



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** May 2, 2008

**In reply refer to:** M-08-5

Mr. Andrew Fraser  
Director, Worldwide Service  
Northrop Grumman Corporation  
Sperry Marine  
1070 Seminole Trail  
Charlottesville, Virginia 22901-2891

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The National Transportation Safety Board is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge you to take action on the safety recommendation in this letter. The Safety Board is vitally interested in the recommendation because it is designed to prevent accidents and save lives.

The recommendation in this letter addresses the reporting of heeling incidents and accidents. The issue derives from the Safety Board's investigation of the July 18, 2006, heeling accident on the cruise vessel *Crown Princess* and is consistent with the evidence we found and the analysis we performed.<sup>1</sup>

An hour and a half before the accident, the Bermuda-registered *Crown Princess*, operated by Princess Cruises, departed Port Canaveral, Florida, for Brooklyn, New York, its last port on a 10-day round-trip voyage to the Caribbean. The vessel had been in service about a month. After the crew engaged the trackpilot (autopilot) function of the vessel's integrated navigation system,<sup>2</sup> 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 rudder limit setting to 10°. Shortly afterward, the captain and staff captain left the bridge, leaving the

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<sup>1</sup> 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.nts.gov/publictn/2008/MAR0801.htm>>.

<sup>2</sup> 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.

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.

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

As part of its investigation of the accident, the Safety Board interviewed representatives of several U.S.-based cruise lines, including Princess Cruises, regarding heeling incidents on their vessels in the 15 years before the accident. For purposes of the study, a heeling incident was defined as an unexpected and unplanned heeling of a vessel during a turn, reaching an angle equal to or greater than 6°. The intent was to determine whether commonalities were present among operator errors in the use of integrated navigation systems. Investigators also reviewed information on 13 heeling accidents and incidents involving large passenger cruise vessels (those carrying more than 1,000 passengers) equipped with integrated navigation systems.

The Safety Board found that there exists no systematic way of providing information or feedback regarding incidents related to integrated navigation systems or integrated bridge systems to the system designers or trainers. Neither the U.S. Coast Guard nor the International Maritime Organization requires cruise lines to report heeling incidents to integrated navigation system manufacturers or to government agencies if the incidents do not meet accident-reporting criteria. Representatives of your company and of SAM Electronics, which together manufacture nearly all the integrated navigation systems installed on cruise ships, told investigators that they learned about heeling incidents related to integrated navigation systems from the news media, from local technical representatives, or directly from their customers. Both companies indicated that, when informed of a heeling incident or accident, their primary concern was to identify system malfunctions rather than operator errors.

Information about hardware or software flaws, while important, provides an incomplete account of actual operations. Data on errors in the use of integrated navigation systems or integrated bridge systems may point to flaws in the system interface or suggest areas of improvement in system design or training. Without such information, manufacturers have no reliable method of learning whether their products are being used as intended or whether their products and training programs are meeting their objectives. The Safety Board concluded that the

systematic collection of data on mishaps related to integrated navigation systems and integrated bridge systems would enhance the systems' design, procedures, and training, and therefore recommends that Sperry Marine take the following action:

Work with cruise lines and other vessel operators to develop a system that provides them with critical information regarding errors or potential problems in the use of integrated navigation systems or integrated bridge systems and apply the lessons learned to system design and crew training. (M-08-5)

As a result of its investigation of the *Crown Princess* accident, the Safety Board also issued recommendations to the U.S. Coast Guard, the Cruise Lines International Association, and SAM Electronics. 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 Recommendation M-08-5. For additional information, you may call (202) 314-6174.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred in this recommendation.

*[Original Signed]*

By: Mark V. Rosenker  
Chairman



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** May 2, 2008

**In reply refer to:** M-08-5

Dr.-Ing. Volker Kohler  
Director, Product Support  
SAM Electronics GmbH  
Automation, Navigation and Communication  
Behringstrasse 120  
D-22763 Hamburg, Germany

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systematic collection of data on mishaps related to integrated navigation systems and integrated bridge systems would enhance the systems' design, procedures, and training, and therefore recommends that SAM Electronics take the following action:

Work with cruise lines and other vessel operators to develop a system that provides them with critical information regarding errors or potential problems in the use of integrated navigation systems or integrated bridge systems and apply the lessons learned to system design and crew training. (M-08-5)

As a result of its investigation of the *Crown Princess* accident, the Safety Board also issued recommendations to the U.S. Coast Guard, the Cruise Lines International Association, and Sperry Marine. 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 Recommendation M-08-5. For additional information, you may call (202) 314-6174.

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