

SP-20



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log M-354A

Date: August 8, 1989

In reply refer to: M-89-52 through -65

Mr. Richard Knott
President
SeaEscape, Ltd.
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About 2325 on March 15, 1988, a fire occurred in the engineroom of the Bahamian flag passenger vessel SCANDINAVIAN STAR. At the time of the fire, the ship was about 50 nmi northeast of Cancun, Mexico, en route from Cozumel, Mexico, to St. Petersburg, Florida, with 439 passengers and 268 crewmembers on board. The master broadcast a distress message and ordered the evacuation of passengers to the four muster stations on the ship. The loss of main generator and emergency generator electrical power and the malfunction of the ship's fixed CO₂ firefighting system hindered efforts to fight the fire. The inability of crewmembers to communicate with each other and with passengers created confusion during the firefighting and evacuation activities. Two crewmembers received minor injuries during the emergency. Two passengers were medivaced from the vessel and flown to a hospital in St. Petersburg, Florida, where they were treated and later released. Damage and repair costs were estimated at \$3.5 million.¹

The watch motorman was in the lower engineroom and witnessed the fuel oil leaking and the subsequent ignition. The fuel oil service system was fitted with a number of valves that, when closed, would isolate either or both the port and starboard engine from the fuel oil supply. These valves were located in the lower engineroom close to where the watch motorman discovered the leak. In addition, a start/stop electrical switch for the main engine fuel oil service booster pump was within the reach of the motorman in the lower engineroom when he discovered the leak. While the prudent action would have been to eliminate immediately the source fuel to the fire, the watch motorman made no attempt to close the valves or to stop the booster pump. Instead, the motorman hurried up the starboard aft ladder

¹For more detailed information, read Marine Accident Report--"Fire On Board the Bahamian Passenger Ship the SCANDINAVIAN STAR in the Gulf of Mexico, March 15, 1988" (NTSB/MAR-89/04).

to the outside front of the engine control room on "D" Deck and, by hand signals, informed the watch engineer of the fire. According to the motorman, he knew where the fuel oil shutoff valve and the switch for the fuel oil booster pump were located, but that the routine on board the SCANDINAVIAN STAR was "to inform the watch officer first before taking any action."

Once the watch engineer was alerted to the fire by the motorman, he had options, which had he exercised, could have prevented the further propagation of the fire. The watch engineer, who should have been knowledgeable of the machinery and piping systems in the engine spaces, could have instructed the watch motorman to go back to the lower engine room and close the valves or stop the pump. More importantly, however, although the watch engineer did activate the emergency shutdown control on the main engine control console for the starboard engine and telephoned the bridge to stop the engines, he had the ability to shut off the fuel oil booster pump at the engine control room console, but failed to do so. The failure to take this action suggests that the watch engineer may not have been as familiar with the machinery and emergency procedures as he should have been. Even though the emergency shutdown control was activated and the engine stopped, the fuel oil booster pump continued to supply fuel to the engines. The watch engineer's testimony that he did not stop the fuel oil booster pump because he believed that it was only the starboard engine that was having the fire suggests that he was not sufficiently knowledgeable of the engine fuel oil system even though, according to the international minimum requirements, the watch engineer should have theoretical and practical knowledge of the operation and maintenance of marine machinery appropriate to the duties of an engineer officer.

The watch engineer's only instructions to the watch motorman was to fight the fire with a portable CO₂ fire extinguisher. The engineer also attempted to fight the fire with a portable fire extinguisher, but the fire had quickly intensified because of the constant flow of fuel, and the crewmembers were unable to use the portable fire extinguishers with any success. The Safety Board believes that had the crewmembers stopped the flow of fuel, the fire could have been extinguished shortly after it was discovered.

When both the watch motorman and the watch engineer evacuated the engine room, they left by the port side door to the "C" Deck passageway, which was the location of the remote emergency controls to shut off the fuel oil tank, the fuel oil pumps to the engines and generators, the engine room ventilation fans, and the remote controls to operate the fixed CO₂ system. Neither crewmember, however, used the emergency controls at this location, although the engineer, at least, should have known of the location and operation of these controls. The Safety Board believes that the failure of the watch engineer to shut off the engine fuel oil supply at either the engine room control console or at the remote emergency control cabinets in the port side "C" Deck passageway increased the severity of the fire and, consequently, the danger to passengers and crewmembers and the damage to the vessel.

Once the bridge had been notified of the fire and the master assumed control of the bridge, the master shortly thereafter initiated Phase I of the ship Emergency Plan and instructed the Mobile Fire Group over the public address system to meet in the Car Deck area. The appropriate personnel, including the watch motorman, the watch engineer, and the staff captain, who was in charge of the firefighting efforts, gathered in the Car Deck area and began donning their fireman's protective clothing and preparing their equipment. Neither the watch motorman nor the watch engineer volunteered information to the staff captain concerning the source of the fire. Likewise, the staff captain, who is responsible for planning an effective firefighting attack and for instructing the firefighters as to the type of fire to be fought, did not seek the information. Furthermore, the staff captain was not aware of the various emergency shutoff control cabinets that were located nearby in the port side "C" Deck passageway. The Safety Board concludes that the staff captain's failure to aggressively seek information on the source of the fire in the engine room and the failure of the engine room crewmembers to provide vital information on the location of the fire contributed to the rapid spread of the fire and thus increased the danger and risk to fellow crewmembers and the passengers.

Although the engineering spaces were equipped with an automatic smoke detection system that activated alarms on the panel in the engine control room, an alarm did not activate at the time of the fire. While the failure of the system to activate did not delay discovery of the fire, since the watch motorman was at the location of the fire when it started, the Safety Board remains concerned that an automatic detection system, particularly one to detect a fire and/or smoke condition in an engine room on board a passenger cruise vessel did not activate. Had there been a delay in discovering the fire as a result of the system not activating, the danger and risk to passengers and crewmembers may have been much greater and the damage to the vessel more extensive. Accordingly, there is a need for SeaEscape Ltd. to determine that all automatic fire and smoke detection and alarm systems on board its passenger cruise vessels function as designed.

During construction of the SCANDINAVIAN STAR, the ship was equipped with a fixed CO₂ fire suppression system which consisted of 36 45-kilogram bottles of CO₂ located on the Sun Deck. By positioning the valves on the distribution manifold at the emergency control cabinet located on the port side "C" Deck passageway, the CO₂ could be directed to the desired machinery space compartment. After the staff engineer eventually closed the fuel oil tank valves and shut down the engine room fuel pumps and ventilation fans from the remote emergency control cabinets, the decision was made to release the CO₂ into the engine room. However, when the staff engineer activated the automatic release from the remote control cabinet, the CO₂ did not release. Consequently, even if the watch motorman and the watch engineer had thought to utilize the emergency CO₂ release controls in the port side passageway of "C" Deck, the CO₂ would not have released. Notwithstanding the failure of the CO₂ to release from the remote controls, the Safety Board believes that all deck and engineering officers and selected crewmembers should be trained to know the location and the operation of the remote emergency shutoff valves and controls, including the remote operation of the fixed CO₂ fire suppression system.

Because the remote controls did not release the CO₂, it was necessary for the staff engineer to run up five decks to enter the CO₂ storage room on the Sun Deck. However, because the four local automatic releases at the end of each of the four rows also malfunctioned due to the limited travel allowed by the CO₂ operating cylinders, it was necessary for the staff engineer to climb on top of the rows and release each bottle manually. Valuable time was lost in the attempt to release the CO₂, and the malfunction of the remote automatic and the local automatic release mechanisms on the fixed CO₂ fire extinguishing system contributed to the duration of the fire and increased the danger to passengers and crewmembers.

The fire destroyed the electrical cables overhead in the engineroom, and, according to both the bridge and engineroom log books, about 15 minutes after the fire started, all main and emergency generator electrical power was lost. At that time, the only source of power on board the ship was from the emergency battery, which came on line as designed supplying only limited lighting to passageways, stairwells, engineroom and bridge control stations, and lifeboat embarkation stations. Since the emergency battery system did not include electrical power to the public address system, the master was unable to communicate with either the various emergency response groups or the passengers via the public address system for a 1-hour period while the emergency generator was being repaired. Also, since the battery supply system could not include electrical power to any of the four fire pumps, the only resource available to the Mobile Fire Group to cool hot spots discovered was by using the water supply from the ship's swimming pool.

The investigation revealed that the electrical power supply for the emergency generator did not comply with International Maritime Organization (IMO) or Coast Guard regulations that require the emergency generator be independent and separated as far as practical from the main machinery spaces to ensure that "a fire or other casualty in spaces containing the main source of electrical power...will not interfere with the supply, control, and distribution of the emergency electrical power." Testimony by the chief electrician and engineering officers revealed, however, that the battery bank which supplied power to excite the magnetic field in the emergency generator was located in the main engineroom. While the Safety Board is concerned that the power source for the emergency generator was located in the main engineroom and believes that SeaEscape should take action to correct the situation in accordance with IMO regulations, the Safety Board is equally concerned that the situation was not detected during the scheduled classification surveys conducted by Lloyd's Register of Shipping.

The IMO regulations require that unlicensed personnel of the engineroom watch have experience or training regarding firefighting. There is, however, no description of the quantity or type of experience or training necessary to meet the requirement. According to the motorman, he had received no firefighting training other than what he learned during the fire drills conducted weekly on board the SCANDINAVIAN STAR. According to the chief engineer, these drills consisted of laying out hoses and teams "acting out" fighting fires in different engine spaces. While these fire drills may have been considered sufficient in terms of meeting the IMO requirements for

firefighting training of unlicensed personnel, the Safety Board is concerned that crewmembers were not taught about the basic components of fire (heat, fuel, and oxygen) and were not taught the various methods of fighting different types of fires, including trash fires, oil fires, and electrical fires, and the importance in fuel fires of eliminating the supply of fuel.

The IMO regulations state that the engineer shall have knowledge of the "safety precautions to be taken in the event of a fire or accident with particular reference to oil systems." The engineer's failure to shut down the main engine fuel oil booster pump, his instructions to the watch motorman to fight the fuel oil fire with a portable CO₂ fire extinguisher, and his own attempt to do so suggest that he did not have a clear understanding of how to combat a fuel oil fire. In this case, removal of the fire's fuel source would have been the first and most effective response in combating the engineroom fire. A fire at sea can be one of the most dangerous hazards confronting the crew and passengers of a ship, especially a large passenger ship. Assistance may not be immediately available, and the crew with the on-board firefighting equipment must be able to provide timely and effective fire protection. On-board knowledge and training in the use of firefighting equipment, the components of fire, the various types of fire, and the most effective methods to fight the various types of fire is the basis of shipboard fire protection. The Safety Board concludes that the training provided crewmembers on board the SCANDINAVIAN STAR was inadequate and did not prepare them for making the proper decisions in fighting a fuel oil fire.

An emergency plan had been developed for the SCANDINAVIAN STAR, in accordance with SOLAS 74, Chapter III, Part A Regulation 25. While the plan outlined in general terms the responsibility of the various groups that were to be formed in the event of an emergency and provided general guidance in the event of a fire on board ship, there were no specific procedures regarding the types of fires that might occur or the various methods to be employed to fight the fires. Furthermore, information about the location, operation, and function of the various emergency shutoff control cabinets was not included in the plan. The Safety Board believes that the lack of detailed written engineroom emergency firefighting procedures contributed to the delay in shutting off the fuel oil booster pump and, consequently, to the propagation of the fire.

Leaks, similar to the one which occurred at the packing gland in the fuel oil supply pipe to the No. 7 cylinder fuel oil injector pump, had occurred before on the SCANDINAVIAN STAR. According to the engineroom log book, engine maintenance records, and testimony of the watch motorman, fuel oil leaks at the packing glands were a recurrent problem and the leaks were at times severe enough to require stopping the engine to make repairs at sea. In fact, on March 14, 1988, 1 day before the accident, while the vessel was en route from Tampa/St. Petersburg to Cozumel, the port engine was stopped to repair a packing gland fuel oil leak to the No. 6 cylinder on the port engine.

The investigation revealed further that in 1975 the engine manufacturer had designed a new packing seal for the packing glands in the fuel oil supply and return pipes and that the ship had recently purchased a number of the new

packing seals. According to the chief engineer, who testified that there was no planned maintenance program on board the SCANDINAVIAN STAR, he would install the new seals only after a fuel oil leak was discovered. He made no attempt to replace all the old packing seals even though he knew that leaks continued to occur at those locations where the old seals were still in place and that he experienced no new leaks at those locations where the new seals had been installed.

The foregoing indicates that the SCANDINAVIAN STAR lacked any type of preplanned maintenance program since the obvious and prudent course of action would have been to replace all of the old packing seals with the new style which were in stock aboard the ship. The Safety Board believes that had all the old packing seals been replaced, as would be accomplished in a preventive maintenance program, the fuel oil leak at the packing gland may not have occurred.

The engine maintenance program that existed on the SCANDINAVIAN STAR only dealt with a defect or problem after it was discovered. The Safety Board believes that a preventive maintenance program, the objective of which is to prevent the breakdown, deterioration, and malfunction of equipment, is necessary to ensure passenger safety.

The post-fire survey of the engineroom revealed the remnants of a deflector sleeve on the packing gland of the fuel oil supply pipe to the No. 7 cylinder injector pump. The survey revealed further that of the 64 deflector sleeves that should have been installed on both main engines about 40 percent were either missing entirely or only had small portions remaining. Furthermore, examination of these sleeves revealed that they had deteriorated from age and not as a result of fire damage. Although the designed purpose of the deflector sleeve is to divert a fuel leak in the packing gland away from hot engine ignition sources, the staff and chief engineer testified that they did not know the purpose of the deflector sleeve. The Safety Board concludes that engineering department personnel were not sufficiently knowledgeable of the engineroom machinery and its function to carry out their responsibility to maintain the vessel in a safe condition. Had the engineering staff known the purpose of the deflector sleeves and taken action to replace those missing or deteriorated, the accident may not have occurred.

There were no procedures in the Emergency Plan developed by SeaEscape to account for all the passengers at the muster stations and at the lifeboat stations. The hotel manager confirmed that the only way the crew would become aware of a missing person was if someone informed the crew. The crewmembers in charge of the muster stations did not have passenger manifests or any other method of determining if passengers were at their assigned muster stations.

The Safety Board's investigation into the fire and explosion on board the passenger ship EMERALD SEAS² revealed that two passengers were found unconscious in their cabins and they were not rescued until another passenger, who was trapped in a passageway, informed crewmembers. As a result of that investigation, the Safety Board recommended to Admiral Cruises, Inc. that:

M-87-20

Before a ship leaves port, provide the crewmember in charge of each lifeboat with a list of passengers assigned to his/her lifeboat.

Although the Safety Board has requested information on two occasions concerning the company's efforts to implement this recommendation, Admiral Cruises, Inc. has failed to respond. Consequently, Safety Recommendation M-87-20 has been placed in a "Closed--Unacceptable Action" status.

The Safety Board believes that this accident investigation again illustrates the need for passenger cruise vessels to account for all passengers during evacuation to muster and lifeboat stations.

A number of factors hampered the successful evacuation of passengers to the muster stations. Although the master was able to stop the ventilation system to the passenger accommodations, all of the ship's ventilation fans and vent dampers were not closed immediately after the fire was discovered and, as a result, smoke quickly spread to the public spaces such as the lounge, passageways and stairwells, and to the two aft muster locations. Passengers stated that the Gasparilla Lounge quickly filled with smoke through the airconditioning ducts. Had the ventilation systems been stopped when the fire was initially discovered, the migration of smoke would not have been as extensive as it was, and some of the problems of reduced visibility and breathing difficulties while searching for and evacuating passengers could have been avoided.

The Safety Board has previously addressed the need to stop ventilation immediately upon detection of a fire. As a result of its investigation of the fire aboard the SCANDINAVIAN SUN, the Safety Board recommended that the Coast Guard:

M-85-57

Direct inspectors conducting control verification examinations to stress to the ship's officers the need to close fire doors and to stop ventilation immediately upon detection of a fire.

² Marine Accident Report--"Fire and Explosion Onboard the Panamanian Passenger Ship EMERALD SEAS in the Atlantic Ocean Near Little Stirrup Cay, Bahamas, on July 30, 1986" (NTSB/MAR-87/04).

In response, the Coast Guard indicated that the marine safety manual had been revised to instruct marine inspectors to question the crew about their emergency duties. According to the Coast Guard, this should ensure that the crew is aware of what prompt and effective action needs to be taken in the event of fire. Although this safety recommendation was placed in a "Closed--Acceptable Action" status, the Safety Board believes that this accident illustrates that further guidance to crewmembers is needed on this issue. The Safety Board believes that at a minimum the need to stop ventilation in the event of a fire should be stressed in the ship Emergency Plan and in the emergency firefighting procedures for the machinery spaces.

Since the Evacuation Group was not provided with protective breathing equipment, the smoke greatly hampered their efforts to search passenger accommodation areas. The Safety Board is concerned that a group designated in the ship Emergency Plan and charged with the responsibility to search for passengers during an emergency situation that could involve smoke conditions are not provided with adequate equipment to accomplish their task.

During the emergency, some passengers were given conflicting instructions regarding the location of their lifejackets. The placards posted on the back of each stateroom door instructed passengers to obtain lifejackets from a crewmember when they reached their respective muster stations. However, during the fire and boat drill that was conducted on March 14, those passengers who attended were instructed to bring the lifejackets that were stored in their cabins under the beds. As a result of this conflicting information, some passengers, who were on the upper decks near their muster stations when Phase II of the emergency plan was initiated, attempted to return to their cabins through the smoke and little light to obtain their lifejackets. The passengers who remained at the muster stations found that there was an insufficient number of lifejackets in the storage lockers on the Sun and Sunset Decks to accommodate all of the passengers at those locations. Furthermore, some passengers stated that they had to wait for nearly an hour or more before crewmembers obtained lifejackets for them. The Safety Board is concerned that the conflicting instructions about obtaining lifejackets needlessly endangered the lives of some passengers.

The Safety Board is also concerned that there was an insufficient number of lifejackets at the muster stations and that some passengers either had to return to their cabins or wait an unacceptable length of time before receiving a lifejacket. Had the fixed CO₂ system never released and, consequently, had the fire on board become far more critical, some passengers could have been faced with the situation of abandoning ship with no lifejacket available. Given the sea conditions at the time of the accident, and the insufficient number of lifejackets on deck, the Safety Board believes that the situation could have been catastrophic had Phase III of the ship Emergency Plan been initiated.

During the accident, there was evidence of language barrier problems on board the SCANDINAVIAN STAR. The Honduran watch motorman communicated by hand signals to the Filipino watch engineer that there was a fire in the engine room. Since the two crewmen did not share a common language, the use of hand signals was the only means available for communicating. While there

is no evidence to suggest that the watch engineer had difficulty deciphering the hand signals of the motorman, the Safety Board remains concerned that the watch crewmen, who are responsible for monitoring the machinery spaces and initiating a timely response to any emergency situation, did not share a common language. Had a situation developed that required the exchange of more complex information, any delay in communicating this information could become critical and further endanger the lives of passengers and other crewmembers. The Safety Board believes that watchstanders should be able to communicate in a common language during normal and emergency situations and that requirements to reduce language barriers should be established.

The investigation revealed further that neither the Filipino engineer or any other engineering or deck officer read French, but that nearly all of the machinery and equipment operating manuals and engineering drawings were written in French. Both the chief engineer and the staff engineer testified that they did not know that the purpose of the deflector sleeve on the packing gland was to prevent leaking fuel oil from contacting hot ignition surfaces. Even though the manuals did state in French the purpose of the deflectors, it is unknown if the crewmen would have replaced them had the manuals been written in a language they could read and understand. Nevertheless, the Safety Board questions the usefulness of having manuals written in a language that is not understood by the ship's operating and maintenance personnel. More importantly, the Safety Board is concerned that SeaEscape Ltd. was probably aware that engineering instructions and drawings were written in a language not understood by the ship's officers.

Postaccident statements by passengers, the majority of whom spoke English, indicated that there were numerous problems during the emergency communicating with the crew, which consisted of 27 different nationalities, many of whom could not speak or understand English. Passenger statements also indicate that crewmembers did not understand each other and, as a result, firefighting and evacuation activities were at times confusing and instructions were given through gestures. The Safety Board is concerned that acceptable levels of safety for passengers and crewmembers may be compromised if passengers and crewmembers are unable to communicate without difficulty, particularly during an emergency situation. The Safety Board believes that crewmembers in charge of muster and lifeboat stations and the evacuation group should have the ability to communicate in a common language with the majority of the passengers.

Although the Bahamian Shipping Act stipulates language requirements for crews of Bahamian flag vessels, there apparently are no provisions to determine that the requirements are adhered to. Lloyd's Register of Shipping does not inspect crews to determine their competency in the English language and has not been charged to do so by the Bahamian government. Likewise, the Coast Guard does not inspect crews to determine their ability to communicate with each other. Consequently, the Safety Board believes there is a need for the ship's officers and crew to be able to communicate with each other and with passengers.

Therefore, the National Transportation Safety Board recommends that SeaEscape:

For each vessel in your fleet provide lifejackets at each muster station for passengers in addition to those lifejackets stowed in the cabins. (Class II, Priority Action) (M-89-52)

Develop written emergency firefighting procedures for the machinery spaces for use on all SeaEscape operated passenger vessels. (Class II, Priority Action) (M-89-53)

Conduct regularly scheduled emergency firefighting drills and training for simulated engine room fires. (Class II, Priority Action) (M-89-54)

Emphasize in the ship Emergency Plan, in the emergency firefighting procedures for the machinery spaces, and during the regularly scheduled emergency fire drills the need to shut down ventilation systems immediately upon detection of a fire. (Class II, Priority Action) (M-89-55)

Determine that all automatic fire and smoke detection and alarm systems on board your passenger cruise vessels function as designed. (Class II, Priority Action) (M-89-56)

Survey your fleet of passenger cruise vessels to determine that the power source for the emergency generator is independent of the main machinery spaces, as required by International Maritime Organization regulations. (Class II, Priority Action) (M-89-57)

Provide operating instructions and engineering drawings for vital ship machinery and emergency equipment written in a language understood by the ship's officers. (Class II, Priority Action) (M-89-58)

Require that the officers and crew of passenger ships are able to communicate with each other and with a majority of the passengers. (Class II, Priority Action) (M-89-59)

Prior to departure from port, provide the crewmember in charge of each muster station and lifeboat station with a list of passengers assigned to those stations. (Class II, Priority Action) (M-89-60)

Provide passengers consistent instructions during fire and boat drills and on the placards posted in passenger staterooms about obtaining lifejackets in the event of an emergency. (Class II, Priority Action) (M-89-61)

Provide protective breathing equipment to all members of emergency groups who may be exposed to smoke while involved in the search and evacuation of passengers. (Class II, Priority Action) (M-89-62)

Initiate a training program for all deck and engineering officers and selected crewmembers of all vessels in the SeaEscape fleet concerning the location and operation of the remote emergency shutoff valves and controls, including the remote operation of the fixed CO₂ fire suppression system. (Class II, Priority Action) (M-89-63)

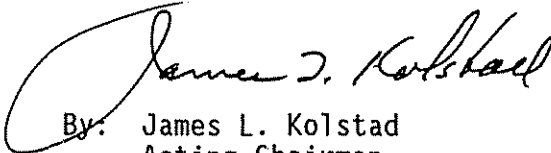
Amend the Emergency Plan booklet distributed to the officers and crewmembers to include information about the location and operation of the various emergency control cabinets. (Class II, Priority Action) (M-89-64)

Develop a preventive maintenance program for the vessels in the SeaEscape fleet so that the main engine and auxiliary equipment and safety equipment are properly maintained. (Class II, Priority Action) (M-89-65)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "... to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations M-89-52 through -65 in your reply.

Also, the Safety Board issued Safety Recommendations M-89-43 through -51 to the U.S. Coast Guard; M-89-66 and -67 to Lloyd's Register of Shipping; and M-89-68 to Bureau Veritas.

BURNETT, LAUBER, and NALL, Members, concurred in these recommendations. KOLSTAD, Acting Chairman, and DICKINSON, Member, concurred in Recommendations M-89-53 through -65, but did not concur in Recommendation M-89-52.


By: James L. Kolstad
Acting Chairman