

UNITED STATES COAST GUARD

ADDRESS REPLY TO:
COMMANDANT
U. S. COAST GUARD
HEADQUARTERS
WASHINGTON 25, D. C.



MVI
25 September 1952
(PENDLETON - 5-1 24)

From: Chief, Merchant Vessel Inspection Division
To: Commandant
Via: Chief, Office of Merchant Marine Safety

Subj: Marine Board of Investigation; structural failure of tanker
PENDLETON off Cape Cod on 18 February 1952, with loss of life

1. Pursuant to the provisions of Title 46 C.F.R. Part 136, the record of the Marine Board convened to investigate subject casualty, together with its Findings of Fact, Conclusions, Opinions and Recommendations, has been reviewed and is forwarded herewith.
2. The tank vessel PENDLETON of 10,448 g. t., built by the Kaiser Company, Inc. in 1944 and owned by the National Bulk Carriers, Inc., departed from Baton Rouge, La., on 12 February 1952, with a full cargo on board destined for Boston, Mass. On 18 February 1952, approximately 20 miles off Cape Cod Light, the PENDLETON, during a northeastern gale, attended by snow and very high seas, suffered a major structural failure causing the vessel to break in two and becoming a total loss. As a result of this casualty, the following 9 crew members perished:

John J. Fitzgerald, Master
Martin Moe, Chief Mate
Joseph W. Colgan, Second Mate
Harold Bancus, Third Mate
James G. Greer, Radio Operator
Joseph L. Landry, A. B. Seaman
Herman G. Gatlin, A. B. Seaman
Billy Roy Morgan, Ordinary Seaman
George D. Myers, Ordinary Seaman

3. The Board made the following Findings of Fact:

"1. That at or about 5:50 a.m. on 18 February 1952, at a point about ten to twenty miles off Cape Cod Light, the tank steamer PENDLETON incurred a major structural failure resulting in a complete failure of the hull girder and causing the vessel to break in two in the way of the number seven and eight cargo tanks and resulting in the loss of 9 lives.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 B4)

"2. That the tank steamer PENDLETON, official number 245144, gross tons 10,448, owner National Bulk Carriers, Inc., 600 3rd Ave., New York, N.Y., was last regularly inspected by the Coast Guard at Jacksonville, Florida, on 9 January 1952.

"3. That the PENDLETON was a tank vessel of the T2-SE-A1 type, commonly referred to as a 'T2 tanker,' built on the longitudinal framing system with nine cargo tanks, Nos. 1 to 9 inclusive, being divided by two longitudinal bulkheads so that there were two wing tanks, port and starboard, and a center tank; tank No. 1 was divided by a center line bulkhead into two tanks.

"4. That the dimensions of the PENDLETON were: length between perpendiculars, 503 feet; moulded beam, 68 feet; moulded depth, 39 feet, 3 inches.

"5. That the propelling machinery consisted of a turbo-electric motor of 6,600 horsepower, driving a single propeller, and the machinery was located aft.

"6. That the PENDLETON was of all welded construction and that modifications to the structure were made as follows: on 3 December, 1946, in drydock at Mobile, Alabama, the bilge keels were scalloped in way of the shell, and that on 31 December 1947, crack arresters were installed on deck, port and starboard, and on the bottom, port and starboard, and a further bilge keel modification was made, these latter modifications in accordance with Maritime Commission Plan No. T2-SE-A1-S11-1-1.

"7. That the PENDLETON was manned and equipped in accordance with the certificate of inspection and at the time of the casualty there were forty-one persons on board, including the master, as listed on Exhibit 15.

"8. That the PENDLETON loaded a cargo of kerosene and heating oil, totalling about 122,000 to 124,000 barrels, at Baton Rouge, La., on 12 February 1952, and that the cargo was distributed among several tanks as follows at the time of the casualty:

Tank No.	APPROXIMATE ULLAGES			CARGO
	Port	Center	Starboard	
1	Empty		Empty	
2	Full	At least 20'	Full	Heating oil
3	4'-9"	4'-9"	4'-9"	Heating oil
4	4'-9"	4'-9"	4'-9"	Heating oil
5	4'-9"	4'-9"	4'-9"	Kerosene
6	4'-9"	4'-9"	4'-9"	Kerosene
7	4'-9"	4'-9"	4'-9"	Heating oil
8	4'-9"	4'-9"	4'-9"	Heating oil
9	Empty	20'	Empty	Heating oil

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"9. That the PENDLETON departed Baton Rouge, La., on 12 February, 1952, bound for Boston, Mass., and that her draft was 30'-4" forward, 30'-6" aft, in fresh water, at departure.

"10. That the bunker fuel and fresh water on board was distributed as follows at the time of the casualty:

Tank	Loading
Pore peak tank	empty
Deep tank, port	about 120 barrels of fuel oil
Deep tank, starboard	empty
All cofferdams	empty
Port fresh water tank	about 20 tons of water
Starboard fresh water tank	about 20 tons of water
Engine room fresh water tank	about 22 tons of water
Distilled water tank	about 32 tons of water
After peak tank	about 50 tons of water
Forward port double bottom	about 10" of water
Forward starboard double bottom	about 12" of water
After port double bottom	full of water
After starboard double bottom	full of water

"11. That the PENDLETON arrived off Boston on the late evening of 17 February 1952, and, due to poor visibility and unfavorable weather, the master elected to await better visibility before attempting to make port.

"12. That the PENDLETON then headed on courses of from 070° T to 080° T at slow speed, approximately 45 rpm, to await more favorable conditions.

"13. That the wind and sea increased steadily during the night and by midnight an east northeasterly gale was blowing, attended by snow and very high seas.

"14. That shortly after 4:00 a.m. on 18 February, the PENDLETON began shipping seas over her stern but the vessel was riding well and no fears for her safety were expressed by crew members.

"15. That no record is available of the course the PENDLETON was steering after 4:00 a.m.

"16. That at about 5:50 a.m. on 18 February 1952, the vessel took a heavy lurch accompanied by a loud explosive sound and then a more violent lurch accompanied by a still louder sound and later in the day in way of the bulkhead between No. 7 and No. 8 cargo tanks.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"17. That when the vessel broke in two the engines were going ahead at 45 rpm.

"18. That, at the time of the break, the circuit breakers kicked out in all circuits to the forward part of the vessel and the remainder of the machinery plant continued in normal operation.

"19. That the First Assistant Engineer, who was on watch in the engine room, put the engines on dead slow ahead immediately following the two lurches and that the Chief Engineer arrived in the engine room immediately thereafter and stopped the engines.

"20. That the Chief Engineer, having no means of communicating with the forward section of the vessel, which had disappeared from view, assumed charge of the after section, mustered the crew and assigned watch details, including lookout watches at each end of the boat deck.

"21. That the following named members of the crew of the PENDLETON were on the stern section after the vessel broke in two:

1.		Chief Engineer
2.		1st Asst. Engineer
3.		2nd Asst. Engineer
4.		3rd Asst. Engineer
5.		3rd Asst. Engineer
6.		Boatswain
7.		A.B. seaman
8.		Ordinary seaman
9.		A.B. seaman
10.		A.B. seaman
11.		Pumpman
12.		Engine room Maintenance man
13.		Oiler
14.		Oiler
15.		Fireman, watertender
16.		Wiper
17.		Messman
18.		Oiler
19.		Wiper
20.		Galley man
21.		Deck Maintenance man
22.		1 A. B. seaman
23.		A. B. seaman
24.		Utility man
25.		Steward
		Fireman, watertender

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

26.
27.
28.
29.
30.
31.
32.
33.

Chief clerk
Fireman, watertender
Messman
Deck Maintenance man
Deck Maintenance man
2nd cook
Messman
Wiper

"22. That the stern section drifted in a southerly direction, riding moderately easy, with a slight port list.

"23. That at about 2:00 p.m. the survivors on the stern section sighted the beach.

"24. That at approximately 2:55 p.m. the radar at Chatham Lifeboat Station picked up two targets one bearing 062° true, distant 5.7 miles, and the other bearing 020° true, distant 5.6 miles, which were later identified as the bow and stern sections, respectively, of the SS PENDLETON.

"25. That no SOS was transmitted from the PENDLETON and this radar report was the first indication of her difficulty to reach any one outside the vessel.

"26. That at 3:00 p.m. the visibility improved momentarily and the Officer-in-Charge of Chatham Lifeboat Station visually sighted the bow section of the PENDLETON; reported this to the Search and Rescue Center in the Coast Guard District Office and then proceeded with part of his crew and beach apparatus, and an amphibious DUKW from the Nauset Lifeboat Station, to North Beach to attempt to render assistance.

"27. That Coast Guard aircraft No. 1242, which had temporarily been diverted from distress operations on the tanker SS FORT MERCER, sighted both sections of the PENDLETON shortly after 4:00 p.m. and made the first identifications of the distressed vessel by rescue forces.

"28. That neither section of the PENDLETON approached close enough to North Beach to enable rescue operations to be carried out with beach apparatus from that point and as they were drifting rapidly to the southward, the lifeboat station crew returned to Chatham Station to prepare for further rescue attempts, using the motor lifeboat.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"29. That after returning to Chatham Station from North Beach, the Officer-in-Charge of Chatham Station advised the Search and Rescue Center that the situation of the stern section was most critical; that it was drifting toward Chatham Bar where it would be in danger of capsizing with the loss of all on board.

"30. That motor lifeboat CG-36580, manned by [REDACTED], EMI (in charge), [REDACTED], EM2, [REDACTED], SN, and [REDACTED] SN, departed Chatham Lifeboat Station shortly before 6:00 p.m., crossed Chatham Bar, and arrived at the stern section of the PENDLETON shortly before 7:00 p.m.

"31. That as the stern section drifted toward Chatham Bar, the tanker's engines were used in an attempt to keep it off the bar but this increased the list and trim to such a dangerous degree that when the tanker crew learned, through radio messages intercepted on personal radios, that a motor lifeboat was on the way out to them they secured the engines.

"32. That the motor lifeboat successfully transferred thirty-two of the thirty-three men on the stern section to the lifeboat, the survivors jumping one at a time, from the bottom of a Jacobs ladder rigged on the starboard quarter of the tanker, into the lifeboat as it repeatedly maneuvered into position under the bottom of the ladder.

"33. That George D. Myers, ordinary seaman, (No. 10 on crew list, (Exhibit 15), missed the lifeboat in attempting to jump from the ladder to the boat, fell into the sea, and perished.

"34. That several men in the boat had hold of Myers and attempted to pull him into the boat but were unsuccessful due to the violent tossing of the boat and Myers' unusually heavy weight, and all attempts to save him failed.

"35. That the stern section of the PENDLETON was touching bottom, rolling deeply and increasing its list to port during the rescue operation.

"36. The lifeboat departed the scene at approximately 8:00 p.m. and proceeded in across Chatham Bar to Chatham, where the survivors were landed.

"37. That as far as is known none of the survivors was seriously injured.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"38. That the stern section of the PENDLETON continued to drag along the seaward side of Chatham Bar until it reached a point approximately five miles south of Chatham Station, where it remains grounded, with a list of approximately 65° to port and down by the stern at an angle of approximately 15° to 20°.

"39. That the following-named members of the crew of the PENDLETON were on the bow section after the vessel broke in two:

1. John J. Fitzgerald	Master
2. Martin Moe	Chief Mate
3. Joseph W. Colgan	Second Mate
4. Harold Bancus	Third Mate
5. James G. Greer	Radio Operator
6. Joseph L. Landry	A. B. Seaman
7. Herman G. Gatlin	A. B. Seaman
8. Billy Roy Morgan	Ordinary Seaman

"40. That the bow section was without power, heat and light (other than flashlights) after the PENDLETON broke in two and drifted in the same general direction as the stern section but at a higher rate and somewhat farther off shore.

"41. That motor lifeboat CG-36383 with [REDACTED] BMC(L) in charge left Stage Harbor, Chatham, at 12:30 p.m., 18 February to proceed via Monomoy Point and Pollock Rip Channel to the assistance of the tanker FORT MERCER in distress about twenty-five miles off Chatham, arrived at Pollock Rip Lightship at 4:10 p.m. and diverted to the bow section of the PENDLETON, which was then drifting down on the lightship from the northward.

"42. That the CG-36383 circled the bow of the PENDLETON close aboard twice and sounded repeated blasts of its horn but was unable to detect any sign of life so returned to Pollock Rip Lightship to report this fact as its own radio transmitter had become inoperative.

"43. That the CG-36383 made its report to the lightship at 5:00 p.m. and immediately departed for the stern section of the PENDLETON.

"44. That at 5:25 p.m. Pollock Rip Lightship sighted a light on the bow section and reported this to the Coast Guard Cutter MC CULLOUGH which was then en route to the bow section.

"45. That the MC CULLOUGH arrived in the vicinity of the bow section at 5:45 p.m., confirmed that there was life on board and directed the CG-36383 to return to the bow section.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

- "46. That the CG-36383 arrived back at the bow section shortly before 7:00 p.m. and sighted one man on the starboard wing of the bridge.
- "47. That at this time the wind was blowing around fifty to sixty miles an hour and the sea was very rough breaking over a good part of the bridge of the PENDLETON as well as the section between the bow and the bridge.
- "48. That while the MC CULLOCH pumped oil overboard, in an attempt to cut down the sea, the CG-36383 stood in close to the bow section.
- "49. That as the CG-36383 approached, the man on the bridge either jumped or was washed overboard by a heavy sea which swept over the bridge from the opposite side.
- "50. That the CG-36383 attempted to pick him up but the heavy swell repeatedly tossed the lifeboat away as it maneuvered to reach him and contact was lost in the darkness and not regained.
- "51. That an intensive search of the vicinity was made by the CG-36383 and the MC CULLOCH, but the body was not recovered and the identity of this man cannot be established.
- "52. That, due to shoal water and heavy seas, the MC CULLOCH was unable to work in close to the bow section of the tanker.
- "53. That the bow section grounded in position approximately 6.7 miles 127° true from Chatham Lifeboat Station (near Pollock Lightship Station), sometime during the early evening of February 18th.
- "54. That the MC CULLOCH stood by the bow section until 7:33 a.m., February 19th, at which time it departed.
- "55. That the Chatham Lifeboat Station crew attempted to board the bow section to search for bodies on February 19th and several times again during the ensuing five days but were unable to do so due to sea conditions.
- "56. That the Chatham Lifeboat Station crew carried out beach patrols, for several days after the casualty, to search for bodies washed ashore but none were found.
- "57. That the salvage tug CURB, after standing by for several days waiting for the weather to moderate, went alongside the bow section of the PENDLETON on the morning of February 24th and put a man on board and that he located one body in the forecabin of the tanker.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"58. That a motor lifeboat from the Chatham Station then helped to remove the body and brought it in to the station where it was turned over to the local coroner and identified as Herman G. Gatlin, seaman.

"59. That no other bodies of members of the PENDLETON's crew have been recovered.

"60. That the technical adviser to the Board went on board the wrecked stern section on 29 February, and examined such portions of the fracture as were accessible and that the condition of the stern at this time was as shown on Exhibits 5(a) to (f), inclusive.

"61. That a fracture originating near the turn of the bilge on the starboard side, about two inches forward of bulkhead 53, progressed downward and inward to the starboard bottom crack arrester and progressed upward, as shown in Exhibits 1 and 2, through the sheer strake, into the stringer plate and inboard to the starboard deck crack arrester.

"62. That the remainder of the break resulted from other fractures which were not accessible for examination but portions of which can be seen in Exhibits 1, 2, 5(a), 5(b), 5(d), 5(e) and 5(f).

"63. That the starboard portion of bulkhead 53 remains with the stern section but the port portion is missing, the bulkhead being torn diagonally from about the starboard longitudinal bulkhead at the bottom to the port longitudinal bulkhead at the deck.

"64. That the deck to port of the center line is ripped fore and aft in way of No. 8 tank as shown in Exhibits 5(b) and 5(f).

"65. That, of twelve parachute flares fired by personnel on the stern section, all went into the air normally but only one flare illuminated and that these flares were manufactured in July, 1942, in Tippecanoe, Ohio.

"66. That of four orange smoke signals used by personnel on the stern section, only one fired and that the date of manufacture of the smoke signals has not been determined.

"67. That the next to the bottom rung was missing from the Jacobs ladder which was used by crew members in evacuating the stern section of the PENDLETON."

Chief, MVI Division
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

4. The Board made the following Conclusions and expressed the following Opinions:

"1. In arriving at its determinations of the cause of this casualty the Board based its opinions on three principal factors which contributed mainly to the breaking in two of the PENDLETON, namely: (1) construction, (2) weather and (3) loading.

"2. It is not proposed to go into detail on the construction of the PENDLETON other than to state that it was of a modified design of the standard T-2 tanker, the modifications consisting of four crack arresters located two on deck and two on the bottom between the turn of the bilge and the center line. The bilge keels were also modified to comply with accepted practices on welded vessels. Due to its welded construction and design, there were many points of stress concentration in the PENDLETON, especially at brackets on transverse bulkheads and where there may have been defective welding. Having this in mind the Board is of the opinion that an initial fracture occurred at or near the turn of the bilge, probably on the starboard side in the vicinity of frame 53, immediately forward of the transverse bulkhead separating #7 and #8 tanks. The initial fracture then extended inboard toward the center line and upward toward the deck and inboard on deck to the starboard crack arrester. The partially submerged condition of the vessel prevents detailed examination of the complete fracture, however, it is probable that the initial fracture so weakened the hull that other breaks occurred and points of concentrated stress in rapid succession. The crack passed inboard through the center line and then diagonally aft toward the bulkhead between #8 and #9 tanks.

"3. The Board is of the opinion that the weather had a vital part in causing this casualty particularly the temperature and the sea. There was a northeasterly gale blowing at the time with very rough seas and the probable position of the vessel with reference to the direction of the seas would at times place the bow and stern portions of the vessel in the crests of waves with little or no support amidship.

"4. No direct testimony is available as to the course the PENDLETON was steering at the time of the casualty. However, the testimony indicates that the vessel which had been on headings from 70° to 80° true during the mid to 4:00 a.m. watch, took several heavy seas over the stern shortly after 4:00 a.m. From this the Board is of the opinion that the vessel changed to a southerly course shortly after the watch was relieved at 4:00 a.m. The position of the bow and stern sections when first sighted supports the theory that the PENDLETON then remained on a southerly course until she broke.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

- "5. It is recognized that low temperatures tend to increase the notch sensitivity of steel resulting in brittle fractures such as occurred in this case. The temperature of the sea water was approximately 38°F.
- "6. The third factor, loading, also had an adverse effect as it would result in the vessel's tending to sag thereby creating additional tension in the bottom part of the vessel. The record shows that the tanks in the forward end of the vessel were empty except, that the port deep tank contained 120 barrels of fuel oil and that No. 1 cargo tank was empty, which would increase the buoyancy at the forward end. No. 2 to No. 8 cargo tanks inclusive were loaded to normal capacity. No. 9 tanks were empty except the center tank which had a 10' ullage. The after water tanks were partially filled.
- "7. The condition of loading and ballasting with excessive buoyance in the bow and stern and heavy weight in the midship section carried a sagging effect which at times was badly aggravated by the extremely heavy seas.
- "8. In view of the foregoing the Board is of the opinion that the fracture of the hull of the PENDLETON was caused by failure of material under stress due to low temperature on a tension set up by the condition of loading and the situation of the vessel in an extremely rough sea.
- "9. The Board is of the opinion that the crack arresters as installed were effective in stopping a crack but will not prevent other cracks from forming; that had the vessel been in calm waters the initial crack would have stopped upon reaching a crack arrester.
- "10. The Board is of the opinion that the vessel was not loaded contrary to the usual practice in the tanker trade.
- "11. That the Coast Guard units engaged in the rescue of the crew of the PENDLETON on the after section performed their duties in a most outstanding and exemplary manner at great personal risk.
- "12. That the loss of George Myers during the evacuation of the stern section was not due to any lack of effort on the part of the Coast Guard, or to defective equipment on the tanker.
- "13. Except in the case of Gatlin, whose body was found in the forecandle and whose death is known to have been due to shock and exposure, and the unidentified man who jumped or was washed from the starboard wing of the bridge, details are lacking as to the manner in which those on the bow section met their end, however, in the opinion of the Board, existing conditions were such that any men washed into the sea could not have lived more than a few minutes and men remaining on board would have succumbed to exposure before rescue was possible.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"14. The Board is of the opinion that the rescue efforts made by the Coast Guard in attempting to rescue these men were pressed to the utmost; their unsuccessful outcome was due to conditions beyond control and should not reflect adversely upon the personnel involved.

"15. The PENDLETON was properly manned and in full compliance with the Coast Guard Regulations governing the inspection of tank vessels and that under the conditions obtaining at the time of the casualty, the master was handling his vessel according to practices of good seamanship.

"16. There was no incompetence, misconduct, unskillfulness or willful violation of the law or any rule or regulation on the part of any licensed officers or seamen, employers, owner or agent of the vessel or any inspector or officer of the Coast Guard which contributed to this casualty."

5. The Board made the following Recommendations:

"1. That a study of loading and ballasting T-2 tankers be made with the view of determining the best distribution of cargo to reduce sagging and the increase of bending moments to a dangerous degree.

"2. That consideration be given to the installation of additional crack arresters and the addition of longitudinal strength members in the bottom of the vessel corresponding to those under the deck with the view of decreasing the bending moments of the hull girder.

"3. The Board recommends the installation of a vertical ladder on the forward side of the bridge structure of tankships, near the centerline, for emergency exit from the bridge to the deck or catwalk forward.

"4. The Board notes that appropriate commendations have been awarded to various officers and men of the Coast Guard who participated in the successful rescue of members of the PENDLETON crew. With these awards the Board is heartily in accord.

"5. The Board considered recommending that signal flares and emergency radio transmitters be installed or located in the after part of tankships of 350 feet in length and over, having superstructures amidship and propelling machinery aft. These items were submitted to the Merchant Marine Council in the form of proposed amendments to be considered at the meeting of that body on 25 March 1952, therefore are not included herein.

Chief, MVI Division to
Commandant

25 September 1952
(PENDLETON - a-1 Bd)

"6. That careful attention be given to the age of pyrotechnic distress signals carried in lifeboats (See CFR 33.15-1(c)) by Marine Inspectors at annual inspections.

"7. Subject to the foregoing it is recommended that no further action be taken and the case closed."

REMARKS

6. In connection with structural failures, the susceptibility of welded ships to extensive fractures has been known and a serious problem since early in World War II when our shipyards turned to welding as the only means of rapidly building enough ships to support the war effort.

7. The T-2 tanker SCHENECTADY broke in two lying at the dock on 16 January 1943. This fracture, together with a number of less extensive fractures which had occurred in Liberty ships prior to that date, brought a full realization that serious problems were to be encountered as a result of the sudden transition from riveting to welding. The fractures which occurred were carefully investigated by the Coast Guard, the Maritime Commission, and the American Bureau of Shipping, and in addition, when the magnitude of the problem became apparent, the Secretary of the Navy, under whom the Coast Guard functioned at that time, appointed a Board in April 1943, to investigate the design and methods of construction of welded steel merchant vessels.

8. This matter has been the subject of intensive study since that time. As the knowledge of the problem increased, corrective means have been applied to the construction of new ships, and steps have been taken on the existing ships to improve their resistance to this type of casualty. The steps taken on existing ships have included the alteration of certain details of the structure, such as the hatch corners on the Liberty ships, and the bilge keels on both the Liberties and the T-2 tankers, as well as the provision of riveted crack arresters, designed to limit the spread of a fracture after its inception. The fitting of such crack arresters at both gunwales of the Liberty ships was completed by June 1947, and in accordance with an American Bureau of Shipping order, 4 such crack arresters were fitted to the T-2 tankers prior to December 1948.

9. With regard to the T-2 tankers, reference has already been made to the order sent out by the American Bureau of Shipping in 1947, calling for 4 crack arresters. It was felt at that time that the measure proposed would provide the means of preventing complete failure of the hull and, that while fractures could still be expected to occur under some circumstances, the ships would be able to get into port. The failures of the FORT MERCER and the PENDLETON have demonstrated that additional measures are necessary to obtain this objective, and the Coast Guard feels that the American Bureau of Shipping has again taken prompt action in the light of this additional knowledge.

Chief, MVI Division to
Commandant

25 September 1952
(FENDLETON - a-1 Bd)

10. T-2 tankers will be required to be fitted with the equivalent of 4 additional crack arresters and the bilge keel attachment to the shell will be changed to a riveted connection. In addition, an increase in the longitudinal strength of the ship will be required, together with a manual of satisfactory loading and ballasting, both of which will bring about a reduction in the stress level in the main hull girder.
11. The knowledge gained by experience, testing, and technical study is being applied to the design and construction of new ships, and the record of ships built since 1945 has been excellent.
12. With respect to the ships now existing which were built during the war, including the Liberty ships and the T-2 tankers, some of the improvements developed, as for example improved steel specifications, cannot be applied to an existing ship. For these ships the Coast Guard proposes to continue its program of careful analysis of any defects which develop, coupled with prompt action when the need for it is apparent. This, together with research programs to determine the fundamental causes of fractures of ships, should enable us to achieve the standards of safety desired on American ships.
13. Subject to the foregoing remarks, it is recommended that the Findings of Fact, Opinions, Conclusions and Recommendations of the Marine Board of Investigation be approved.

P. A. OVENDEN

FIRST ENDORSEMENT to MVI memorandum of 25 September 1952

M
17 October 1952

From: Chief, Office of Merchant Marine Safety
To: Commandant

Forwarded, recommending approval.

APPROVED:

OCT 20 1952

A. C. RICHMOND
Rear Admiral, U. S. Coast Guard
Acting Commandant