

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

SP-20
Log M-202

ISSUED: November 26, 1982

Forwarded to:

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President
Massachusetts Maritime Academy
Buzzards Bay, Bourne, Massachusetts 02532

SAFETY RECOMMENDATION(S)

M-82-43 through -49

About 1310, e.s.t., on December 22, 1981, a fire erupted in the engineroom of the training ship BAY STATE while it was moored alongside the dock at the Massachusetts Maritime Academy. The fire caused heavy damage to the vessel's engineroom and crew accommodation spaces. One person was killed and six persons were injured. Damage to the BAY STATE was estimated at \$5 million. 1/

The investigation revealed that the fuel oil strainer had a history of being difficult to operate. It had become an acceptable practice to use a wrench or tool for leverage, a hammer, and even a kick by someone's foot on occasion to apply greater than normal force to shift the strainer. The chief engineer, being aided by temporary employees and confronted with many serious problems, might overlook the fact that a duplex strainer was difficult to operate even if it had been brought to his attention.

The other engineering officers similarly regarded the fuel oil strainer as a simple machine, the operation of which could be delegated to the cadets since the cadets had been instructed in its operation at some time by an upper class cadet. Only one of the faculty's engineering officers interviewed had actually operated the strainer, and he recognized that it was occasionally difficult to operate. The engineering officer on watch at the time of the accident also knew that the strainer was more difficult to operate than normal. Despite knowledge that the strainer was a problem, it appeared that none of the engineering officers were sufficiently concerned to see if its operation could be improved nor was there any evidence that they were concerned about the methods being employed by the cadets to move the levers or about any potential hazard which might result from these methods.

The abandonment of the qualification program some years before the accident resulted in loss of a procedure which had required officer-involvement at certain points in the cadets practical training. Without some systematic method to monitor the cadets' progress in the practical area, it is likely that improper procedures can be adopted and that some cadets will fail to learn certain simple tasks, as demonstrated by the first class cadet who had somehow failed to learn the operation of a duplex strainer. The fact that a clogged strainer basket was found in the standby compartment of the fuel oil strainer indicates that the cadets were lax in caring for the strainer and that there was a lack of

1/ For more detailed information read Marine Accident Report—"Fire Onboard the Training Ship BAY STATE at the Massachusetts Maritime Academy, Buzzards Bay, Bourne, Massachusetts, December 22, 1981" (NTSB-MAR-82-7).

officer supervision or involvement in monitoring the cadets' activities. While the chief engineer and his small staff are responsible for the maintenance and operation of the ship, the mission of the ship is training; therefore, an appropriate amount of involvement by licensed engineers assigned to the ship must be devoted to cadet training. There must be procedures whereby each cadet is afforded an opportunity to learn the operation of all equipment and be tested in the operation of all equipment by qualified engineering officers.

Since the BAY STATE was not originally designed as a training ship, some amount of alteration might be necessary to provide a safer environment in which to train students. Conceivably, there might be fragile fittings, particularly in the engineroom, which were acceptable when the ship was being operated by a small, professional crew, but which would be hazardous when 27 to 100 cadets are in the space. The brass vent fittings on the fuel oil duplex strainer appear to be examples of such fittings. The vent fittings and the strainer may have been operated by former crews without any problem before the ship was deactivated in 1971; however, these fairly vulnerable vent fittings can become hazards in a training ship environment. The hazard presented by these fittings, which were constructed of brass rather than steel, and which discharged upward, rather than downward into a drip pan, was demonstrated on March 30, 1981, when the vent fitting on the forward chamber was accidentally kicked and broken off by a cadet attempting to shift the strainer. The oil spill which resulted and the fire which occurred a few days later presented a preview of the December 22, 1981, accident.

Any engineroom fire, particularly a fuel oil related fire aboard a training ship, is a serious matter and should be investigated thoroughly to determine the cause and the necessary corrections to prevent its recurrence. Even a modest effort to analyze the cause of the March 30, 1981, accident might have alerted the chief engineer and other officers that the strainer was a problem to operate, requiring on this occasion the force of a hammer to effect its operation, and that the brass vent fitting replaced on the forward strainer compartment was vulnerable to being broken at some future time. The strainer could have been repaired or replaced during the overhaul and more rugged vent fittings could have been installed. Since no such investigation was conducted, the accident was all but forgotten during the intervening 9 months and a hazardous condition was allowed to continue, resulting in a fatal accident. The Safety Board believes that a program should be established at the Massachusetts Maritime Academy to investigate all accidents that occur on the training ship and to inform personnel of the findings and recommendations resulting from each investigation.

The Safety Board believes that the fuel oil strainer should be replaced, vent fittings using steel pipe should be fitted, and a spray shield should be installed above the strainer. The vent connection should discharge downward and, if possible, be fitted to the side of the strainer, rather than into the top of the covers.

Despite the concern of the faculty for the lack of practical training due to the earlier absence of the training ship, no program was devised to indoctrinate the fourth class cadets in emergency procedures to be followed on board the ship or escape routes to be used in case of an emergency. The disruption suffered by the Academy's practical training program suggests that the third class cadets were not much better prepared on the escape routes from the engineroom than the fourth class cadets. Some cadets were not aware of an escape route via the shaft alley or even where the shaft alley was located.

Even a short indoctrination on available escape routes conducted at the beginning of each watch by the cadet engineer, under the supervision of the engineering watch officer, would have been of great value. A simple lesson plan, evaluating the benefits and hazards

of the limited routes from the engineroom, may have been sufficient to alert everyone, particularly the licensed engineer officers, that a fire near the boilers might make the main, second deck exits from the engineroom, which are near the boiler uptakes, dangerous to use. A brief introductory tour of the shaft alley would have sufficed to inform all personnel of its location and that it offered a safe, convenient exit in case of emergency.

The rapidly spreading fire probably made the upper level of the engineroom untenable about 1 minute after ignition and combined with the fact that the two fire doors in the engineroom casing were open, probably resulted in the two passageways on the second deck becoming untenable about the same time. However, all personnel could readily have escaped via the shaft alley had the peril of attempting to escape by the usual route out the doors on the second deck been recognized. Unfortunately, no one reasoned ahead of time that going up could result in a dangerous encounter with heat and smoke. When an emergency occurs, it is sometimes too late to ascertain the best course of action. In this case, some preplanning of escape routes to use, depending upon the emergency, would have been invaluable. When the ship is engaged in a training cruise with numerous cadets in the engineroom, careful preplanning and the regular conduct of realistic escape drills are considered essential to insure that optimum use is made of the limited exits from the engineroom.

Regardless of any convenience afforded by restraining the engineroom doors open, this was an unsafe practice. The fire entering the starboard passageway, which resulted in additional damage, especially to the electric cables in the second deck passageways outside the engineroom, and endangered the entire ship, quickly resulted in smoke and heat in most passageways of the extensive accommodations and jeopardized access to the CO₂ flooding controls, which were located in the second deck, starboard passageway outside of the engineroom.

The two main exits from the engineroom, opening into fore and aft passageways on the second deck, are served by only one ladder between the operating level and the third deck level. This ladder, located on the portside, is also the primary route to the auxiliary generator room and the stairwell inside. If a platform were installed linking the third deck level platform on the starboard side (leading to the crew mess) and the platform on the portside (connecting to the auxiliary diesel generator room), personnel would be able to use the starboard ladder, as well as the port ladder to reach the second deck exits. Should the second deck exits become blocked, as in this accident, it would be possible for personnel to shift from the portside to the starboard side at the third deck level to take advantage of stairwells in the crew messhall as well as in the auxiliary generator room.

On the lower level of the engineroom, the cadets had to proceed forward to get around the main engine in order to reach the shaft alley door; this circuitous route passed near the boilers. An escape route to the shaft alley door from the port ladder to the lower level appears possible by installing a walking platform and a ladder arrangement over the propeller shaft. Such a route might have enabled the first class cadet to lead the cadets directly to the shaft alley before the lower level became filled with heavy smoke.

The chief engineer's recommendation that two new exits be installed, one through the after engineroom bulkhead from the machine shop and the other through the forward engineroom bulkhead on the lower level, forward of the port boiler, seems reasonable. The two exits would greatly facilitate a rapid evacuation of the engineroom in case of an emergency. In view of the limited access to and from the engineroom, the Safety Board believes that at least two more openings should be provided for access to and from the engineroom of the BAY STATE. The Massachusetts Maritime Academy and the Maritime Administration should conduct a joint study to determine an actual number of openings

needed. This joint study should address the questions of linking the third deck ladder platforms together and the possibility of installing an escape route over the propeller shaft from the port ladder to the shaft alley door.

The standing orders for cadet watch standers underway in the engineroom were well written and comprehensive; however, there were no effective means to apprise the cadets of the contents of the orders. The general practice aboard ship is to require all officers to sign or initial the standing orders to certify that they have read the orders and to indicate the date that this was done.

While the standing orders for underway watches may be informative to cadets standing inport engineroom watches, they do not actually apply to the inport watches or clearly define the specific duties and responsibilities of the inport watch standers. The Safety Board believes that there should be similar standing orders for cadet inport engineroom watches and that there should be a procedure whereby each cadet is afforded an opportunity ahead of time to read the standing orders for the assigned watch, and be required to certify by signature and date that the orders have been read and understood before actually going on watch.

The Safety Board believes that standing orders also should be developed for licensed engineering personnel who stand watch in the engineroom underway or in port when the engineering plant is being operated, and require each licensed watch stander to certify by signature and date that the orders have been read and understood. These order, among other things, should clearly set forth the extent of responsibility for supervising the cadets.

As a result of its investigation of this accident, the National Transportation Safety Board recommended that the Massachusetts Maritime Academy:

Conduct training drills on a regular basis to acquaint all cadets and those officers whose duties involve going on board the training ship with the various routes available to exit from the engineroom and other spaces on the training ship. (Class II, Priority Action) (M-82-43)

Conduct a study prior to the next training cruise to determine the maximum number of persons that could be safely evacuated from the engineroom of the BAY STATE at any time in the event of fire or other emergency, and limit the number of persons in the engineroom to that number until additional means of exiting the engineroom are provided. (Class II, Priority Action) (M-82-44)

Conduct a study, in conjunction with the Maritime Administration, to determine what immediate improvements, such as additional exits or modifications of ladders and walkways, are feasible and necessary to facilitate safe, effective evacuation of personnel from the engineroom of the BAY STATE in the event of fire or other emergency. (Class II, Priority Action) (M-82-45)

Establish a program to investigate and analyze casualties and accidents occurring on board the training ship in order to develop means to prevent their recurrence. (Class II, Priority Action) (M-82-46)

Establish and enforce a policy of keeping the doors to the engineroom and stair towers on the training ship closed at all times except for the passage of personnel. (Class II, Priority Action) (M-82-47)

Develop standing orders for inport cadet engineering watches in the engineroom on the training ship similar to the standing orders for the underway watches and afford the cadets an opportunity to read the orders ahead of time, and require the cadets to certify by signature and date that the orders have been read and understood. (Class II, Priority Action) (M-82-48)

Develop standing orders for licensed engineer officer watches on the training ship both underway and inport when the engineering plant is in operation, and require assigned licensed engineer officers to certify by signature and date that the orders have been read and understood. (Class II, Priority Action) (M-82-49)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.


By: Jim Burnett
Chairman