National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 2, 2008

In reply refer to: M-08-1 and -2

Admiral Thad W. Allen
Commandant
U.S. Coast Guard
Washington, D.C. 20593-0001

At 1406 on July 18, 2006, the Bermuda-registered cruise ship *Crown Princess*, which was operated by Princess Cruises and had been in service about a month, departed Port Canaveral, Florida, for Brooklyn, New York, its last port on a 10-day round-trip voyage to the Caribbean. The vessel was equipped with an integrated navigation system[1] that included a trackpilot (autopilot). About an hour after leaving port, the crew shifted from manual steering to the trackpilot. Two minutes later, the vessel's heading began to fluctuate around the set heading. In response to an alarm indicating that the rudder had reached its set limit of movement (5°), the staff captain increased the trackpilot's rudder limit setting to 10°. Shortly afterward, the captain and staff captain left the bridge, leaving the second officer in charge of the navigation watch. The vessel was traveling at nearly full speed, about 20 knots, by that time.

When the instrument panel showed a high rate of turn to port, the second officer became concerned, disengaged the trackpilot, and took manual control of the vessel's steering system. He turned the wheel first to port and then between port and starboard several times, eventually causing the vessel to heel at a maximum angle of about 24° to starboard. The heeling caused people to be thrown about or struck by unsecured objects, resulting in 14 serious and 284 minor injuries to passengers and crewmembers. The vessel incurred no damage to its structure but sustained considerable damage to unsecured interior components and to cabinets and their contents.[2]

The National Transportation Safety Board determined that the probable cause of the *Crown Princess* accident was the second officer's incorrect wheel commands, executed first to

[1] Princess Cruises referred to its integrated navigation system as an integrated bridge system. Until recently, the terms were used interchangeably. However, International Maritime Organization regulations now distinguish between them. An integrated navigation system is considered to be a component of an integrated bridge system, which includes other components such as communications, security, and cargo control.

[2] For further information, see *Heeling Accident on M/V* Crown Princess, *Atlantic Ocean Off Port Canaveral, Florida, July 18, 2006*, Marine Accident Report NTSB/MAR-08/01 (Washington, DC: NTSB, 2008). The report is available on the Safety Board's website at <http://www.ntsb.gov/publictn/2008/MAR0801.htm>.

counter an unanticipated high rate of turn and then to counter the vessel's heeling. Contributing to the cause of the accident were the captain's and staff captain's inappropriate inputs to the vessel's integrated navigation system while the vessel was traveling at high speed in relatively shallow water, their failure to stabilize the vessel's heading fluctuations before leaving the bridge, and the inadequate training of crewmembers in the use of integrated navigation systems.

The Safety Board concluded that the captain and staff captain did not recognize that high speed and shallow water were adversely affecting the vessel's course stability. The Board further concluded that the captain and staff captain inappropriately adjusted the trackpilot's rudder limit in response to unintended deviations in the vessel's set heading and failed to adjust the rudder economy setting, which was inappropriate for the sea state and was exacerbating the fluctuations. The Board also found that the captain should not have transferred control of the ship's movements to the second officer and left the bridge unless he could verify that the heading fluctuations had diminished. Further, the Board found that the errors of the captain and staff captain in operating the integrated navigation system resulted from inadequate training.

The Safety Board identified deficiencies in integrated navigation system training 10 years earlier in its investigation of the grounding of the *Royal Majesty*[3] and issued the following safety recommendation to the U.S. Coast Guard:

> M-97-5
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> Propose to the International Maritime Organization that it develop appropriate performance standards for the training of watch officers assigned to vessels equipped with integrated bridge systems and require this training.

The Coast Guard disagreed with the recommendation and notified the Safety Board that it planned to take no action on it. Consequently, the Board classified Safety Recommendation M-97-5 as "Closed—Unacceptable Action" on April 20, 1999. Since the Safety Board issued its recommendation in 1997, errors in integrated navigation system use have continued. Although in recent years the International Maritime Organization has recognized the need for additional attention to integrated navigation system training for bridge watch officers, the training is still not mandatory. The record of passenger vessel incidents and accidents related to deficiencies in integrated navigation system training since the *Royal Majesty* accident contradicts the outcome foreseen by the Coast Guard when it responded to Safety Recommendation M-97-5 that "there is no indication that the existing international standards of qualification are inadequate" and that "the 1995 amendments to the international convention on standards of training, certification, and watchkeeping for seafarers, 1978, (STCW) provide ample international standards and regulations" governing integrated navigation system training.

The International Maritime Organization has developed a model training curriculum for integrated navigation system and integrated bridge system equipment. The curriculum, which is advisory only, addresses many of the shortcomings in integrated navigation system training requirements that the Safety Board noted in its investigation of the *Crown Princess* accident.

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[3] National Transportation Safety Board, *Grounding of the Panamanian Passenger Ship* Royal Majesty *on Rose and Crown Shoal Near Nantucket, Massachusetts, June 10, 1995*, Marine Accident Report NTSB/MAR-97/01 (Washington, DC: NTSB, 1997).

However, because there is no international requirement for integrated navigation system training, the proposed model curriculum may not be effective in addressing the shortcomings in integrated navigation system training noted in this investigation.

Until crewmembers are required to demonstrate mastery of integrated navigation systems and integrated bridge systems through formal, well-designed training programs, there can be no assurance that watchkeepers are proficient in the use of these sophisticated systems. The model International Maritime Organization curriculum, or other training endeavors that meet similar instructional objectives, if implemented and made mandatory with mariner participation in the training, would increase the likelihood that crewmembers will use integrated navigation system or integrated bridge system equipment effectively in all operating conditions. Therefore, the Safety Board believes that the Coast Guard should propose to the International Maritime Organization that, in conjunction with the upcoming revisions to the Standards of Training, Certification, and Watchkeeping for Seafarers, it make training in integrated navigation systems and integrated bridge systems mandatory for watchkeepers on vessels equipped with such systems.

The *Crown Princess* accident demonstrated the need for obtaining and archiving data on vessel angles of heel. Investigators had to determine the *Crown Princess*'s maximum angle of heel from images taken by cameras installed on the vessel for purposes other than accident investigation. The vessel's voyage data recorder (VDR), designed to collect data for use in accident investigations, did not record heel angles, and there is no requirement that VDRs do so. Data that accurately record a vessel's angle of heel can considerably assist those attempting to understand the nature of a heeling event. Therefore, the Safety Board believes that the Coast Guard should propose to the International Maritime Organization that it mandate the recording on voyage data recorders of heel angles through the complete range of possible values.

The National Transportation Safety Board therefore recommends that the U.S. Coast Guard take the following action:

> Propose to the International Maritime Organization that, in conjunction with the upcoming revisions to the Standards of Training, Certification, and Watchkeeping for Seafarers, it make training in integrated navigation systems and integrated bridge systems mandatory for watchkeepers on vessels equipped with such systems. (M-08-1)

> Propose to the International Maritime Organization that it mandate the recording on voyage data recorders of heel angles through the complete range of possible values. (M-08-2)

As a result of its investigation of the *Crown Princess* accident, the Safety Board also issued recommendations to the Cruise Lines International Association, SAM Electronics (manufacturer of the integrated navigation system installed on the *Crown Princess*), and Sperry Marine (manufacturer of other integrated navigation systems). The Board would appreciate a response from you within 90 days, addressing actions you have taken or intend to take to implement its recommendation. In your response, please refer to Safety Recommendations M-08-1 and -2. For additional information, you may call (202) 314-6174.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HIGGINS and CHEALANDER concurred in these recommendations. Member HERSMAN concurred with Safety Recommendation M-08-2 but disapproved Safety Recommendation M-08-1 and filed a dissenting statement, which is attached to the accident report.

[*Original Signed*]

By: Mark V. Rosenker
Chairman