DEPARTMENT OF TRANSPORTATION
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20591

February 8, 1968

OFFICE OF
THE CHAIRMAN

Admiral Willard J. Smith,
Commandant, U. S. Coast Guard,
Washington, D. C. 20591.

Dear Admiral Smith:

In reviewing the Marine Board of Investigation on the sinking of the SS DANIEL J. MORRELL, and your action on that report, the National Transportation Safety Board is concerned that a similar tragedy may occur to other bulk carriers under similar circumstances. The fractures sustained by the sister ship SS EDWARD Y. TOWNSEND in the same vicinity and under like conditions substantiate this concern. Another example is the breaking and sinking of the SS CARL D. BRADLEY in Lake Michigan on November 18, 1958, which was attributed to an undetected structural weakness or defect.

In the MORRELL case, the recommendations of the Marine Board should adequately cope with emergencies resulting from fractures and other accidents in these vessels. We are also concerned with measures to prevent the failure of the hull girder in vessels of that general type.

We share your interest and responsibility for the prevention of accidents. Accordingly, we request a summary of the results of your special inspections of the older Great Lakes vessels, and of joint studies now in process, at an early date. In addition, information is requested concerning current plans for construction of replacement vessels, which seems to be the ultimate solution to this problem. A list of the current U. S. Great Lakes bulk carrier fleet, giving date of construction, size, owner, and other significant data would also be helpful to the Board.

While we fully appreciate the economic aspects involved in methods that would help prevent failure of hull girders, from a safety standpoint, we recommend that you consider further action as follows:

A. Strengthen the deck and/or sheer strake structure in the midships area in vessels over 400 feet long constructed prior to 1948, or curtail the operation of these vessels during specific days and period of the fall season when adverse weather and wave conditions approach or exceed those encountered by the SS DANIEL J. MORRELL.

B. Based on the special inspection program, implement a progressive structural renewal program on an individual ship basis.

The Safety Board recognizes the efforts of all those involved in the research and study of the forces and effects of sea and weather on the safety of vessels, and urges the continuation and intensification of such studies to develop objective technical criteria relating hull structural integrity to weather, sea, and other conditions of operation. *

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* The Chairman and Members McAdams and Laurel concur in the observations made with respect to the desirability of the continuation and intensification of efforts to develop better objective criteria relating to hull structural integrity, but wish still further to stress and amplify on the importance of such a program.

Specifically, they have this to say:

"Completely adequate information was not available to the master of the SS MORRELL as to the hull strength of his vessel under temperature and sea conditions forecast and observable at the time he determined to leave port. As you know, the master of another vessel of nearly identical design also left port and proceeded in the vicinity of the SS MORRELL under identical temperature and sea conditions and was fractured in the same manner, but to a lesser degree. Both ships, however, had exceeded the margins of fracture resistance and it seems clear that the master of neither ship had reason to expect what happened. We recognize that efforts are constantly being made by the Coast Guard and private organizations to learn more of the forces and effects of sea and weather on the safety of vessels, and it is apparent that this tragedy has resulted in a continuation and intensification of them.

This Board concurs in the recommendations contained in the MORRELL report, and urges implementation of them prior to the next shipping season, along with our recommendation to provide emergency lighting in the forward quarters and liferaft embarkation location. The need for a position-reporting system is considered of prime importance, and voluntary compliance by the Great Lakes operators should be obtained prior to next season.

Sincerely,

s/ [redacted]

Chairman

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* (Continued)

"However, we wish to emphasize that even had the master of the SS MORRELL had all the currently available information concerning the basic structural integrity of the vessel under sea conditions, temperature and loading conditions existing immediately prior to the accident, he would still have been unable to make an intelligent judgment as to the hull integrity of the vessel under the then existing conditions. Under the conditions here present, the master could have estimated the sea conditions but could not have estimated the ability of the vessel to meet them, and therefore we are of the belief that special efforts seem warranted to develop information better calculated to provide a master with data useful and, in this case, vital to intelligent decisions."

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT (MVI-3)
U.S. COAST GUARD
WASHINGTON, D.C.
20591

5943/DANIEL J. MORRELL
A-9 Bd
4 OCT 1967

Commandant's Action

on

The Marine Board of Investigation convened to investigate the sinking of the SS DANIEL J. MORRELL in Lake Huron with loss of life on 29 November 1966

The record of the Marine Board of Investigation convened to investigate subject casualty has been reviewed and the record, including the Findings of Fact, Conclusions and Recommendations, is approved subject to the final determination of the cause of the casualty by the National Transportation Safety Board and the following comments.

REMARKS

1. The Coast Guard instituted a review immediately after this casualty looking into every Great Lakes bulk cargo vessel structural failure since 1956. The review considered vessel age, section modulus, length to depth ratio, structural changes, repowering, location of the failure together with the circumstances of the failure including the prevailing air temperature. This review served to pinpoint those vessels of the Great Lakes bulk cargo vessel fleet that warranted particular examination for possible incipient fractures or other indications of structural weakness. Sixteen such vessels were examined for incipient fractures primarily in the critical area of midships hatch corners. Two were found to be in need of corrective action. Corrective action was taken on one vessel. The other vessel remains in a laid-up status and will require corrective action before being permitted to return to operation. This program was then extended and is continuing to include additional vessels. One of the results of the program has been the development of a relatively simple non-destructive method of examining concealed portions of the main deck stringer plating in way of hatch coamings.

2. In order that the magnitude of the dynamic forces involved may be better understood, a number of comprehensive scientific studies have been underway for a considerable period of time. With the close participation of the Coast Guard, The Society of Naval Architects and Marine Engineers have been working on the following projects.

a. In cooperation with a number of government agencies of both the United States and Canada, the Society is conducting a detailed study of Great Lakes wave action. Analysis of results of observations for 1965 and 1966 is expected before the end of 1967.

b. A U. S. Great Lakes bulk cargo vessel has been provided with stress measuring and recording equipment which will make available a determination of the dynamic forces to which the vessel's hull is subject during all stages of her operation. Stress data is available for 1965 and 1966, and will be available for part of 1967. This information will be correlated with wave data obtained by means of radio wave buoys recorded in 1966 and with the further data being recorded for 1967. The Canadian Government is also conducting similar studies and has several vessels so instrumented.

c. Models of 700 foot and projected 1000 foot Great Lakes vessels are now being tested. The information obtained in the wave data and the vessel stress project will be correlated with the model basin tests.

3. A joint Canadian-U. S. Great Lakes Load Lines Technical Committee has been established by the Coast Guard and the Canadian Board of Steamship Inspection. The objective of this Committee will be to determine the strength, freeboard and other requirements pertinent to the assignment of applicable vessel load lines. This Committee will utilize the latest and most up-to-date scientific information. It is expected that the groups working on these studies will make a worthwhile contribution to a better understanding of the problems of adequate hull strength.

4. In order to determine the cause of the casualty as fully as possible the Board had the benefit of underwater diving and television picture relays on the sunken stern section. In addition, a large section of the sheerstrake and a small section of deck plate were recovered and subjected to metallurgical study. This enabled the Board to determine that the fracture sustained was "brittle fracture typical of many prior ship fractures in pre-1948 steel." However, while the fracture was clearly of brittle type, it differed from fractures previously noted in welded ships in that it progressed through a transverse line of rivet holes. Thus, the rivet holes clearly were not effective as crack arrestors. In the case of the sheerstrake fracture a rivet hole was identified as a fracture source.

ACTION CONCERNING THE RECOMMENDATIONS

1. The Board's recommendations concerning providing inflatable liferafts, emergency source of power for radio communication, and modifications to the general alarm system are being given prompt consideration by the Coast Guard and will be submitted to the Merchant Marine Council for consideration of implementing regulations. Insofar as the emergency source of power for radio communication is concerned this recommendation is being considered in cooperation and in conjunction with the Federal Communications Commission which has indicated its support of the recommendation.

2. The Board's recommendation that future Great Lakes bulk cargo vessels be constructed with sufficient compartmentation so that the vessel can remain afloat even if any one main cargo hold is flooded, warrants consideration and study. All organizations and individuals interested in safety on the Great Lakes must be concerned with casualties such as this and the loss due to the collision of the CEDARVILLE and TOPDALSFJORD in May 1965. In that casualty, the TOPDALSFJORD struck the fully laden CEDARVILLE amidships at nearly a right angle. Once the main cargo hold was breached by collision and the flooding could not be controlled, the vessel's sinking was inevitable. It seems that the departures from present design and construction which would be necssary to provide an effective degree of compartmentation may be small enough to be justifiable having regard to economics as well as safety. Accordingly, the Coast Guard will undertake to consult with other interested organizations looking to the feasibility of such a design.

3. The Board recommended evaluation of the need for tarpaulins on vessels equipped with secured sliding plate type hatch covers during all seasons when not carrying cargo. Since this involves an amendment to the existing load line regulations, the recommendation will be forwarded by the Coast Guard to the joint Canadian-U. S. Great Lakes Load Lines Technical Committee for consideration and evaluation.

4. The Board's recommendation concerning providing the Master of a Great Lakes bulk cargo vessel with a loading manual that would indicate the limiting longitudinal bending moment factor that his vessel can safely sustain will likewise be presented to the joint Canadian-U. S. Great Lakes Load Lines Technical Committee.

5. The absence of a distress message precluded prompt institution of search and rescue efforts. Therefore, the recommendation that vessels be provided with a datum marker buoy has considerable merit. This subject has been under discussion and study by the Maritime Safety Committee of the Inter-Governmental Maritime Consultative Organization for some time. There is now international agreement on the characteristics and frequencies of such marine emergency position indicating radio beacon. Therefore, the Coast Guard will undertake a study in consultation with concerned industry representatives, government agencies and others to determine whether this emergency radio beacon should be required on United States vessels. In the interim the voluntary equipping of Great Lakes vessels with the device is encouraged.

The record indicates that the owners of the DANIEL J. MORRELL had in effect a daily reporting system during certain periods of the operating season. The Board's recommendation that when a vessel fails to report as scheduled positive action should be instituted by the persons concerned has been presented to the owners and operators. This positive action should include early notification to the Coast Guard in order that their search and rescue facilities may be alerted while the vessel's owners continue to try to determine the status of the vessel. This early notification, preferably within one hour, will enable all facilities at hand to be more promptly utilized.

6. A copy of the Board's report will be forwarded by the Coast Guard to the Environmental Science Services Administration of the U. S. Department of Commerce for study and consideration of the recommendation that on-scene sea conditions be reported in regular marine weather broadcasts. Preliminary discussions with personnel of that agency have been held.

7. Concerning the reported separation of the signal pistol, Coast Guard casualty statistics do not indicate a similar failure of a signal pistol screw such as is reported to have occurred. Accordingly, in lieu of an amendment to the regulations governing the construction of this signal pistol, the Coast Guard has taken steps to carefully examine these pistols at subsequent vessel equipment inspections in order to determine if similar conditions exist. In addition, the manufacturers of currently approved signal pistols have been advised of the necessity for adequate securing of these screws.

CONCLUDING REMARKS

1. While every effort is being taken to prevent recurrence of this type of casualty, the magnitude of the problem must be recognized in order that the corrective steps taken or contemplated or subsequently deemed necessary may be understood within the parameters of the situation as it exists. The average age of the Great Lakes bulk carrier fleet is about 45 years. There are more vessels in the 50 to 60 year age group than any other 10 year period. These vessels are constructed of a type of steel which has not been used in large vessel construction since 1948. This pre-1948 steel generally has a high transition temperature, and is therefore susceptible to brittle fracture. While it is true that corrosion of steel under the fresh water conditions of the Great Lakes is minimal, fatigue as a result of repeated stress cycling over a long period of years can and does result in local structural deterioration in the form of fatigue cracks. This type of deterioration may be difficult to detect despite diligent inspection. Because of these conditions it must be recognized that the remedial steps necessary to reduce the possibility of a recurrence of this tragedy must involve all groups concerned. The vessel's loading, discharge and ballasting must be such as to minimize stress. Full allowance and consideration must be given to the restrictions that adverse weather will place upon the vessel. The operation, maintenance and husbanding of the vessel must at all times give full recognition to these factors and therefrom result in prudent, careful operating procedures and practices. Safe operation of the present Great Lakes fleet will require the efforts of all groups and individuals concerned.

[redacted]

W. J. SMITH
Admiral, U. S. Coast Guard
Commandant

NATIONAL TRANSPORTATION SAFETY BOARD
Department of Transportation

MARINE ACCIDENT REPORT

Adopted: February 9, 1968 Released: March 4, 1968

SINKING OF THE SS DANIEL J. MORRELL
IN LAKE HURON WITH LOSS OF LIFE
November 29, 1966

ACTION BY THE NATIONAL TRANSPORTATION SAFETY BOARD

This marine accident was investigated by the U, S. Coast Guard at a public proceeding in Cleveland, Ohio, conducted December 5, 1966 through March 21, 1967, under authority of 46 USC 239 and the regulations prescribed in 46 CFR 136. The report of this Marine Board of Investigation and the Commandant's action thereon is included in and made a part of this report, for the convenience of the public. By publication of this report, the National Transportation Safety Board does not adopt the portions of the Coast Guard report which are concerned with activities within the exclusive jurisdiction of the Department of Transportation and the U. S. Coast Guard.

The Department of Transportation Act, effective April 1, 1967, assigned the responsibility to the National Transportation Safety Board for determining the cause of transportation accidents, and reporting the facts, conditions, and circumstances related to such accidents. Accordingly, the Board has considered those facts in the Coast Guard report of this accident investigation pertinent to its statutory responsibility to make a determination of the cause.

The Board finds the cause of this accident with attendant loss of life was the structural failure of the main hull girder amidships, which caused the vessel to break in two and both sections to sink. Factors which are

considered to have contributed to this structural failure are: high longitudinal stress on the hull girder due to height and wave length of the seas; limited original design section modulus for a vessel having such a large length to depth ratio; use in the original construction of the vessel of steel which is highly notch sensitive at the low atmospheric and sea temperatures experienced; a notch in the structure which was the nucleus of the initial fracture; low cycle stress fatigue; and steel of high transition temperature characteristics, relatively susceptible to brittle fracture.

Factors which are considered to have contributed to loss of life of all but one crew member are (1) no distress signal or communications from the sinking vessel were received, (2) report of the vessel being overdue was received by the Coast Guard a day and a half after the sinking, and (3) lifesaving equipment on the SS MORRELL did not provide the weather protection necessary for survival under existing weather and sea conditions.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ [redacted] Chairman

/s/ [redacted], Member

/s/ [redacted] Member

/s/ [redacted], Member

/s/ [redacted] Member

The letter of recommendation to the Coast Guard is attached.

From: Marine Board of Investigation
To: Commandant (MVI)

Subj: SS DANIEL J. MORRELL, O.N. 203507, sinking of in Lake Huron on 29 November 1966, with loss of life

FINDINGS OF FACT

1. At approximately 0200, EST, 29 November 1966, while en route from Buffalo, N. Y. to Taconite, Minnesota in ballast, the SS DANIEL J, MORRELL, broke into two sections during the height of a storm and sank in Lake Huron in the approximate position of latitude 44°15.9'N and 82°50'W. At the time of the sinking neither lifeboat was launched and no distress message was transmitted by that vessel. The first notification of alarm for her safety was received by the U. S. Coast Guard Rescue Coordination Center at Cleveland, Ohio at 12:15 EST, 30 November 1966. Of the 29 crew members on board at the time, 22 are known dead, 6 are still missing and one person survived. U. S. Lake Survey, Lake Huron Chart No. 5 encompasses the area.

2. The following are the particulars of the vessel involved:

Name:	DANIEL J. MORRELL
Official Number:	203507
Service:	Freight
Structural Form:	Typical Great Lakes bulk freighter
Gross tons:	7,763
Net tons:	6,216
Length:	586.5'
Breadth:	58.2'
Depth:	27.4'
Propulsion:	Steam, single screw, Skinner Unaflow, three cylinder, 2 coal fired watertube Babcock and Wilcox boilers.
Horsepower:	3,200
Home Port:	Cleveland, Ohio
Where Built:	West Bay City, Michigan
Date Built:	1906
Owners	Cambria Steamship Company 2600 Terminal Tower Cleveland, Ohio 44113
Operators:	Bethlehem Steel Company Great Lakes Steamship Division 2600 Terminal Tower Cleveland, Ohio 44113

Master: Arthur I. Crawley

License: [redacted]
Certificate:
Last Drydock Inspection:
Date: 25 February 1966
Port: Toledo, Ohio
Last Annual Inspection for Certification:
Date: 15 April 1966
Port: Toledo, Ohio
Date Certificate of Inspection Issued: 15 April 1966
Last Midseason Inspection:
Date: 20 July 1966
Port: Buffalo, N.Y.
Classification: American Bureau of Shipping - Maltese cross A1 Great Lakes Service, Maltese cross AMS - Classification being maintained at time of sinking

3. The following crew members, who lost their lives as a result of this casualty, have been recovered and positively identified:

Name and Address	Capacity	Next of Kin
Arthur I. Crawley, age [redacted]	Master	Mrs. [redacted], Sister
Phillip E. Kapets, age [redacted]	1st Mate	Mrs. [redacted] Wife
Duncan R. MacLeod, age [redacted]	2nd Mate	Mrs. [redacted], Wife
Charles H. Fosbender, age [redacted]	Wheelsman	Mrs. [redacted], Wife
Henry Rischmiller, age [redacted]	Wheelsman	Mrs. [redacted] Mother

Stuart A. Campbell, age [redacted]	Wheelsman	Mrs. [redacted] Wife [redacted]
Albert P. Whoeme, age [redacted]	Watchman	Mrs. [redacted] Wife [redacted]
Norman M. Bragg, age [redacted]	Watchman	Mrs. [redacted] Mother [redacted]
Larry G. Davis, age [redacted]	Ordinary Deckwatch	Mrs. [redacted], Wife [redacted]
Arthur E. Stojek, age [redacted]	Deckhand	Mrs. [redacted] Wife [redacted]
John J. Cleary, Jr., age [redacted] Temporary Permit [redacted]	Deckhand	Mr. [redacted] Father [redacted]
John H. Schmidt, age [redacted]	Chief Engineer	Mrs. [redacted] Wife [redacted]
Valmour A. Marchildon, age [redacted]	1st Asst. Engineer	Mrs. [redacted], Wife [redacted]
Wilson E. Simpson, age [redacted]	Oiler	Mr. [redacted], Brother [redacted]
Arthur S. Fargo, age [redacted]	Fireman	Mrs. [redacted] Wife [redacted]

Chester Konieczka, age [redacted]	Fireman	Mr. [redacted] Brother
Leon R. Truman, age [redacted]	Coalpasser	Mrs. [redacted], Wife
Nicholas Homick, age [redacted]	2nd Cook	Mrs. [redacted] Sister
Joseph A. Mahsem, age [redacted]	Porter	Mrs. [redacted] Daughter
Charles J. Sestakauskas, age [redacted]	Porter	Mrs. [redacted]
George A. Dahl, age [redacted]	3rd Asst. Engineer	Mrs. [redacted], Wife
Saverio Grippi, age [redacted]	Coalpasser	Mrs. [redacted], Wife

4. The following crewmembers aboard the DANIEL J. MORRELL at the time of sinking are still missing:

Name and Address	Capacity	Next of Kin
[redacted]	3rd Mate	[redacted]
	Ordinary-Deckwatch	

[redacted]	2nd Asst. Engineer	[redacted]
	Oiler	
	Coalpasser	
	Steward	

5. The following crewmember of the DANIEL J. MORRELL is the only survivor of this casualty:

Name and Address	Capacity
[redacted]	Watchman

6. All Merchant Mariner's Documents that have been recovered in this case have been forwarded under separate cover.

7. The weather in the general area of the casualty was: seas 20 to 25 feet, northerly to north northeast; visibility 4 miles; sea temperature 44° to 47°F; air temperature 33°F; barometer 29.10. A recording of the wind by the Harbor Beach Coast Guard Station, as taken from a Weather Bureau Wind Recorder, indicated that the wind was variable from 2200, 28 November 1966 to 0500, 29 November 1966, ranging from 30 knots to 57 knots and gusty, shifting back and forth from northwest to east. At 0128, 29 November, the wind shifted from northwest over to east northeast and except for a period of about five minutes when it shifted to northwest, it generally remained from that direction until 0207. At about 0200 the wind velocity was 35 to 40 knots, with gusts to 57 knots. Further information regarding weather conditions is indicated in succeeding paragraphs.

8. The weather forecast for Lake Huron as originated by the Weather Bureau, Chicago Illinois, and broadcast to become effective at 1200 EST, 28 November 1966, was.

a. Gale warnings. For the northern one-third, north-easterly winds 34 to 40 knots the first six hours, becoming northerly 34 to 40 knots, occasionally northerly 41 to 47 knots the following 12 hours and north-westerly winds 28 to 33 knots the following six hours.

b. For the southern two-thirds, westerly winds 34 to 40 knots the first six hours, northwesterly winds 41 to 47 knots the following 12 hours, with winds diminishing northwesterly 28 to 33 knots the following six hours. The weather for the entire period snow, or rain and snow the entire 24 hour period.

c. The forecast effective 1800 EST, 28 November 1966, was: Gale warnings continued in effect. Northerly winds 28 to 33 knots at the beginning of the period but increasing to 34 to 40 knots, occasionally gusty, or occasionally 41 to 47 knots and snow, or rain and snow for the entire 24 hours.

d. The forecast effective 0000 EST, 29 November 1966 was: Gale warnings continued in effect, with northerly wind 41 to 47 knots for the entire 24 hours; snow, or rain and snow the entire 24 hour period.

9. The DANIEL J. MORRELL was a non self-unloading bulk freighter. The forepeak, or collision, and the after peak bulkheads were watertight. The blind hold bulkhead at the forward end of the No. 1 cargo hold and the after bulkhead of No. 3 cargo hold were watertight to the main deck. There were no doors in the watertight bulkheads below the main deck level. The main deck was at the level of the side tank tops. Two non-watertight screen bulkheads separated the three cargo holds. Openings were located at the port and starboard corners of the screen bulkheads at the tank top level for drainage purposes. Water was removed from the cargo spaces by means of suctions at the port and starboard after corners of the No. 3 cargo hold. Water could be pumped into the cargo hold through this same piping arrangement.

10. There were 14 combination side and double bottomed tanks, 7 on each side of the center vertical keel. The exact capacity of any of the ballast tanks is unknown; however, the capacity of each tank was approximately 8.5 short tons per foot of length. The feed water tank was located below the engine spaces. The hull was of riveted construction and the vessel was transversely framed. There were 18 hatches with sliding steel type hatch covers and Mulholland hatch securing clamps. The hatches were on 24 foot centers. The dimensions of the hatches were 12 feet by 36 feet. In 1942, new side tanks were installed. In 1945 the vessel was re-boilered, with boilers constructed by Babcock and Wilcox Company. In 1956 new plate tank tops were installed, at which time there was much renewal of steel internals. In 1956 the vessel was repowered with a Skinner Unaflow engine of 3200 H. P. Prior to being re-powered the old engine plant was triple expansion steam of 2000 H.P. The Skinner Unaflow engine was of lighter weight than the engine previously installed. The old shaft was 12 inches in diameter, the new shaft diameter was 14 inches, the old propeller was of 4 bladed cast iron construction and the new propeller was 5 bladed. The maximum speed of the vessel increased approximately $2\frac{1}{2}$ to 3 m.p.h., but there was a little more vibration noticeable subsequent to the new engine installation. A former Chief Engineer of the DANIEL J. MORRELL knew of no problems created by the installation of the Skinner Unaflow engine.

11. The berthing quarters for deck officers and personnel were located forward. Quarters for all other personnel were located aft.

12. The lifesaving equipment on the DANIEL J. MORRELL included two 21 person lifeboats aft and two 15 person liferafts; one raft located on the spar deck between No. 3 and 4 hatches and the other located on the boat deck aft. The boats were of steel construction, built by the Welin Davit and Boat Corporation. Davits were of the sheath screw type. Lifeboat releasing gear consisted of common hooks. Boat falls were wire rope. There were no electric boat winches aboard. The lifesaving equipment provided no means of protecting personnel from exposure. The liferafts were of wood and metal construction, built by Frank Morrison, Inc., and were the catamaran float free type.

13. The power for the general alarm system consisted of dry cell batteries located both forward and aft. The alarm switch was located in the pilothouse, and once the switch was engaged, the alarm would continue to ring forward and aft. In event the wiring was severed aft of the forward superstructure, the alarm bells aft would not ring. The source of electrical power for all other units on the vessel was two 60 KW Westinghouse generators which were located adjacent to the main throttle. There was no emergency lighting system on the vessel, although there were battery powered battle lanterns aboard.

14. There was one AM and one FM radio installation located in the pilothouse, with remote stations for each located in the Captain's cabin. There was no emergency radio aboard. The vessel was equipped with a radio direction finder and radar. Steam piping and electrical cable were installed immediately below the spar deck on the starboard side. There was no public address system aboard. The vessel was equipped with sound powered phones and engine order telegraph for communication between the engineroom and pilothouse. Wires and cables for these systems were also located beneath the spar deck starboard side.

15. There was no cargo loading plan prepared by Bethlehem Steel Corporation, nor is one required by regulations. Vessel operating personnel, however, believe that the procedure generally used is one which produces the least strain on the hull structure. As the cargo is admitted into the holds the ballast is removed. The chief mate plans the loading of each cargo. His usual procedure is to put partial loads in hatch 18 and then in even number hatches proceeding forward. Then partial cargoes are loaded in the odd numbered hatches starting with number 17. Additional cargo is distributed in the hatches until the completion of loading.

16. The DANIEL J. MORRELL departed Buffalo, New York for Taconite, Minnesota on 26 November 1966 and cleared the Buffalo breakwater at 2300 EST that date. She was on her 34th and last scheduled voyage of the 1966 operating season. The vessel was in a ballasted condition at the time of departure because of known rough weather existing in Lake Erie. There is no record of the exact distribution of ballast or drafts upon her departure. The fleet Engineer for Bethlehem Steel Corporation observed the vessel at the time of her departure from Buffalo and was aware of no vessel structural defects at that time.

17. In accordance with company policy requiring all vessels of the Bethlehem Fleet to communicate with a company dispatcher at Cleveland to make daily position reports during early Spring and late Fall, at or about 0900, 27 November 1966, Captain Crawley called Mr. Dobson, the dispatcher, by radio telephone and reported that he was due at Detroit about 1830 to 1900, 27 November. On the evening of 27 November 1966, Captain Crawley called to report that the DANIEL J. MORRELL had anchored below Detroit, Michigan at 1800 due to adverse weather. At about 0900, 28 November 1966, Captain Crawley called Mr. [redacted] again to report that he had heaved anchor at 0655, 28 November 1966, that he had passed Detroit and that he was short two deck hands and one fireman. At the time of sinking, the vessel was actually one fireman and one oiler short of the crew required by the Certificate of Inspection. It is noted, however, that the vessel was carrying more crew in number than was required. There were no further conversations or contacts between the master of the DANIEL J. MORRELL and company officials in Cleveland, Ohio; and no report or notification from any source was received to indicate there might have been any problems on board the DANIEL J. MORRELL from the last radio contact at 0900, 28 November 1966, until the time of sinking.

18. Upon departing Buffalo, the DANIEL J. MORRELL had orders to stop for fuel (coal) at the Consolidation Fuel Dock (Mullen Dock), Windsor, Ontario, Canada, in event fuel was required. The DANIEL J. MORRELL did arrive at the above dock at 0705, 28 November 1966 and, after taking on 221 tons of stoker fuel, departed at 0730. No draft reading of the vessel was taken by dock personnel. The ETA of the DANIEL J. MORRELL at Taconite was about 2100, 29 November 1966, barring unexpected delays. The J. W. Westcott Company, Detroit, Michigan, an automatic reporting station for Bethlehem Fleet vessels passing Detroit, reported that the DANIEL J. MORRELL passed Detroit upbound at 0753 on 28 November 1966.

19. The smooth log of the DANIEL J. MORRELL, covering previous trips in 1966, indicates its usual ballasted condition upon departure from Buffalo without cargo, as was the case on 26 November 1966, was approximately 8 to 10 feet forward and 16 to 17 feet aft, depending on weather conditions. Testimony from the DANIEL J. MORRELL's previous master, Captain [redacted] indicated that this ballasting procedure as carried out by Captain Crawley followed basically his own ballasting procedures while on that vessel. In good weather he normally carried about six feet of water in #1, #2 and #3 tanks and about 8 to 10 feet in the after tanks. Then as the weather increased in severity, he would fill all ballast tanks in an attempt to increase his draft forward and aft. All tanks were filled simultaneously while the vessel was at unloading ports. A draft of 14'8" aft was sufficient to submerge subject vessel's propeller completely. Bethlehem Steel Corporation dispatchers designated the ports at which vessels are to load and unload bulk cargo and the cargoes to be carried. The determination as to whether or not a vessel will proceed in the face of a storm is in the province of the master. The cargoes carried by the DANIEL J. MORRELL were coal, rock (limestone), and Taconite.

20. The EDWARD Y. TOWNSEND, also of the Bethlehem Fleet and a sister ship of the DANIEL J. MORRELL, was moored astern of the DANIEL J. MORRELL at the Bethlehem Steel Plant, Buffalo, New York, at the time of the latter vessel's departure from Buffalo. The EDWARD Y. TOWNSEND departed Buffalo for Taconite Harbor, Minnesota at 0310, 27 November 1966 in ballast. Captain Thomas J. Connelly was master of that vessel. At approximately 2310, 27 November, the upbound EDWARD Y. TOWNSEND passed the MORRELL while it was anchored in the Detroit River below Detroit, Michigan. At that time, the masters of the two vessels engaged in radio conversation concerning the weather conditions in Lake Huron and the intention of the master of the EDWARD Y. TOWNSEND to anchor in upper St. Clair River to await more favorable weather. The EDWARD Y. TOWNSEND then continued upbound and anchored below Stag Island in the St. Clair River at 0400, 28 November 1966. The next communication with the DANIEL J. MORRELL was at about 1300, 28 November 1966 as it passed the anchored EDWARD Y. TOWNSEND. The two masters discussed the noon weather report for Lake Huron and the weather that might be anticipated. The wind at Stag Island at that time was estimated as westerly and light (6 to 18 miles per hour).

21. Prior to heaving anchor at 1453, the master of the EDWARD Y. TOWNSEND listened to radio conversations between unidentified vessels in Lake Huron and to shore station radio broadcasts, to get some indication of on-scene weather in the southern part of Lake Huron. The wind in the southern part of Lake Huron was westerly and light to fresh (6 to 28 miles per hour). Immediately prior to his heaving anchor, the masters of the TOWNSEND and the MORRELL again conferred by radio. At this time the DANIEL J. MORRELL was in the vicinity of the Lake Huron Lightship. The conversation generally concerned weather conditions. The next conversation between the two vessels was at about the time the EDWARD Y. TOWNSEND was abeam of Harbor Beach. That vessel logged Harbor Beach Breakwater Light abeam at 2028 at a distance of 4.3 miles and the master was attempting to follow the recommended upbound track as indicated on Lake Survey Chart No. 5. The DANIEL J. MORRELL was ahead of the EDWARD Y. TOWNSEND, proceeding upbound at this time but her exact position is unknown. Again, general weather conditions were discussed. At this time the wind was northerly, at about 35 miles per hour and increasing rapidly. The sea was estimated to be northerly eight feet and building up. Distance between crests was approximately 250 to 300 feet. The next communication between the two vessels was at about 2200 and concerned the deteriorating weather and sea conditions and courses of the two vessels. The wind was still northerly and had increased to about 50 miles per hour. The seas were then 12 feet and northerly. The EDWARD Y. TOWNSEND, although riding fairly well to this point, had started to pound and roll. Captain Connelly restricted movement of personnel between the forward and after sections of the vessel from 2200, 28 November until 2200, 29 November 1966 because of the fear of broaching. Captain Crawley indicated that he was steering 347°T in order to make good 341°T, the recommended upbound course. There was further radiotelephone communication at about 2315 and at this time the wind had increased to an estimated 50 to 55 miles per hour and the seas were still building up. Until this time the EDWARD Y. TOWNSEND had experienced no difficulty in steering or holding into the sea. While

on Lake Huron the EDWARD Y. TOWNSEND carried nine feet of water in #1 port and starboard tanks. All other ballast tanks were full except that the after peak tank was filled to within approximately one foot of the top. The master of that vessel had considered proceeding to Thunder Bay to anchor in protected waters and had discussed this possibility with Captain Crawley. An alternative which had been discussed by the two masters earlier was whether to return to Port Huron. Captain Connelly deemed it safer to head into the sea. He stated that there would be more twisting action of his vessel in a quartering sea and expressed the fear of broaching and not being able to get his light vessel out of the trough. At about 2350, 28 November 1966, Captain Crawley called the EDWARD Y. TOWNSEND. The master of the latter vessel said, "I will call you back," and hung up the phone. At the time of the call the EDWARD Y. TOWNSEND had just started to blow around or broach into the seas. The vessel fell off to starboard approximately 22 degrees before it could be brought back on course with left full rudder. At approximately 0015, 29 November 1966, Captain Connelly called Captain Crawley. At this time Captain Crawley indicated that the DANIEL J. MORRELL had just had a similar experience to that of the EDWARD Y. TOWNSEND, in that his vessel had also been blown off course. This conversation was brief because both masters were busy attempting to hold the two vessels into the sea. At no time did Captain Crawley indicate what his exact plans were concerning vessel operations or itinerary. This was the last known contact with the DANIEL J. MORRELL. From the time of the DANIEL J. MORRELL's departure from Buffalo, New York on 26 November 1966 through the last communication with the EDWARD Y. TOWNSEND at 0015, 29 November 1966, the master of the DANIEL J. MORRELL had not reported any difficulty with his vessel, radios, equipment, structure, operations, machinery, or problems of any kind except weather conditions and the difficulty of holding the vessel into the sea.

22. Communications between the two vessels through the time of the last contact had been normal. Channel 16 (156.8 Mcs.) (FM) had been used as calling frequency and channels 6 and 8 (156.3 Mcs. and 156.4 Mcs.) (FM) were used in conducting radio conversation at all times between the two vessels. Channel 51, the calling and distress frequency (2182 kc.) or channel 52, (2003 kcs.), the working frequency for the AM radio, had not been used between the two vessels. The EDWARD Y. TOWNSEND was maintaining a continuous listening watch on channel 51.

23. Captain Connelly estimated the wind to be northerly at 65 miles per hour at 0015 and described the seas as "tremendous." The height of the seas was 20 feet and the distance between crests was still 250 to 300 feet. By 0200 the wind was about 65 miles per hour and had shifted to the north-northeast. Seas had built up to about 25 feet. The EDWARD Y. TOWNSEND was pitching, rolling and pounding at this time but even though there was difficulty experienced in holding her into the sea, she did not fall off more than approximately 25 degrees and did not roll more than approximately 20 degrees. During the height of the storm some solid water was taken over the bow. At approximately 0145 and again at about 0345, Captain Connelly attempted radio contact with the DANIEL J. MORRELL without success.

He attributed this failure to make radio contact to radio problems on the MORRELL. The radar on board the EDWARD Y. TOWNSEND had been turned on at approximately 1800, 28 November 1966, but at no time was there known radar contact with the DANIEL J. MORRELL and she was not sighted visually. No attempt was actually made to establish radar contact with that vessel.

24. Captain Connelly could not give an accurate distance separating the two vessels subsequent to the heaving of the anchor by the EDWARD Y. TOWNSEND at 1453, 28 November 1966. His best estimate was that 20 miles separated the two vessels at that time and that the distance probably had shortened by the time of the casualty because the DANIEL J. MORRELL had experienced adverse weather earlier.

25. The last estimated position of the EDWARD Y. TOWNSEND prior to 0200, 29 November 1966, was 066°T and 7.7 miles from Point Aux Barques Light, at 2350. The master was attempting to follow the recommended charted trackline of 341°True. He indicated that at 0200 the vessel would have made good approximately three miles from the 2350 position.

26. From the time of passing the Lake Huron Lightship until 2028, 28 November the EDWARD Y. TOWNSEND was able to make turns that would normally give her 13.9 miles per hour over the bottom and was making good approximately 13.3 m.p.h. when it passed abeam of the Harbor Beach Breakwater Light. Due to weather conditions, Captain Connelly had to reduce speed to 90 revolutions per minute at 2045 and 75 revolutions per minute at 2050, which would give him approximately 10 and 8 miles per hour over the bottom respectively under normal conditions. His vessel was making an estimated 5 to 6 miles per hour at 2050. By 2350, the vessel was making about two miles per hour over the bottom. After 2350 it was necessary occasionally to increase to full speed to keep the vessel's bow from falling off; and the engineers automatically reduced RPM when the propeller came out of the water. This occurred at approximately two minute intervals. Thereafter the engineers attempted to maintain 80 RPM.

27. By 1130, 29 November 1966, the winds had diminished to approximately 50 to 55 miles per hour. At 1400, 29 November 1966, the EDWARD Y. TOWNSEND, after gradually changing course to head into the wind and sea, was at an estimated position of 56.3 miles bearing 203°True from Cove Island Radio Beacon. The master of the EDWARD Y. TOWNSEND found the wind and sea conditions in the area off Point Aux Barques more severe than anticipated as a result of weather forecasts and on-scene weather in the lower two-thirds of Lake Huron prior to his passing Lake Huron Lightship. He could not recall having experienced sea conditions of this magnitude on the Great Lakes. He expressed the opinion that he could not have lowered his boats safely had such action been necessary.

28. On 29 November, water was discovered in the cargo holds of the TOWNSEND to a depth of approximately 45 inches at the after bulkhead. This water extended forward to the mid cargo hold length. The master was surprised to discover such a quantity of water because none had been pumped into the holds intentionally. This quantity of water was attributed to side tank leakage since the time of departing Buffalo. A former third mate of the DANIEL J. MORRELL stated that the only water normally found in the cargo hold was the result of leakage from the ballast tanks. The only times that he has seen a considerable tonnage of water in the cargo holds of Great Lakes bulk carriers was when water was placed in the holds deliberately. He stated that carriage of such water in the holds as ballast was a normal Great Lakes practice. He expressed the belief that if too much water

is carried in the cargo holds the hatches may be damaged by water impact as the vessel rolls.

29. A former master of the DANIEL J. MORRELL testified that he has pumped water into cargo holds when in heavy seas in order to keep the propeller submerged. He believed that this cargo hold ballast would make the ship more stable. He would, however, limit the depth of water to three feet at the after cargo hold bulkhead. The reason expressed for this form of ballasting was that the propeller must be kept submerged in order to prevent damage to propulsion machinery.

30. Tarpaulins were not installed over the sliding plate type hatch covers of the EDWARD Y. TOWNSEND on 28 or 29 November 1966. The master stated that this type hatch cover leaks very little and that tarpaulins are normally used during Spring and Fall months when the vessel is loaded with cargo. The previous master of the DANIEL J. MORRELL stated that he does not require tarpaulins to be installed over the hatch covers when there is no cargo aboard, even in bad weather.

31. On 30 November 1966 the EDWARD Y. TOWNSEND stopped for fuel at Lime Island in the Lower St. Mary's River. At this time the master received a report that there were some loose rivets in the deck plating, starboard side, weather deck (spar deck). Upon further inspection, it was found that there was a crack extending from the forward starboard corner of number 10 hatch to and running beneath the deck strap which is located between the hatches and the sheer strake, starboard side. Prior to this time the master was not aware of any structural damages. Normal working and springing had been experienced but it was not considered excessive. The damages were reported to the company officials who in turn made the required report to the Coast Guard.

32. The M/V BENSON FORD, having anchored at Bois Blanc Island, Straits of Mackinac, because of weather conditions, heaved anchor at 0850 EST, 28 November 1966, and proceeded downbound into Lake Huron. The loaded vessel was basically following the recommended downbound track line. At the time of heaving anchor there was a northerly gale. The log book for the BENSON FORD indicated that she passed Presque Isle at 1509 EST at which time the wind was NNE whole gale. The passing of Thunder Bay Island was logged at 1800 and wind was NNE whole gale. Log book entries from 1947, 28 November to 0702, 29 November 1966, the time of arrival of that vessel at Lake Huron Lightship, indicated northerly whole gale winds. The master of the BENSON FORD estimated that the storm was at its greatest intensity between the hours of 2200, 28 November and 0600, 29 November. During this period the wind was "fairly constant" at an estimated 60 knots and the seas were from the north northeast at 20 to 25 feet, 250 to 300 feet from crest to crest. The vessel did take some water over the stern and there was the normal difficulty in shiphandling to be expected with heavy following seas. After overhearing a conversation between the EDWARD Y. TOWNSEND and the DANIEL J. MORRELL concerning the possibilities of proceeding to Thunder Bay for shelter, the master of the BENSON FORD joined the

discussion to give information concerning the status of anchored vessels at Thunder Bay. He reached the definite opinion that both Captain Crawley and Captain Connelly were planning to seek shelter at Thunder Bay. During this conversation both upbound vessels had indicated that their speeds had been reduced. Although the BENSON FORD was experiencing difficulty with his AM radio due to "static electricity," he was maintaining a continuous listening watch on channel 51 and had overheard some communication on that channel. No actual distress communication was received on the 28 or 29th of November, however. At 0015 29 November the BENSON FORD was at an estimated position of 055°T, 19.7 miles from Pt. Aux Barques Light. During the period 0100 to 0130 the BENSON FORD picked up a radar contact off her starboard beam at a distance of about 5.8 miles. At this time the BENSON FORD was on a heading of 180°. The target was not identified but was believed to be either the DANIEL J. MORRELL or the EDWARD Y. TOWNSEND because he knew of no other vessels in that general area. The target was intermittent due to weather conditions and no other target on his starboard side was observed. The BENSON FORD suffered no damages as a result of the storm. The master of the BENSON FORD indicated that the weather conditions experienced were more severe than expected. He had anticipated winds from the NNW. He also expressed the opinion that he would not have been able to safely lower his lifeboats during this storm, had it been necessary.

33. The SS KINSMAN INDEPENDENT, a Great Lakes bulk freighter constructed in 1907, proceeded upbound into Lake Huron and passed the Lake Huron Lightship with a cargo of coal at 1727 EST on 28 November. The master, Captain [redacted], stated that at that time there were light winds from the west. As the vessel approached the Harbor Beach area the wind had moved to the North and was 45 knots. The engine was held at 3/4 speed in order to maintain steerageway. This speed was 83 RPM, which would normally give the vessel a speed of approximately 10.6 MPH. At 2205 speed was reduced to 68 RPM. At 0145, 29 November 1966, when the KINSMAN INDEPENDENT was in position 010°T and 3.2 miles from Harbor Beach Light, it was blown off course and was caught in the trough of the sea for approximately four minutes before being able to reverse course to return to Port Huron. The vessel had been unable to regain its former heading. Until being blown around she had been able to hold into the sea without too much difficulty. The wind had increased to an estimated 47 to 55 knots. The draft of the KINSMAN INDEPENDENT on entering Lake Huron was 17'2" forward and 18'9" aft. The horsepower of this 592 foot vessel is 1800.

34. Captain [redacted] had expected the wind and seas to go to the Northwest and that his vessel would be in the lee of the eastern shore of Michigan. At the height of the storm the estimated height of the sea was 15 to 17 feet and he observed two "rollers" with an estimated height of 25 to 28 feet. Until his return to Port Huron for refuge, Captain [redacted] had intended to continue through the storm to Superior, Wisconsin. Captain [redacted] indicated that he had experienced one storm on the Great Lakes that was more severe than that experienced on 28 and 29 November. This was a 1952 storm in Lake Superior in which the winds were about 95 MPH and the seas 25 feet high.

35. Captain [redacted] was Second Mate on the DANIEL J. MORRELL in November 1958 when that vessel was proceeding in a storm in Lake Superior. The winds at that time reached 100 miles per hour and the seas reached a height of 25 feet. The DANIEL J. MORRELL was then in ballast and additional water ballast was carried in the cargo hold.

36. The following upbound vessels were also in the general area off Pt. Aux Barques, during the storm on 28 and 29 November 1966:

a. SS HOWARD L. SHAW (Canadian)

This 451'6" vessel of 4769 gross tons, built in 1900 at Wyandotte, Michigan, passed Lake Huron Lightship at 1545, 28 November 1966. At 2115 she was abeam of Harbor Beach, proceeding at three-fourths speed and making one to two knots over the bottom. At 2330, 29 November 1966 she was blown off course, and after making two unsuccessful attempts to regain her heading into the sea, proceeded to Port Huron for refuge. The HOWARD L. SHAW was light and in ballast. She had no radio contact with the DANIEL J. MORRELL while in Lake Huron on 28 or 29 November.

b. SS FRED A. MANSKE, O.N. 206695

This is a 504 foot self-unloading Great Lakes bulk freighter, built in 1909 of 2500 horsepower. Although the vessel was almost blown around, she proceeded upbound to her destination, through the area off Pt. Aux Barques, during the storm. The master was reluctant to come about because of the topside weight of the self-unloading boom

c. SS ROBERT HOBSON, O.N. 225175

This 586 foot Great Lakes bulk freighter, built in 1926 of 2200 horsepower, passed the Lake Huron Lightship at 1736 EST, 28 November 1966. She was blown around at 0230, 29 November 1966, approximately three to four miles above Harbor Beach, and proceeded to the Port Huron area. The ROBERT HOBSON, which was loaded with coal to the winter marks, sustained no known damages. The master of this vessel indicated that the winds experienced were not surprising but the seas were more than were anticipated under such wind conditions.

d. SS HARRY COULBY, O.N. 226742

This 615 foot Great Lakes bulk freighter, built in 1927 of 5000 horsepower, passed the Lake Huron Lightship at 0126 EST, 29 November 1966. When at a position 6 miles above Port Sanilac on the upbound track, it experienced one wave estimated to be 20 feet in height and took solid water over the bow. At this time the master was informed that conditions were more severe in the Pt. Aux Barques area and that other vessels were returning downbound in the snow storm. He then intentionally reversed course and proceeded to the Port Huron area. The master of the HARRY COULBY said that the master of the HENRY STEINBRENNER reported that it took 8 minutes for that vessel to come about. The master of the HENRY STEINBRENNER intentionally turned his vessel around and returned to Port Huron.

e. Several other vessels were reported to have been blown around, turned around voluntarily or proceeded through Lake Huron at various times during 28 and 29 November 1966.

37. The U. S. Coast Guard Cutter ACACIA (WLB-406), having departed Harbor Beach, Michigan at 1650, 28 November 1966 with a deck load consisting of two Coast Guard craft, the CG-40507 and CG-36550, while en route to Sault Ste. Marie, Michigan was diverted to assist personnel on the grounded M/V NORDMEER off Thunder Bay Island Light. At 2215 she was released from the NORDMEER assistance case. At 2330, CG-36550 broke loose due to heavy weather. At this time the vessel was at an estimated position of 44°12'N, 82°51'W and was attempting to reach shelter at Thunder Bay. At 0300, 29 November 1966 both the CG-40507 and the CG-36550 were loose on deck and were receiving damages. The seas were estimated to be 15 to 25 feet in height. The wind was reported as 40 to 50 knots. The ACACIA then came about at an estimated position of 44°30'N, 82°55'W to head for shelter. She was unable to enter Harbor Beach because of the heavy seas and accordingly proceeded to Port Huron, Michigan, for safe refuge.

38. While the DANIEL J. MORRELL was taking on fuel at Windsor, Ontario on the morning of 28 November 1966, [redacted] boarded the vessel and assumed his regular duties as watchman. [redacted] had a total of three years sea service, all of which was served on board the DANIEL J. MORRELL. He had been serving as watchman for approximately a year.

39. [redacted] normally stood the 4-8 watch and commenced his last watch shortly after the vessel passed the Lake Huron Lightship at approximately 1530, 28 November 1966. Between 1600 and 1630, Hale, as directed, entered the cargo holds for the purpose of marking leaks and cargo bucket damages, which were incurred during normal unloading operations in way of side tank slopes. Damage to side tank slopes had been repaired several times during the 1966 operating season. The vessel's smooth log indicated that the last repairs in that area had been completed in Buffalo, N. Y. on 26 October 1966. He marked three leaks, one in the general area of number 6 hatch and two in the general area of number 8 hatch. He was unable to drive wedges into the holes because the cracks were not parted sufficiently to receive wedges. The largest of the cracks was described as "moon shaped" and 8 inches long. The three cracks were "spurting water." He was unable to enter the number three cargo hold because free surface water extended from the after bulkhead of number three cargo hold to midway into number two. He estimated the depth of water to be 18 inches at the after bulkhead of #3 cargo hold. [redacted] attributed the water to leaks from the side tanks and so informed the master of the amount of water in the cargo holds. The vessel's hatch covers were in place and tarpaulins were on deck, rolled up adjacent to the hatches. At 2000, 28 November, at the time of completing his watch, Hale indicated that it was snowing but the weather was not severe, and the vessel was riding "well." He was able to proceed aft to the galley for food after getting off watch. However, at the time of his going to bed at about 2130, the weather was worsening. Hale's quarters were located on the spar deck, starboard side forward, adjacent to the anchor windlass room. At the time of going to bed he could hear the anchors bumping against the bow. Other than the noise produced by the

anchors, [redacted] was not aware of the actual weather and sea conditions from the time of going to bed until at or about 0200, 29 November 1966. At about that time he was awakened by what was described as a loud bang. A few minutes later he heard another bang. At this time, books from his book shelf fell out into the deck. The book shelf had no retaining bar and was installed in a fore and aft direction. He became alarmed and decided to get up. He then learned that his bunk light was inoperative. About this time the general alarm was sounded. He jumped up, grabbed his lifejacket and ran out into the starboard passageway. There were no lights on in the forward section of the vessel, but as he looked aft he could see lights on the after superstructure. He noticed that the center of the vessel was "higher" than the after part of the vessel; that is to say, it was in a hogging condition. He went back into his room to look for his pants, but in the darkness and excitement he could find only his peacoat. He then proceeded to the forward liferaft. There was melting snow on the deck. He had looked for the lifeboats but was convinced that they both had already been lowered. While still forward he could hear what he took to be metal cracking and working or rubbing together. When he reached the forward liferaft, there were several men standing around it. He thought the whole forward or deck crew was there at that time. No attempt was made to proceed to the lifeboat area because of the damage in the midship section. Someone said, "get on the raft and hold on tight." He indicated that virtually all deck force personnel, including the Master, 1st Mate and 2nd Mate sat on the raft to await the sinking of the vessel. No attempt was made to throw the raft over the side and no instructions regarding the use of lifesaving equipment were given by any of the ship's officers in [redacted] presence. One crew member tried to get men off the raft in order to open the storage locker to reach the distress flares. The master decided to wait until the raft was in the water to use the flares. The crew members assembled at the raft were in various stages of dress, some with various items of clothing missing. For example, [redacted] was wearing only a pair of shorts, lifejacket and peacoat. They were all wearing lifejackets. [redacted] knew that there were two vessels following fairly close behind the DANIEL J. MORRELL earlier and Captain Crawley had indicated that there had been a vessel sighted off the port bow. Hale did not actually see any other vessels immediately prior to or at any time after the sinking. Two men had attempted to tie themselves to the raft with line. [redacted] saw only one person on the after end of the ship, but he could not be certain of his identity. Although there were no lights in the midship area, [redacted] indicated he did observe that the crack in the vessel started in the area of the gunwale bar, starboard side, in the general area of hatches 11 and 12, and proceed across to the port side. The forward section's deck at the starboard side seemed to drop lower than the after section in a twisting effect. [redacted] could see metal sparks as the two sections of the vessel rubbed together. He could also see steam coming from the parted steam line. Then the vessel broke into two sections and the stern section appeared to be pushing and ramming the forward section. This, together with sea and wind action, caused the bow section to work around to port, reaching a perpendicular angle in relation to the stern section. (See Exhibit No. 49.) The stern section appeared to be still under power and continued to bump into the port side of the bow section. As the bow

section swung to port and parted from the after section, it started settling and very shortly thereafter the forward life raft and several members of the crew were washed over the starboard side. Time elapse from the sounding of the emergency alarm until the vessel parted was estimated to be eight minutes. The raft was thrown well clear of both sections of the vessel and no one remained on the raft as it entered the water. [redacted] came up within approximately 10 feet of the raft. By the time he reached the raft, two deckhands, Arthur E. Stojek and John J. Cleary, Jr., had already arrived. Then Charles Fosbender, wheelsman, reached the raft and they were all able to crawl onto the raft. [redacted] saw no one in the water prior to his going over the side. After his entry into the water, the only persons he saw were the other three on the raft and one person still on the forecastle of the vessel. He never saw a lifeboat or the after raft in the water. [redacted] was of the opinion when the forward raft entered the water that the after raft was still on the vessel. None of the four men on the raft were on watch at the time of the casualty. No one indicated to [redacted] any knowledge as to the cause of the casualty, incidents leading up to the actual sinking or whether radio distress signals had been transmitted. [redacted] heard the master state on 28 November that channel 52 was inoperative. There were no other known radio problems on board the DANIEL J. MORRELL. The vessel's speed or heading, and the direction of the wind and sea in relation to the vessel at the time of the casualty is unknown. He did not know the vessel's location at the time of sinking. Approximately 15 minutes after [redacted] entered the water he observed the after portion of the bow section settle evenly beneath the water, followed by the stem. The raft was at a distance of approximately 200 yards from the bow section and an estimated one-half to one mile from the stern section when the bow sank. The stern still seemed to be under power and lights were still visible. The men on the raft did not see the stern section sink. Other than the actual breaking up of the vessel, no fires, explosions or any other material, machinery or equipment casualties were observed by [redacted] while on board or after going over the side. The life raft was provided with the equipment required by Federal Regulations. [redacted] used several of the distress flares within a short period after sinking as there were other vessels known to be in the general area. Two flares were lost over the side. After having fired the signal pistol two or three times, the handle and barrel separated into two pieces. He was able to hold them together in order to fire off the remaining parachute flares. [redacted] knew of no other deficiencies with lifesaving equipment. All the parachute flares and hand held flares were used within the first 24 hours. The storage locker and other portions of the wood and metal raft structure sustained damages as it went over the side. However, it remained intact and offered adequate support for the four men. The men lay on the raft huddled together on one end, there being no other means of keeping warm. [redacted] testified that Cleary and Stojek died around 0600, 29 November 1966 and that Fosbender died around 1600 the same day. They were all believed to be conscious until shortly before death. The cause of death for these three men was listed on their Death Certificates as drowning. Exposure was listed as an antecedent cause. The life raft supporting Hale and the three deceased men was located by the Coast Guard at 1600, 30 November 1966. [redacted] was semi-conscious when he was taken from the raft. He was able to give preliminary testimony to Coast Guard Investigating Officers on 1 December 1966. (See Exhibit 26.) He suffered from exposure, frost bite of his feet and right hand and sustained other minor injuries. As a result, he is still incapacitated.

40. [redacted] testified during the preliminary interrogation that prior to the sinking, the vessel was "sound" as far as he was concerned. However, he stated that there were some rivets marked for replacement by Frank Brian, wheelsman, throughout the cargo holds just before winter lay up in 1965. He could give no estimate as to the number of marked rivets. He indicated that he didn't know if any had been replaced but that he knew some still had not been replaced prior to the 1966 season. These rivets were alleged to be in the shell plating between the side tank tops and the spar deck. At initial questioning, he knew of no other structural discrepancies. When questioned before the Marine Board, he testified that over 1000 rivets were marked for replacement in the shell plating between the main and spar decks, port and starboard, and that these rivets had not been replaced at the time of the casualty. He related that about a week prior to the latter questioning, [redacted], deck watchman on board the DANIEL J. MORRELL in 1965, told him that one-fourth of the shell rivets in the side tanks were bad. Neither the company representatives, inspectors, surveyors, or previous vessel personnel who were questioned had ever seen or heard of defective or marked rivets in the shell plating between the main and spar decks.

41. [redacted] testified that the 1st mate had given [redacted] instructions in mid-November 1965, in his presence, for Brian and [redacted] to enter No. 4 and 5 port tanks to mark leaky rivets with paint. He stated that [redacted] was in charge as he had 30 years experience. [redacted] stated that he observed two leaking bead welds in the area of lapped butt plates. He indicated that the worst leak was approximately seven inches in a vertical direction. He also stated that there were 250 to 500 leaky shell rivets marked in these two tanks from above the turn of the bilge to within two feet of the side tank tops and that the vessel's side plating was partially wet when the leaky rivets were marked. He saw no sheared or missing rivets. The leaky rivets were allegedly grouped to the extent that the men painted circles around some areas up to 3 and 4 feet in diameter. A report of the condition of the rivets was reportedly made to the 1st mate by Brian. [redacted] also entered the cargo holds to mark up bucket damage for repair during winter lay up.

42. [redacted] stated that several of the vessel's side tanks were leaking during the 1965 season and that as a result of his personally sounding vessel tanks, he had observed the collection of up to 3 inches in a side tank within a 24 hour period. He personally observed up to seven inches in side tanks and on one occasion up to 10 inches that he attributed to leakage. The port side tanks 4 and 5 were leaking more than the others.

43. [redacted] testified that he had never discussed the structural condition of the DANIEL J. MORRELL with [redacted]. [redacted] total sea experience consists of service on the DANIEL J. MORRELL from 3 June to 21 December 1965 as deckhand and deck watch.

44. Mr. [redacted] informed the Board that he has never entered side and double bottom tanks to mark leaky rivets. He considered this work to be the mate's responsibility. He did enter all the DANIEL J. MORRELL's port side and double bottom tanks in the Spring of 1965 to remove debris left by shipyard personnel. On this occasion he saw no structural defects.

45. After being informed by an official of the Bethlehem Steel Corporation at 1215 EST, 30 November 1966 that the DANIEL J. MORRELL was overdue, the U. S. Coast Guard Rescue Coordination Center, Cleveland, Ohio initiated an all ships broadcast, requesting that all vessels be on the lookout for that vessel. A fixed wing aircraft, CG-1266, en route from Alpena, Michigan to Detroit, Michigan was directed to offload cargo at Detroit and then commence a search for the DANIEL J. MORRELL. At 1312, 30 November 1966 the Coast Guard in Cleveland, Ohio was informed that the SS G. G. POST had sighted a body wearing a life jacket stencilled with the name, "DANIEL J. MORRELL", 8 miles, 005° true from the Harbor Beach Breakwater Light. The CG-30386 had already been dispatched by the Harbor Beach Coast Guard Station and actually recovered the body at 1210, 30 November 1966. The Coast Guard aircraft, CG-1266, arrived in the general area of the disaster at 1335 and was designated as on scene commander. The following Coast Guard units participated in the search:

Vessels and small craft

USCGC MACKINAW (WAGB-83)
USCGC BRAMBLE (WLB-392)
USCGC ACACIA (WLB-406)
CG-30386 and CG-36463 from Harbor Beach Coast Guard Station
CG-40560 from the Port Huron Coast Guard Station
CG-40558 from the Saginaw River Coast Guard Station

Aircraft

Helicopters CG-1395 and CG-1412 and fixed wing aircraft CG-1242 and CG-1266 from CG Air Station, Traverse City, Michigan
Helicopters CG-1401 and CG-1415 from CG Air Station, Detroit, Michigan

Upon arrival of the CGC MACKINAW in the area of the casualty, she was designated as on scene commander.

46. In addition to the first body recovered at 1210, 30 November 1966 by CG-30386, additional bodies, the survivor and debris were recovered as follows:

a. At or about 1600, 30 November 1966, seven bodies were recovered by CG-30386 and helicopters CG-1401 and CG-1415, within a five mile radius of a position seven miles, 025° true from Harbor Beach Breakwater Light.

b. At about 1600, 30 November 1966, three bodies and one survivor were recovered from the DANIEL J. MORRELL's forward life raft, on the beach, three miles below Huron City, Michigan by helicopter CG-1395. The survivor, [redacted], was transported by the helicopter to the Harbor Beach General Hospital.

c. At about 0930, 1 December 1966, one body was recovered ten and one-half miles, 137° true from the Harbor Beach Breakwater Light by the CGC MACKINAW.

d. At about 0945, 1 December 1966, at a position of 43°40'N, 82°20.5'W, two bodies were recovered by the CGC ACACIA.

e. At about 1355, on 1 December 1966, at a position of 43°37'N, 82°20'W, six bodies were recovered by the CGC ACACIA.

f. At about 1445, 5 December 1966, one body was recovered under the DANIEL J. MORRELL's after liferaft at Pt. Aux Barques by a commercial salvager. The raft was generally in good condition, with only minor damages.

g. On the morning of 11 December 1966, one body was recovered by the Ontario Provincial Police on the beach eight miles north of Kincardine, Ontario.

The active search continued until 1905 EST, 4 December 1966. Daily surveillance searches were conducted along the shoreline several days thereafter, as weather permitted, in attempts to locate the remaining bodies and vessel debris.

47. In addition to a number of Great Lakes vessels there were several Coast Guard units in the Lake Huron area that were maintaining continuous listening watches on channel 51 (2182 kc.) at the time of the casualty. No distress message was received from the DANIEL J. MORRELL by Coast Guard units or other vessels in the area. The material and debris from the DANIEL J. MORRELL recovered and collected during and after completion of the active search including two liferafts, several life jackets, life rings, boat oars, etc., as indicated in Exhibit 52, have been released to the vessel owners.

48. During November and December 1960, while the DANIEL J. MORRELL was on drydock in Ashtabula, Ohio approximately 9500 shell rivets and 13 shell plates were replaced. Numerous replacements and repairs were completed to internals in way thereof. Various other repairs were also completed at this time. (See Exhibit No. 21.) All the above repairs were allegedly required as result of the vessel surging against the dock at Taconite Harbor, Minnesota on 2 December 1959; heavy weather on 18 November 1958 in Lake Superior; rubbing of the bottom in Nicolet Lake on 3 August 1958; the vessel's striking of a dock prior to 26 June 1960 at an undetermined time and place; the vessel's striking of a wall at Lock 4, St. Mary's River, Sault Ste. Marie, Michigan, on 15 June 1960; and as a result of cargo loading and unloading "bucket" damages prior to the date of drydocking. It is noted that bucket damage repairs included cropping and renewing sections of auxiliary deck stringer plates at some hatches. One 8" by 24" section of the inboard edge of the auxiliary deck stringer at hatch number 11 starboard side was cropped and renewed by welding. All repairs during the drydocking of the DANIEL J. MORRELL in November and December 1960, were completed and tested satisfactorily.

49. The subject vessel was next drydocked in Toledo, Ohio, on 18 February 1966 and was given credit for drydocking by the U. S. Coast Guard on 25 February 1966. From drydocking in December 1960 to drydocking in February 1966, there were no

reported major damages to the DANIEL J. MORRELL and no major repairs or alterations were completed to the vessel during that period. However, there were minor repairs completed during this period, such as routine "bucket damage" repairs in way of cargo holds.

50. Seven (7) inspectors and surveyors participated in the 1966 drydock inspection of subject vessel. This group included the Fleet Engineer of the Bethlehem Steel Corporation and his assistant, a representative of U. S. Salvage, a representative of the American Bureau of Shipping and three Coast Guard inspectors, including one boiler and two hull inspectors. During this inspection, the entire external body, all side and double bottom tanks, forepeak and after peak tanks and all other vessel compartments were inspected thoroughly. As a result of this inspection, three shell plates in the starboard "E" strake were removed and replaced by two longer plates. The plates removed were E-21-S, E-22-S and E-23-S, located between frames 107-127. The plates were installed with welded butts and riveted seams whereas the previous installation consisted of riveted butts and seams. In addition, eleven (11) bilge brackets and three (3) web floors in the area involved were cropped back and replaced or partially replaced because of buckling. These repairs were necessitated by damages sustained at an undetermined date and discovered during the 1966 drydock inspection. The three (3) plates were set in approximately two inches. The remainder of the hull plating appeared to be in good condition. There was no condition found during the drydock examination to indicate the necessity for drilling or gauging to determine the thickness of metal. While the vessel was on drydock, approximately 50 shell rivets were replaced as required by the inspection party. In eight (8) of the vessel's side and double bottom tanks, the Coast Guard inspector required numerous minor or routine type repairs, such as the refastening of stiffeners and brackets and repairing cracked welds in brackets, stiffeners, and angles. In the number 4 starboard double bottom tank the Coast Guard inspector required that a seven (7) foot by one and one-half (1.5) foot section of the after watertight bulkhead be cropped and replaced, necessitated by a fracture in the bulkhead plate adjacent to the bottom transverse standing angle. Numerous repairs were completed in cargo holds. These were necessitated by bucket damage. The senior Coast Guard hull inspector present during the drydock inspection made the following entry in the Drydock Examination Book for February 1966: "It was noted that approximately 80% of the bottom keelson shell rivets had been renewed recently, probably at the last credit drydocking. Deterioration seems to be effecting these rivets more than other bottom rivets. Although it does not present a problem at this time, they may well require renewal at the next drydock exam." He considered that the amount of deterioration was not sufficient to justify the issuing of a requirement to replace the rivets. This entry was made in the Drydock Examination Book for future reference only. Neither of the Coast Guard hull inspectors could determine the reason for the "unusual" deterioration, but did postulate that electrolytic action was involved. All repairs that were required by Coast Guard inspectors or other members of the inspection party were completed satisfactorily and were inspected by Coast Guard inspectors after completion. Upon completion of the drydock examination, all drydock inspection items were checked off in the Drydock Examination Book

as having been completed and the senior hull inspector and the boiler inspector signed the entry: "In my opinion the vessel is fit for the service and route specified." There were no outstanding requirements upon completion of the drydock examination of the DANIEL J. MORRELL. All inspectors and surveyors interrogated indicated that at the conclusion of the drydock inspection, this vessel was in good condition.

51. The last annual inspection was completed 15 April 1966 at the Lakefront Ore Dock, Toledo, Ohio. All items required to be inspected by Federal Regulation were examined and were determined to be in satisfactory condition at the completion of the annual inspection. The Load Line Certificate was endorsed by an American Bureau of Shipping Surveyor, on 26 February 1966. Fire and boat drills were conducted at annual inspection and at the time of mid-season inspection at Buffalo, New York, 20 July 1966. During the annual inspection, all personnel except the master, the mate and the chief engineer were exercised in the starboard lifeboat. The port lifeboat was swung out. Crew performance during the boat drill was considered to be fair because crew members were slow in launching the boat. The first mate then instructed the crew as to their duties. The performance of the second and third boat crews was much improved. The fire and boat drills during the mid-season inspection were conducted satisfactorily. There were no requirements outstanding against the vessel or its equipment at the time of completion of the annual or mid-season inspections. Subsequent to the date of completion of annual inspection and prior to the date of the casualty there were no known hull or structural damages suffered by the vessel.

52. Prior to winter lay up of the DANIEL J. MORRELL in December 1965, a winter work list was prepared for that vessel and was signed by the master for deck items and by the chief engineer for engineering items. The deck section of the work list was prepared by the 1st mate. Of the 46 items on the winter work list all were completed except two which were not of structural significance. The deck section of the work list contained the following item, "Leaks in the hull will be marked. Port tanks make water." No other item pertaining to midship structural strength of the vessel was contained on the list. The master and chief engineer serving on board subject vessel at the time of winter lay up in 1965 both testified that no other vessel deficiencies were reported by crew members prior to winter lay up. Captain Hull served as master of the DANIEL J. MORRELL from July 1964 until 3 August 1966, when he was relieved by Captain Crawley. Captain Hull stated that the side tanks and cargo holds of the MORRELL were entered by vessel personnel for the purpose of marking leaky rivets in the shell plating and bucket damage in the cargo holds and to inspect for other damage in the Fall of 1965. He estimated that a maximum of twelve (12) leaking rivets were reported in the shell plating in way of side tanks, although he could not remember which side tanks were involved. He indicated that the reason the side tanks were entered for checking rivets was that some of the side tanks were "making water." He said that maximum leakage into any side tank was approximately 5 to 6 inches over a period of a three or four day trip. He did not report the leaks to the vessel owners nor did he direct personnel to enter the tanks until shortly prior to winter lay up because he did not consider the leakage to be significant or excessive.

53. Captain [redacted] considered that the leaking shell rivets had been corrected during drydocking. However, during the 1966 season there were two or possibly three unidentified side tanks that leaked slightly. He did not inform the company of this condition.

54. The fire and sanitary piping to the forward part of the vessel was installed through the port side tanks. Leaking joints in this piping necessitated repairs during the 1966 season and the vessel operators had planned to relocate these pipes on the spar deck during winter lay up in 1966-1967. The fire line was also used for washdown. This same situation has existed in the past on other vessels of the Bethlehem Fleet and similar corrective measures have been taken. Upon departing the DANIEL J. MORRELL on 3 August 1966, Captain [redacted] knew of nothing that would cast doubt as to the soundness of that vessel. He had received no report or complaints from vessel personnel and made no report to company officials to indicate any outstanding vessel structural, equipment or mechanical deficiencies through that date.

55. A Coast Guard inspector boarded the EDWARD Y. TOWNSEND at Sault Ste. Marie, Ontario on 2 December 1966, to conduct a heavy weather damage survey. The following conditions were found:

a. The visual part of the crack on the spar deck was approximately 13 inches in length with a maximum opening of approximately 1/8 inch. The crack was almost perpendicular to the axis of the vessel. There was a herringbone effect giving the indication that the crack commenced somewhere beneath the number 10 hatch coaming's forward supporting standing angle at the starboard corner.

b. At the forward starboard corner of number 10 and number 11 hatches, rivets in the deck strap showed signs of working. There were no signs of working on the spar deck, port side. Visual inspection of the shell plating, sheer strake and gunnel bars, port and starboard, revealed no apparent change in form resulting from stress.

c. In numbers 3, 4 and 5 doublebottom and side tanks, starboard, there was minor distortion of metal adjacent to some side keelson lightening holes and there was evidence of previous minor stress corrosion. At some of the distortions there was evidence of working. It could not be determined whether the minor distortion was the result of recent working or was previously existing, but there was indication that rust and scale had recently been jarred or popped loose from some of the stress corrosion areas. There was only one crack noticed in way of the stress corrosion. This was a crack approximately six inches in length commencing diagonally from the edge of a lightening hole. This crack was not a new one as scale or rust had formed over the edges. There were several rivets in the center vertical keel that showed signs of recent working. There was an old crack of approximately 6 feet in length in the after bulkhead of number 4 starboard double bottom tank between the outboard side keelson and the turn of the bilge. This crack was in the

same general location as one discovered on the DANIEL J. MORRELL in February 1966. One of the shell rivets at the bulkhead standing angle in this area were loose, eaked slightly and showed signs of deterioration. It could not be determined whether the bulkhead had worked recently but there was no apparent distortion. The distortion, stress corrosion and evidence of working rivets were more pronounced in the number 4 side and double bottom tanks than in adjacent areas. The corresponding tanks on the port side showed some signs of minor distortion at the lightening holes of the side keelsons.

d. The metal in the midship area of the vessel, including deck, shell, internals and all structural members appeared to be in surprisingly good material condition. The weardown, or deterioration, was considered negligible.

e. Other than the normal stress corrosion, cracks and evidence of working rivets as indicated above, there was nothing found that would explain the reason for the crack in the spar deck. Excluding the crack in the spar deck, no evidence of major structural weakness was found.

f. The EDWARD Y. TOWNSEND's Certificate of Inspection was withdrawn as a result of this inspection and requirement was issued directing the vessel to be drydocked for further internal and external inspection and necessary repairs. A Permit to Proceed to the location of a drydock was issued, authorizing the vessel to be towed unmanned.

g. The owners of the EDWARD Y. TOWNSEND have agreed to provide samples of metal removed in way of the crack for analysis at such time as repair work is ommenced. At present, the vessel is in a winter lay up status at Sault Ste. arie, Ontario.

56. From initial construction through the date of subject casualty, the SS DANIEL J. MORRELL and the SS EDWARD Y. TOWNSEND had no significant structural or propulsion unit changes or alterations that would alter their classification as sister ships. The latter vessel was reboilered in 1946 and repowered with a Skinner Unaflow engine in 1954.

57. The Bethlehem Steel Corporation contracted the McQueen Marine Company, Amherstburg, Ontario, Canada to locate and positively identify the sunken DANIEL J. MORRELL. Due to adverse weather conditions experienced while attempting to locate the MORRELL between 13 December 1966 and 20 December 1966, attempts to locate and identify that vessel were abandoned on the latter date.

58. The Commandant, U. S. Coast Guard contracted with Ocean Systems Incorporated, Alexandria, Virginia through the cooperation of the Supervisor of Salvage, U. S. Navy, to locate, identify, take television pictures of vessel structure and retrieve metal samples from the DANIEL J. MORRELL. The U. S. Coast Guard Cutter BRAMBLE (WLB-392) was used as a working platform for the entire survey operations. On 6 January 1967, after mooring over a target located by magnetic detection equipped aircraft from the U. S. Naval Air Station, Grosse Ile, Michigan, divers working

from the BRAMBLE were able to positively identify by television pictures the stern section of the DANIEL J. MORRELL. Further diving operations were then continued from 14 January 1967 to 2 February 1967.

59. As a result of the diving operations, the following facts were established:

a. The stern section of the vessel was resting on the bottom of Lake Huron in approximately 200 to 210 feet of water on a heading of about 320° true. It has settled appreciably in the mud, and has a slight port list. She has a slight trim by the forward end. There were piles of mud on the spar deck adjacent to the point of the crack and it appeared that the forward end had plowed into the bottom first. This area of the stern was buried in mud to within 6' to 7' of the spar deck.

b. The primary crack in the deck and sheerstrake on the starboard side occurred at web frame 107. This frame is located adjacent to and even with the forward coaming of number 11 hatch. The fracture line on the deck, starboard, ran through a transverse row of rivet holes to the hatch coaming. The forward portion of the number 11 hatch coaming was missing. The crack in the starboard sheerstrake was basically vertical and passed from rivet hole to rivet hole. The location of the break on the port side was between hatches 11 and 12 at about frame 113. The break in the deck stringer followed a transverse row of rivets. The crack in the sheerstrake, port side, was vertical and did not occur in the area of rivets. The port deck seam strap cracked through a line of rivets about six inches forward of the break in the deck stringer. All underdeck longitudinals in the area of the break were bent, twisted, torn loose and displaced from their normal positions. Remaining deck and side plating as well as longitudinals show evidence of severe distortions. Some longitudinals were doubled back upon themselves. Deck and side plating showed evidence of extreme bending. Some sections had been bent back upon themselves to approximately 180° from original. The deck stringer starboard side had been bent down to an angle of about 90 degrees. A section of this plate was recovered for analysis. The surface of the crack in this plate contains chevrons pointing inboard. A large section of the sheerstrake starboard with a section of the seam strap and "L" strake attached was also recovered. Chevrons on the edge of fractured surface on either side of the 3rd rivet hole below the upper edge of the sheerstrake pointed toward that rivet hole. This section of side metal had been bent outboard and around upon itself to 180° from normal. The retrieved metal shows signs of little or no wear down or deterioration and the rivets contained therein were in very good condition. The edges of rivet holes showed no signs of wastage. The forward edges of the retrieved metal were shiny and flattened as if they had sustained severe pounding by other metal.

c. Cargo hatches and the coal bunker were found open. Hatch covers were strewn about the area of the hulk. Many hatch clamps had been broken.

d. The port and starboard lifeboat davits were found in the cranked-in position. The port lifeboat was missing and has not been recovered. The starboard lifeboat was hanging over the starboard side still attached to the after boat falls. Its boat cover was in place. The after mast had toppled and had fallen in the area of the missing port lifeboat.

e. None of the missing crew members of the DANIEL J. MORRELL were located as a result of the diving operations.

f. The forward section of the DANIEL J. MORRELL was not located.

g. Diving operations were hampered by silt, weather and sea conditions and the divers were not able to make an internal survey to determine distortions or weaknesses that might have contributed to the casualty.

60. The report of the metallurgical study, dated 6 March 1967, of steel plate samples from the DANIEL J. MORRELL and completed by the Battelle Memorial Institute, Columbus Laboratories, Columbus, Ohio supports the following facts:

a. A brittle fracture typical of many prior ship fractures in pre-1948 steel occurred in the spar deck and sheer strake on the starboard side at frame 107.

b. The source of the fracture in the deck plate was not contained in the sample recovered from the hulk. However, the chevron pattern in the fracture indicated that the fracture initiated inboard of the sample retrieved.

c. The fracture in the sheer strake at frame 107 initiated at the 3rd rivet hole below the upper edge of the sheer strake.

d. The original weight of the deck and sheer strake was 40 pounds per square foot (assumed to be 39.98 pounds rather than 40.8 pounds). This corresponds to a thickness of .980 inches. The average thickness of the sample retrieved was .965 inches, which would indicate corrosion of less than 2 per cent.

e. The chemical and physical properties and microstructure of the steel were typical of ship plate steel used prior to 1948. The nil ductility temperature as determined by "The Standard Method for Naval Research Laboratory Drop Weight Test" was 50°F. The 15 foot pound "V" notch Charpy transition temperature averaged 97°F.

61. Of the 22 persons recovered, 13 drowned and 9 died of exposure.

62. The Federal Bureau of Investigation has given authority to include their reports showing positive identification of the persons recovered into the record.

CONCLUSIONS

Based on the foregoing Findings of Fact, it is concluded that:

1. The casualty was caused by a structural failure in the hull girder amidships which resulted in the break-up of the vessel, and subsequent sinking with loss of life.

2. The cause of the structural failure was a combination of factors which produced successive brittle fractures. These factors were:

a. High load due to extremely heavy weather conditions.

b. A notch sensitive steel.

c. A notch. Among others, some of the possible locations of the notch are:

(1) A radial crack in a rivet hole.

(2) A welded plate insert on the inboard edge of the auxiliary stringer at number 11 hatch, starboard side.

(3) Recently incurred bucket damage to the inboard edge of the auxiliary stringer in the vicinity of frame 107, starboard side.

d. Temperature of 33°F, which was below the nil ductility temperature of the steel.

3. The exact location of the initiation of the fracture (whether bottom, deck or side shell) is unknown. However, the most probable location was on the spar deck starboard side at frame 107 in way of the number 11 hatch corner.

4. A number of other factors, including one or any combination of the following, might have contributed to this casualty:

a. The free surface water in cargo holds 2 and 3 might have caused an unusual strain to an already weakened area as a result of the dynamic forces of shifting weight due to pitching, rolling, pounding, and possible twisting of the vessel as its bow was blown around.

b. The vessel might have broached and sustained the crack while attempting to hold into the sea as she was broaching or while attempting to regain her heading into the sea. It is concluded that any ballasted vessel of a design similar to that of the DANIEL J. MORRELL would suffer severe stresses and strains in sea and wind conditions such as those present on 29 November should it remain in or at angles to the trough for any length of time. This evaluation is predicated upon the fact that a 600 foot vessel at an angle of approximately 30 degrees to seas having crests of 250 to 300 feet apart will suffer severe hogging, sagging and twisting stresses.

c. The crack in the midship section occurred at Frame 107. The welded butt joining plates E-20 and E-21 was located on the starboard side also at Frame 107. Although there is no evidence to indicate any defect in this weld, the possibility exists that the butt weld contained an undetected defect at installation.

d. The crack in the after bulkhead of the number 4 starboard double bottom tank was very similar in dimension and location to the crack found on the EDWARD Y. TOWNSEND during the heavy weather damage survey conducted on 2 December 1966. Although this may be coincidence, it may tend to indicate the existence of a pattern of structural weakness on the starboard side of these two practically identical sister vessels and possibly other vessels of approximately the same age and of similar design. This is supported by the facts that the crack commenced on the EDWARD Y. TOWNSEND and the DANIEL J. MORRELL in the same general deck area, both vessels were headed into the wind and sea under the same weather and sea conditions, both vessels were light and in ballast and both probably had basically the same free surface water in their cargo holds.

5. The actual drafts, extent of ballasting, exact courses and speeds, and reaction to sea and wind conditions on board the DANIEL J. MORRELL from the time of entering Lake Huron until immediately prior to sinking, could not be determined. However, it is assumed that they were basically the same as those that existed on the EDWARD Y. TOWNSEND during the same period.

6. Although the vessel sailed from Buffalo short of the crew required by the Certificate of Inspection, the shortages were in required ratings only. The actual number of persons aboard exceeded the number required. There was no evidence of violation of law on the part of the master or company officials in this regard. There is no evidence to indicate the crew shortage contributed to the cause of the casualty.

7. The lifesaving equipment on board met the requirements of the Federal Regulations and there is no evidence to indicate that any person lost his life due to faulty or improperly maintained lifesaving equipment. However, under the circumstances that existed at the time of sinking, the lifeboats and life-rafts aboard could not be used properly to save lives. Under the existing sea conditions, the lifeboats could not have been lowered and launched successfully. Notice is taken of the fact that when Great Lakes freight vessels break in two, it is probable that approximately one-half of the crew would be at the forward end and unable to move to the after end where the larger percentage of life-saving equipment is located. Had the boats been lowered safely, there would have been little hope for survival of persons aboard for an extended period since there was no means of protection from exposure. The common boat hooks in use are considered to be adequate only in calm water operation. The life-rafts proved to be substantially constructed since one of the rafts showed signs of much abuse incident to the sinking and still provided adequate support.

Even though these rafts were intended to float free, it could not be established why the forward raft was not thrown over the side prior to sinking. It may have been that the vessel broke up in less time than estimated by the survivor and that the master might have considered, in light of the slush on deck, the angle of the deck after the rupture, the time available, and the weight of the raft, that to wait for the vessel to sink was the safest, or only available procedure. Once in the water, the rafts offered no protection against the elements. It could not be established how and when the after raft went into the water. Had there been approved inflatable life rafts forward and aft, they probably could have been launched by vessel personnel and would have offered some protection from exposure.

8. The six persons listed as missing are presumed dead.

9. The electric cables leading forward from the source of power parted in the midships area as a result of the commencement of the crack in that area and prior to the sounding of the general alarm. The steam line, the general alarm cable and all other means of communication between the pilot house and the engineroom were also parted at about the same time. After this, there was no source of power forward except batteries for the general alarm.

10. The radio installation on board the DANIEL J. MORRELL met the requirements of the applicable Federal Regulations. The system proved to be inadequate under the existing circumstances. Power was lost forward before bridge personnel were aware of the extreme condition that existed amidship. Great Lakes vessels are not required to carry emergency radios. Therefore no means for transmitting a distress signal was available after the cables were severed. More lives might have been saved if a distress signal had been transmitted. Although it was known that problems existed in the use of channel 52 prior to the sinking, a distress message probably could have been transmitted had there been a source of power forward. There was no evidence of any difficulty in reception on any other radio frequency on the DANIEL J. MORRELL.

11. The free surface water sighted by Hale in the cargo holds resulted from side tank slope damage. It is apparent that Hale would not have been directed to enter the holds for marking leaks in the side tank slopes and driving wedges into the cracks if ballast had previously been pumped in intentionally. It could not be determined whether this water was pumped from the cargo holds subsequent to its discovery by Hale in the afternoon. The tonnage of free surface water in the cargo holds could not be accurately determined since the vessel drafts are not known. In lieu of the estimated 18" there might have been nearer 45" of water at the after bulkhead of No 3 cargo hold, as was the situation on the EDWARD Y. TOWNSEND. It is noted that water extended to approximately the center of No. 2 cargo hold on both vessels when discovered. It is estimated that the quantity of water in the cargo holds could have been from 300 to 800 tons. The effect of this quantity of water is not considered to have significantly changed the vessel's stability, which was more than adequate even with the reduction of the metacentric height caused by the free surface water. There was no evidence to indicate water was intentionally pumped into the vessel's cargo holds during this last trip.

12. The signal pistol came apart probably because the screw type hinge pin located forward of the trigger assembly and connecting the barrel of the pistol to the handle was either jarred loose or worked loose in use.

13. It is concluded that the inspections conducted by the Coast Guard during the 1966 drydocking, annual and midseason inspections were conducted in accordance with the Federal Regulations and in keeping with Coast Guard standards. There were no known deficiencies concerning the vessel's structure, equipment or machinery at the time of completion of these inspections.

14. The operators of the DANIEL J. MORRELL had not been informed of leaking rivets or any major structural, machinery or equipment deficiencies from the beginning of the 1966 season until the time of sinking. They were aware of minor items that had been repaired periodically, e. g., bucket damage to side tank slopes, radio deficiencies and leaking sanitary and fire main piping.

15. Other than the leaking shell rivets, which allowed leakage into the side tanks, leaking side tank slopes - which is common aboard Great Lakes bulk (non self-unloading) freighters - , and the non-use of tarpaulins or equivalent means for insuring tightness of the hatches there was no evidence to indicate that vessel watertight integrity was not being properly maintained.

16. There was evidence of violation of 46 CFR 97.15-20 in that although the hatch covers were in place, tarpaulins, gaskets or similar devices were not used to ensure watertightness of the hatches prior to entering Lake Huron on 28 November 1966 in the face of adverse weather. However, there is no evidence that this violation either caused or contributed to the cause of the casualty. There is evidence that other vessels are proceeding during Fall and Spring months while in a ballasted condition without ensuring watertightness of the cargo hatch covers. There is evidence that it is common practice to install tarpaulins over sliding steel type hatch covers only when the vessel is loaded, regardless of weather conditions. Other than the evidence of violation of 46 CFR 97.15-20, there was no evidence to indicate that there was any misconduct inattention to duty, incompetency or willful violation of law or regulation regarding this casualty on the part of persons licensed or certificated by the Coast Guard.

17. No personnel of the Coast Guard, other agency of the Government or any other person either caused or contributed to the cause of the casualty or to the loss of life as a result thereof.

18. The evidence indicates that it is a practice for some Great Lakes ship masters to intentionally put water in their cargo holds in adverse weather in the belief that it will not only make their vessel ride better but will make it more stable. There is an apparent lack of knowledge of the reduction of stability caused by free surface effect.

19. It could not be determined whether the general alarm or other means of communications alerted all persons in the after section of the vessel. There was sufficient time before the sinking for all persons aft to be informed. It is unknown whether any persons were actually trapped inside the vessel at the time of sinking.

20. Although the requirements of the Federal Regulations were met, the general alarm system as installed is susceptible to improvement. There was no method for activating the system aft once the lines leading forward were parted.

21. Although the cause of death of the three persons on the raft with Hale was listed as drowning, they probably drowned from their own body fluids, or mucus, since they were still on the liferafts and all were believed to be conscious until immediately prior to death.

22. Although the lifeboat davits were not cranked out, the after crew might have removed the gripes. It is also considered possible that the force of water might have broken them loose. It could not be determined what happened to the port lifeboat as it was never located. However, it could have sustained damages from the fallen after mast or the air tanks could have been crushed by water pressure.

23. All persons who are missing or known dead probably lost their lives before the Coast Guard was informed that the DANIEL J. MORRELL was overdue. A positive vessel reporting procedure is considered highly desirable.

24. There were leaking rivets in some of the DANIEL J. MORRELL's side tanks upon arrival in Toledo, Ohio for winter lay up in 1965. The tanks causing most concern were the numbers 4 and 5 port side tanks. Vessel personnel entered tanks 4 and 5 port and marked leaking rivets with paint prior to lay up. The exact number of leaks could not be determined, as estimates ranged from no more than 12 to a maximum of 500 leaky rivets. It is held that the actual number was much closer to the lower estimate. The statements by Mr. [redacted] that he assisted in marking up to 500 leaking rivets in side tanks and of [redacted] that he observed approximately 1000 rivets marked for repairs on the hull of the vessel above the side tank top level is not sufficiently reliable to support a finding of fact. The probability does exist, however, that Mr. [redacted] did actually enter side tanks with another person and marked a small number of leaking rivets. Support for the rejection of the above statements is that trained inspectors, surveyors and company personnel did not observe the supposedly marked rivets during the 1965 lay up season. It is possible that markings of side tank rivets were obliterated at the time that inspections were made. That the leaking into the port side tanks had been stopped or reduced and that Captain [redacted] was satisfied that the rivet problem had been corrected in drydock is accepted as fact. It is reasonable to assume that had there been any unusual leaking into side tanks or alarm over the condition of shell rivets, subsequent to his assuming command, Capt. Crawley would have reported this fact to company officials. There is no evidence to substantiate any inference that leaky or faulty rivets caused or contributed to the cause of the casualty.

25. The forecast issued by the U. S. Weather Bureau for the southern two-thirds of Lake Huron at 1200 EST, 28 November 1966 to cover the ensuing eighteen hour period was not sufficient to cause apprehension on the part of shipmasters. Vessels could generally expect protection in the lee of the Michigan shore. The weather information broadcast at 1800, which forecast winds of gale force from the north, was not interpreted by vessel masters as presenting conditions clearly dangerous to their operations. For this reason, most of the upbound vessels located in the Port Huron-Harbor Beach area continued northward until the wind force and action of the seas turned them around and forced their return to refuge in the Port Huron area. The winds were somewhat stronger and were from different directions than those expected. The sea conditions were much worse than would ordinarily be anticipated with the existing winds.

Whether a ship should or should not proceed in heavy weather conditions is a command decision. There is no clear showing that either the master of the SS DANIEL J. MORRELL or the masters of the other vessels who proceeded into the face of the storm were negligent for doing so.

26. The procedure of preparing forecasts every 6 hours does not in itself give sufficient advance warning to mariners since the seas build up so rapidly on the Great Lakes. It is believed that actual sea condition reports and sea condition forecasts issued by the U. S. Weather Bureau would contribute to the safety of vessels transiting the Great Lakes.

27. There was no evidence to indicate the reboilering, repowering, or vessel alterations since initial construction either caused or contributed to the cause of the casualty. No evidence was received to support a finding that previous loading, unloading or ballasting procedures contributed to the casualty.

28. Based on estimated positions of vessels in the area, the radar target observed by the master of the BENSON FORD between 0100 and 0130 off the starboard beam was probably the EDWARD Y. TOWNSEND.

29. Had the two screen bulkheads located in the cargo holds been of watertight construction, it is possible that one or both sections of the vessel would have remained afloat.

30. Loading manuals are not as a rule furnished to masters of Great Lakes bulk carriers and consequently masters cannot readily determine the effect of a particular loading or ballasting condition upon longitudinal bending moments. In the instant case it is felt that there was a shift in the normal loading pattern of the ballast caused by leakage from the ballast tanks and this effect was probably unknown to Captain Crawley. This effect is indeterminate because it is not clear whether the ballast tanks were refilled periodically to replenish the water which had leaked into the holds.

RECOMMENDATIONS

Based on the foregoing, it is recommended that:

1. The required forward and after life rafts on Great Lakes vessels be of the inflatable type to provide for easy launching and protection of personnel against the weather.

2. The capacity of the forward and after life rafts be sufficient to provide protection for all persons normally quartered in each part of the vessel.

3. To improve reliability of radio communication under conditions where the connection with the source of power aft is severed, that:

   a. The Federal Regulations be changed to require an emergency source of power forward on Great Lakes vessels which have berthing and/or working spaces located both forward and aft, or

   b. That consideration be given to recommending to the Federal Communications Commission, Washington, D. C. that an emergency radio with a self-contained source of power be required, and

   c. That there be provided a datum marker buoy with the capacity of transmitting on 2182 kc. and capable of being either manually activated or automatically released and activated at a predetermined depth upon the sinking of the vessel. This could be stored with one of the required life rafts or attached with a pressure-release device to the side of the pilot house.

4. Special examinations of the hull structures of all Great Lakes vessels built prior to 1948 be conducted in order that a determination might be made as to whether weaknesses in hull plating or supporting structure have developed since the date of construction. NOTE: New ship steel specifications were adopted in 1948.

5. The owner or operator of each Great Lakes Bulk Carrier be required to furnish the Master a loading manual which shows the effect of various loaded and ballasted conditions upon longitudinal bending moments. The effects of dynamic forces of free water in cargo holds should be included.

6. Consideration be given to change 46 CFR 113.25 to provide, for typical Great Lakes bulk carriers, regardless of date of construction, which have manned spaces separated by cargo holds, that:

   a. The general alarm system shall be operated by means of manually operated contact makers located in the wheelhouse and in the engine room or at another suitable location in the after section of the vessel.

   b. A separate source of power for the general alarm system be installed in the circuit at each end of the vessel and the installation be made so that if the circuit be broken the forward alarms and the after alarms may be operated independently.

7. Further evaluation be made of the necessity to install tarpaulins over sliding plate type hatch covers which are properly secured, to determine whether or not the Master of a Great Lakes vessel may be authorized by regulation to sail without tarpaulins in place during all seasons when the vessel is not carrying cargo.

8. Vessel owners and operators be encouraged to initiate a positive vessel reporting system. Reports at 24 hour intervals would be desirable. If the vessel does not report within one hour of the scheduled time the company should take positive action to determine the status of the vessel.

9. Consideration be given to requiring cargo hold compartmentation on newly constructed Great Lakes vessels so that in the event any one main cargo hold should be flooded the vessel will have sufficient buoyancy to remain afloat.

10. A recommendation be made to the U. S. Weather Bureau that some system be instituted to make possible the inclusion of on scene and forecasted sea conditions into regular marine weather broadcasts.

11. Since the screw joining the two major component groups of many signal pistols is not installed to prevent its working loose and dropping out, it is recommended that 46 CFR 160.028 be revised to require that when such screws are installed there be provision, such as use of lock nuts or peening of the ends, to prevent the screw from backing out.

12. The Master of the SS DANIEL J. MORRELL, Arthur I. Crawley, being deceased, it is recommended that no action be taken regarding his omitting the use of tarpaulins over the sliding plate hatch covers.

[redacted]

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W. A. BRUSO
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