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V. RECOMMENDATIONS

Based on the analysis of the petitions, the information received by the Board concerning radar observer certification, available radar equipment, and other aspects, the National Transportation Safety Board makes the following recommendations:

A. Radar Observer

1. The U. S. Coast Guard 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.
2. The Coast Guard review the existing regulations for raise of grade or increase in scope of deck licenses and consider revisions which would place more emphasis on the utilization of radar, particularly plotting.
3. The Coast Guard consider increasing 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.
4. The Coast Guard and the Department of Transportation continue vigorous support of proposed towing vessel legislation which includes a requirement for the licensing of operators.

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5. The Coast Guard consider modifying the radar observer examination to require a time limit, realistic to radar range and closing speeds, for completion of plotting problems.
6. Vessel owners and operators require or encourage deck officers to plot by radar during conditions of good visibility as a matter of watch routine to gain experience and maintain a high degree of efficiency.
7. Ship operators and unions encourage deck officers to take advantage of the advanced radar observer instruction and training provided by the recent installation of simulator equipment at the MARAD schools.

B. Radar Effectiveness.

- 8 1. The Coast Guard and the Department of Transportation consider means to encourage the use of radar reflectors by vessels constructed of material having poor radar reflecting capability, such as wood and plastics. Specify the most effective size, type, installation, etc.
- 9 2. The Coast Guard and the Department of Transportation continue vigorous support of proposed legislation to require bridge-to-bridge radio telephone as an aid in maneuvering, based on radar provided information.

C. Radar Equipment.

- 10 1. The Coast Guard and the Department of Transportation support the recommendation of the Maritime Safety Committee of IMCO

for mandatory radar and facility for plotting on all seagoing vessels over 1,600 gross tons.

2. Vessel owners and operators and marine radar contractors consider, where applicable, the following recommendations relative to new or existing installations:

- a. Test on different ranges with booms raised, and
11 post on bridge any information developed relating to blind sectors, etc.
- b. Install additional radar repeaters so that more
12 than one person can observe the presentation.
- c. Mount at least one repeater, with sufficient
13 brightness for daytime use, in a vertical plane at or above eye level on the forward bulkhead in the center of the bridge control area.

The Safety Board also makes the following recommendations derived from the many worthwhile contributions made at the seminar.

D. Radar Observer.

1. The Coast Guard consider amending the vessel inspection
14 regulations to require vessels to have stopping and turning capability data at different loading conditions posted on the bridge.

E. Radar Effectiveness.

1. The Coast Guard and the Coast and Geodetic Survey consider
15 the feasibility of providing, on nautical charts, information indicating the radar reflecting capability of aids to navigation so that radar equipment efficiency can be checked when operating in coastal waters.

F. Radar Equipment.

- 16 1. The Coast Guard, relative to mandatory radar, consider regulations to require a semiannual or annual testing/ servicing and certification of vessel radar installations in order to maintain peak efficiency and minimal error.
- 17 2. The Coast Guard consider amending the manning regulations to require that one of the required ship's personnel be certified as a radar technician for the purpose of routine maintenance of the radar equipment.
3. Vessel owners and operators and contractors consider, where applicable, the following recommendations relative to new or existing installations:
 - 18 a. Give specific attention to installation of antenna and equipment relative to avoiding or minimizing error, loss of efficiency, and blind sectors.
 - 19 b. Arrange ship's bridge to place radar and its related equipment in the best position, i.e., a central location convenient to visual conning area and to all controls (engine, phones, communications, helmsman, etc.).
 - 20 c. Provide gyro stabilization for true target bearing and to reduce error due to yawing.
4. The Department of Commerce, Coast Guard, Department of Transportation, and the electronic industry give consideration to the following recommendations

a. Develop and/or make economically available a radar alarm system actuated by:

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- (1) Target crossing specified range ring.
- (2) Target getting within area of a predetermined combination of CPA factors.

NOTE: The system should provide an audio alarm or a visual alarm such as change in appearance of the target pip which has entered into a possible collision situation with own ship.

b. Continue the development of a radar computer to solve for CPA and to provide automatic tracking of several targets.

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c. Develop a practical transponder-type identification system between radar equipped vessels.

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d. Improve true motion radar target trail persistence, such as by circuitry which has a longer storage time and with a variable control.

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e. Develop a more accurate "over the ground" speed measuring device for radar equipment input.

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f. Develop an electronic stabilization device to compensate for the effects of pitch and roll.

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