maturity there comes a reduction in the percentage of accidental deaths, but it is still a fact that until a man reaches 45 he's more apt to die from somebody's mistake than from any other single cause. To that age human error is more malignant than cancer or cardiac.

With this premise, we can agree that the vast field for accident prevention is in the mind. There will always be some of every age who can only be impressed through the seat of their pants--and that action should receive public support. But most accidents are caused by well intentioned people. Occasionally, through inexperience they do not recognize the danger, but that can be corrected by education. However, education does not appear to be the complete answer. We have many reports in which the person responsible knew of the danger. A friend of mine, above average in intelligence, knew full well that gasoline vapors are explosive, but that knowledge did not stop her from using gasoline

to clean draperies in her kitchen, completely forgetting the pilot light on her range. Every tankerman knows the danger of entering an unventilated tank, but each year experienced men die that way.

Here Are a Few Cases in Point

- Fishermen, on a cold night, tightly closed all doors and port holes, leaving a coal stove burning while they slept.

- An amateur racing enthusiast with a hydroplane obtained more RPMs with a smaller propeller, but the flywheel disintegrated.

- A shipyard worker used a burning torch on a non-gas-free tank.

- A deck hand on a fast tug tried to dip water from over the side with a bucket on a line. The line tangled on his foot.

- A group of men were working in a compartment. Some attempted to move a large CO_2 bottle without unhooking it from the line. They accidentally tripped the release lever. Then it was every man for himself.

- Someone forgot to lock a hatch beam in position.

- Rather than go around material piled on deck, a longshoreman tried to walk on the coaming of the open hatch.

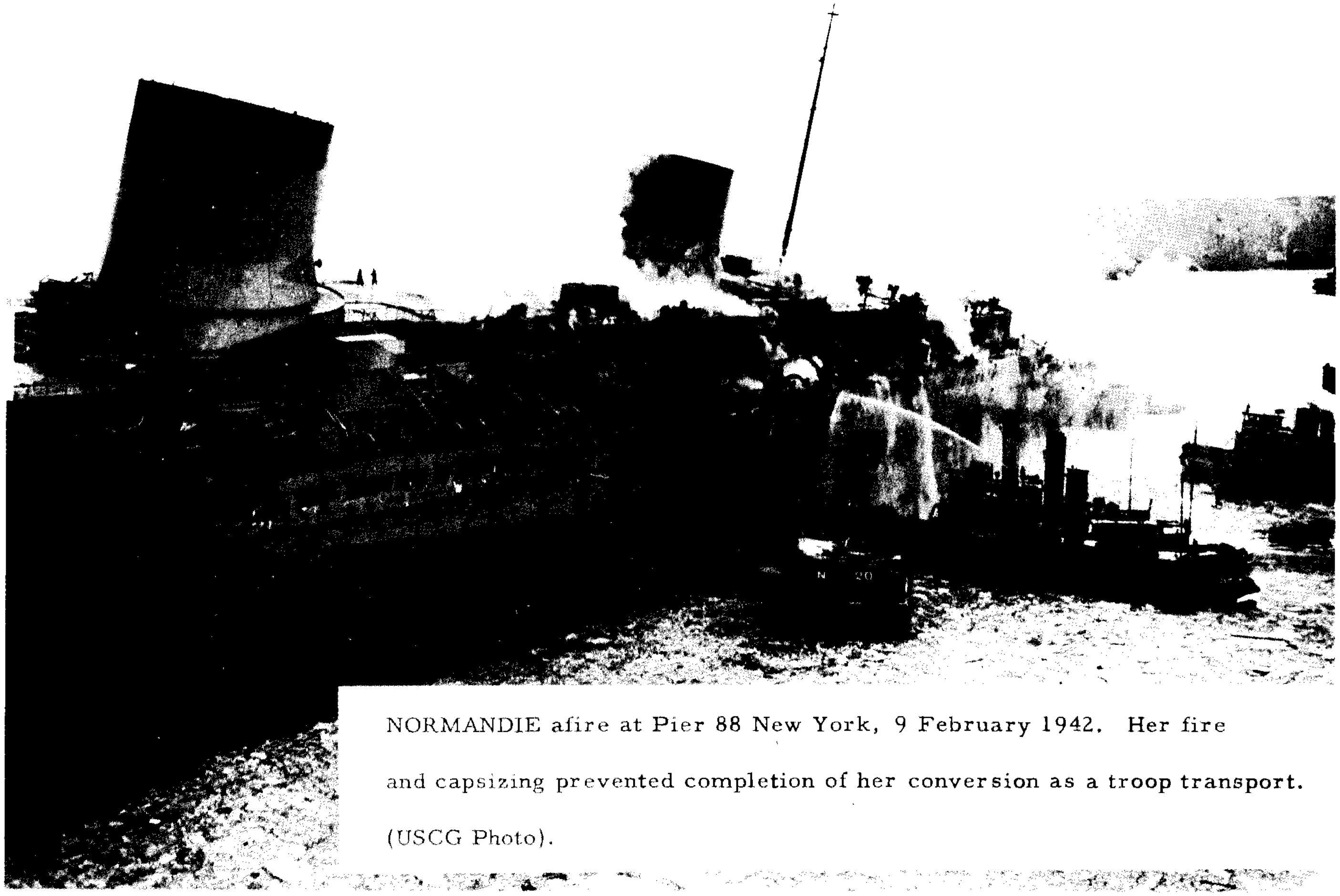
- An early morning sport fisherman took a chance running his boat without lights. In the collision he was NOT the man who was killed.

- Skin diving unaccompanied.

- He thought the gun was empty after they finished duck hunting.

In each of these instances there was no lack of knowledge as to the potential danger--just an absence of care, of foresight, of thinking.

Scientists tell us that the average human uses only a part of his brain power. Accident prevention is now aimed at making people think. Signs and slogans, campaigns and cartoons are all designed to drive into the conscious and subconscious the seeds of safety mindedness; to be so conditioned mentally that danger is recognized automatically, just as we automatically stop at the curb before attempting to walk across a busy street. The development of this safety impulse may hold the greatest promise for the future.



NORMANDIE afire at Pier 88 New York, 9 February 1942. Her fire and capsizing prevented completion of her conversion as a troop transport. (USCG Photo).

Section 7.17

THE NORMANDIE FIRE

In a comedy of errors, everything goes wrong throughout the play but all turns out well in the end. In the tragedy of errors that caused the Normandie fire and her loss, almost everything that could go wrong went wrong. The resultant loss of a critically needed troop transport was tragic for the United States and the war effort.

The Normandie was at one time the largest ship in the world, holder of the Atlantic Blue Ribbon, and the pride of France. When World War II broke out in September 1939, the Normandie was in New York and the French decided to leave her there. Then Hitler declared war on us in December 1941, and the Normandie was turned over to the U. S. Navy for conversion as an auxiliary transport to be named the USS LAFAYETTE.

The conversion job was only two weeks from completion on February 9, 1942. Already aboard were 400 naval personnel, 300 Coast Guardsmen, 1500 civilian mechanics, helpers and longshoremen, and supervisors from the Robins Dry Dock and Repair Co. who the Navy thought were to be responsible for all fire precautions.

On the afternoon of 9 February, a welder using an acetylene torch was burning away four ornamental stanchions in the ship's main lounge. When the job was practically done, the metal fire screen was removed and the fire watch started for the door. It was 2:45 p.m.; perhaps he was thinking of coffee time.

As the welder worked on the final cut, his back was practically touching some bundles of kapok life preservers which were wrapped in tar paper and burlap. Sparks from his torch set these bundles afire.

In the initial confusion of throwing bales from the vicinity of the fire, the fire watch's pail of water was kicked over and wasted. A nearby portable fire extinguisher was brought to the scene. It wouldn't work! Fire hose was led out from the racks, but they weren't connected! It wouldn't have mattered anyway since the fire hydrants had French threads while the hose fittings had American threads and wouldn't fit. The fire grew steadily worse.

It was eleven minutes after the fire started before the general alarm was sounded. When the bridge got the word, officers pulled the hook which would summon the New York City Fire Department. The system was out of order, and more valuable time was lost before the alarm was transmitted from the pier.

Successive alarms eventually brought a total of 36 fire trucks and three fire boats. By this time, smoke had spread longitudinally, fore and aft along the main passageways. Since no one seemed to know where the fire was, and where there is smoke there must be fire, 39 fire units poured straight streams of water almost the entire length of the ship. In fact, no one in authority asked any of the workmen where the fire had started.

The fire was finally brought under control after four hours of indiscriminant pouring-on of water. The damage resulting from the fire itself was estimated to be relatively slight. However, a large amount of run-off water was trapped in staterooms on the upper decks and levels. A slight list developed to port from the free surface effect of the loose water.

Now was the dramatic moment in this tragedy of errors for the man who knew the ship best to arrive on the scene and advise what to do to save her. But the pleadings of her designer, naval architect Yourkevitch, were ignored by the policemen who kept the crowds, and Mr. Yourkevitch, back.

Navy and Coast Guard salvage experts were on the scene. There was still time to save the ship! Since the river bottom was only eight feet under her keel, deliberate scuttling was considered. However, the ship was constructed without sea-cocks or sluice valves, and she lacked longitudinal bulkheads to prevent free water from flowing to the port side.

POLARIS* magazine described the salvage attempt as follows:

> "It was learned that seven of the Normandie's double-bottom tanks on the starboard side were empty. No plans of the ship that showed the exact location of these tanks were available, but the decision to flood was made in spite of the lack of information. A rough estimate was made of the location of these tanks, and holes were made in the side of the ship. The cuts were all made above the waterline and when a tank was located it was filled with water from a fire hose. Only four of the tanks could be found. Because of the location of the holes the tanks could not be filled to the top, and more free surface was created.
>
> "It was then decided that the water should be removed from the upper decks. The pumps that were set up for the job were not designed for the purpose and proved ineffective. Efforts to obtain adequate pumps were unsuccessful. Only holes cut in the upper plating would remove the water that was causing the ship to list. No one thought of that method, so the water remained.

*U. S. Merchant Marine Academy Publication, Winter 1955-56 edition.

"By 9:30 p.m. the list had increased to about 15 degrees, then remained constant for several hours. Hope was expressed that the list would not increase, and operations slackened. They did not want to cut any more holes in her, they did not want to scuttle her, and they did not want to have her capsize; they did not know what to do.

"At about midnight the list increased to approximately 35 degrees. Water was found to be entering several open ports and a garbage chute. Several persons tried to close these openings, but it was impossible to do so under the conditions. At 12:30 a.m. orders were issued to abandon the ship. Everyone stood around and watched to see what would happen. At 2:45 a.m. the once proud queen of the French Line and holder of the Atlantic Blue Ribbon capsized."

Millions of dollars and seven months of prodigious diving and salvage efforts were expended in trying to raise the Normandie. She was finally raised, but the superstructure had been removed, her machinery was practically useless, and the hull itself was split in several places. The Normandie was eventually sold for scrap.

TIME magazine posed the question--Was it sabotage or worse than sabotage--carelessness? A New York reporter a few weeks before the fire had signed-on as a longshoreman lugging furniture ashore. There was no security check made on him, and no security watches were stationed at the gangplanks. He testified that there were no fire drills and no fire station assignments.

LIFE magazine called it "a tragedy of negligence and incompetence as gross as Pearl Harbor."

What are the lessons to be learned from this tragedy of errors? They make a long list, but if any one of these items had been correctly handled, the sorry chain of errors might have been broken at some point, and the ship saved.

These are the lessons:

1. Highly flammable substances such as tar paper do not belong in a ship, or on a pier either, for that matter.

2. A fire watch must remain vigilant until the torch is out and all metal areas have cooled down. He should use a tested portable fire extinguisher, not a pail, in stand-by.

3. Portable fire extinguishers must be checked regularly.

4. In taking over a ship, the first step is to organize a fire bill and check out all firefighting equipment, including the methods of giving the alarm. The next step is to hold regular fire drills so that all hands know their assigned duties.

5. Investigation of fire must be thorough and cautious. The information must be reported and repeated to the bridge or damage control central.

6. Fire alarms must be sent promptly to city fire departments while berthed at a pier in a port city. After all, it is their city the ship is berthed at. Also, a messenger must be stationed at the gangplank to direct the city firemen to the fire.

7. The relative advantages and disadvantages of water fog and of straight streams of water to fight shipboard fires were demonstrated to Navy personnel during World War II. Shore firemen are generally not too concerned with run-off water and tend to prefer the straight stream over fog in fighting fires.

8. If you would save your ship, you must KNOW YOUR SHIP, especially the operation of all built-in systems and the location and use of all emergency gear.

9. Ships should be constructed with sufficient transverse and longitudinal bulkheads to prevent progressive flooding. When the general alarm sounds for fire or collision, watertight integrity must be set immediately and maintained by all hands.

10. You cannot pour tons of water onto the upper decks of a ship without seriously affecting its stability. This added weight high in the ship must be run-off, drained down into the ship and pumped out, or counterbalanced by additional ballast in the double bottoms, holds, or side tanks.

11. Firemen in port cities are becoming increasingly aware of the problems of ship stability in firefighting aboard ship.

12. A ship at the dock or in the shipyard, especially with work going on, is far more vulnerable to fire than at sea. Planning, organization, and prevention are a must!

SECTION 7.18

TRAINING PAYS DIVIDENDS

(Reprinted from Proceedings of the Merchant Marine Council, USCG, February 1959.)

An outstanding example of shipboard training paid dividends. The Isthmian Lines SS STEEL AGE was on the 1,472 mile leg between Djibouti and Karachi when the following message crackled over the air waves:

XXX URGENT TO ALL SHIPS

CROSTAFELS/DDTM 0530 GMT IN POSITION 23.21N 65.02E COURSE 50 DEGREES SPEED 10 KNOTS X HATCH NO 5 ON FIRE X EXTINGUISHING BY WATER IMPOSSIBLE BEING CALCUIM CARBIDE X SHIPS IN VICINITY WITH CO2 PLEASE STAND BY

Quickly ascertaining the distance between the 2 ships as 74 miles, Captain W. W. Meyer of the STEEL AGE, notified the German freighter CROSTAFELS of his position and that he was en route to render assistance. The STEEL AGE, ex SEA FLASHER, is a C-3 type ship fitted with 71 100-pound bottles of CO_2 in its main bank.

Through radio contact, particulars of the CROSTAFELS' emergency equipment, size of the hold on fire, and other information was obtained. The motor lifeboat of the STEEL AGE was prepared for launching. Twelve 100-pound CO_2 cylinders were loaded in the boat with piping, hose, a self contained breathing apparatus, and a fresh air breathing rig.

The Chief Mate, Third Mate, Chief Engineer, First Assistant, and six unlicensed men manned the boat. Once aboard the German freighter, a consultation was held with the Master. With the hatches and ventilators securely battened down, it was decided to cut a hole in the deck and release the CO_2 bottles one at a time into the hold. This was done and, with the fire under control, the CROSTAFELS was able to proceed on its destination.

The STEEL AGE's fire and rescue party was back aboard their ship less than 2 hours after leaving it. In his report of this effective open sea rescue work, Captain Meyer said:

"The safety and education program as carried out on this vessel during the present voyage proved of considerable benefit in our successful assistance of the German vessel. All the officers and crew who assembled the emergency equipment and operated same on the CROSTAFELS were very familiar with its use, as well as the equipment's limitations. By being well acquainted and having recently witnessed active demonstration of the emergency gear, the men lost no time in employing the equipment once on board the stricken vessel.

"It is never pleasant to be faced with a near disaster to gain experience in the ability of our emergency equipment, but the men of the STEEL AGE who were fortunate enough to be included in the assisting crew, saw quite forcefully demonstrated how the CO_2 gas, O.B.A., and Fresh Air Mask equipment are of great importance.

"I am sure that the feeling of my crew is that the time taken at each weekly drill and further education conducted during the monthly departmental safety meetings in the explanation and active use of the various pieces of equipment, is most worthwhile.

"I can report that our assistance to the CROSTAFELS was carried out in a seamanlike manner by the participating men. This I attribute to the men knowing what was required and the knowledge that if the equipment was properly used, a serious condition of fire at sea, even on a strange vessel, could be succesfully combated by them."

Let's not kid ourselves -- in accomplishing a feat of this type, training does pay off.

SECTION 7.19

REVIEW OF MARINE CASUALTIES, FY 1959

(Condensed from Proceedings of the Merchant Marine Council, USCG, January 1960)

During fiscal 1959 there were 10 casualties considered to be of sufficient importance to require investigation by Marine Boards. This is twice the number of cases investigated by Marine Boards during the previous fiscal year. The most significant of these 10 casualties are summarized below:

I. GULFOIL - S. E. GRAHAM

The first Board case involved the collision between the tankers GULFOIL and S. E. GRAHAM. The collision occurred in dense fog at the entrance to the East Passage of Narragansett Bay, R.I., at 0553, 7 August 1958.

The inbound GRAHAM was fully loaded with gasoline; the outbound GULFOIL was partially ballasted with a number of empty tanks which were not gas free.

As the vessels approached the narrow entrance to Narragansett Bay, between Conanicut Island and Newport Neck, each was proceeding at reduced speed with radars in constant operation due to low visibility. Although the buoy on Bull Point was on the radar screen until close aboard, it had not been seen or heard on the GULFOIL and her master was reluctant to alter course to the right, as the pilot proposed, until he had satisfied himself that his vessel was clear of the point. It had still not been sighted when the fog signals of the GRAHAM were heard on the starboard bow, close aboard, and shortly thereafter she loomed out of the fog scarcely 50 feet from the bow of the GULFOIL. Collision appeared imminent, and the general alarm was rung as the engines were ordered full astern.

Only the master and the helmsman were on the bridge of the GRAHAM; there was no lookout on the bow as she proceeded cautiously toward the bay entrance. On the radar screen, the master could see Bull Point Buoy and a much larger target (the GULFOIL) proceeding out. The GRAHAM's master expected the larger target to alter course to the westward as she passed Bull Point Buoy ahead but he noticed the GULFOIL was not changing course as he heard her fog signals on the GRAHAM's port bow. He altered course to the right, heading for Fort Adams as each blast on the fog whistle appeared closer than the preceding one. Just before the collision he rang the general alarm.

The GRAHAM was dead in the water, or nearly so, when her No. 1 port cargo tank was penetrated by the bow of the GULFOIL, a circumstance which permitted her cargo of gasoline to escape and probably ignite through the impact. In the almost instantaneous fire which engulfed both vessels, the crews were driven overboard and 17 crew members, among them the master, of the GULFOIL were known to have lost their lives. Their bodies were recovered but one other disappeared and is presumed dead. Others of the GULFOIL crew suffered varying degrees of injury through burns and immersion, while those from the GRAHAM escaped relatively unscathed.

Shortly after the collision, the GULFOIL grounded on Newport Neck in the vicinity of Fort Adams, where her No. 8 tank, which was not gas free exploded. The GRAHAM, aflame from stem to stern, drifted with the flooding tide into Narragansett Bay, where she was grounded by vessels of the U.S. Navy and Coast Guard on the north end of Rose Island. The fires on both vessels continued to rage until the next day when they were finally extinguished by units of the Newport Naval Command and those of the First Coast Guard District. As a result of the collision, fires, and explosions, both vessels incurred severe structural damage.

The Board found that the fault lay with the GULFOIL in that her master, who was responsible for her navigation, failed to act on the advice of the pilot.

Damage to the GULFOIL was reported to be in excess of $1 million. The GRAHAM was considered a total loss with damage amounting to approximately $500,000 and $100,000 to her cargo.

II. THE CARL D. BRADLEY

Another Board was convened to investigate the sinking of the CARL D. BRADLEY in Lake Michigan on 18 November 1958. This was by far the most serious casualty of the year.

The BRADLEY was a self-unloading bulk freighter built in 1927. She departed Gary, Ind. 17 November 1958 en route to Calcite, Mich. in ballast. The weather forecast was for whole gale winds of 50 to 65 miles per hour from the south, shifting to the southwest. The vessel proceeded up Lake Michigan hugging the western shore and, although the wind continued to increase, the vessel was riding easily. In the vicinity of Cana Island in the early afternoon of 18 November, course was altered to the northeast across the lake toward Lansing Shoal. Speed was 14 to 15 knots. The seas on the starboard quarter were estimated to be 20 feet high with 50 to 75 feet between crests but the vessel was riding smoothly both as to roll and to pitch. In describing these conditions, one of the survivors stated that the sideboards for the mess table were not required at the evening meal. It was at 1730, just at dusk, when suddenly an omincus thud was heard. Looking aft, the Chief Mate, one of the two survivors, saw the stern sagging. There was no doubt in anyone's mind that the vessel was in serious trouble. The general alarm was sounded and distress calls were sent out. Within 3 minutes the ship heaved up amidships and apparently broke in two. Subsequent information indicates that the vessel suffered extensive fractures, but that the two halves did not completely separate. Four men from the forward section managed to reach the life raft that had been stowed forward but two of these were lost during the night. A lifeboat from the after section was later found overturned but whether or not it was successfully launched and later capsized is not known.

Weather conditions and darkness severely handicapped the search and despite the fact that there was a German motor vessel close at hand when the disaster struck and response to the distress call was prompt, it wasn't until after daylight that the two survivors were located and bodies were recovered from the water.

After review of the case, it was concluded that there was evidence of a structural weakness. Since there are other vessels of similar age and design it was recognized that this could be of tremendous significance. A program of technical evaluation to determine if there was evidence of structural weakness in other bulk carriers operating on the Lakes was immediately embarked upon. In addition it was apparent that Coast Guard inspection procedures should be reexamined in an effort to increase the possibility of detecting structural weakness. This program is now in progress. Of course, the early detection of structural weaknesses by the Coast Guard is not the final answer. Owners and operators still have the initial responsibility to set up overall safe operating and maintenance standards and this is in addition to the master's responsibility to see that such standards are adhered to on the day-to-day and voyage-to-voyage basis.

The cause of the vessel sinking was, of course, of utmost importance but also, as a result of this casualty, special study by the Merchant Marine Council is to be given to the possible need for an additional liferaft and the need for mechanical disengaging apparatus on lifeboats on Great Lakes vessels.

III. PASSENGER LINERS

Of particular importance this past year were the two collisions each involving one of our top passenger liners. These cases were doubly significant because both were fog collisions in which radar was a factor.

Oddly enough, our casualty tabulations for the year reveal that another year has passed without death to a single passenger aboard an inspected passenger vessel as a result of a vessel casualty. I wish I could say that we point with pride to this record. Actually, but for the grace of God, this might have been the worst year for passenger casualties aboard U. S. inspected vessels since 1934 when 124 persons were killed on the MORRO CASTLE.

A. CONSTITUTION-JALANTA

The first of these two collisions involved the CONSTITUTION and a Norwegian tanker, the JALANTA, about 5 miles southeast of Ambrose Light, at 10:40 a.m. on 1 March. The CONSTITUTION was approaching Ambrose Light Vessel on a northerly course en route from Newport News, Va., to New York with 116 crew members and 33 additional persons. At approximately 0955, fog was encountered. The master began conning the vessel by radar and fog signals were sounded. The vessel was making slightly more than 18 knots and this speed was maintained. The radar target later identified to be the JALANTA was first sighted 5° on the port bow, 7½ miles distant. Based on continued observations, the master concluded that the target was on an opposite parallel course but no plot was maintained. According to the course recorder, the CONSTITUTION began coming right easily 8 minutes before the collision, from a heading of 000° T, and was steadied briefly on about 035° T. When the target was 2 miles away on the port bow, it was lost in the sea return on the radar scope. At about 1037, 3 minutes before the collision, the fog signal of another vessel was heard on the port bow. Two minutes later the signal was again heard on the port bow, at which time engine speed was reduced to the RPM which would deliver 11.1 knots when momentum was finally lost. However, almost immediately, the bow of the JALANTA appeared out of the fog one-quarter mile off, fine on the port bow, on a course at right angles to that of the CONSTITUTION. Full astern and hard right rudder were immediately ordered on the CONSTITUTION but were not sufficient to prevent the collision.

The JALANTA, in ballast but not gas free, had taken departure at about 10 o'clock approximately 2 miles off Ambrose en route to Aruba. At 1005 visibility decreased, speed was reduced to one-half ahead, fog signals were commenced and a course of 144° T. was set. This course was maintained up until the time of the collision. Although no radar plots were made, the vessel navigated with caution by proceeding at greatly reduced speed and using the radar to supplement eyes and ears. Sea return also affected the JALANTA's radar, depriving her of bearings and ranges for several minutes before the collision. She was proceeding at 5 knots when the signal of the CONSTITUTION was first reported abeam. Speed was reduced to dead slow and the Master, upon hearing the second signal, concluded the sound was forward of the beam and stopped his engines. Within moments, the CONSTITUTION appeared out of the fog forward of the beam one-quarter of a mile away. The JALANTA ordered full astern and the vessel was estimated to be dead in the water at the time of impact.

The bow of the CONSTITUTION almost completely severed the bow of the JALANTA forward of her pilothouse and approximately 25 minutes later the bow finally broke off. Considerable hull damage was sustained by the bow of the CONSTITUTION; miraculously, however, since the JALANTA was not gas free, there was no fire or explosion and there were no lives lost and no injuries to any persons.

Unquestionably, had a radar plot been maintained aboard the CONSTITUTION, the true course of the JALANTA would have been determined and the collision could thereby have been avoided, but only because the JALANTA maintained the same course throughout. In weighing the merits of the radar plot in this case we must not lose sight of the fact that the JALANTA could have changed course at any time and, had she done so after the sea return obscured the CONSTITUTION's scope, any information gleaned from previous plotting would have been useless. The principal fault, however, was the excessive speed and failure to stop when the fog signals of the JALANTA were heard forward of the beam. Had the requirements of the law been adhered to in this case the collision would never have occurred.

B. SANTA ROSA - VALCHEM

The second case involved the SANTA ROSA and the tanker VALCHEM. This collision occurred at 0301 e.s.t., 26 March 1959. The failure to comply with the Rules of the Road once again accounted for the loss of 4 lives, injuries to 21 persons, and nearly $2,000,000 in property damage.

The SANTA ROSA, en route Pt. Everglades, Fla., to New York with 247 passengers, was proceeding at 21 knots on a northerly course off the Jersey coast in patchy fog. Ten minutes before the collision, the VALCHEM was picked up on radar 5° on the starboard bow 4.9 miles away. Two ranges and bearings were taken 3 minutes apart and plotted and it was estimated that the VALCHEM was heading 202½° making 16 knots. These courses were converging slightly and it was further estimated that the two vessels would pass three-tenths of a mile apart. In the next 5 minutes, until collision occurred, no further plots were made. Course was altered about 10° to the left to allow for more room. Four minutes before collision, a fog signal was heard off the starboard bow. A glance at the radar showed the VALCHEM had changed course to her own right. Two minutes before collision the fog signal of the other vessel was again heard. The SANTA ROSA was ordered full left. In less than a minute the VALCHEM appeared out of the fog one-fourth of a mile away ½ to 2 points on the starboard bow and moving fast. Hoping to clear the stern of the VALCHEM, the rudder was shifted to full right. Up until this time the engines, which were still going full ahead, were finally rung full astern by the mate on watch.

The VALCHEM, outbound from New York en route to Baytown, Tex., was empty, but not gas free. She first saw the SANTA ROSA on radar at 8 miles 1° or 2° on the starboard bow. Ten minutes before the collision the VALCHEM was on 194° T., speed 16 knots. Course was altered to the right and 6 minutes before the collision the VALCHEM steadied briefly on 210°. With the SANTA ROSA now 15° on the port bow, the VALCHEM began coming more to the right in 5° or 10° increments. The SANTA ROSA continued to bear down on the VALCHEM on a collision course. Two separate fog signals were heard aboard the VALCHEM and at the time of the second, about 2 minutes before collision, the engine was ordered stopped. The SANTA ROSA finally appeared out of the fog 100 yards off the port beam. The VALCHEM was still coming right, heading about 257° T., and making between 13 and 14 knots when the bow of the SANTA ROSA penetrated the engineering spaces.

Once again fate was instrumental in preventing the explosion and fire which so often accompanies collisions with empty tankers.

In this casualty, as in the previous case, the principal cause was violation of the International Rules--specifically immoderate speed and failure to stop when a fog signal was heard forward of the beam.

The misinterpretation of the radar aboard the VALCHEM needs no comment but the use of the radar aboard the SANTA ROSA is particularly interesting when considered in the light of the CONSTITUTION-JALANTA case.

Although it could hardly be considered timely in the light of the speed she was making, the SANTA ROSA did plot two ranges and bearings from which a predicted course and speed was obtained. If you will recall the VALCHEM was first picked up on the radar 10 minutes before collision and it was about that time that the VALCHEM began coming gradually to her own right from course 194° T. In other words the plotting which could have aided the CONSTITUTION did not and could not provide the information sought by the SANTA ROSA simply because the VALCHEM was not steadied on a course at the time the observations were made.

Even when plotted radar observations establish a course and speed, there is still no assurance that the other vessel is not going to change her mind at the last minute. It has been suggested that radio communication between vessels might overcome this diffuclty. If all ships could be required to have radio and the problem of cluttered frequencies and a practical universal language could be overcome there would still be the problem of pairing off radio transmissions with radar targets when more than one appears on the scope.

Neither of these cases did anything to change the Coast Guard's view that radar is still only an aid to navigation. Undoubtedly a safe system of navigation in fog can be devised. Obviously it is not here now. In the meantime the Rules of the Road is the only effective anticollision device.

IV. TABULATIONS OF CASUALTIES.

During fiscal 1959 there were 5,016 marine casualty cases reported to the Coast Guard. This includes 3,125 cases involving vessel casualty and 1,891 cases of personal accident not involving vessel casualty. An even 200 persons were killed in vessel casualties involving commercial vessels of all sizes and 358 persons were killed in vessel casualties involving pleasure boats. On commercial vessels 211 persons died as the result of personal accidents and 1,393 persons were injured and incapacitated in excess of 72 hours.

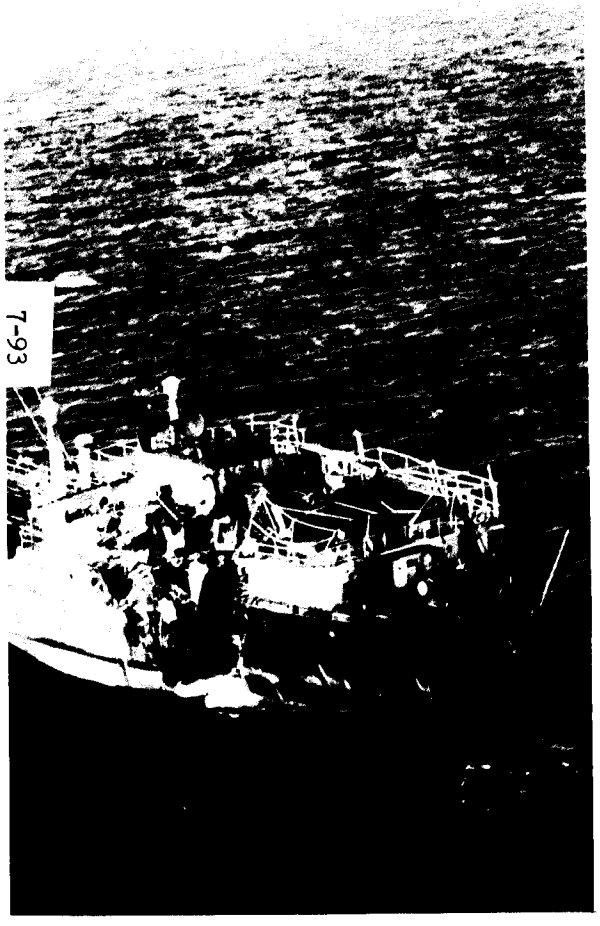
The tabulations thus compiled permit some interesting observations. The greatest loss of life on commercial vessels occurred as the result of foundering, sinking, or capsizing. Out of a total of 96 lives lost, 3 were lost on inland uninspected tugs, 33 were lost on the BRADLEY, and the remaining 60 were lost on commercial fishing vessels. In 24 cases, out of the 78 which involved fishing vessels, the failure of equipment or unseaworthiness was the principal cause. These vessels are not inspected by the Coast Guard.

On commercial vessels explosions and fires, which were not the result of any other casualty, accounted for 22 deaths, only one of which was on a tank ship and only 2 on tank barges.

It will probably come as a surprise to no one to learn that in grounding cases and collision cases which involved either another vessel or some other object, personnel fault appeared as the largest single cause.

In the tabulation of personal accidents aboard commercial vessels, the greatest number of deaths resulted from natural causes which accounted for 174 and of which 108 were crew members who died of one of the cardiovascular diseases. The second largest group of deaths resulted from falling overboard. One hundred and four persons were lost in this type of accident. Next year we hope that there will be a marked decline in this category as a result of the recent Coast Guard approval of a work-type lifevest and the publicity that has been given it. Tugs and barges usually account for a large number of the casualties occurring in this category. This year was no exception. The final score was tugs 18 and barges 22.

VALCHEM & SANTA ROSA AFTER COLLISION IN FOG, MARCH 26, 1959, OFF ATLANTIC CITY. FOUR DEAD SIXTEEN INJURED ON TANKER.



7-93

COMSTSINST 3541.5B
13 Sep 1965

Section 7.20

SEAMANSHIP—PRUDENCE—RULES OF THE ROAD

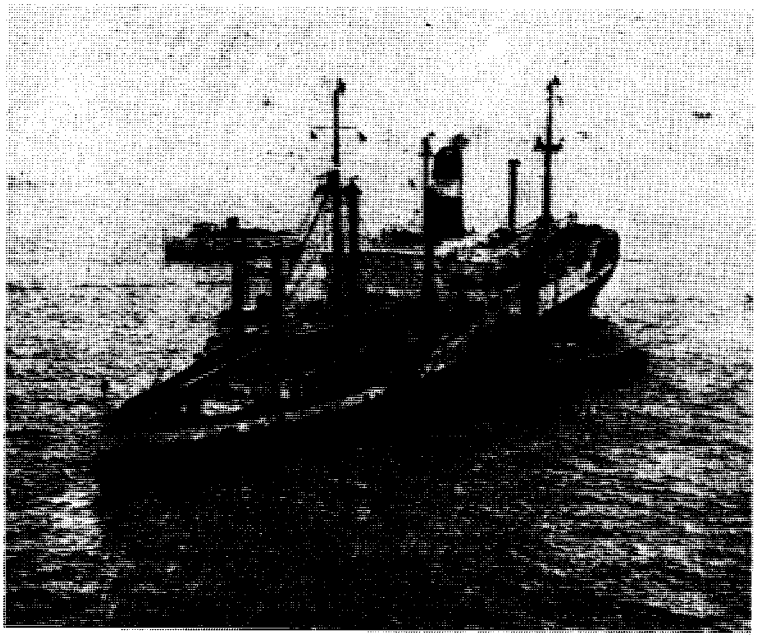
(Reprinted from Proceedings of the Merchant Marine Council, USCG, April 1957)

UNCERTAINTY, confusion, and speed were the contributing factors to a collision that teetered on the brink of disaster between a crack American flag cruise ship and a foreign freighter is a case recently decided in U. S. Court of Appeals, Second Circuit.

Ability of the passenger ship to beach herself without loss of life or serious injury to her 114 passengers and crew, with a 35 x 38 foot hole gashed in her side from main deck to turn of bilge, prevented a catastrophe.

In the libel in admiralty by Det Forenede Dampshibs-Selskab, A. S., owner of the MV *Colombia,* against the SS *Excalibur* and her owner, the American Export Lines, the U. S. Court, Eastern District of New York, held the *Excalibur* solely responsible for the collision between the two vessels The U. S. Court of Appeals affirmed the trial court (216 F. 2d 84).

Circuit Judge Harold R. Medina's entire opinion is quoted below as an excellent illustration of the necessity for prudent seamanship despite being under pilotage and in sheltered waters.



BEACHED: Shortly after the collision the SS *Excalibur* was put ashore on Bay Ridge Flats where she stayed for 10 days preparing for shift to a nearby New York shipyard.

COURT'S OPINION

"The collision occurred on an ebb tide of two knots in the early afternoon of a clear summer day, under ideal weather conditions, and without the presence of interfering traffic, on the easterly side of the Main Ship Channel leading from the Narrows to New York Harbor, a short distance northwest of the Bay Ridge Channel Junction Buoy.

"The *Colombia,* a cargo vessel carrying a few passengers, was inbound from Philadelphia, and the *Excalibur,* a combination passenger and cargo vessel, with 114 passengers aboard, was leaving for Mediterranean ports. Each was a large vessel, the *Colombia* about 416 feet long, of 5146 gross tons and the *Excalibur* 452 feet, with a gross tonnage of 9644. As they sighted one another at a distance of three miles, each was on the starboard side of the channel proceeding at full speed or an aggregate of 24 nautical miles an hour over the ground.

"The version of the sequence of events as given by those on board the *Excalibur* is so fantastic and in such conflict with the probabilities and established facts that we shall pass it over. The real question is whether the *Colombia* also was at fault.

"The preliminary movements of the two vessels are pretty well established. At all times the *Colombia* was on the easterly side of the channel where she belonged. But the *Excalibur,* when she reached a point abeam of Robbins Reef, swung to port and crossed over to the Brooklyn side of the channel so that her captain might wave to his wife as he went by. As the Narrow Channel Rule, Article 25, Inland Rules, 33 U. S. C. A. § 210, was applicable to this main and often crowded artery of traffic in and out of New York Harbor, the *Excalibur* should have held to starboard as the usual course was unquestionably safe and practicable. This was a statutory fault, as held by the trial judge, and it remains such even though the course to port, under such circumstances as here obtained, might seemingly be carried out in safety. One who deviates from the rules must take, at least to some extent, the risk of subsequent events.

NO STEAM FEATHER

"Having changed her course the *Excalibur* sounded two blasts for a starboard to starboard passing and the *Colombia* responded. As she was diesel-powered, the usual white feather of steam did not appear at her funnel head, but the responsive two blasts were nonetheless given. As the windows on the deckhouse of the *Excalibur* were closed, the signals from the *Colombia* were not heard. Accordingly, in compliance with Article 18, Rule III, 33 U. S. C. A. § 203, the *Excalibur* should have immediately sounded the danger signal of not less than four short and rapid blasts; but she did not. This was a serious delinquency at a critical moment and set the stage for what followed.

"The *Colombia* in response to the agreement on a starboard to starboard passing changed her course to port. As the *Colombia* responded to this change of course the vessels continued at full speed ahead and were in close proximity of one another, with every prospect of a safe starboard to starboard passing.

"Then came the final and disastrous step in the series of errors committed by the *Excalibur.* Probably because of the confusion resulting from what those in the wheelhouse of the *Excalibur* must have considered a failure

RESCUE CRAFT: Gathered around the MV *Colombia* are commercial tugs and Coast Guard cutters fighting fire after collision with SS *Excalibur*.

of the *Colombia* to respond to the two blast call for a starboard to starboard passing, all of which might readily have been dispelled by a compliance with Article 18, Rule III, and in some measure due also to inattention or faulty observation, the *Excalibur* decided to get back on the starboard side of the channel, or at least to mid channel, and sounded one blast, calling for a complete reversal of the course previously agreed upon. Not only this, but even before giving this signal, she already had changed her course to starboard. This was established by the testimony of several witnesses. Thus, on a set of facts scarcely open to any serious dispute, we find the two vessels turning in the same direction, with the *Excalibur* headed for a position immediately in the path of the *Colombia;* neither had settled on a course straight ahead.

SERIOUS CONTROVERSY

"Aside from speculations and expressions of mental operations concerning what might or might not have happened, and the reasons for doing this or that, we now enter the area of serious controversy. The distance between the two vessels when the *Excalibur* switched her signals is in dispute. We think the evidence amply supports the finding of the trial judge that the single blast was sounded when only a half a mile separated the two ships. At the speed with which they were approaching one another this distance would be traversed in something like seventy-five seconds. The trial judge found that this final change of course and the giving of the one blast call for a port to port passing placed the vessels 'almost in extremis.' We find that there was no 'almost' about it; the vessels then were in extremis.

"The principal contentions of the *Excalibur* are based upon what the *Colombia* did in the brief interval of time just prior to the collision. The pilot of the *Colombia* who had observed the *Excalibur* swinging to starboard before the change of signals, responded with one blast from his whistle, ordered the wheel hard astarboard, rang the engines full speed astern, gave the danger signal, followed by three blasts, the regulation backing signal. These actions followed one another in rapid sequence. They were all part of a single effort to avoid a collision, in the vain hope that the vessels might slide by one another, port to port. The claim that the giving of the single blast was a fault under these circumstances is completely unwarranted. The pilot testified that he did not see what else he could do; and we agree with him.

COLLISION IMMINENT

"As said by Judge Learned Hand in *City of New York* v. *American Export Lines,* 2 Cir., 1942, 131 F. 2d 902, 905: '* * * "it was in no sense an 'acceptance' of the 'Coney Island's' proposal; it was forced upon her willy-nilly by conduct which as we shall show was utterly unjustified."'

"Just as the *Excalibur* sounded the single blast above referred to the master of the *Colombia* was coming through the chart room, immediately aft of the wheelhouse. He saw that the *Colombia* was still swinging to port as the change of helm and the reversing of her engines had necessarily done no more than reduce the effect of the port helm previously in force; he could see that a collision was imminent as the *Excalibur* was then across his bow; he observed where the engine room and the passenger quarters of the *Excalibur* were located; and he ordered the second officer up to man the anchor and directed the quartermaster to hard aport. This probably averted a major disaster as the bow of the *Colombia,* a few seconds later, struck the *Excalibur* just forward of the passenger quarters. Incidentally, some notion of the confusion aboard the *Excalibur* may be derived from the undisputed fact that at the time of the collision the *Excalibur* was still proceeding at full speed and the vessels came together at an angle of seventy degrees.

"Whenever a master takes charge while a pilot is at his task, the claim is made that he is at fault in doing so; but it is safe to say that seldom if ever was the claim so lacking in substance as it is here. We agree with the trial judge who found that what the master did was not only not a fault but rather the act 'of a careful and intelligent master' in the performance of his duty. But, had it been otherwise, a mere error of judgment in such an emergency would have been of no avail to the *Excalibur.*

"Finally, in an endeavor to cast some doubt upon the master's testimony, which was credited by the trial judge, appellants say that the time interval and hence the distance between the two vessels was greater, because it was physically impossible for the second officer to make his way up to the bow in so short a time. But a man moves fast when his ship is about to hit another vessel amidships and this was but one of the many attendant circumstances which in the aggregate it was the duty of the trial court to consider.

"We are satisfied that he disregarded none of the proofs adduced before him and that the record presents no substantial error.

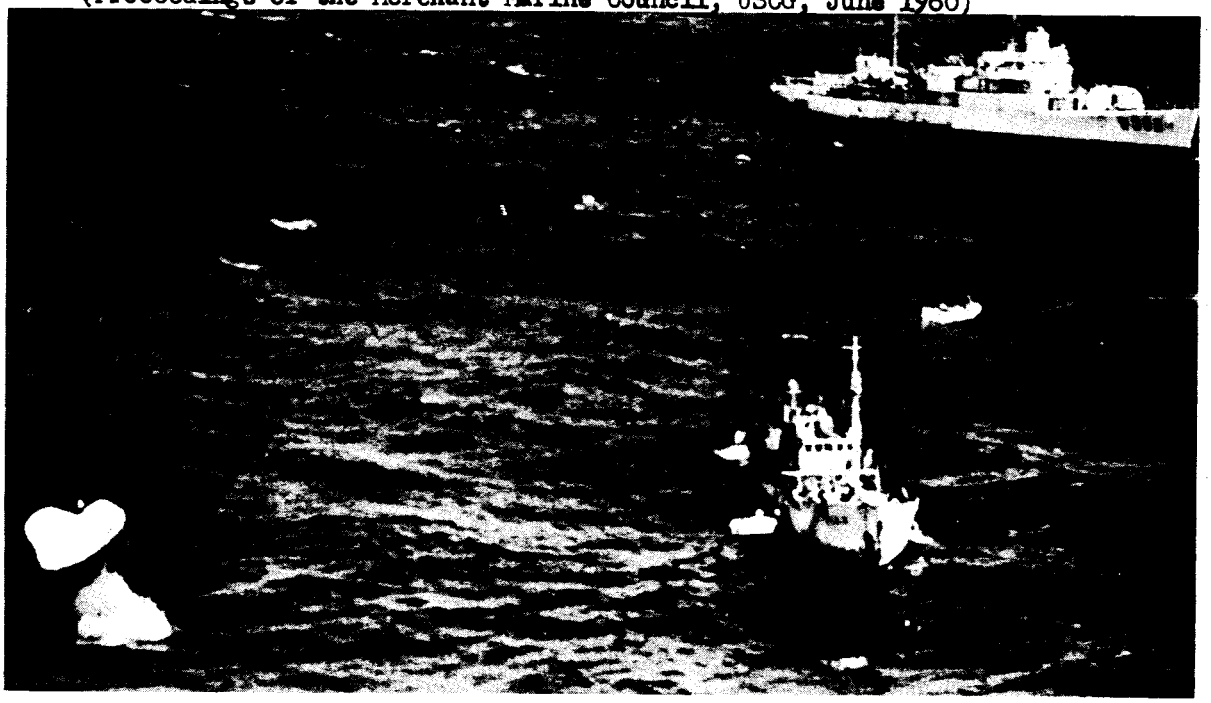
"Affirmed."

(Reprinted from Proceedings of the Merchant Marine Council, USCG, April 1957)

Section 7.21

PACIFIC RESCUE

(Proceedings of the Merchant Marine Council, USCG, June 1960)



SUCCESSFUL air-drops of 2,500 pounds of cement, gravel, sand, pump and other equipment from a new Coast Guard "Hercules" plane to assist the disabled vessel *Toyama Maru* (foreground). A work boat from the Cutter *Bering Strait* (background) retrieved the material and the cutter's damage control crew boarded the *Toyama Maru* to make temporary repairs.

A FINE EXAMPLE of teamwork, good seamanship, and ingenuity on the part of the officers and crew of the SS *M.E. Lombardi,* the U.S. Coast Guard Cutter *Bering Strait,* the U.S. Coast Guard Air Detachment, Barber's Point, Oahu, and the Rescue Coordination Center, 14th Coast Guard District, was demonstrated in the Pacific last February in what may be regarded as a unique air-sea rescue and repair of a vessel in distress.

The Japanese Fisheries-Training Ship, MV *Toyama Maru,* 175 miles north of Palmyra, was in distress and sinking. The SS *M.E. Lombardi,* a tanker of the California Shipping Company, went to her aid and helped in stopping a large leak in the hull of the training vessel, which had 20 students of high school age aboard and 20 seamen. Without question, the *Lombardi* saved the vessel from sinking. The tanker stood by until the arrival of the USCGC *Bering Strait,* whose damage control crew repaired the vessel with the assistance of air drops of sand, gravel and cement from a new SC-130 "Hercules" from Barber's Point, Oahu.

Here is the story in detail:

On February 13, 1960, the SS *M.E. Lombardi* was en route from Canton Island to Richmond and some 800 miles south of Honolulu. At 9:10 a.m. she received word that the MV *Toyama Maru* was in distress and sinking. The *M.E. Lombardi* proceeded to the vessel which was 78 miles to the southeast.

The distress call was transmitted by the U.S. Coast Guard from Honolulu and was picked up on the *Lombardi* by the automatic auto alarm. Accordingly, at 9:15 a.m., Captain Clayton Hiller of the *Lombardi* set the course for the position of the distressed vessel. The vessel was in heavy northeasterly weather with the wind east northeast force 5 and was heavily ballasted. At 10:00 a.m. the Coast Guard confirmed the *Lombardi* was the closest vessel to the scene.

With the change of course, the wind and sea were now abaft the beam and it was possible to run some sea water ballast out to increase the vessel's speed. At 11:10 a.m. radio contact was established with the disabled vessel whose Captain advised that they were sinking and might founder in two hours. The *Lombardi* estimated that she would be there in five and one-half hours. The Japanese vessel stated that they had 40 persons aboard and no lifeboats, only 2 rubber rafts.

At this time a bearing was taken on the *Toyama Maru* with the radio direction finder and the course changed on the strength of this bearing.

While under way, preparations were made for rescue work. No. 1 lifeboat and No. 3 lifeboat (a motorboat) were cleared for launching. All equipment was double checked to assure that it was in perfect working order.

Rope nettings were rigged from the after side of the main deck to assist in picking up survivors, and all deck gear that could possibly be used for rescue work was broken out and placed strategically about the decks. The Stewards Department prepared to handle 40 survivors. Bunks, coffee, blankets, and stretchers were made ready.

At 1:30 p.m. lookouts were placed aloft with binoculars. At 1:40 p.m. the *Toyama Maru* was sighted from aloft dead ahead at an estimated distance of 14 miles. At 1:15 the motor lifeboat was swung out and frapped in to the fish plates. A boat crew was selected from volunteers.

The Third Mate spoke Japanese and was most helpful throughout the entire operation.

The line throwing gun was rigged and readied for possible use. Due to the heavy seas running, the launching and retrieving procedure for the boat was thoroughly discussed and planned out in advance with the boat crew. In this regard the Chief Mate reported as follows:

> I thought you might also be interested in the following concerning safety procedures: A

preliminary briefing on boat launching and recovery with a demonstration of the proper and safest way of hooking on in a seaway with the boat's crew paid wonderful dividends. Despite a mean sea running alongside the ship, we hooked on and carried out a very smooth recovery without any damage or injury to boat or personnel. I realize "lady luck" was with us, and coordination between the ship and boat crew was excellent, but advance planning and a dry run including swinging out and frapping the boat in to the embarcation deck for immediate launching was principally responsible for a smooth job and a happy ending.

At 2:24 p.m. the U.S. Coast Guard Search and Rescue Plane arrived and circled. Captain Hiller contacted the plane on the radiotelephone and coordinated activities. At 2:48 p.m. the *Lombardi* hove to near the *Toyama Maru*. This vessel was flying the International Code Signal Flags "P.Q." with the meaning of "I have sprung a leak and require immediate assistance." The *Toyama Maru* had a rubber raft launched and alongside. This vessel indicated that she wished to put personnel aboard the *Lombardi* for a conference. Due to the rough sea and the short heavy swell, it was decided not to put a boat into the water but to haul the people over in the rubber raft.

Accordingly, Captain Hiller maneuvered the *Lombardi* close to the *Toyama Maru's* bow and a line was put aboard. Using this line, Captain Namura, the Chief Engineer, the Chief Mate and the Bosun were hove over in the raft.

A conference was held. The vessel had an 11-inch by 14-inch hole in her hull plating in the port side of the engine room. The crew had been able to get a collision mat over the hole and to check the flow of the water somewhat but the mat was wearing through and the situation was desperate. Captain Namura did not wish to abandon ship but hoped to make repairs with materials and assistance from the *Lombardi* and with the aid of equipment dropped by planes.

At 4:45 p.m. the motorboat was put into the water and shortly thereafter towed the raft with the Japanese Captain and his men back to his own vessel.

At 5:20 p.m. the Coast Guard Search and Rescue Plane dropped a pump into the sea. The pump was enclosed in a watertight tank that floated and was picked out of the sea by the *Lombardi's* motor lifeboat with considerable difficulty and put aboard the *Toyama Maru*.

Next action was to place all available sand (100 lbs.) and 2 sacks of cement aboard the *Toyama Maru*. This was done by the motorboat. (Emergency repairs can sometimes be made by building a box around the hole and filling it with cement.)

During the boat operation, numerous large sharks were noted around the boat and the ships.

About 6:00 p.m. the motor lifeboat was taken aboard.

The *Lombardi* circled the *Toyama Maru* throughout the entire night and kept her under constant watch. Arrangements were made to immediately establish radio contact should the situation worsen.

At 6 o'clock the next morning the *Toyama Maru* situation had improved A heavy sea was still running, and Captain Hiller advised the U.S Coast Guard in Honolulu that it would be unsafe to attempt to use the lifeboats to pick up any more air drops and that such action should be taken only in an extreme emergency.

On the request of Captain Namura 100 square feet of canvas and all available palms and sail needles were sent over to the *Toyama Maru* for use in making an additional collision mat. This was done by floating a line over 100 feet in length buoyed by 6 empty oil drums.

A second float with 400 feet of 3-inch circumference rope was made up and towed and dropped across the *Toyama Maru's* bow.

Throughout this second day the *Lombardi* maintained close watch and established radio contact with the U.S. Coast Guard Cutter *Bering Strait* that was due to arrive on the scene on the 15th at 6:00 p.m.

That night at 8:30 p.m. another Japanese fishing vessel, the *Norato Maru*, arrived. At the Coast Guard's request, the *Lombardi* remained on the scene.

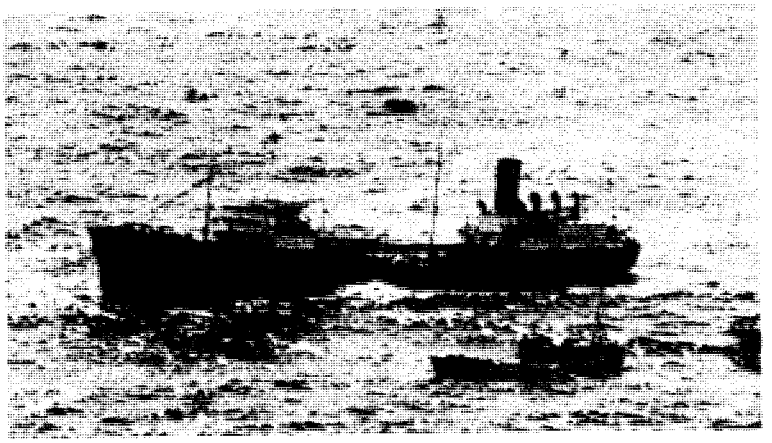
Next day, on the 15th, the *Lombardi* passed nails and lumber for building forms to the *Toyama Maru*. At 1:30 p.m. that day the *Lombardi* was released and continued her voyage.

The *Bering Strait* arrived to carry on the good work of the *Lombardi*. Coast Guard aircraft made a successful air-drop of 2,500 pounds of sand, gravel, and cement packed in 50-gallon drums, and some welding equipment. The material was retrieved by a self-bailing surfboat from the cutter and taken aboard the disabled vessel. The Engineering Officer of the cutter supervised the pouring of the quick-drying cement and the completion of a cofferdam by his damage control squad.

After standing by for sufficient time to make the repairs and for the cement to dry, the *Bering Strait* returned to Oahu. The *Toyama Maru* was able to get under way and reach Honolulu under escort of two Japanese fishing vessels.

Due to the extra fuel consumed, the *Lombardi* did not have sufficient bunkers to proceed directly to San Francisco with a safe reserve, so the vessel was diverted to Honolulu. She had been delayed 2 days, 04 hours, 45 minutes by the rescue operation and steamed some extra 180 miles.

Congratulations to all for a job well done.



PICTURED is the tanker *M. E. Lombardi* maneuvering along side the disabled Japanese fishing-training vessel *Toyama Maru*.

Ships That Pass in the Night

. . . BUT NOT QUITE!

BELIEVE it or not, darkness is more conducive to collisions than daylight. That bright conclusion is made clear in a Coast Guard report entitled, "A Statistical Analysis of Selected Marine Collisions During the Three Fiscal Years 1957, 1958, and 1959."

Out of 199 cases studied, involving commercial oceangoing and Great Lakes ships of over 500 gross tons, 111 collisions occurred at night. Of these, 80 (or 40 percent) took place in darkness where lights could be seen for over 5 miles. On the other hand, 41 collisions took place in daylight with visibility of over 5 miles, emphasizing the need for maintaining a good lookout, probably more so in clear weather.

The point is made that—like a personal injury—the difference between a major and a minor collision is usually only a matter of chance. The obvious conclusion is that the problem of collisions, as in personal injuries, is almost exclusively the human element.

Other significant facts and conclusions brought out in the report:

- Most collisions occured in locations where Inland Rules applied; in narrow channels; and under the "meeting" situation. (153 out of 199).
- About half of the ships involved in these collisions did not exchange passing signals.
- Of the 398 ships involved in the 199 collisions studied, 301 first became aware of their collision partners *visually*. Only 40 did so by radar.
- Article 18 of the Rules of the Road, covering meeting of vessels, was violated in some part at least by 105 of the ships. The next largest number, 64 ships, violated Article 16, *Speed in Fog.*

Causes of the collisions, in order of frequency, are listed as:

Excessive speed	77 ships
Wrong side of channel	58 ships
Failure to sound signals	45 ships
Failure to keep clear on part of overtaking vessel	29 ships
Turning left in the meeting situation	27 ships
Burdened vessel's failure to give way in the crossing situation	24 ships
Evasive maneuver too little or too late	21 ships

According to Maurice Foreman, Director of the COMSTS Training Division, and John Wolfe, Safety Director:

"In the light of these findings, the policy expressed in COMSTS Instruction 3530.1, *Ship's Safety and Use of Radar*, is even more appropriate. Close adherence to COMSTS policies for ship's safety will do much to reduce if not do away with collisions." ⚓

SECTION 7.23

TWO TALES OF WOE

(Reprinted from "Proceedings of the Merchant Marine Council," USCG, January 1961)

The Military Sea Transportation Service has drills which simulate real emergencies. Steering casualty drills are always conducted in broad open expanses of water away from the shipping lanes.

In one such drill, the Damage Control Instructor, who was conducting the drill, cut off the power to the rudder angle indicator on the bridge. The Master was the only one on the bridge who was aware that the ship was still answering her helm. The mate mistook the rudder angle indicator failure for a steering power failure and ordered the steering casualty team into action. They rushed to the steering engine room, secured the power to the steering motor, started to hook up the hand steering aft, and frantically searched for indications of the trouble. Meanwhile the ship made lazy circles in the sea. The Master put an end to all of this by ordering power back on the steering engine. He then took the helm himself and waited for the red-faced Mate to return to the bridge. The best time to have such things happen, if they must, is during practical drills on the open sea.

Years ago, a somewhat similar happening put a tanker on the beach in the Williamette River. The engineers were working on the IC generator which supplies juice to the rudder angle indicator, the engine room telegraph, and hand electric steering gear, as well as to other controls.

When they were finished, they started up the generator and shut the other one down, but they neglected to put the first generator on the line.

The ship was being steered by the hydraulic telemotor control and was unaffected by all this until the quartermaster glanced at the rudder angle indicator and found it hard over in the off position. He concluded that he had no helm and sang out to that effect. Actually, the steering gear was working perfectly. The Master put the steering gear in hand electric and had the bypass opened on the telemotor. Right then things started happening. The ship headed for the shore. The current was off the engineroom telegraph. The buzzer, which is supposed to ring when current goes off the telegraph, wasn't working. Precious seconds were lost getting the engineroom on the phone.

They finally got her going astern, and the mate dropped both anchors, but to no avail. She piled up on the beach, high and dry. Fortunately, the beach was soft and, after lightering her cargo off, they were able to pull her free with tugs. Miraculously, the ship was not damaged.

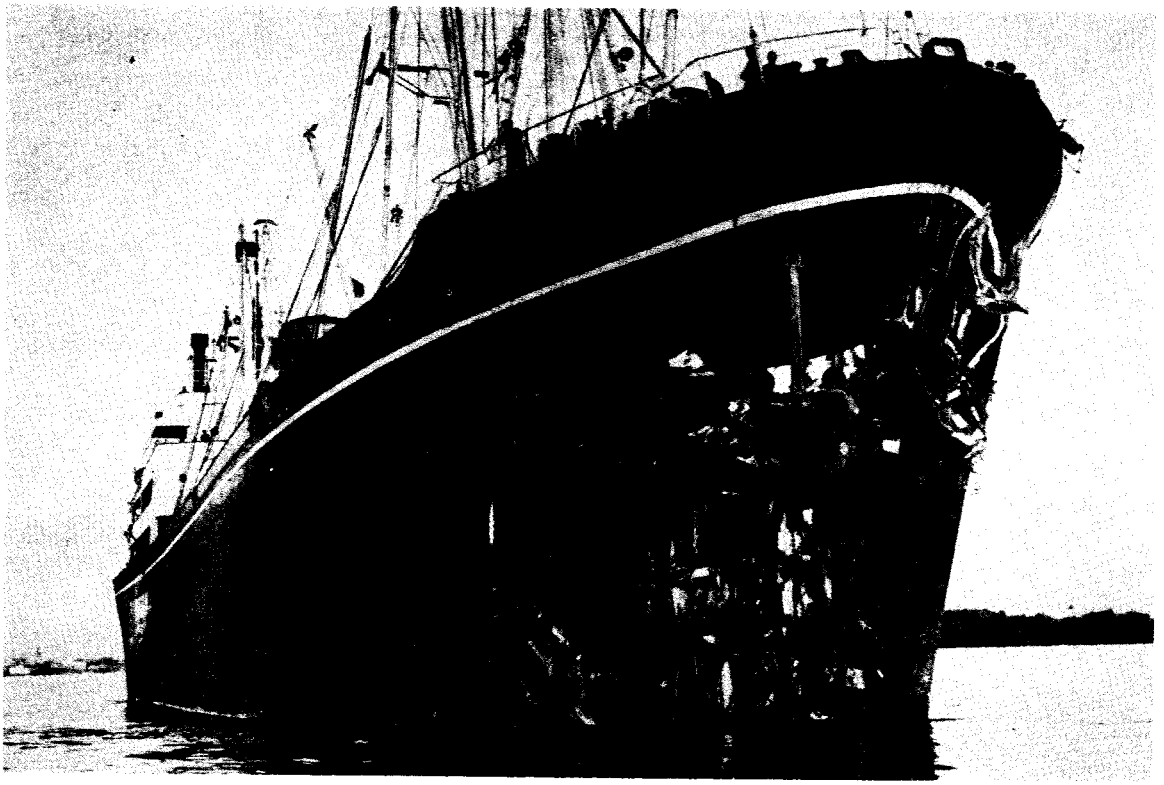
Subsequently, orders were sent to the ships that they were not to make routine repairs to critical operating machinery involving switchovers when the ship was in narrow waters. These orders still stand. Another lesson obvious from the above is that failure of the rudder angle indicator does not necessarily mean that the ship cannot be steered.

SECTION 7.24

REVIEW OF MARINE CASUALTIES, FY 1961

By Commander John H. Hawley, USCG
Chief, Casualty Review Branch, Headquarters

(Reprinted from Proceedings of the Merchant Marine Council, USCG, 1 December 1961)



AT THE ENTRANCE to the Archives in Washington is inscribed "What is Past is Prologue." One story has it that a visitor to the Capital asked his taxi driver what it meant. The cabbie replied "It means we ain't seen nothin' yet."

From a marine casualty point of view, at least, we've seen plenty. In many areas we've profited by past mistakes. In others more effort is indicated. A brief review of some of the significant aspects of more recent casualties may light the way.

You no doubt will recall the *Amoco Virginia* disaster on 8 November 1959 in the Houston Ship Channel. The vessel was loading automotive gasoline and number 2 heating oil at the Hess Terminal.

The evidence developed by the Marine Board of Investigation was largely circumstantial but it appears that there was accidental discharge of gasoline into the water from the tanker which was ignited by open flame oil lanterns used as running lights on a loaded sand barge being push-towed past the area. Incredible as it may seem, the evidence indicated that the night mate in charge of loading aboard the *Amoco Virginia* and the master of the tug *Pan Six* who was the officer in charge of the pumping operations on two tank barges alongside had both been put on notice an hour or more before the fire that there was gasoline on the water around the vessel but pumping operations were continued. Six crew members from the *Amoco Virginia* and one fireman lost their lives as a result of that casualty.

This article on marine casualties was delivered by Commander John H. Hawley before the Marine Section of the National Safety Council during the 1961 National Safety Congress in Chicago, Ill.—ED.

Aside from the more obvious lesson, this casualty pointed up the problem created by accidental spillages of any commodity which might create a hazard to safety. In the *Amoco Virginia* case, the Board also found that at some time prior to the casualty a tank barge had been holed while being shifted and as a result gasoline flowed into the channel. While not contributing since it preceded the fire by 12 hours, it unquestionably created a dangerous situation at that time.

Largely as a result of this casualty, the entire problem of spillages, leakages, or discharge of hazardous or dangerous material into navigable waters of the United States has been made the subject of a special Coast Guard study. That study is still going on. The problem is vast and goes beyond the basic responsibility of the Coast Guard for safety of life at sea. While petroleum products in the water are primarily a hazard to ships and waterfront facilities, the spillage of other dangerous materials such as

poisonous chemicals into rivers which provide water for drinking and industrial purposes could conceivably imperil the lives and livelihood of thousands of people. The solution is basically simple. Prevent spillages and discharges to the extent possible.

This is nothing new. Normally, no vessel will purposely dump cargo into the rivers. On the other hand, accidents do happen. Recognizing the potential danger if some commodities are accidentally spilled, extra care is indicated when they are being handled. Greater attention to navigation and the placement of barges strategically within a tow are two of the more obvious considerations. When accidental spillages occur, immediate reporting by the master, operator, owner, or person in charge is essential so that precautions may be taken to close off water intakes and protect waterfront facilities as well as other shipping. For the present time at least, such reports should be made to the nearest office of the Coast Guard.

Undoubtedly when the Coast Guard study is completed, there will be recommendations for specific regulations in this regard.

PASSENGERS' LIVES LOST

A 14-year record for U.S. ocean going certificated passenger ships was broken on 22 October 1960 when the combination freight and passenger vessel *Alcoa Corsair* collided with the Italian freight vessel *Lorenzo Marcello* in the lower Mississippi River. Five passengers and five crew members lost their lives and six passengers and four crew members were injured in this casualty—all from the *Alcoa Corsair*. Not since 1946 has a passenger been killed aboard an inspected U.S. ocean going passenger vessel as a result of a vessel casualty. It was in that year that the passenger vessel *Yukon* stranded on the shores of Cape Fairfield, Alaska, with the subsequent loss of nine passengers and two crew members and the total loss of the vessel.

The *Alcoa Corsair/Lorenzo Marcello* collision, typical of most other collisions, was due to personnel fault. The *Alcoa Corsair* was downbound and rounding 60 Mile Point which entails about a 90° right turn over a 2-mile course. The *Lorenzo Marcello*, upbound, was heading for the Point as is the custom and the *Alcoa Corsair* was keeping to the bend. It was a clear dark night. The vessels were in sight of each other when over 2 miles apart and when within 1½ miles, two-blast signals were exchanged. There were conflicting versions as to what subsequently occurred but two facts were indisputable. The *Alcoa Corsair* was permitted to swing about 16° farther right than the axis of the channel below 60 Mile Point and the *Lorenzo Marcello* turned right at the last minute in the face of the *Alcoa Corsair*. It was the opinion of the Coast Guard that this casualty was caused by the failure of both vessels to navigate with caution. The *Alcoa Corsair* failed to make a timely and sufficient alteration of course to port to insure a safe starboard to starboard passing and the *Lorenzo Marcello* failed to recognize the increasing danger of the situation which should have been apparent.

The case was unique in one respect. In the face of the traditional master/pilot relationship, it is seldom that the vessel's officers do not share the blame for an accident. In this instance the situation was more than just a case of meeting vessels but one of vessels meeting in a river where a knowledge of local conditions and customs dictated the special qualifications of a pilot. In addition, it was considered that under the circumstances, the officers on the bridges of the two vessels who were not pilots would not realize that their vessels were standing into danger prior to the time collision was imminent. Hence, it was concluded that the responsibility for this collision rested solely with the pilots of the two vessels.

RADAR

No review of past casualties would be complete without comment about radar. In the past 2 fiscal years there have been two particularly significant radar cases. One was the collision between the SS *Mormacpine* and the fishing vessel *Jane* off Cape Flattery, Wash., on 27 September 1959 and the other was between the British freighter *South African Pioneer* and the fishing vessel *Powhatan* off Cape May, N.J., on April 10, 1961.

In the first case, the *Mormacpine* was proceeding full ahead at 11.5 knots on a northerly heading off the Washington coast early on the morning of 27 September 1959. Upon sighting a fog bank ahead, the lookout was posted on the bow and fog signals were commenced. The engine was placed on standby but no reduction in speed was made. The radar was on and appeared to be operating satisfactorily showing a good presentation of land mass but no vessel targets were observed. The vessel had entered the fog bank and visibility was between 500 and 1,000 yards. At 0746 the master ordered right rudder to enter the Strait of Juan de Fuca. At this same time, the lookout reported by phone to the master that he heard a whistle ahead. Immediately the engine was stopped and the master checked the radar which was on the 8-mile scale but observed no vessel targets. Approximately 1½ minutes later the lookout reported sighting a vessel 1,000 feet ahead fine on the starboard bow. This later proved to be the FV *Jane*. The *Jane* appeared to be underway with little or no way on and was heading across the bow of the *Mormacpine*, from starboard to port. Upon receiving the report from the lookout, the master ordered full astern on the engines. The rudder was already hard right. The response to the engine order was immediate but these maneuvers did not succeed in evading the *Jane* and at about 0755, with the *Mormacpine* making an estimated 3 to 4 knots through the water, her bow struck and holed the *Jane* on her port side.

The *Jane*, a 49-foot, wood hull fishing vessel, was en route Neah Bay, Wash., to Destruction Island. After clearing the harbor, she headed west at half speed—approximately 5 knots—into a 9-foot westerly swell. At 0720 fog was encountered. Fog signals were commenced and speed was reduced to 4 knots. The *Mormacpine* was first observed bearing down on the port side of the *Jane* about 50 or 60 feet away. The *Mormacpine* was undamaged but the *Jane* was severely holed and sank 3 minutes after the collision. Three of the five crew members aboard the *Jane* were rescued but the master and the fifth crew member were lost.

In the second case the *South African Pioneer* was en route to New York from Charleston, S.C., heading on a course of 015° T at 14 knots. At about 0542 on the morning of 10 April 1961 visibility decreased to 1½ miles. Fog signals were commenced and the engine was placed on standby which would result in a reduction of speed to 10.2 knots as the vessel reached maneuvering RPM. The radar was on the 8-mile scale. Sea return extended 3 miles from the center of the scope and rain areas appeared beyond this range. No contacts were observed on the scope. At 0545 the lookout was sent below to call the stewards' department. Between 0549 and 0550 a red light was observed close aboard 10° on the starboard bow. Hard right rudder was ordered and moments later was shifted to hard left, then amidships and full astern. At 0551 the stern of the *Pioneer* struck the *Powhatan* amidships on the port side at a 60° angle. The *Pioneer's* speed was estimated to be slightly under 10 knots.

The *Powhatan*, a 78-foot wood hull fishing vessel was proceeding south-southwest at a speed of 7 knots towards Hampton, Va., through rough seas and heavy swells. There was no lookout on the bow. There was a helmsman at the wheel and the mas-

ter was making a loran fix from the receiver located in his room immediately abaft the wheelhouse. The *Pioneer* was first observed by the helmsman who shouted the warning. When the master came out of his room the *Pioneer* was so close he could not see her navigation lights. Almost immediately thereafter the *Powhatan* was struck and cut in two. The speed of the *Powhatan* at the time of impact was estimated somewhat less than 7 knots. There was no damage to the *Pioneer*. Out of five crew members aboard the *Powhatan*, four lost their lives.

In both of these cases personnel fault was considered to be the principal cause. Both the *Mormacpine* and the *South African Pioneer* were going at an immoderate speed. On both fishing vessels there was evidence of improper lookout. In both of these cases sea conditions were such that the fishing vessels could reasonably be expected to be obscured as radar targets. Both of these fishing vessels were constructed of wood and could further be expected to produce poor radar returns and on both the *Mormacpine* and the *Pioneer* the navigation personnel was undoubtedly influenced by the absence of any radar targets on the scope.

You are all familiar with the recommendations annexed to the International Rules of the Road adopted at the 1960 SOLAS Convention concerning the use of radar. The following is quoted from recommendation 2: ". . . . Information obtained from the use of radar is one of the circumstances to be taken into account when determining moderate speed. In this regard it must be recognized that small vessels, small icebergs, and similar floating objects may not be detected by radar. . . ." If heeded this recommendation should go far in preventing the type of casualty suffered by the *Jane* and the *Powhatan*. These two casualties also indicate the need for increasing the radar reflectivity of wooden vessels. Radar reflectors are available and prudence dictates that small seagoing vessels install such devices. But as pointed out by the Commandant of the Coast Guard in action on the *Mormacpine/Jane* case "the increase in radar detectability presently offered by this equipment is definitely limited and offers no assurance that vessels so equipped will be observed by radar."

In heavy seas the odds are even further reduced.

From the safety point of view another particularly significant casualty was the breaking up of the T-2 tanker *Pine Ridge* off Hatteras on 21 December 1960. The resume and Commandant's Action in this case appears in the November issue of the Proceedings of the Merchant Marine Council. Briefly, the vessel, in ballast, was heading into heavy weather. Speed had been reduced to about 9 knots. She was rolling and pitching heavily and possibly taking green seas over the bow but none of the witnesses had the impression that she was pounding or slamming hard. At 1145, 21 December, without any warning, there was a loud crack and the vessel forward of number 6 tank was observed to raise up out of the water. On a subsequent sea the vessel tore across the deck and the bow sheared around to the right, then broke completely off. At the time of the casualty the master, chief mate, second mate, third mate, radio officer, chief steward and quartermaster were in the midship house which was on the forward section. As the forward section separated the bow was observed to be high out of the water and the after end awash up to the boat deck. No lifeboats were launched from the forward section and sometime during the late afternoon or early evening of 21 December the forward section sank. There were no survivors from the forward section, nor were any bodies recovered.

The Marine Board convened to investigate this casualty found that the failure was primarily of the ductile type indicating a high stress condition. In this connection, the Board found that the loading distribution of the vessel resulted in a sag numeral of almost plus 150 and a hog numeral of almost minus 20, calculated in accordance with the American Bureau of Shipping publication "Guidance Manual for Loading T-2 Tankers." The maximum sag numeral recommended in the manual is 100 and the figure of plus 150 reflects a dangerous condition of stress.

In addition to improper ballasting, the Board concluded that the weakened structural condition of the vessel was also a contributing factor. Audio gauge readings of the main hull structure after the casualty indicated a generally borderline condition and some areas where wastage was actually excessive. The vessel had been drydocked 2 months before the casualty and was attended by a Coast Guard inspector as well as a classification surveyor and the owner's representative. There is no doubt that they

did what they thought should have been done and their requirements for repairs and renewals were made in good faith.

The problem they faced is the most difficult one in the field of vessel inspection. That is the determining of the condition of an aged vessel and deciding what must be done to permit the vessel to continue operating with safety. It seems logical that as a vessel advances in years, examinations and inspections must necessarily be increasingly detailed and critical. Beyond that there must be a satisfactory resolution of the differences of opinion which are bound to arise. In his action on the *Pine Ridge* case, the Commandant commented as follows in this regard: "Obviously the proper balance between economy of operation and safety can only be achieved with full cooperation, mutual assistance, and a frank exchange of information between those directly concerned."

TRENDS

During fiscal 1961 there were 2,015 casualties to commercial vessels reported to the Coast Guard. This compares with 1,988 the year before. In fiscal 1961, 156 persons lost their lives in vessel casualties aboard commercial vessels of all sizes as opposed to 153 in fiscal 1960.

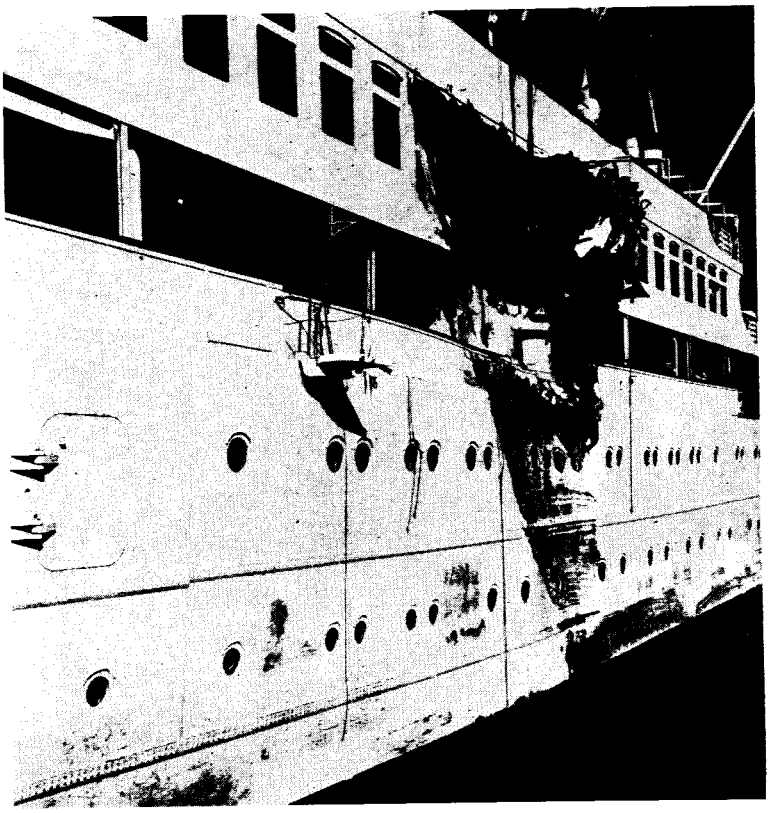
Forty of these deaths occurred on inspected vessels and 116 on uninspected vessels. Among the uninspected vessels those engaged in commercial fishing once again accounted for the most deaths with a total of 58. Uninspected tugs ran second with a total of 21. The classification of vessel casualty which accounted for the greatest percentage of these deaths on uninspected vessels was flooding, sinking, and capsizing. In the case of commercial fishing vessels 29 lost their lives in casualties of this type and on uninspected tugs 16 lost their lives.

PERSONAL ACCIDENTS

In our tabulation of personnel accidents aboard commercial inspected vessels the category which accounted for the greatest number of deaths in fiscal 1961 was death from natural causes. The total was 165. In this category 80 of the deaths to crew members resulted from one of the cardio vascular diseases.

The second largest number of deaths from personal accidents on board inspected vessels occurred as a result of falling overboard. Sixteen persons were killed from this cause of which nine were crew members.

Aboard uninspected commercial vessels the situation was reversed.



Natural causes was second, having accounted for 26 deaths of which 21 resulted from cardio vascular disease to crew members.

The major cause of death from personal accidents aboard uninspected commercial vessels was falling overboard. A total of 70 lives were accounted for in this category of which 28 were crew members off fishing vessels and 27 were crew members off tugs and tows. These figures on deaths from falling overboard are the most disturbing of the year. On uninspected vessels this was the greatest single cause of death.

In June 1959 when the Coast Guard issued its first approval on the work vest type life preserver it was hoped that deaths due to falling overboard would be materially reduced. They haven't. The reports of investigations received on these cases indicate that in most instances on tugs, tows, and dredges life vests were available. How can we get people to wear them? Stating it more broadly, how can we get people to take safety precautions of any kind?

Scare statistics obviously have little effect and certainly our seamen if not our entire population are safety educated. The problem seems to lie in the same basic human weakness that keeps us from taking our doctor's advice. If this is true, it would appear that more forceful leadership on the part of ships' officers and other designated supervisors among the unlicensed persons can go a long way towards correcting the unsafe conditions and preventing unsafe practices which cause these casualties.

Our records appear to indicate that in the lower echelons particularly there is a marked reluctance on the part of supervisors to insist on safe work methods. This is especially true if the subordinate himself is known to be an experienced man. Going back for a moment to the figures on deaths resulting from falls over the side, if the masters or supervisors required that life jackets or life vests be worn and accepted no deviation, it is reasonable to assume that many of those who died would still be with us.

The third largest number of deaths from personal accidents on inspected commercial vessels occurred as a result of suicide. Twelve persons died in this manner of which nine were

crew members and three were passengers. In addition, 11 crew members disappeared from inspected vessels under circumstances which suggested the possibility of suicide.

The third largest number of deaths from personal accidents on uninspected commercial vessels resulted from disappearances of which there were nine cases, eight of which involved crew members. While some of these cases might have been suicides six cases were on fishing vessels which tends to increase the probability of accidental falls.

On commercial uninspected vessels, positive suicides were almost inconsequential with only two cases tabulated.

Among the categories which account for the greatest number of nonfatal personal accidents resulting in incapacitation for a period in excess of 72 hours, slips and falls on deck and other slips and falls same level accounted for the most with a combined total of 202 injury cases on all commercial vessels both inspected and uninspected. In these categories no one was killed aboard inspected vessels but two were killed on uninspected vessels. The principal causes of these accidents were unsafe practices and poor maintenance or housekeeping which accounted for 57 cases; human error not otherwise classified, which means a misstep on the part of the individual, accounted for 46 cases; and weather conditions were given as the cause in 53 cases.

The second largest group of injuries occurred as a result of slips and falls on ladders and stairs. There were 116 injury cases in this group covering all commercial vessels plus 2 deaths on inspected vessels but none on uninspected vessels. Principal causes were unsafe practices or conditions and missteps in that order.

Our casualty reports in recent years are beginning to reflect a greater number of personal accidents being attributed directly to intoxication. During fiscal 1961, 11 deaths and 41 injuries were considered to have been caused primarily by intoxication. Fights aboard ship are also accounting for more casualties. There was 1 death and 92 injuries recorded in this category. It is doubtful that this reflects a true increase in casualties of these types but rather that reporting superiors and even witnesses are becoming less reluctant to call a spade a shovel.

From an analysis of the death and injury tabulations it is apparent that continued efforts to make vessels safe have paid off and this is particularly true of inspected vessels. Of course, there is still plenty of room for improvement as evidenced by some of the individual cases we have discussed here. On the other hand the sum of our casualty experience for fiscal 1961, supported by figures for previous years, indicates that greater effort must be exerted to get individuals to work safely. It is in the area of personnel fault, both from the standpoint of vessel casualties and personal accidents, that the greatest strides towards maximum safety remain to be made.

Section 7.25

ENGINEROOM CASUALTY

(The following article is excerpted from the Esso Fleet News for general interest and to describe how sound thinking and prompt action averted the flooding of an engineroom.)

A rubber expansion joint on the discharge side of the main circulator failed aboard the *Esso Zurich* recently. Through prompt action by engineroom personnel, serious consequences were prevented.

The *Zurich* was on a ballast voyage from Philadelphia to Baytown, via Freeport. She was about seven miles off Dry Tortugas at 0830, March 9. The Chief engineer and the First assistant went to the forward lower engineroom to locate a drain prior to renewing a gasket. The gasket was forgotten when they noticed a fountain of water shooting up near the main circulator motor and 1½ feet of water in the bilges.

The Chief engineer immediately shouted to the First assistant and the Third assistant, who were present, to put the auxiliary plant in service and to the Oiler to start the bilge pumps. He quickly called the bridge, informed the Mate of the rapid flooding and asked him to call out all engineroom hands. By 0835 the main engine stopped and the closing of the main injection valve was started. Additional help arrived while the sea suction was closing. At 0840, the water was approximately 3 feet deep.

Meanwhile, the Second assistant was getting the auxiliary plant going and the First and Third were closing and checking cross-over valves and other sea connections to the main condenser. At about 0840 the auxiliary plant was in service and 5 minutes later all sea valves were closed.

The Third took the switchboard breakers for the main condensate pumps and main circulator out of service. Water level was about 4 feet.

The First and a Machinist lifted floor plates and went into the bilges about 0848. By touch they located the ruptured expansion joint. The water was now 5 feet.

The First sent for blankets and log line and with assistance of the Machinist, succeeded in looping a twisted wool blanket into location so they could apply pressure against the hole. They then whipped it with line and applied supporting rags.

While working they were able to determine how fast the water was rising—1 foot per 10 minutes. As the whipping pressed the blanket in, the rate of increase began to slow down.

At about 0855 the Chief gave attention to bilge and general service pumps and had strainer boxes opened and strainers cleaned, one at a time. Then bilge suction valves were checked as to which would be most efficient.

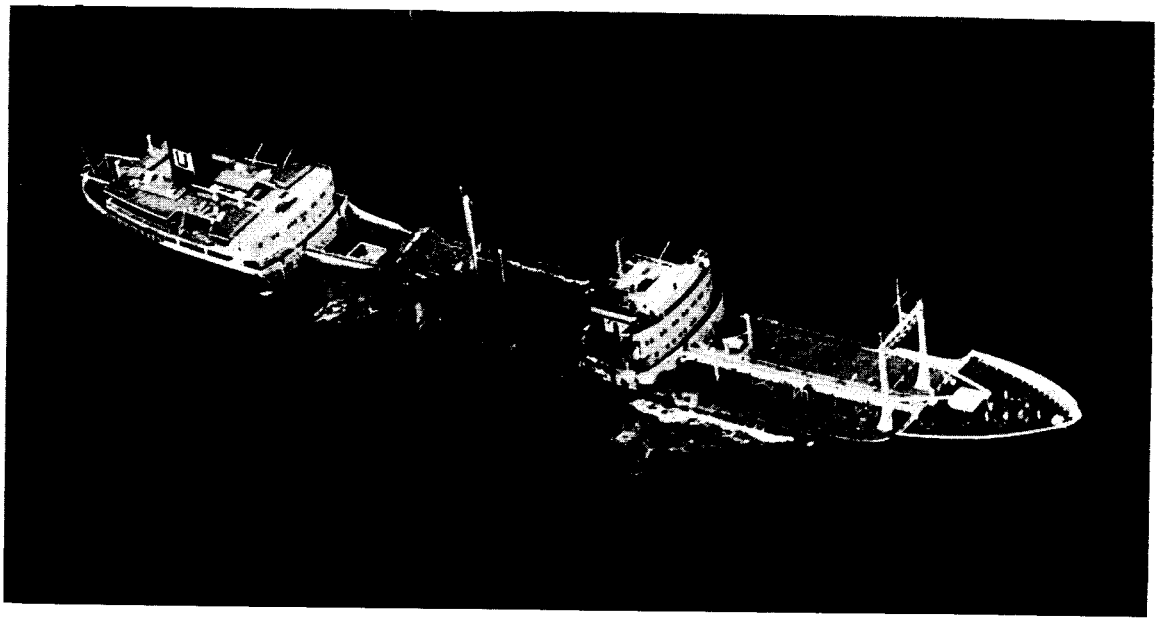
Water was still rising, but at a much slower rate. At 0910 it was 5½ feet. By 0920 pumps were keeping up with water intake. At 0950 pumps were slowly gaining through the continuous cleaning of strainers.

About 0900 the Chief was informed by the Third that condensate was heavily contaminated with sea water. This was caused by cargo pump turbines being under water and a leaking bypass valve at the auxiliary condenser. This 10-inch bypass is on the cargo pump exhaust line and was causing the line to act as a makeup feed. The Chief had steam pressure put on the line and this stopped sea water entering the condensate. Boiler salinity went over 100 grains. The boiler was put on an evaporator and alternately given blow downs and compound.

The *Zurich*'s engineers had the bilges pumped dry by 1430 and all sea connections holding tight. They removed the bolts on the expansion joint with a rivet buster and using the joint as a template, made a blank for the condenser side of the circulator. The repair was tested, main condenser put in service with the auxiliary circulator, and at 2300 they were able to proceed. At daylight March 10, the *Zurich* went into Tampa under her own power—40 rpm at first, then 65 to 70 percent of full power.

(REPRINTED FROM PROCEEDINGS OF THE MERCHANT MARINE COUNCIL, USCG, MARCH 1963)

COLLISIONS



INTRODUCTION

AN EXAMINATION of ship casualties for the years 1957–61, inclusive, indicates that, on the average, approximately 20 percent of these casualties resulted from collisions. For these years, collisions varied from a low of 1,288 to a high of 1,628, usually with an increase over the previous year's total; while total losses from collisions ranged from 7 in 1961 to 16 in 1957. Obviously, the prevalence of collisions constitutes a serious problem for the mariner. Therefore, the following cases are being presented both to focus attention on the problem and to consider some of the causes contributing to collisions; also, with the hope that serious consideration of these causes will lead to a significant reduction in the number of collisions.

CASE 1

The principals in this case were a Swedish cargo vessel (*Ship A*) of 5,137 gross tons and a U.S. merchant tanker (*Ship B*) of 531 gross tons. The collision occurred, at about 0025 hours EDST, 25 June, in the East River, N.Y., about 100 yards off the head of Pier 3, Brooklyn. The weather was clear, the wind southerly, force 2 to 3, and the tide was flooding at about 2.5 knots in the direction of 045° true.

This material on collisions is reprinted from the October 1962 edition of H.O. Pilot Chart 1400 published by the U.S. Naval Oceanographic Office.—Ed.

SHIP A

In the early morning hours of 25 June, *Ship A*, a Swedish cargo vessel en route from New Haven, Conn., to Port Newark, N.J., was westbound in the East River, with 1,407 metric tons of cargo. Her speed was 10 knots through the water, bucking a 2.5-knot flood current. The pilot, who had boarded off City Island, N.Y., at 2300, 24 June, was directing the movements of the vessel. With the pilot were the master, a helmsman, and a deck officer handling the telegraph. A lookout was on the bow.

When *Ship A* was approximately 100 yards above the Manhattan Bridge, in midstream, heading for the green light affixed to the span marking the center of the navigable channel, her pilot noted ahead the green side light of an upbound vessel in the vicinity of the Brooklyn Bridge but closer to the Brooklyn side. He then blew a two-blast signal and altered his course to port with a 20° left rudder. No reply was heard, and the ship, which turned out to be *Ship B*, continued to show a green side light. When *Ship A* was about 100 yards below the Manhattan Bridge, her pilot noticed *Ship B*, which was now approximately in midstream, turn toward the Brooklyn shore as its green side light passed from view and the red revealed itself. The pilot of *Ship A* then, at about 0023 hours, sounded the danger signal and backed his engines full, as *Ship B* continued to turn to its own right. With its way considerably lessened, the bow of *Ship A* struck the port quarter of *Ship B* aft of the wheelhouse and the ships remained fast.

At the impact, a muffled explosion emanated from *Ship B*. Both vessels and the surrounding water were

SHIP CASUALTIES AND COLLISIONS, 1957–61 [1]

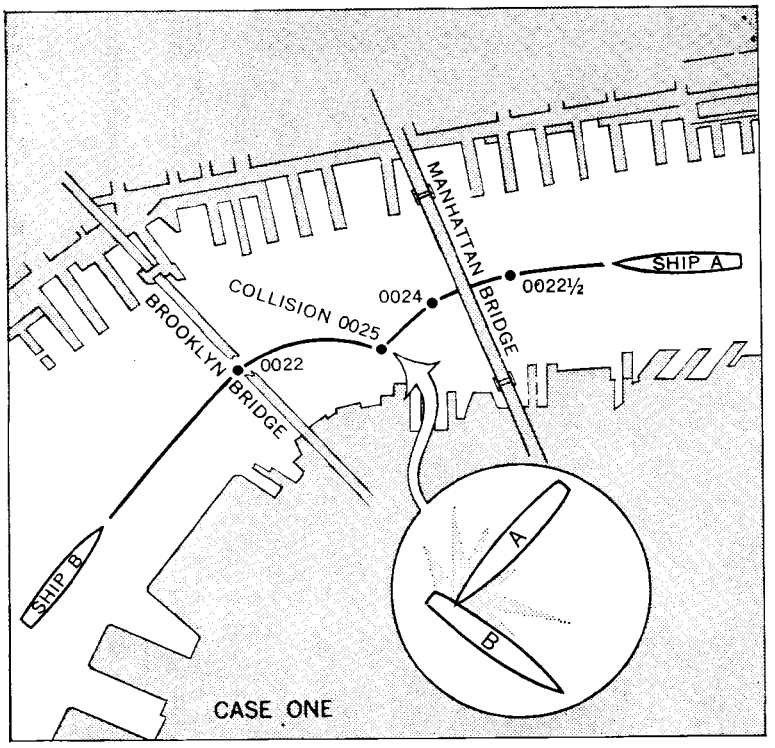
Year	Total casualties	Collisions	Collisions—Percent of total casualties
1957	7333	1288	17.56
1958	6944	1381	19.88
1959	7359	1592	21.63
1960	7368	1472	19.97
1961	7818	1628	20.82
Average	7364.4	1472.2	19.97

[1] The tabulation of ship casualties and collisions is from the Liverpool Underwriters' Association Return of Casualties to Steam & Motor Vessels of 500 tons gross register and upwards.

quickly enveloped in flames from burning gasoline. *Ship A*'s engines were used to maintain the position of the two vessels in the stream and to avoid their drifting onto the Manhattan piers. The forward deck of *Ship A* and both sides aft to the poop were afire. The bow of *Ship A* was firmly embedded in *Ship B* for about 1½ hours. They were separated by use of a tug which placed a line to the bow of *Ship B* and forced it away. The tanker sank by the stern immediately, but its bow remained afloat.

SHIP B

Ship B, a U.S. tankship, en route from Bayway, N.J., to Mount Vernon, N.Y., with 6,500 barrels of automobile gasoline, was eastbound in the East River making 7.5 knots through the water with a favorable current of 2.5 knots. The pilot was at the helm of *Ship B*, and with him in the wheelhouse was an able seaman who was stationed as a lookout. The master was in his room adjacent to the wheelhouse. When just below Brooklyn Bridge, the pilot noted a tug with carfloats alongside heading downstream, about 50 yards off the Brooklyn shore between the Manhattan and Brooklyn Bridges. As *Ship B* navigated under the Brooklyn Bridge, it passed the carfloats, on its starboard hand about 150 yards off. At about the same time, the pilot observed a vessel which proved to be *Ship A*, about 200 yards above the Manhattan Bridge. Upbound at the Brooklyn Bridge, East River turns to the right. The pilot of *Ship B* stated that, while his ship was making this turn to starboard, he heard a one-blast signal from *Ship A*. He replied with one blast and continued to swing right, increasing his rudder. Observing the oncoming cargo ship swinging to its own port, the pilot repeated the one-blast signal about 30 seconds later. In about 10 seconds he heard a danger signal from *Ship A*, which was then slightly below Manhattan Bridge heading to the Brooklyn side of the river with only its red side light visible. With the helm hard right, the tanker was heading almost directly for the Brooklyn shore, when it was struck by *Ship A*'s bow on the port side at about right angles in the vicinity of No. 4 tank. Slightly before the crash the pilot directed the lookout to call the master. He had already been aroused by whistle signals and responded immediately to the call from his room adjacent to the wheelhouse. The master arrived in time to shift the rudder to hard left in an effort to throw his stern away from the oncoming ship. This maneuver was not successful, due to the close proximity of *Ship A*, and the collision occurred.



ANALYSIS

The two vessels sighted each other less than one-half mile apart as *Ship A* was nearing Manhattan Bridge and *Ship B* was turning to her own right just prior to passing under the Brooklyn Bridge. Signals were sounded by both vessels but were not heard by each other. It appears that *Ship A* and *Ship B* were in sight of each other at the time a one-blast signal was sounded by a tug (in response to an earlier signal by *Ship A*). A subsequent one-blast signal by *Ship B* appears to have coincided with *Ship A's* two-blast signal, so that both vessels' signals were drowned out by the signal of the other.

After sounding a two-blast signal and without hearing a reply, *Ship A* altered her course to her own port in anticipation of a starboard-to-starboard passing. *Ship B*, desiring a port-to-port passing, continued to turn to her own right as she rounded the bend under the Brooklyn Bridge. Thus, the failure of both vessels to timely ascertain the intention of the other began the sequence of events which resulted in collision about 2 minutes later.

Under the circumstances prevailing at the outset, *Ship B* had the right to expect a port-to-port passing, but, when a few moments later it became apparent that *Ship A* was turning toward the Brooklyn side, *Ship B* had the duty to stop, and, if necessary, reverse. Her failure in this regard is considered to have contributed to the collision.

The pilot navigating *Ship B* stated that it was a one-blast signal that motivated his reply of one short blast and additional right rudder. When he observed a confusing situation developing, namely, *Ship A* heading toward the Brooklyn shore, he blew a second one-blast signal. He should have blown the danger signal, and his repetition of his own one-blast signal, without so sounding the danger signal, was contrary to the Rules of the Road.

The principal cause of this collision was the improper alteration of course by *Ship A* to her own port upon sounding a two-blast invitation to pass. Within the meaning of the Pilot Rules for Inland Waters, the two vessels were *clearly meeting* and each recognized the situation as such. Accordingly, a port-to-port passing was indicated, and the circumstances did not warrant an assumption by the pilot of *Ship A* that *Ship B* might desire a starboard-to-starboard passing

without a proper exchange of whistle signals.

Additionally, this collision serves to emphasize an effect of excessive speed. In a meeting situation, with a consequently high relative speed, the time available for maneuvering to avoid collision is so drastically reduced that there is insufficient time left to evaluate and resolve confusing situations. Consequently, early reductions in speed are absolutely necessary when there is any uncertainty over the other ship's intentions. Reductions in speed will provide the additional time to clarify a situation.

The collision also emphasizes the necessity for a proper *exchange* of signals. An exchange of signals is *mandatory*, under Section 80.3, Pilot Rules for Inland Waters, for vessels in sight of each other when passing or meeting at a distance within half a mile. This is a duty all too frequently ignored. The signal should be initiated as early as practicable, and the reply should be given promptly. If the initiating ship fails to receive a reply, it must sound the danger signal (Sec. 80.1, Pilot Rules for Inland Waters), prior to sounding a second signal.

As a result of this casualty, two men were killed and two officers injured aboard *Ship B* and the ship, valued at $225,000, was a total loss. Ten crewmembers were injured aboard *Ship A* and the ship received damages estimated at $415,000.

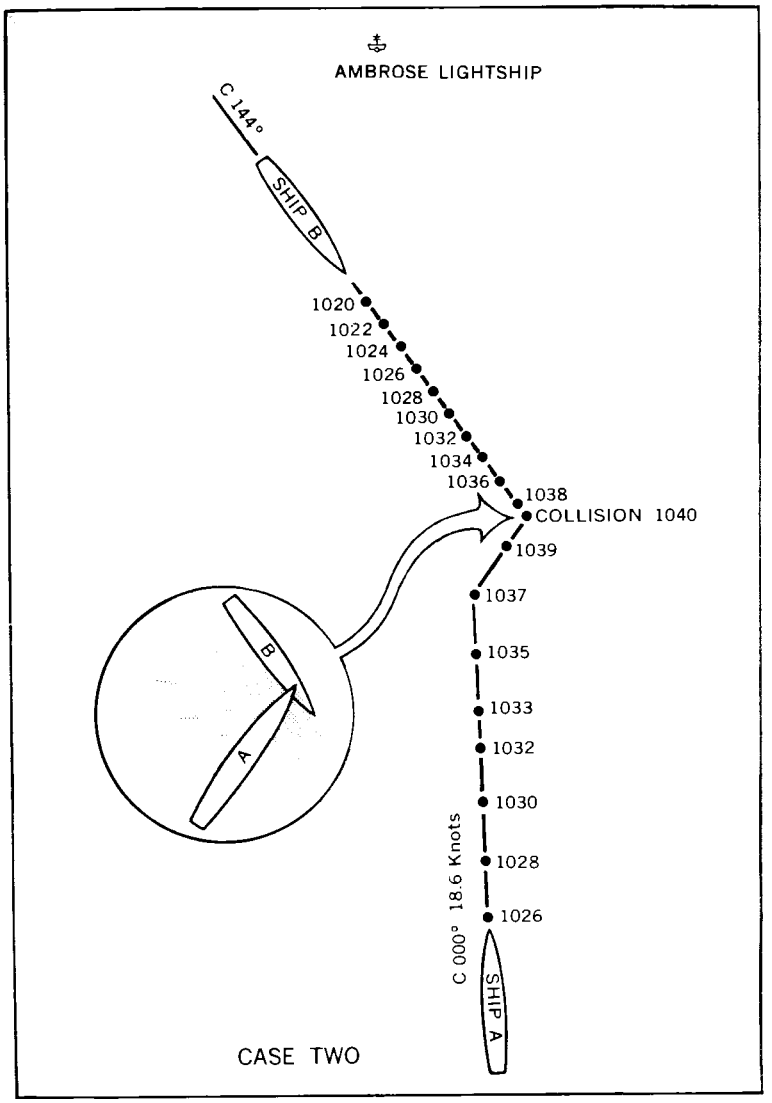
CASE 2

The principals in this case were a U.S. passenger steamship (*Ship A*) of 23,754 gross tons and a Norwegian motor tanker (*Ship B*) of 12,228 gross tons. The collision occurred about 5 miles southeastward of Ambrose Lightship. At the time of the casualty, there was a slight northeasterly sea with a short easterly swell; the wind northeast, force 3; a dense fog, with visibility less than one-quarter mile.

SHIP A

Ship A departed Newport News, Va., at 1334 EST, 28 February, on a coastwise voyage to New York with a crew of 116 and 33 observers. The draft on departure was 25 feet 4 inches forward and 27 feet 2 inches aft.

At approximately 0955 EST, 1 March, *Ship A* encountered fog about 25 miles north of Barnegat Lightship. The engine order telegraph was placed on "Standby" and operation of the fog whistle commenced under automatic control, sounding a prolonged blast at intervals of not more than 2 minutes. On course 004° and making a speed of 18.6 knots, the master took charge of the vessel's movements and placed himself at the radar, which was located on the starboard side of the wheelhouse. With him in the wheelhouse were the staff captain and a helmsman. The second officer and a messenger were stationed on the port wing of the bridge, and the third officer was stationed on the starboard wing. A lookout was on the bow.



At 1000, course was changed to 020° to avoid a southbound radar target, which passed 2 miles off the port beam at approximately 1010. At this time, *Ship A* was swung left and had steadied on course 000° by 1020.

A short time later, another target, bearing 5° on the port bow, 7½ miles distant, appeared on the radar (set on the 8-mile scale). This target was observed, using the cursor bearings and range rings, but not plotted. When the target was about 4 miles away, the range scale of the radar was changed to the 4-mile scale. At 1032, when 2 miles away on the port bow, the target disappeared in the sea return. At 1032, engine revolutions were reduced to 100 RPM (18.4 knots). At about 1037, a one-blast whistle signal was heard on the port bow. *Ship A* was swung right to 035° (the course recorder indicated that the turn had started at approximately 1032 from a heading of 000°). At