Log M-415B

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 21, 1998
In reply refer to: M-98-58 through -67

Ms. Cynthia A. Colenda
President
International Council of Cruise Lines
1211 Connecticut Avenue, N.W.
Suite 800
Washington, D.C. 20036

Early on July 27, 1996, while the Panamanian cruise ship *Universe Explorer* was en route from Juneau, Alaska, to Glacier Bay, Alaska, with 1,006 people aboard, a fire started in the main laundry near an open fire door next to a stairway. Dense smoke and heat spread upward to a deck on which crew accommodation quarters were located. Five crewmembers died from smoke inhalation and 55 crewmembers and 1 passenger sustained minor or serious injuries. Sixty-nine people were transported to area hospitals, where 13 of the injured were admitted for further treatment.[1] The estimated total damage to the ship was $1.5 million.

In this accident, when the watch officer on the bridge received the first fire alarm, he immediately radioed the fire watch to verify the presence of a fire as required by company procedures. After the fire watch was below deck, the bridge watch officer radioed him a second time via UHF radio but heard no response, although the fire watch did receive and acknowledge the transmission using his UHF radio. When the fire watch realized that his radio transmissions were ineffective from his location, he tried to telephone the bridge with a report of smoke conditions, but the telephone line was busy. Upon hearing the announcement to report to emergency stations, the fire watch then went to his muster station, never reporting his observations to the bridge. Thus, the *Universe Explorer* suffered a communications breakdown during the early phase of this emergency, not only because the type of instrument used was ineffective, but also because the fire watch did not follow effective procedures, failing to pass on essential information to the bridge.

The *Universe Explorer* is typical of passenger vessels whose steel structure results in "dead spots" where UHF radios become ineffective. In an emergency situation, it is absolutely essential that personnel who may be going into harm's way be able to receive and transmit messages. Had the fire watch, who was acting alone, been seriously injured or trapped and in need of assistance, he could not have notified the bridge. Additionally, had he had vital

[1]For additional information, refer to Marine Accident Report—*Fire On Board the Panamanian Passenger Ship* Universe Explorer *in the Lynn Canal Near Juneau, Alaska, July 27, 1996 (NTSB/MAR-98/02)*

information about the progress of the smoke, the fire, the safety of the crew, or the safety of the passengers, he could not have transmitted it to the bridge. In this accident case, the National Transportation Safety Board found that the UHF radio did not provide the communications capability to ensure the safety of the fire watch, which, in turn, was needed to ensure the safety of passengers and crewmembers. The Safety Board determined that had the *Universe Explorer* been equipped with an internal radio antenna network, which eliminates dead spots, radio communications would have been more effective during the emergency.

The fire occurred immediately below the hospital, forcing the ship's doctor and nurses to evacuate immediately. The *Universe Explorer* medical staff had only one radio, which meant that the nurses repeatedly had to go to the doctor to determine where their assistance was most needed. The lack of effective communications interfered with the medical staff's ability to render treatment to injured passengers and crewmembers. Had each member of the medical staff had a radio and a separate frequency on which to communicate so as not to interrupt other emergency transmissions, the doctor and nurses could have conferred over the radio without having to leave patients; as a result, many injury victims could have been treated sooner.

Fire conditions prevented the medical staff from accessing the medical supplies stored in the hospital. The bridge maintained an emergency medical kit, but it did not contain oxygen to treat the crewmembers who sustained smoke inhalation injuries. The Safety Board determined that the circumstances of this accident point out that cruise ships should have an auxiliary store of medical equipment and medicine for use in emergencies should the hospital become inaccessible.

Smoke from the main laundry fire on the *Universe Explorer* probably began spreading upward to the crew accommodations area before the bridge received the first fire alarm. Because of the delay in the bridge watch's closing the magnetic fire doors and because crewmembers compromised the effectiveness of some fire doors by tying them open, a massive, lethal amount of smoke quickly accumulated in the crew accommodations area, trapping a number of crewmen in their quarters. Their cabins lacked telephones or other means of communication with which they could signal their location or call for help. Crewmen tried to signal their need for assistance by waving a towel out of a porthole, by banging on walls, and by yelling for help; however, their efforts were ineffective. Because of the steel construction of the vessel, noises either migrated or were not audible, making it difficult for rescuers to accurately determine where trapped crewmembers were located. Rescuers did not locate several trapped crewmen until more than 2 ½ hours after the fire started. Had some stranded crewmen not found a room with a porthole, the number of fatalities would have been higher. However, had they had a means, such as an emergency call system similar to the flight attendant call system used on commercial airlines, by which they could signal their location, rescuers could have determined that location and helped them sooner, thereby reducing the number and severity of injuries to the trapped crewmen and exposing the search teams to fewer risks.

A number of factors adversely affected survivability on this ship. During the Safety Board's postaccident examination of the laundry, investigators observed that a bulkhead isolating the laundry area from the stair towers had been removed. The presence of the bulkhead would

not have prevented a fire from starting; however, it would have mitigated the propagation of smoke, thereby affording the crew a better chance for survival.

Records show that the vessel now known as the *Universe Explorer* was built in 1958 as a combination passenger/cargo ship, has been owned by a number of companies, and has undergone a number of major modifications. The present vessel operator indicated that the main laundry bulkhead was removed with the approval of the American Bureau of Shipping during a conversion completed in the early 1970s while the vessel was being operated by another company. However, classification and inspection authorities had no record of granting approval for removal of this bulkhead.

What particularly disturbs the Safety Board about the missing bulkhead is that it was still indicated on the fire control plan. Having an inaccurate fire control plan compromises the ability of officers to direct operations during a fire, which, in turn, places crewmembers and passengers at risk. This accident therefore demonstrates that passenger ship owners and operators need to be aware of the potential degradation to safety that can result not only from altering bulkheads, but also from failing to correct important vessel plans when such modifications are made.

When Safety Board investigators examined the main laundry after the fire, they noted that the smoke detectors were not connected to the fire detection system. The only active fire detection devices in the area were heat detectors. Records do not indicate why the smoke detectors were disconnected. However, from discussions with people experienced in laundry operations, fire experts, and detector manufacturers, the Safety Board determined that moisture, dust, and lint in the air of a laundry facility can trigger smoke detector sensors, resulting in false alarms, unless the devices are maintained appropriately. Heat-actuated detectors require more time than smoke detectors to actuate because a minimum level or minimum rate of heating must occur in the area of the device's sensor before the detector activates. The limitations of each type of detector could be reduced by establishing systems using both types of devices. Moreover, combining the system of detection with an automatic sprinkler system would provide a greater measure of safety by limiting the spread of fire. Based on its findings, the Safety Board concluded that greater fire protection can be attained in laundry facilities by using a combination of different types of detection devices, as well as an automatic suppression system.

The Safety Board is aware of other fire detection systems that are in development, including infrared and ultraviolet flame detectors and carbon monoxide detection systems. Some of these systems are currently available, and others are still being tested. Investigative research at the National Fire Academy has shown that using an alarm verification reset feature and cross zoning of fire detectors significantly reduce random false alarms and increase the reliability of fire detectors.

Given the high fire risk in laundry operations, improvements in the methods used to monitor such areas are essential. Conventional fire surveillance consists mainly of smoke and heat detectors. However, other methods are available that could augment passive sensory devices. Safety aboard a passenger vessel could also be improved by instituting improved surveillance measures, such as installing video cameras in high-fire-risk areas.

The *Universe Explorer* had electromagnetic fire doors on all stairway enclosures and main vertical zone boundaries, including the forward bulkhead of the main laundry. These fire doors did not close automatically; they had to be released either by someone pushing a local switch or by someone on bridge watch remotely closing them. Records indicate that on the morning of the accident, all fire doors were closed within less than 10 minutes of the first fire alarm. Nevertheless, during postaccident examination of the vessel, investigators found soot and debris patterns indicating that the fire doors, while open, had allowed the smoke and heat from the fire to enter the stairway, which then served as a flue, rapidly transmitting smoke and hot gases upward to other decks.

Had the fire doors leading from the main laundry to the stairways automatically closed when the fire started, the smoke and heat of the fire would probably have been contained within the boundaries of the main laundry long enough for crewmembers to have been warned of the fire and to have escaped from their berthing area. The Safety Board concluded that had automatic closure of the fire doors been incorporated in the fire detection system of the *Universe Explorer*, the doors near the fire would have shut immediately when nearby detectors activated, thereby restricting the spread of lethal amounts of smoke to the crew berthing areas.

Based on surveys of passengers and interviews with crewmembers, the Safety Board identified some deficiencies in on-board emergency procedures.

Some survey respondents stated that the passenger fire drill consisted of providing them with instructions on how to don a life preserver and on how to locate their muster stations. A large majority of those responding indicated that passengers were not told what to do should they see a fire or smell smoke. Passengers were particularly critical of the lack of information provided about the fire doors. About one-fourth of the responders characterized the drill as unrealistic because many passengers who knew the scheduled time of the drill went in advance to their lifeboats, using the elevators to reach their stations. One passenger complained that the drill did not prepare him to locate his life preserver because it had been placed on his bunk for the drill when he first arrived at his stateroom, whereas it was stowed in his room when he needed it during the actual emergency.

To have the maximum effectiveness, fire drills should be as realistic as possible. The content of the drill on the *Universe Explorer* left many passengers unprepared to meet the demands of the actual fire emergency. Allowing passengers to use elevators to reach their assembly stations during a drill does not prepare them to identify a safe route of escape. Further, not requiring passengers to observe approved safety procedures during drills may lead them to attempt the same shortcuts during the actual emergency, perhaps with tragic results. When dealing with a large group—in this case, 732 passengers—undoubtedly some individuals will become agitated or frightened during an actual emergency. When events occur for which passengers are not prepared, such as magnetic doors suddenly slamming shut, the likelihood increases that they will panic. Such reactions clearly support the need for passenger fire drills and for placards in staterooms that contain adequate instructions about fire emergencies. To be effective, a drill must provide passengers with the basic information, including:

- how to report a fire;
- what to expect if a fire occurs, such as typical announcements, actions of the crew, operation of the emergency lights, and operation of fire doors;
- the location and meaning of emergency signs;
- the description of emergency signals;
- if incapacitated, how to call for assistance; and
- the route to take from their stateroom to their assembly area.

The *Universe Explorer* conducted weekly crew emergency drills as required by the *Safety of Life at Sea* (SOLAS) Convention. The drills did not include, and were not required to include, identifying alternate escape routes from cabins and work sites. The berthing area where the fatalities occurred was forward of the crew galley and most work areas. Consequently, when crewmembers were alerted to the fire, they reacted according to habit in attempting to escape. They first tried to walk aft but could not continue because the increasing intensity of the heat and smoke forced them to turn around to find alternative escape routes. They said the heavy smoke stung their eyes and severely limited their visibility, requiring that they feel their way along the corridors until they found an exit. Although they had several other means of escape 50 to 60 feet away, locating an exit quickly was difficult. The position of the deceased crewmen's bodies in the passageways indicates that they probably were overcome by the heavy, toxic smoke while trying to find an escape route.

The 1995 amendments to the Standards for Training Certification and Watchkeeping Convention that became effective February 1, 1997, recognize the need for improved survival training. The amendments require that before being assigned to shipboard duties, crewmembers who are new to a seagoing ship must receive familiarization training in personal survival techniques or receive sufficient information and instructions to be able to perform certain tasks, including identifying emergency escape routes and muster and embarkation stations.

As the *Universe Explorer* fire demonstrates, knowledge of alternate escape routes is critical to the survival of crewmen during a fire emergency. While the Safety Board is pleased with the International Maritime Organization's initiative to improve survivability training for new seafarers, it is concerned that comparable instruction and refresher training is not available for all crewmembers. The Safety Board recognizes the impracticality of requiring today's passenger ships to drill their entire crews weekly on identifying and using alternate escape routes from work and berthing areas. Nevertheless, crewmembers need more than a one-time training session in survivability, especially if, as new employees, they receive such instruction when they also have to familiarize themselves with numerous other vessel operations.

As mentioned earlier, several trapped crewmen were not located by rescuers until more than 2 ½ hours after the fire started. According to interviews, the ship's two fire teams assembled, donned protective gear, and marshaled firefighting equipment within minutes of the crew alert to report to emergency stations. Despite the prompt initial action, the trapped crewmen

were not located in a timely manner because the search was not conducted in an organized, systematic manner. Rather, the staff captain directed one fire team member to don breathing equipment and search the crew area. The lone searcher said that he encountered intense and blinding smoke, saw the fallen crewmembers, and heard people calling for help but saw nothing but smoke. He returned to the staging area, whereupon the staff captain directed a second team member to join the first searcher and return to remove the fallen crewmen. However, they did not immediately initiate follow-up actions to find the trapped crewmen.

Again, having a lone individual—in this case the fire team member—search an area of a vessel during a fire was ill-advised and dangerous. The searcher could have needed help himself or could have encountered people who needed assistance that was beyond the ability of one person to provide. The delay and lack of systematic effort in rescuing trapped crewmembers demonstrates that the *Universe Explorer* crew was not adequately prepared to conduct rescue operations. The Safety Board concluded that if the *Universe Explorer* had had a properly equipped rescue team that was trained in locating and recovering people trapped in smoke-filled areas, the crewmen probably would have been rescued sooner and would have sustained less severe injuries; moreover, fewer crewmen may have died.

Before this fire, the *Universe Explorer* had sailed for almost 40 years without a major incident. The combined effect of a few physical conditions, several systemic problems, and less than adequate company policies and procedures compromised the safety of the vessel, ultimately resulting in a fire and the deaths of several crewmen. Safety-conscious passenger vessel owners and operators need to be made aware of the circumstances of this accident so that they may examine their fleets and policies for the purpose of potentially improving the fire safety environment of their vessels.

Therefore, the National Transportation Safety Board recommends that the International Council of Cruise Lines:

> Advise member companies of the circumstances of this accident and recommend that they institute procedures and, if necessary, upgrade equipment to establish reliable internal radio communications from anywhere inside a vessel during an emergency. (M-98-58)
>
> Recommend that member passenger ship companies install emergency call systems in passenger staterooms and crew cabins so that people trapped during a fire emergency will have a means of signaling their location. (M-98-59)
>
> Inform member companies of the importance of providing each member of the shipboard medical staff with a reliable radio and communications training for emergencies. (M-98-60)
>
> Remind member companies of the possible need to institute improved surveillance measures for high-fire-risk areas on their ships. (M-98-61)

Recommend that member companies integrate heat and/or smoke detectors with automatic fire door release switches so that the doors in the immediate area of a fire will close automatically when the detectors are activated. (M-98-62)

Recommend that member companies review and, if necessary, revise passenger fire drills and stateroom placards to advise passengers what to expect in the event of a fire emergency. (M-98-63)

Recommend that member companies provide periodic instruction or drills on alternative escape routes to all crewmembers on passenger ships to reinforce the familiarization training required of new seafarers by the 1995 Amendments to the Standards for Training Certification and Watchkeeping Convention. (M-98-64)

Encourage member companies to establish specially trained and equipped shipboard rescue teams to conduct rescue operations from smoke-filled areas. (M-98-65)

In consultation with member passenger ship operators, determine the amount and type of medical equipment and medicines needed during an emergency and recommend that such supplies be maintained in suitable locations outside of the ship's hospital in case the hospital becomes inaccessible. (M-98-66)

Remind member companies of the degradation to structural fire protection that can result from altering fire control boundaries and of their responsibility to maintain the accuracy of vessel fire control plans. (M-98-67)

Also, the Safety Board issued Safety Recommendations M-98-31 through -41 to the U.S. Coast Guard, M-98-42 through -57 to New Commodore Cruise Line, Ltd., and to V. Ships Marine, Ltd., and M-98-68 to the American Bureau of Shipping.

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 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-98-58 through -67 in your reply. If you have any questions, you may call (202) 314-6455.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: Jim Hall
Chairman