Log M-177A AI-4

# NATIONAL TRANSPORTATION SAFETY BOARD
## WASHINGTON, D.C.

ISSUED: February 18, 1982

Forwarded to:
Admiral John B. Hayes
Commandant
U.S. Coast Guard
Washington, D.C. 20593

SAFETY RECOMMENDATION(S)

M-82-1 through -3

About 0716 e.d.t. on May 6, 1981, the Norwegian cargo vessel M/V HØEGH ORCHID, inbound from sea to a berth in Brooklyn, opposite The Battery, collided with the New York City ferry AMERICAN LEGION in dense fog in Upper New York Bay near buoy No. 24. The ferry was en route from Staten Island to Manhattan with approximately 2,400 passengers aboard. The ferry was damaged from below the main deck up to and including the bridge deck, the uppermost passenger deck. A total of 71 passengers were treated for injuries; 3 passengers were hospitalized. The HØEGH ORCHID suffered minor damage, and there were no injuries to persons aboard. The estimated cost of repairs to both vessels was $520,000. 1/

The ferry master's Coast Guard license included an endorsement as radar observer, inland. This license was renewed on March 30, 1981, about 2 months before the accident. At that time, in addition to an abbreviated rules of the road examination, the master was required to pass a radar examination or present a certificate of successful completion from an approved radar school to qualify for renewal. Having failed the Coast Guard radar examination, he attended a 1-day course at a radar school and was given a certificate which he presented to the Coast Guard.

Investigation of examination records revealed that the majority of renewal applicants attend some type of approved radar school rather than take the Coast Guard examination, and over half of those taking the Coast Guard examination failed. A Coast Guard license examiner testified that in an 18-month period, 57 percent of those taking the Coast Guard's radar examination failed. The radar schools use more of an instructional type approach with lectures, plotting techniques, and actual practice on a radarscope followed by an examination. The Coast Guard radar examination does not offer any "hands-on" type of demonstration, but uses a problem and solution type of approach.

1/ For more detailed information read "Marine Accident Report—Norwegian Cargo Vessel HØEGH ORCHID and New York Ferry AMERICAN LEGION Collision, Upper New York Bay, May 6, 1981" (NTSB-MAR-82-1).

The inland and ocean radar examinations given by the Coast Guard differ slightly. Solutions to the ocean radar observer questions usually require a substantial course change, whereas the inland solutions require more speed changes, recognizing that restricted waters do not permit large course alterations. There is little in the inland radar examination that relates to those mariners who operate in rivers and harbors and do not practice radar plotting. In the day-to-day job of navigating the Staten Island ferry in Upper New York Bay, the ferry master seldom plots on his radarscope to determine a contact's course and speed or closest point of approach (CPA). When he renews his license every 5 years, the Coast Guard does not examine him for knowledge of the special radar problems that he encounters in a harbor.

In 1968, the National Transportation Safety Board published a special study 2/with recommendations to the Coast Guard to:

> Amend the regulations to require a demonstration of knowledge of radar, to include plotting, by an examination or exercise by deck officers at the time of each renewal of license. (M-69-1)
>
> Increase the scope of existing regulations to require that applicants for license as pilot or as master or mate, on waters other than ocean or coastwise, be included in the requirement to demonstrate by professional examination their qualifications as radar observer. (M-69-3)

On August 21, 1970, the Coast Guard responded, in part:

> On 5 May 1970, amendments to Title 46 of the Code of Federal Regulations pertaining to the licensing of merchant marine officers and the manning of vessels were accepted by the Merchant Marine Council and will be published in the Federal Register in approximately three months. The amendments require that every pilot and deck officer, who holds a "radar observer" endorsement, must demonstrate his proficiency in radar prior to renewal of his license. The same amendments also extend existing regulatory requirements, that all pilots and deck officers on board radar-equipped, inspected vessels of 300 gross tons and over [on] ocean, coastwise and Great Lakes routes hold a radar endorsement, to the same vessels on U.S. inland water routes as well.

Federal Register, Vol. 35, No. 252 amended the regulations (46 CFR 10.05-46) effective July 1, 1972.

Recent proposals by the Coast Guard to amend the regulations governing the issuance and renewal of radar endorsements have partially responded to the need for a demonstration of radar skills in order for a merchant marine officer to renew his license. The need for simulator training instead of relying on written examinations to demonstrate radar skills is the primary thrust of the proposed amendments. However, they do not recognize the type of proficiency required by those radar observers who operate harbor craft such as ferries. The Safety Board concludes that any curricula for radar observer training that would be developed by the Coast Guard for radar observer, inland waters, should include instruction and practical demonstration in the type of proficiency needed to safely navigate harbor craft in restricted waters.

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2/ "Study of Collisions of Radar-Equipped Merchant Ships and Preventive Recommendations," December 18, 1968.

As the HØEGH ORCHID passed buoy No. 22, the pilot heard the AMERICAN LEGION's security call announcing that it was "coming up on the KV buoy heading for buoy 24." Although the HØEGH ORCHID was less than 1 mile from buoy No. 24, the pilot apparently had not yet noticed the ferry on his radar. Although the postaccident examination of the radar revealed that the HØEGH ORCHID's 10-cm radar had a malfunction in the anticlutter control circuit (STC) at less than 1/2 nmi range, this should not have prevented the ferry contact from being seen earlier. The two vessels anchored at the northern end of the Stapleton anchorage, a tug and tow approaching buoy No. 24 heading east toward Bay Ridge, and the EDITA, anchored in the Bay Ridge anchorage about 300 to 400 yards east of buoy No. 24, were all visible on the HØEGH ORCHID's radars. The HØEGH ORCHID's pilot was unaware that the AMERICAN LEGION, having left the Staten Island ferry terminal and turned toward the Kill Van Kull before reversing course, had headed for a point north of the KV buoy. The radar contacts that were outside of the buoys along the main ship channel did not pose any apparent threat to the HØEGH ORCHID, and probably did not engage the pilot's attention. It was only when the ferry entered the main channel that he became concerned and, given a minimum time for evaluation, made his decision to take evasive action as soon as he identified the ferry. If the ferry had been equipped with a transponder or similar device that would enhance the display on the radars of other vessels and provide positive identification, the ferry's identity could have been distinguishable from other harbor traffic and identified by the HØEGH ORCHID.

In analyzing the use of radar by the pilot of the HØEGH ORCHID and the master of the AMERICAN LEGION, it was evident that both parties apparently did not make effective use of all the radar information that was available to them. Both the master and the pilot of the HØEGH ORCHID were observing the two radars, each using both units at one time or another. The malfunction subsequently found in the 10-cm radar within the 1/2 mile range probably did not contribute to the cause of the accident. Although the 10-cm radar was used to get an overall picture of the harbor, it was not being used effectively. When the master of the AMERICAN LEGION broadcast a security call at 0711, the pilot of the HØEGH ORCHID should have attempted to identify the ferry on radar and also attempted to establish radio communication. The ferry's radar image should have been visible before 0.5 nmi. Because greater use was being made of the 3-cm radar, the traffic beyond 1 1/2 nmi shown on the 10-cm radar was not monitored as it should have been. With the 3-cm radar set on the 1 1/2-mile scale, the image of the AMERICAN LEGION would have begun to appear on the edge of the radarscope at about 0708 after it steadied up on the east-northeast course to the KV buoy. From this time until the collision, the ferry would have maintained approximately the same relative bearing on the HØEGH ORCHID's 3-cm radarscope. When the ferry first appeared on the HØEGH ORCHID's radars, the two vessels anchored at the northern end of the Stapleton anchorage would have been almost in line with the ferry's image; however, the resolution in range of the 3-cm radar should have been sufficient to portray each image distinctly. Because of the relatively small size of the ferry compared to the anchored vessels, it is possible that its radar image may not have been as noticeable. However, from about 0709 to 0713 1/2, the range was less than 1 1/2 nmi; therefore, the ferry should have been displayed on both of the HØEGH ORCHID's radars and then on the 3-cm radar alone from 1/2 nmi up to the collision. No other images should have interfered with the radar display.

The effectiveness of navigational radar would be greatly improved if it provided positive identification of ferries. Radar beacons (racons) are commercially available transponders which, when triggered by a radar signal, send back a response which appears on the receiving ship's radarscope as a bright line extending beyond the contact. This distinguishes the racon-equipped contact from the remainder of the display. Racons operate in the 3-cm and 10-cm radar bands and are currently being used on waterways in conjunction with other navigational aids. The use of transponders aboard vessels to enhance radar return has been determined to be feasible by the U.S. Maritime Administration. The Safety Board believes that a study should be made by the Coast Guard to evaluate the merits of installing basic transponders or similar devices on the New York ferries so that they may be positively identified on 3-cm and 10-cm radars.

The U.S. Coast Guard granted a deviation 3/ from the requirements of the Navigation Safety Regulations, Title 33, Code of Federal Regulations, Part 164.35 for the ferries owned and operated by the city of New York on the Staten Island/Manhattan ferry route. Ferries may operate on this specified route without a gyrocompass, illuminated gyrocompass repeater, echo depth sounding device, and a device for recording soundings. With the addition of larger capacity vessels in the Staten Island ferry fleet, the number of passengers in transit, especially during the "rush hour" periods, will ultimately increase. Any upgrading of the ferry system should also include a review of the type of equipment and the methods used to navigate the ferries over the established route. The modern collision avoidance systems and stabilized radars that are available together with a modern gyrocompass would provide additional navigational safety for the passengers and greatly enhance the all-weather capabilities of the ferries.

The master of the AMERICAN LEGION testified that with the present method of navigating the ferries, plotting of targets on a radarscope is not done nor is it practical. With the present equipment in the pilothouse of the ferries, this may be a reasonable conclusion. The basic function of radar in limited visibility is to provide information to the observer that can be used to determine if risk of collision exists with one or more approaching vessels. To achieve this with any degree of accuracy depends on the ability of the operator to reduce radar contact error. It is difficult to observe accurate radar bearings when the vessel is not held to a steady course or when in a yawing condition. Radar ranging or distance measuring is not affected by the yawing effect. Presently, the radar observer on the ferries must request the compass heading from the pilot or helmsman while he obtains a relative bearing of a contact on the radar. To make a projection of its relative motion, another bearing must be taken after an interval of time. Because the nonstabilized presentation on the radarscope rotates with any change of heading of the vessel, the radar observer must again request a compass heading from the helmsman and apply any angular difference between this heading and the heading of the vessel at the time of the first bearing. Meanwhile, because the heading of the vessel may not be steady enough to allow a clear image to be imprinted on the radarscope, a blurred radar image may result. If multiple contacts are present, which most likely would be the condition in New York Harbor, the process is time-consuming and requires complete concentration by the observer. Meanwhile, the same radar is also used to determine courses to steer and to monitor navigational aids. As a result, the effectivenes of the ferry's radar as an anticollision device is limited.

3/ Letters to the Commissioner of Marine and Aviation, City of New York from the U.S. Coast Guard Captain of the Port of New York, dated October 19, 1977, and December 5, 1978.

If the ferries were equipped with a gyrocompass, radar contact error could be significantly reduced. A radar, stabilized with a gyro input, would be more effective in monitoring radar contacts. It would also give the ferry master the means to further utilize the advantages of a gyrocompass by establishing courses to steer directly from the gyrostabilized radar during periods of limited visibility in a more accurate manner. Providing a gyro input to the radar unit would also furnish a key element necessary for adding an automatic radar plotting aid (ARPA).

The Safety Board believes that the city of New York, through its Department of Marine and Aviation, should provide and install a gyrocompass aboard the Staten Island ferries and upgrade the radar units aboard the ferries to include a gyrostabilized presentation and that the Coast Guard should withdraw the deviation permitting the ferries to operate without a gyrocompass and illuminated gyrocompass repeater and require this equipment to be installed. The Safety Board further believes that an evaluation should be conducted to determine the feasibility of the use of an ARPA in conjunction with the stabilized radar presentation.

As a result of its investigation, the National Transportation Safety Board recommends that the U.S. Coast Guard:

> Evaluate the curricula of the approved radar schools to determine if the courses offered include training and testing in radar navigation as used by operators of ferries and other harbor craft, who do not normally plot radar contacts, and require those applicants seeking an endorsement as radar observer (restricted to inland waters), both original and renewal, to demonstrate this type of radar proficiency before such endorsement is issued. (Class II, Priority Action) (M-82-1)
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> Conduct a study to evaluate the feasibility of requiring the installation of a transponder or similar equipment that would identify the Staten Island ferries on all 3-cm and 10-cm radar units in current use aboard vessels. (Class II, Priority Action) (M-82-2)
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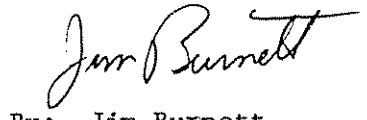
> Revoke the deviation from the equipment requirements of the Navigation Safety Regulations, 33 CFR 164.35, granted to the city of New York that permits the Staten Island ferries to operate without a gyrocompass and an illuminated gyrocompass repeater and require installation of this equipment. (Class II, Priority Action) (M-82-3)

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



By: Jim Burnett
Acting Chairman