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ASSESSMENT OF PILOT NEEDS FOR SHIPBOARD DATA AND INFORMATIONAL DOCUMENTS

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16. Abstract

This report describes a study of the needs and desires of ship pilots for ship characteristic and ship maneuvering performance data to be used during piloting. The report presents results of interviews of 25 pilots in five different pilot associations on the East and West coasts of the USA. These interviews had three primary purposes. The first was to familiarize a broad cross-section of pilots with International Maritime Organization (IMO) proposals for pilot cards and wheelhouse posters and the current plans of the U.S. Coast Guard with regard to adoption of these recommended IMO documents. The second purpose was to obtain from the pilots information on their current exposure to and use of such documents. The third purpose was to obtain from the pilots specific recommendations or desires concerning additions to, modifications of, or deletions from the proposed IMO documents. Based upon the results of these interviews, it was concluded that pilots would primarily use the pilot card when available. Also, several modified versions of the IMO pilot card, which reflected the primary inputs of the 25 pilots, were prepared.

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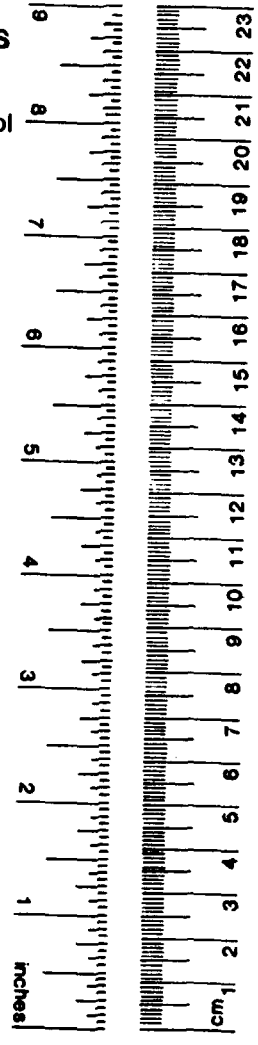
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

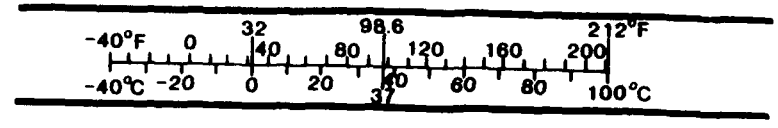
Symbol	When You Know	Multiply By	To Find	Symbol
	LENGTH			
in	inches	* 2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (WEIGHT)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (EXACT)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures. Price $2.25. SD Catalog No. C13.10.286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (WEIGHT)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (EXACT)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Section 1

INTRODUCTION

1.1 PURPOSE OF STUDY

This study is the first task of a two-task delivery order in the subject area of bridge display maneuvering information for merchant vessels. The purpose of this study, Task A, was to involve pilots in an international effort to improve and assure information availability to vessel operators and pilots. Specifically, Task A was to solicit pilot input on the best means for rapid access to ship characteristic and maneuvering performance data, with particularly emphasis on those data included in the International Maritime Organization (IMO) specified Pilot Card and Wheelhouse Poster contained in IMO Resolution A.601(15), "Provision and Display of Manoeuvering Information On Board Ships," which is reproduced as Appendix A to this report. Task B under the same delivery order was to develop an enhanced ship maneuvering data base for merchant vessel and is reported by Reference 1.

This study did not consider the IMO specified Maneuvering Booklet which is also addressed by Appendix A, because that document is intended for use by the ship's crew rather than pilots. Discussions with pilots confirmed that they would not make use of such a booklet, particularly if they had a pilot card and wheelhouse poster.

1.2 BACKGROUND

Sections 33 CFR 164.35 *and* 46 CFR 97.19 of the Code of Federal Regulations (CFR) currently contain requirements for the posting of certain data on board U.S. flag ships and other ships entering U.S. waters. The requirements of these existing Sections are summarized in Table 1. It should be noted that 46 CFR 97.19 applies only to large vessels. Similar regulations appear for other ship types in CFR subchapters applicable to tank vessels, passenger ships, etc. The data required by these regulations is similar to the data contained in pilot cards and wheelhouse posters proposed in 1980 by Panel H-10, Ship Controllability, of the Society of Naval Architects and Marine Engineers (SNAME), Reference 2, and that proposed in 1987 by the IMO, Appendix A.

In November 1987 the Assembly of the IMO adopted Resolution A.601(15), "Provision and Display of Manoeuvering Information On Board Ships," Appendix A, which defined proposed requirements for a pilot card, wheelhouse poster and maneuvering booklet. The guidance of Appendix A should be regarded as interim, as the IMO is planning to revisit these circulars beginning in 1990. At an appropriate time, the Coast Guard intends to issue a Navigation and Vessel Inspection Circular (NVIC) which will specify guidelines for pilot cards. There are no near term plans to issue new requirements or guidelines for wheelhouse posters and maneuvering booklets based on Appendix A. The purpose of this current study is to help assure a well defined response of U.S. pilots to the proposals set forth in Appendix A.

Table 1. Current Federal Regulations Governing Requirements for Display of Maneuvering Characteristics

A. U.S. Flag Vessels - 46 CFR, Chapter 1, Subpart 97.19

Subpart 97.19--Maneuvering Characteristics

§ 97.19-1 Data required.

For each ocean and coastwise vessel of 1,600 gross tons or over, the following apply:

(a) The following maneuvering information must be prominently displayed in the pilothouse on a fact sheet:

(1) For full and half speed, a turning circle diagram to port and starboard that shows the time and the distance of advance and transfer required to alter the course 90 degrees with maximum rudder angle and constant power settings.

(2) The time and distance to stop the vessel from full and half speed while maintaining approximately the initial heading with minimum application of rudder.

(3) For each vessel with a fixed propeller, a table of shaft revolutions per minute for a representative range of speeds.

(4) For each vessel with a controllable pitch propeller, a table of control settings, or a representative range of speeds.

(5) For each vessel that is fitted with an auxiliary device to assist in maneuvering, such as a bow thruster, a table of vessel speeds at which the auxiliary device is effective in maneuvering the vessel.

(b) The maneuvering information must be provided in the normal load and normal light condition with normal trim for a particular condition of loading assuming the following--

(1) Calm weather--wind 10 knots or less, calm sea;

(2) No current;

(3) Deep water conditions--water depth twice the vessel's draft or greater; and

(4) Clean hull.

(c) At the bottom of the fact sheet, the following statement must appear:

Warning

The response of the (name of the vessel) may be different from those listed above if any of the following conditions, upon which the maneuvering information is based, are varied:

(1) Calm weather--wind 10 knots or less, calm sea;

(2) No current;

(3) Water depth twice the vessel's draft or greater

(4) Clean hull; and

(5) Intermediate drafts or unusual trim.

(d) The information on the fact sheet must be:

(1) Verified six months after the vessel is placed in service; or

(2) Modified six months after the vessel is placed into service and verified within three months thereafter.

(e) The information that appears on the fact sheet may be obtained from:

(1) Trial trip observations;

(2) Model tests;

(3) Analytical calculations;

(4) Simulations;

(5) Information established from another vessel of similar hull form, power, rudder and propeller; or

(6) Any combination of the above.

The accuracy of the information in the fact sheet required is that attainable by ordinary shipboard navigation equipment.

Table 1. Current Federal Regulations Governing Requirements for Display of Maneuvering Characteristics (Continued)

B. All Ships Navigating in U.S. Waters - 33 CFR, Chapter 1, Para. 164.35

(g) The following maneuvering information prominently displayed on a fact sheet in the wheelhouse:

(1) A turning circle diagram to port and starboard that shows the time and distance and advance and transfer required to alter course 90 degrees with maximum rudder angle and constant power settings, for either full and slow speeds. For vessels whose turning circles are essentially the same for both directions, a diagram showing a turning circle in one direction, with a note on the diagram stating that turns to port and starboard are essentially the same, may be substituted.

(2) The time and distance to stop the vessel from either full and half speeds, or from full and slow speeds, while maintaining approximately the initial heading with minimum application of the rudder.

(3) For each vessel with a fixed propeller, a table of shaft revolutions per minute for representative range of speeds.

(5) For each vessel that is fitted with an auxiliary device to assist in maneuvering, such as a bow thruster, a table of vessel speeds at which the auxiliary device is effective in maneuvering the vessel.

(6) The maneuvering information for the normal load and normal ballast condition for"

(i) Calm weather--wind 10 knots or less, calm sea;

(ii) No current;

(iii) Deep water conditions--water depth twice the vessel's draft or greater; and

(iv) Clean hull.

(7) At the bottom of the fact sheet, the following statement:

Warning

The response of the (name of the vessel) may be different from those listed above if any of the following conditions, upon which the maneuvering information is based, are varied:

(1) Calm weather--wind 10 knots or less, calm sea;

(2) No current;

(3) Water depth twice the vessel's draft or greater

(4) Clean hull; and

(5) Intermediate drafts or unusual trim.

1.3 SCOPE OF REPORT

This report describes the process used to interview ships' pilots from five U.S. East and West Coast pilot associations. In addition, it presents a statistical summary of the results of these interviews and an analysis of the significance of these results. It presents summary results and conclusions in a fashion considered to be potentially most useful for developing a NVIC to specify the format and required information for ship pilot cards. The primary emphasis of the report is on the pilot cardpilot, since the pilot card was found to be the document of primary interest to pilots.

Section 2

THE PILOT INTERVIEW PROCESS

The primary goals of pilot interviews were to obtain a clear definition of pilot needs in the areas of ship characteristics and maneuvering performance data. This included both determining how well the IMO specified Pilot Card and Wheelhouse Poster meet these needs and informing pilots and pilot associations about Coast Guard and IMO activities relating to pilot cards and wheelhouse posters. Results of standardized interviews of a significant number of pilots, representing different ports and different levels of experience, were used to meet these goals.

In order to clearly define pilot needs and responses to the IMO documents, it was considered essential to use an interview process which was based primarily on questions which required a straightforward yes/no or quantitative answer. However, it was also considered essential to include questions which required pilots to provide more qualitative answers. Such questions were needed to solicit information which was most important to them and that information which was of little or no value to them. All proposed interview questions were incorporated in an interview form.

Copies of the interview form were provided to the pilot associations for informational purposes before each visit. However, it was not requested that pilots answer questions prior to the interview. It was requested that each pilot association try to provide as many pilots as possible for interviews and that the interviewed pilots have a wide range of years of piloting experience.

It was initially planned to conduct interviews both on-shore and on vessels being piloted, and separate procedures and forms were developed for on-shore and shipboard observations/interviews. For on-shore use the form addressed primarily pilot use of available data and reaction to the IMO Pilot Card and Wheelhouse Poster. For shipboard use, the form included separate sections for observations of pilot use of onboard data and actions, and for debriefing of the pilot about use of available data at the end of the transit. The difficulties in obtaining timely permission of ship owners to board ships with pilots forced abandonment of plans for on-ship interviews and observations.

2.1 STANDARDIZED INTERVIEW PROCESS

As noted above, it was considered essential to use a standardized interview format or procedure in all pilot interviews. This was done by developing and using standard interview form which addressed all aspects of the IMO Pilot Card and Wheelhouse Poster. This form provided a natural structure for the interviews while still providing a suitable opportunity for pilots to express their needs and concerns.

An interview form was developed and reviewed by the Coast Guard. The resulting interview form, which is presented in Appendix B, emphasized the nature of and use of IMO format Pilot Cards and Wheelhouse Posters. This form was used to conduct interviews at the first three pilot associations. As a result of the interviews carried out at the three West Coast pilot

associations, the interview form of Appendix B was modified, and the resulting form was then used for all subsequent interviews. This final interview form is presented in Appendix C.

2.2 INTERVIEW PROCEDURE

A standardized procedure was used for all interviews. Except as noted below, each interview was conducted with a single pilot. During the visit to the first pilot association, two pilots were interviewed together to insure their availability for a full interview. While care was taken to seek independent responses by the two pilots, it was concluded after the interview that there had been cross-influence on pilot responses and that all subsequent interviews should be limited to single pilots. In several subsequent interviews initial descriptive portions of the process, which involved no pilot judgements or opinions, were carried out jointly with several pilots to save time.

Several pilot associations expressed concern about identification of specific responses with their association or their individual pilots. It was agreed to identify each pilot only by his experience. Therefore, pilots were identified only by the number of years they had been a pilot and had previously held related positions such as ship or tug master, docking or mooring master, or chief mate.

Introductory comments were used to briefly review past actions of the U.S. Coast Guard and the IMO in this area and to indicate the desire of the Coast Guard to conform, to the maximum extent practical, to IMO established guidelines and formats. The desire of the Coast Guard to obtain the needs and opinions of a broad cross section of pilots was also emphasized.

Every effort was made to encourage and to provide suitable opportunities for pilot comments on both the need for pilot cards and wheelhouse posters and desirable and undesirable features of the IMO formats for these documents.

In order to provide consistency of procedures and results, all interviews were conducted by a single interviewer, Roderick Barr.

Section 3

IMO FORMAT PILOT CARD AND WHEELHOUSE POSTER

The information and general data format of the IMO prescribed Pilot Card and Wheelhouse Poster are given in 1987 IMO Resolution A601(15), Appendix A. However, Appendix A does not prescribe such details of these documents as dimensions or what, if any, information would be placed on the back side of the pilot card. Decisions on the size and arrangement of these documents were made using suggested guidelines found in a number of IMO documents, References 3, 4 and 5.

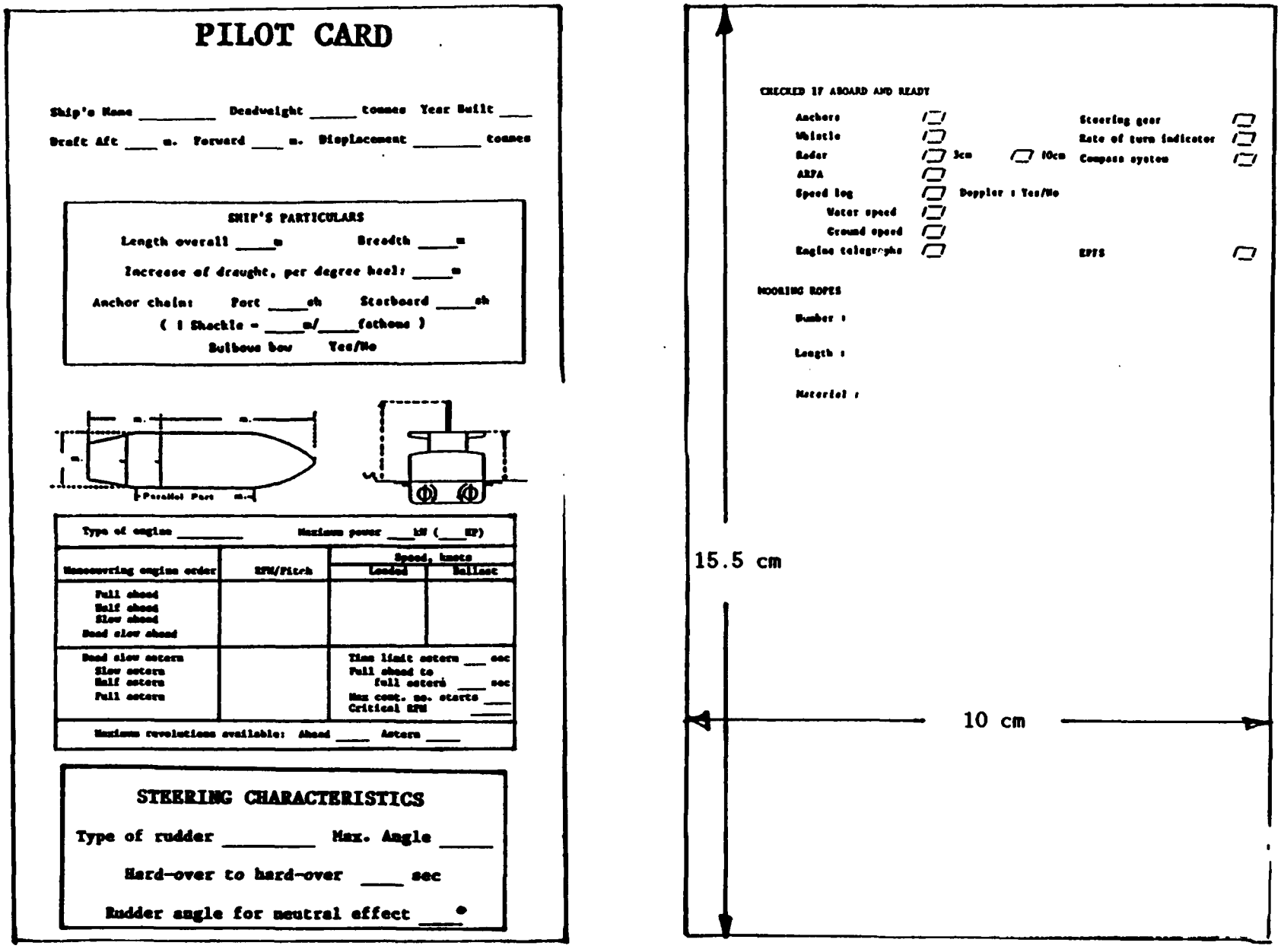
3.1 PILOT CARD

Figure 1 presents the sample pilot card used in pilot interviews. This card contains all of the information in Appendix A and in the proper order. The size of this card was based primarily on the proposal in Reference 3 that the width and length of the card be 9 to 10 and 18 to 20 cm, respectively. The selected dimensions of 9 by 16 cm were chosen to best fit the IMO format defined by Appendix A, to be comparable to the dimensions proposed by Panel H-10, Ship Controllability, of SNAME, Reference 2, and to insure that the card would fit in a typical shirt or jacket pocket, as proposed by Reference 3.

All information but the "aboard and ready" and "mooring rope" information was placed on the front of the card, as recommended in Reference 3. This choice placed the potentially more important information on one side of the card, but necessitated the use of rather small print size, which proved a concern to many pilots. It is undoubtedly possible to increase the print size in Figure 1 without increasing card size.

3.2 WHEELHOUSE POSTER

The sample wheelhouse poster used in the pilot interviews was an enlarged version of the IMO Wheelhouse Poster provided in Appendix A. The information on and arrangement of this poster are exactly those specified in Appendix A. For convenience, the sample wheelhouse poster used in pilot interviews was made 28 by 43 cms (11 by 17 inches). This size, which is smaller than suggested in References 4 and 5 (46 by 60 cm to 60 by 90 cm), was selected to facilitate use during interviews. The reduced size of the sample poster was noted during interviews. Figure 2, a reproduction of the IMO Wheelhouse Poster from Appendix A, is provided for purposes of reference and discussion.



A. FRONT

B. BACK

Figure 1. Sample Pilot Card Based on IMO Format Used in Pilot Interviews

APPENDIX 2

WHEELHOUSE POSTER

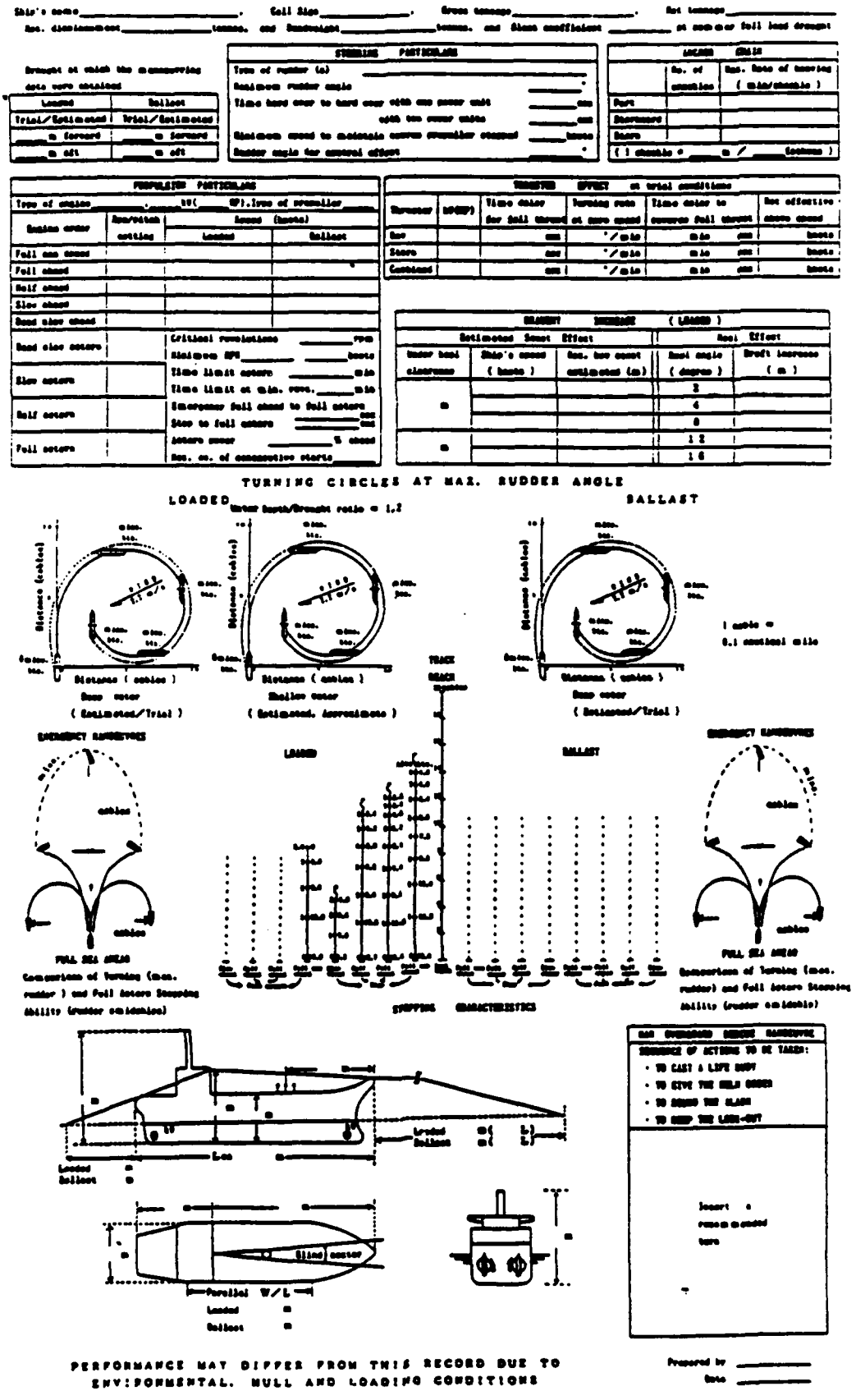


Figure 2. IMO Wheelhouse Poser

Section 4

SUMMARY OF INTERVIEWS

4.1 SUMMARY OF PILOT ASSOCIATIONS AND PILOTS

Visits were made to a total of five pilot associations on the East and West Coast of the United States. These pilot associations, listed in Table 2, were selected to reflect a range of locations and piloting environments. The decision to interview pilots on both East and West Coasts was based in large part on the assumption that piloting in different parts of the country would reflect both local traditions and environments.

A total of 25 pilots were interviewed. Biographical data was available for 24. Figures 3 and 4 summarize the experience of these pilots by number of years as a pilot and number of years of total experience as a pilot and as a ship's master, a tug master, a docking master and a chief mate. Table 3 presents average experience of pilots and Table 4 presents an individual pilot experience summary in which each pilot is identified by his years of experience as a pilot.

Table 4 notes the number of years spent by pilots in the extended pilot apprentice program used by the Sandy Hook Pilots and, to a lesser extent, by the Maryland Pilots. Sandy Hook (New York and New Jersey) Pilots undergo a seven and one-half year apprenticeship and none of the interviewed Sandy Hook pilots had prior experience as a master or chief mate, while pilots at West Coast associations have all served as some type of master (ships, tug, docking) or as a chief mate, and have had a rather short (about one year) training period.

4.2 SUMMARY OF RESPONSES TO QUESTIONS

The response of all pilots to objective (yes/no or quantitative) questions and to subjective (preference) questions on the interview form were tabulated, and the results are presented in Tables 5 through 15. Results are generally presented separately for responses relating to the pilot card and the wheelhouse poster.

Responses were summarized according to number of pilots responding or percentage of pilots responding, as appropriate. It should be noted that not all pilots responded to all questions and therefore the total response was sometimes less than the total number of pilots interviewed.

Table 5 addresses current availability and current use by pilots of pilot cards. This table indicates that pilot cards were received only about 5 percent of the time, with some pilots reporting one percent of the time or less. The table indicates that the card is or would be widely used when available. Pilots indicated that the data on the card were presented in a clear manner and that the speed/RPM/pitch data, which were of particular value to pilots, were adequate for their use. Nearly three-fifths of the pilots indicated that data should be added to the card, while about two-fifths indicated that data should be removed from the card.

Table 2. Pilot Associations Included in Study

San Francisco Bar Pilots	San Francisco, CA
Port of Los Angeles Pilots	San Pedro, CA
Jacobsen Pilot Service	Long Beach, CA
Sandy Hook Pilots Association	Staten Island, NY
Association of Maryland Pilots	Baltimore, MD

Table 3. Experience Profile of Pilots

Average years as pilot*	13.5
Average years as pilot and apprentice pilot	15.0
Average years as pilot, apprentice pilot, master, and chief mate	20.0

* May include some experience as an apprentice pilot or pilot trainee

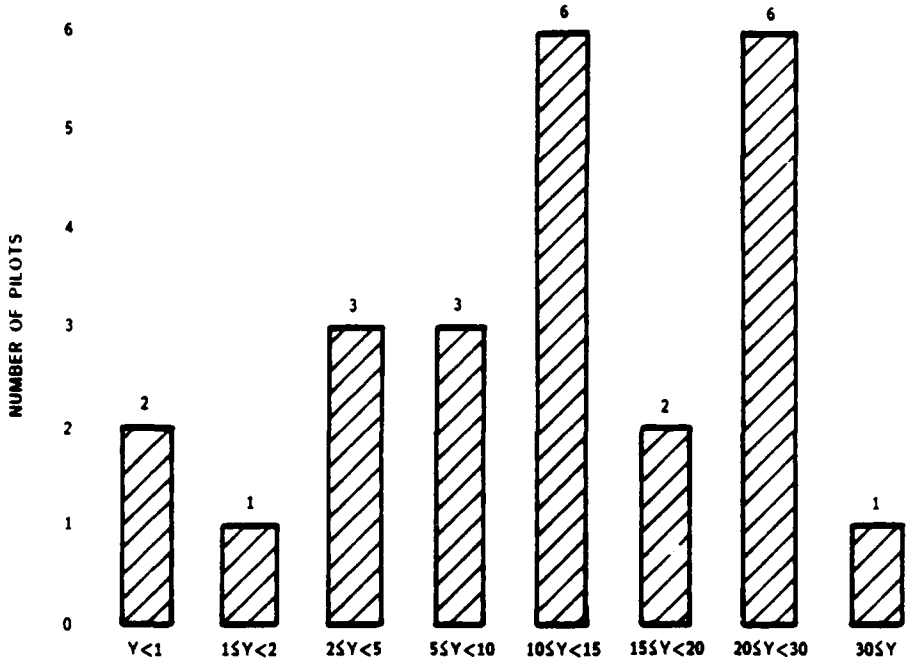


Figure 3. Years of Experience as a Pilot

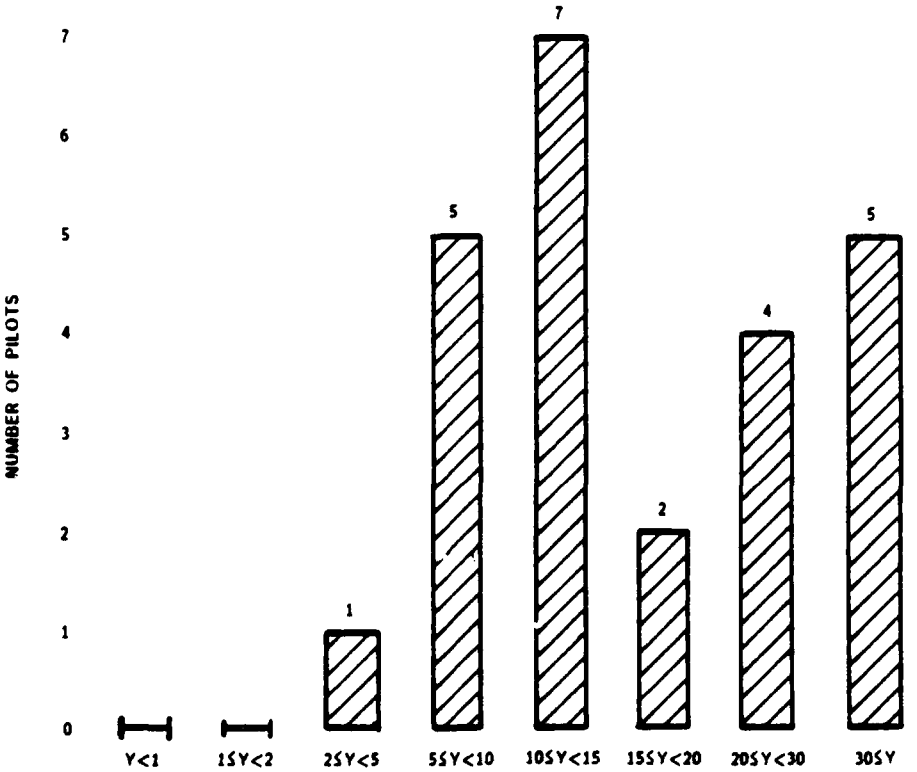


Figure 4. Total Years of Experience as a Pilot, Apprentice Pilot, Master and Chief Mate

Table 4. Summary of Experience of Interviewed Pilots

Pilot I.D.	Pilot	Apprentice Pilot*	Ship Master	Tug Master	Mooring Master	Chief Mate or Other
1	31.0	7.0	--	--	--	--
2	31.0	6.0	--	--	--	--
3	29.0	--	--	--	4.0	--
4	28.0	--	--	17.0	--	--
5	27.5	7.5	--	--	--	--
6	22.0	--	--	--	--	--
7	20.0	--	2.0	--	--	--
8	19.0	--	--	--	--	1.0
9	15.0	--	--	--	--	--
10	12.5	--	4.5	--	2.0	--
11	12.5	--	--	--	--	--
12	12.0	7.5				
13	10.0	--	2.0	--	--	--
14	10.0	--	--	--	--	6.0
15	10.0	--	--	--	--	3.0
16	8.0	6.0	--	--	--	--
17	6.5	--	--	15.0	--	--
18	6.0	3.0	--	--		--
19	3.0	--	--	--	4.5	--
20	2.0	--	--	7.0	--	--
21	2.0	--	2.0	--	--	--
22	1.75	--	4.0	--	--	--
23	1.5	--	--	11.0	--	--
24	0.5	--	4.5	--	--	--
Average Years of Experience	13.4	1.5	0.8	2.1	0.4	0.4

* A number of pilots served short periods (1 year or less) as pilot trainees.

Table 5. Availability and Current Use of Pilot Cards

	Percent (No. of Pilots)
Percent of Time Card is Received	5
Regularly Use Card When Available	79 (19 of 24)*
Review Card as Soon as Possible after Boarding Ship	90 (19 of 21)*
Would Use Card in Situations Requiring Critical Maneuvering or Actions	33 (7 of 21)*
Card More Useful than Poster	82 (18 of 22)*
Additional Data Should be Added	57 (12 of 21)*
Data Should be Deleted to Improve Clarity	38 (8 of 21)*
Data are Presented in a Clear Manner	83 (15 of 18)*
Speed/RPM/Pitch Data are Adequate	100 (21 of 21)*

*Not all 25 pilots responded to each question.

Table 6. IMO Pilot Card Information Considered Most Useful by Pilots

Information	Number of Pilots
Draft, fwd and aft	19
Length, overall	18
Thruster power(s) and location(s)	17
RPM/Pitch and ship speed table	16
Air draft	11
Beam	9
Type of rudder*	9
Direction of propeller rotation	8
Maximum number of continuous engine starts	7

No other item was mentioned by more than six pilots

* Particularly if of a special type such as Becker rudder

Table 7. IMO Pilot Card Information Considered Not Useful by Pilots

Information	Number of Pilots
Anchor chain shackles	14
Mooring rope information	11
Type of rudder*	9
Aboard and ready checklist**	9
Rudder angle for neutral effect	6

No other item was mentioned by more than three pilots

* Most of these nine pilots wanted a notation if a special type of rudder (Becker, etc.) was used.

** Each of these nine pilots wanted either: (1) a list of any equipment that was not working fully or at all (thrusters, etc.) or was in error (gyro, etc.); or (2) a check only if equipment was not working properly.

Table 8. Information Pilots Desired to be Added to Pilot Card

Information	Number of Pilots
Propeller type (fixed pitch or CRP)	9
Locations of cleats, chocks, and tug push points	5
Data on squat	4
Identification of anything abnormal	4

No other item was mentioned by more than two pilots

Table 9. Information Pilots Suggested be Deleted from Pilot Card

Information	Number of Pilots
Anchor chain shackles	5
Aboard and ready table	5
Mooring rope data	4

No other item was mentioned by more than two pilots

Table 10. Availability and Current Use of Wheelhouse Posters

	Percent (No. of Pilots)
Percent of Time Poster is Observed	85
Percent of Time Poster Location Permits its Use During Piloting	55
Regularly Use Poster	58 (14 of 24)*
Review Poster as Soon as Possible after Boarding Ship	45 (10 of 22)*
Would Use Poster in Situations Requiring Critical Maneuvering or Actions	33 (7 of 21)*
Additional Data Should be Added	12 (2 of 16)*
Data Should be Deleted to Improve Clarity	29 (4 of 14)*
Data are Presented in a Clear Manner	86 (12 of 14)*

*Not all pilots responded to each question.

Table 11. IMO Wheelhouse Poster Information Considered Most Useful by Pilots

Information	Number of Pilots
Turning data	11
Stopping data	9
Visibility data	6
Squat effects	5
Thruster speed effects	5

No other item was mentioned by more than three pilots

Usefulness of Visibility Data	Number of Pilots
Very useful (no qualifications)	10
Very useful (with qualifications)	5
Somewhat useful	5
Not useful	4

Table 12. IMO Wheelhouse Poster Information Considered Least Useful by Pilots

Information	Number of Pilots
Turning data	6
Stopping data	5
Squat effect	4
Thruster speed effects	4
Emergency maneuver data	4

No other item was mentioned by more than one pilot

Table 13. Desired Maneuvering Performance Data Types and Formats

		Percent (Number of Pilots)
Turning Diagram	Diagram	60 (9 of 15)*
	Tabular Data	40 (6 of 15)*
Stopping Data	Mushroom Diagram	39 (7 of 18)*
	Comb Diagram	33 (6 of 18)*
	Tabular Data	28 (5 of 18)*
Stopping Data for	Full Speed	12 (2 of 16)*
	Half Speed	63 (10 of 16)*
	Full and Half Speed	19 (3 of 16)*
	Slow Speed	6 (1 of 16)*
Stopping Data for Astern Operation		22 (4 of 18)*
Turning Data for Shallow Water		72 (13 of 18)*
Data for Other Maneuvers		45 (5 of 11)*

*Not all pilots responded to each question.

Table 14. Other Pilot Comments on Desired Features of Pilot Card or Wheelhouse Poster

Desired Feature	Number of Pilots
Larger/More readable card	10
Card that can be put in pocket	6
Notation of problems	5
Data on wind effects	5
Data on torquing, particularly going astern	5

Table 15. Pilots' Overall Assessment of IMO Documents and Available Maneuvering Data

		Percentage or (Number of Pilots)
The IMO Pilot Card would be	Very Useful	68 (17)
	Somewhat Useful	20 (5)
	Of Limited Use	12 (3)
The IMO Wheelhouse Poster would be	Very Useful	12 (3)
	Somewhat Useful	52 (13)
	Of Limited Use	36 (9)
Ship Speed was as expected from data		76 (13 of 17)*
Ship stopped as expected from data		17 (1 of 6)*
Ship turned as expected from data		57 (4 of 7)*

*Not all pilots responded to each question.

A significant majority of pilots considered the pilot card more useful than the wheelhouse poster. This result was consistent with comments by pilots about these two documents and with the opinion expressed by many pilots that the poster was primarily for use by the vessel crew.

Table 6 indicates the information on the IMO Pilot Card considered most useful by the pilots. Four items, draft and trim, length overall, thruster power(s) and location(s), and the RPM/pitch/speed table were by far the most widely desired. These items were all mentioned by large majority of the pilots. Other items mentioned frequently by pilots were air draft, beam, rudder type, direction of propeller rotation and maximum number of continuous engine starts. There was considerable difference of opinion on whether air draft should be defined from the waterline or from the keel.

Table 7 indicates the information on the IMO Pilot Card considered least useful or not useful by pilots. Four items were fairly widely mentioned, number of anchor chain shackles, mooring rope information, rudder type and the "aboard and ready" check list. The only other item mentioned by more than three pilots was rudder angle for neutral effect, which was mentioned by six pilots.

It is interesting to note that rudder type appears in both Tables 6 and 7. This result reflected the indication by many pilots that they do not care about rudder type if the rudder is of conventional type, but do want to know if the ship is fitted with a unusual, high performance rudder such as a Becker or Schilling rudder. A number of pilots particularly noted their desire to know if the vessel has a Becker rudder.

Table 8 indicates the most widely identified pilot desires for information to be added to the IMO Pilot Cards. The only item that was mentioned by a significant number of pilots was propeller type (CRP or fixed pitch).

Table 9 indicates the information that pilots most frequently specifically suggested removing from the card. These items correspond closely to the least useful items identified in Table 7. The suggestion that the "aboard and ready" table be removed was closely related to the desire, as expressed in Table 8, to have information on equipment that had problems or errors rather than on equipment that was functioning properly. Several pilots suggested the use of a check-off list similar to the IMO "aboard and ready" list to identify problems or errors would reduce the possibility of the vessel failing to note a problem.

Table 10 addresses current availability and current use by pilots of wheelhouse posters. This table indicates that posters are observed by pilots most of the time, but that these posters are in a location which permits their use somewhat greater than half of the time.

Pilots indicated that existing posters are generally similar to, but usually less detailed than, the IMO Poster. A number of pilots noted that the this information is often distributed between several placards and posters, with RPM/pitch/speed data located on an engraved placard next to the engine telegraph or control and thruster data often located on a placard next to the thruster controls. These pilots felt that this division of information by function was desirable. Most pilots indicated that the data on the poster were presented in a clear manner.

Frequency of regular use and pilot indications of when and how they would use the poster shown in Table 10 seem to confirm the pilots' stated preference for a pilot card. Relatively few pilots felt that data should be added to the poster. About one-third of the pilots indicated that information should be deleted from the poster. These pilots typically suggested deleting some or all of the maneuvering performance data, although they felt those data could be useful to the crew and particularly to new ship's officers. Their suggestion that maneuvering performance data be deleted reflected their experience that these data were rarely applicable to typical piloting situations, particularly for shallow water and/or low ship speeds.

In assessing the IMO Wheelhouse Poster information that was most and least useful to the pilots, the pilots were told to consider only the information on the poster which was not on the IMO Pilot Card, as it was assumed that duplicate information was well covered in questions on the card.

Five items - turning data, stopping data, visibility data, squat effects and thruster speed effects - were considered the most useful data, although none of these data were mentioned by even half of all pilots. No other item was mentioned by more than three pilots. The visibility data on the IMO Poster were considered very useful by a majority of pilots, although one-third of these expressed concerns or reservations about fixed values due to the large effect on visibility of trim and particularly container configuration (stack heights) for container ships. Only four pilots found the visibility data not useful.

Table 12 indicates the information on the IMO Wheelhouse Poster considered least useful or not useful by pilots. Five items were mentioned by more than one pilot. These were turning data, stopping data, squat effect, thruster speed effect and emergency maneuver or "man overboard data." However, none of these items were mentioned by more than one quarter of the pilots. The fact that the first four items were also mentioned as most useful in Table 11 reflects the small number of basic data items which are on the poster and not on the pilot card. Turning and stopping data were considered useful, although with the strong reservations noted above, by approximately twice as many pilots as considered them of limited use. Squat and thruster speed effects were considered useful and of limited use by approximately equal numbers of pilots. The value of emergency maneuver data for the vessel's crew, but not for pilots, was noted by a number of pilots.

Table 13 indicates desired manner of presentation and desired scope of maneuvering data. Pilots preferred turning diagrams to tabular turning data by a margin of 3 to 2. Pilots preferred graphical stopping data to tabular stopping data by an even greater margin, and preferred the "Mushroom" diagram to the "Comb" diagram by a relatively small margin. The term "Mushroom" refers to the type of diagrams in Figure 2 which are labeled "Emergency Manoeuvers, Full Sea (speed) Ahead, Comparison of Turning (max. rudder), and Full Astern Stopping Ability (rudder amidships)." The term "Comb" refers to the type of diagram in Figure 2 labeled "Stopping Characteristics" on the abscissa and "Track Reach" on the ordinate. A few pilots indicated a desire for only one type of stopping diagram, but there was no strong desire for eliminating one type of stopping diagram.

Table 13 also indicates that a large majority of pilots wanted turning data for shallow water. A rather large number of pilots wanted stopping data for half speed or a typical maneuvering speed, while a much smaller group wanted data for both full and half speeds. Relatively few pilots expressed a desire for stopping data for astern operation. Five pilots, constituting slightly less than half of those responding, expressed a desire for data for other maneuvers, including kick (accelerating) turns, zig-zag or Z- maneuvers and straight line backing where significant "torquing" or turning frequently occurs.

Table 14 indicates non-IMO Pilot Card or Wheelhouse Poster features or information specifically requested by a significant number of pilots. Almost twice as many pilots expressed a desire for a larger, more readable card as expressed a desire for a card that would fit in a pocket. Additional information requested by about one-quarter of the pilots were notation of any problems which could affect piloting, wind effect data and data on torquing, particularly when going astern.

Table 15 summarizes the pilots' overall assessments of the IMO documents and assessment of the reliability or accuracy of currently available maneuvering information. Most pilots said that the IMO Pilot Card would be very useful, and only a few said it would be of limited use. Most pilots felt that the IMO Wheelhouse Poster would be somewhat useful, while only a few said it would be very useful. Most pilots felt that ship RPM/pitch/speed data was generally as expected from available wheelhouse data. Smaller numbers of pilots felt that ships turned as expected and fewer considered that ships stopped as expected from available data, although a large proportion of pilots indicated that they had not and could not make such an assessment. Many of the pilots who did not make an assessment of turning and stopping data were those who felt that posted data were of little or no use or value to pilots.

4.3 SUMMARY OF RECOMMENDATIONS OF PILOTS

Primary recommendations of the interviewed pilots for changes in the IMO Pilot Card were drawn from the summary findings found in Tables 5 through 9 and 14 and 15. These recommendations are:

1. It is desirable to make the pilot card small enough to put in a pocket, but it is more important to assure that card size will allow the use of print which can be easily read at night with reduced lighting (flashlight illumination);

2. The pilot card should emphasize equipment problems such as inability to operate, restricted operation, and known inaccuracies/errors rather than equipment that is "aboard and ready";

3. Specific pieces of information that should be added to (propeller type) or deleted from (anchor chain shackles, mooring rope data) pilot cards were identified by a number of pilots.

Primary recommendations of pilots for changes in the IMO Wheelhouse Poster were drawn from the summary findings found in Tables 10 through 15. These recommendations are:

1. The specified maneuvering information is not relevant to most piloting - these data need to be provided for appropriate ship speeds and water depths;

2. It may be desirable to provide required poster information in several separate posters or placards which are located, where appropriate, adjacent to relevant controls (speed data beside telegraph, etc.); this may be better than a single poster;

3. It is desirable to include information on wind effects, and perhaps data from other maneuvers, on the poster.

Several potentially important general observations were drawn from extended discussions during the pilot interviews. At present, pilots rarely receive a pilot card, but when they do receive one they typically use it more than the wheelhouse poster. Pilots currently obtain desired data verbally from the master and/or from notes posted on a board, although most felt it would be desirable to have all desired information available on a pilot card.

Several more experienced pilots expressed a concern that provision of a pilot card would provide a means for helping to shift blame for accidents to the pilot. Pilot willingness to sign currently offered pilot cards varied between associations.

Other observations or conclusions from the discussions with pilots which appear to be significant include:

1. Many pilots felt that pilot cards would be more readily accepted and more widely used if they contained information required for their billing (e.g., gross tonnage, ship's agent), although this may not be feasible due to the variety of required information;

2. While pilots currently use wheelhouse posters, most consider them to be primarily of use to the crew, particularly new ship's officers - pilots have little faith in and make little use of maneuvering performance data (advance, transfer, head reach) on the poster;

It is felt that each of these specific recommendations and general observations should be carefully considered in requirements for pilot cards and wheelhouse posters. A number of these areas are considered in greater detail in Sections 5 and 6 of this report.

4.4 ALTERNATIVE, EXISTING PILOT CARDS

This study was designed in part to assess pilot response to the format and content of the IMO Pilot Card and Wheelhouse Poster and not to develop or consider alternative document formats. However, during the course of the pilot interviews, a number of existing or recommended alternative pilot card formats

were obtained from pilot associations or from individual pilots. As these pilot card reflected usage by and/or needs of a significant number of pilots, it was considered important to review these alternative pilot cards and to define important differences between them and the IMO Pilot Card. In the following paragraphs these alternative formats are presented and discussed.

4.4.1 Current Industry Pilot Card

Figure 5 presents a full size reproduction of the pocketable pilot card used by Marine Transport Lines. This card presents basic information on ship and engine particulars, speed and RPM data, and deep water turning radius. Information contained on this card that is not on the IMO Pilot Card includes:

1. Type and make of engine;
2. Astern power as a percent of ahead power;
3. Turning radius for full speed and rudder turn.

4.4.2 Los Angeles Pilots Ship Information Sheet

Figure 6 presents a copy of the information sheet which is collected for every ship when it first calls at Los Angeles harbor. In addition to the name of the ship's agent and its gross and net tonnage, which are required for billing purposes, this sheet includes the following information not included on the IMO Pilot Card:

1. Call sign;
2. Flag;
3. Type of propeller - fixed or variable pitch;
4. Whether ship is "safety tagged."

As noted earlier, many pilots wanted the card to indicate whether the propeller was of fixed or variable pitch. Many pilots considered flag an important aid in judging the probable condition of the ship and reliability of its equipment. The safety tag identifies any ship problems or equipment deficiencies previously experienced on the ship by a pilot.

These sheets are used to create cards which are kept on file at the pilot station. Each pilot is supposed to consult this card before reporting to the ship, primarily to determine if the ship has been safety tagged and, if so, why. These cards may also be used to review particulars of a ship which the pilot does not know, but copies are not taken aboard ship, so they are not really used as pilot cards.

PILOT CARD SAFETY FIRST

MARINE TRANSPORT LINES

S.S. MARINE CHEMIST

CALL LETTERS - KMCB OFFICIAL NO. 529399
LENGTH 672' BREADTH 89' DEPTH 46' 09"
ENGINE G.E. GEAR TURBINE - BULBOUS BOW
DRAFT F_____ A_____ M_____

PRUDENT NAVIGATION REDUCES ACCIDENTS

NORMAL OPERATIONS

Maneuvering Speeds

Harbor Speed	12.5 Knots	R.P.M.	80
Half Speed	9.5 Knots	R.P.M.	60
Slow Speed	6.5 Knots	R.P.M.	40
Dead Slow Speed	3.0 Knots	R.P.M.	20

Astern Power 75% of Ahead Power
Time Lapse Full Ahead to Full Astern 165 SECS.
Turning Radius Full Speed/Full Rudder 2317'
Distance Bridge To Stem 553'

THE SCHEDULE IS FLEXIBLE — THE SHIP IS NOT

Figure 5. Sample of Current Pilot Card - Actual Size

Los Angeles Harbor Department -Pilot Station
Ship Information

SHIP NAME _____

FLAG _____ CALL SIGN _____

AGENT _____

LOA: Meters _____ Feet _____

BEAM: Meters _____ Feet _____

DRAFT: Meters _____ Feet _____

GROSS TONS _____ NET _____ D.W. TONS _____

HORSEPOWER _____ TYPE: S.S. _____ M.V. _____

BULBOUS BOW: YES _____ NO _____

VARIABLE PITCH: YES _____ NO _____

RIGHT/LEFT R _____ L _____

BOW THRUSTER: YES _____ NO _____

HP _____

STERN THRUSTER: YES _____ NO _____

HP _____

SHOULD VESSEL BE SAFETY TAGGED? YES _____ NO _____

REASON _____

_____

_____

DATE _____ PILOT _____

Figure 6. Pilot Information Sheet Used By Los Angeles, CA Pilots

4.4.3 Jacobsen (Long Beach) Pilots Information Files

Figure 7 presents a copy of the computerized ship information file created by the Jacobsen Pilot Service for each ship when it first calls at Long Beach Harbor. This information can be displayed on a screen for quick review by the pilot, or the hard copy shown in the figure can be generated. The lower box is used to note special features or known problems with the ship. These data are used primarily when the pilot does not know the ship or believes that the ship may have some problems. Information included in this data file that is not included on the IMO Pilot Card is the same as that for the Los Angeles Pilots information sheet.

4.4.4 Pilot Card of Captain Tom Knierim

Captain Thomas Knierim is a Sandy Hook pilot who has been an active member of SNAME Panel H-10, Ship Controllability, for many years and has rather unusual insight into the relationship between ship handling and measures of maneuvering performance developed from results of trials. Captain Knierim has developed, over a period of some years, his own proposed pilot card.

Figure 8 presents a copy of Captain Knierim's proposed pilot card. This card contains a significant number of items not found on the IMO Pilot Card, including:

1. Compass error;
2. Air draft above keel, as well as above waterline;
3. Type of propeller;
4. Minimum engine RPM and corresponding ship speed;
5. Deep water steady turning diameter;
6. Fuel in use;
7. Present status of directional stability;
8. Original or previous name;
9. Net and gross tonnage;
10. Flag, call sign and agent.

As noted earlier, many pilots expressed a need for clear documentation of problems such as compass error. Pilots were rather evenly divided about whether air draft should be from keel or waterline. A number of pilots wanted to know minimum engine RPM and ship speed. Captain Knierim was the only pilot who mentioned the potentially important effect of the type of fuel on engine behavior and the desirability of knowing something about directional stability. He was also the only pilot to express a clear opinion about how to best use data from turning maneuvers. Citing a previous ship name would provide a rapid means for identifying a renamed vessel.

SHIP NAME	ARCO ALASKA	CALL SIGN	KSBK

FLAG	=	USA	TYPE	=	TKR
LENGTH METERS	=	290.36 M.	LENGTH FEET	=	953.00 FT.
AGENT	=				
SEA SPEED	=	15.0 KT.			
ENGINE	=	TURBINE	HORSE POWER	=	28000.00
PROPELLOR	=	F	ROTATION	=	RH
BOW THRUSTER	=	N	HORSE POWER	=	0.00
STERN THRUSTER	=	N	HORSE POWER	=	0.00
DWT TONS	=	188437.00	GROSS TONS	=	83675.00
BREADTH	=	166.00 FT.	SUMMER DRAFT	=	59.32 FT.
BRIDGE TO BOW	=	794.00 FT:	BRIDGE TO MANIFOLD	=	325.00 FT.
KEEL TO HIGHEST	=	163.00 FT.	BULBOUS BOW	=	N

LAST QUERY 06/20/89 LAST REVISION 12/21/88

NOTES - PROBLEMS, ETC.

Figure 7. Computer Stored, Updated, and Printed Pilot Information Sheet Currently Used by Jacobsen Pilot Service of Long Beach, CA

M.V. (Ship's Name) Date _____
Agent _____
ex. (Original Name)
(Nationality) (Call Sign) (Yr. Built)

Compass Error (Degrees) East ____ West ____

(Following values in meters or feet consistent with pilotage)

Draft Aft _____ Fwd _____ Increase per degree of heel _____

Air Draft (above water) _____ (above keel) _____

Overall Length _____ Max. Breadth _____ Max. Depth _____

Tons Net _____ Gross _____ DWT _____

Engine Type _____ Max. Power KW ____ HP ____

Engine Order	RPM or Pitch	Tons Thrust	Loaded	Ballast
Sea Speed Ahd.				
Full Ahead				
Half Ahead				
Slow Ahead				
Dead Slow Ahd.			Time Limit Astern ___	
Dead Slo Astern			Full Ahd-Full Astern ___	
Half Astern			Min. Revs. ___ Speed ___	
Full Astern			Max. No. of Starts ___	
			Fuel in Use ___	
			Time to Maneuver ___	

Propeller

Single Right Turning ☐ Left Turning ☐

Twin Inboard Turning ☐ Outboard Turning ☐

Variable Pitch Left Hand ☐ Right Hand ☐

Steering Characteristics (Deep Water Steady State)

Turn Diameter _____ % Ships Length _____

Rudder Degrees Per Sec. _____ Max. Angle _____

Thrusters Bow KW _____ HP _____

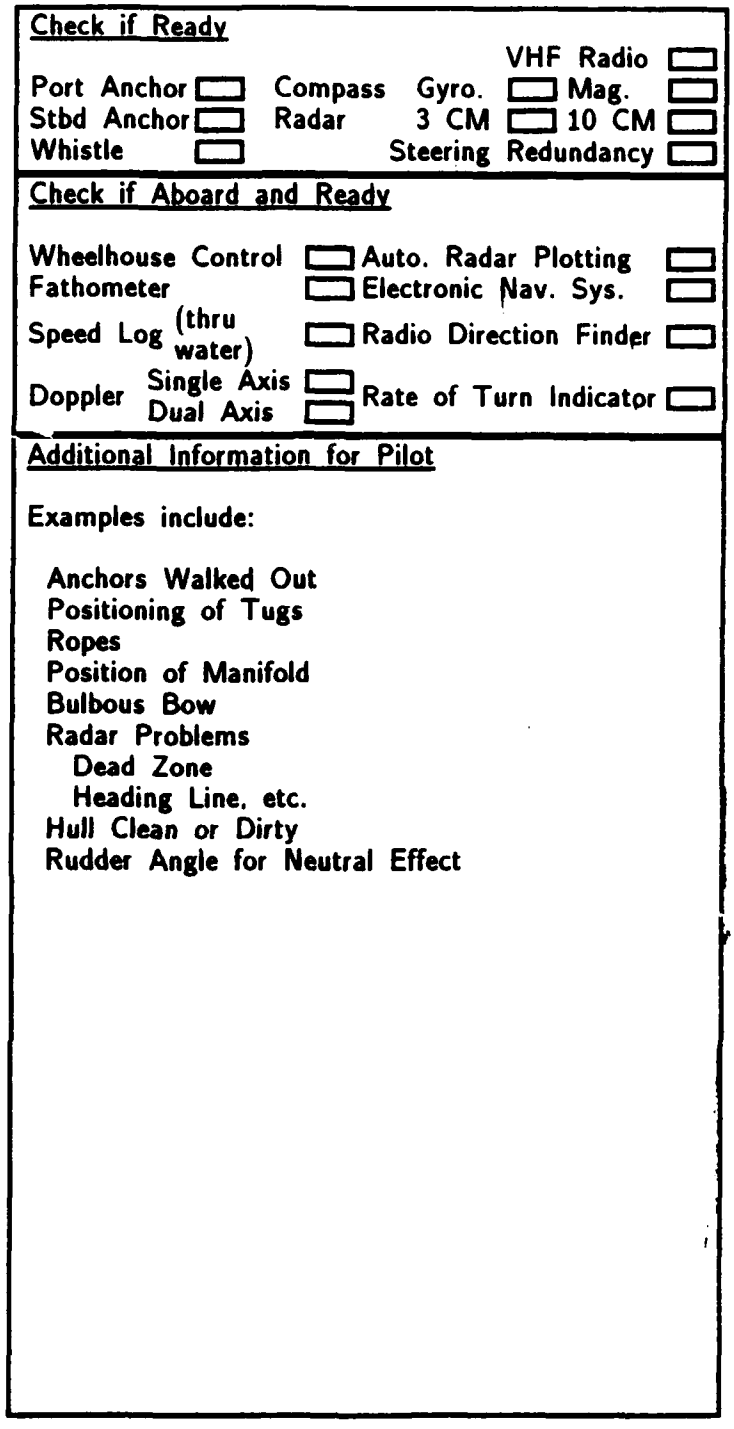
Stern KW _____ HP _____

Present Directional Stability Yes ☐

Requires Added Attention No ☐

A. FRONT SIDE OF CARD

Figure 8. Pilot Card of Capt. Thomas Knierim



B. BACK SIDE OF CARD

Figure 8. Pilot Card of Capt. Thomas Knierim (Concluded)

4.4.5 American Pilot Association Card

Figure 9 presents an IMO Pilot Card in a format and size developed by the American Pilot Association (APA). This card is very similar in content and arrangement to the IMO Pilot Card of Appendix A. Additions to the IMO recommended card include:

- Date
- Call sign
- Draughts in feet and inches as well as meters
- Stern anchor shackles
- Parallel waterline length for both loaded and ballast conditions
- Location of cargo manifolds (tank vessels)
- Air draught from keel as well as waterline
- Astern power as percent of ahead power
- Constant gyro error

This card deletes the following items shown in Figure 1:

- Increase in draught, per degree heel
- Mooring ropes data

A number of these changes are the same as those recommended by a significant number of pilots.

PILOT CARD

Ship's Name _____ Date _____

Call sign _____ Deadweight _____tonnes Year built _____

Draught Aft ____m/____ft____in. Forward _____m/ ____ft____in. Displacement _____tonnes

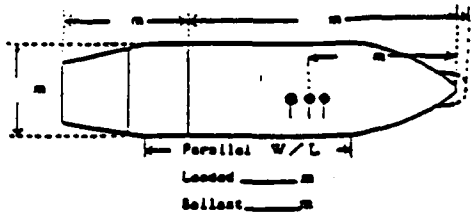
SHIP'S PARTICULARS

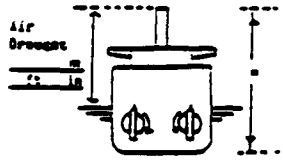
Length overall _____m Breadth _____m

Anchor chain:

Port _____shackles Starboard _____shackles Stern _____shackles

Bulbous bow Yes/No (1 Shackle = _____m/ _____ fathoms)





Type of engine _____ Maximum power _____kW (_____HP)

Maneuvering Engine order	Rpm/pitch	Speed (knots)	
		Loaded	Ballast
Full ahead			
Half ahead			
Slow ahead			
Dead slow ahead		Time limit astern	_____min
Dead slow astern		Full ahead to full astern	_____sec
Slow astern		Max. no. of consec. starts	_____
Half astern		Minimum RPM _____	_____knots
Full astern		Astern power	_____% ahead

STEERING PARTICULARS

Type of rudder _____ Maximum angle _____ Hard-over to hard-over _____sec.

Rudder angle for neutral effect _____

Thruster: Bow _____ kV (_____HP). Stern _____ kV (_____HP)

CHECKED IF ABOARD AND READY

Anchors ☐
Whistle ☐
Radar ☐ 3cm ☐ 10 cm
ARPA ☐
Speed log ☐ Doppler: Yes/No
Water speed ☐
Ground speed ☐
Dual-Axis ☐
Engine telegraphs ☐

Steering gear ☐
Number of power units operating ☐
Indicators: Rudder ☐
Rpm/Pitch ☐
Rate of Turn ☐
Compass System ☐
Constant Gyro Error = _____ ☐
VHF ☐
Elec. Pos. Fix. System ☐
Type _____

Figure 9. American Pilot Association Version of IMO Pilot Card

Section 5

RECOMMENDED CHANGES TO PILOT CARD FROM PILOT INTERVIEWS

It is recommended that the Coast Guard consider certain changes in the IMO Pilot Card before development of any revised format IMO Pilot Card or implementation of IMO requirements in the form of an NVIC or other format. These recommendations are made with a knowledge of the desire of the Coast Guard to adhere to IMO proposals, the time and effort that went into the development of those IMO proposals and the effort required to modify the IMO recommendations of Appendix A.

5.1 ADDITIONS TO PILOT CARD

Based on the response of the pilots, it is recommended that the following information be added to the pilot card:

1. Propeller type (fixed pitch or CRP);

2. Clear identification of errors or other problems with equipment important for piloting and maneuvering.

Several pilots suggested that the list of the current "aboard and ready" section be retained but used for identification of errors or problems. The use of such a list could help to insure identification of problems with all important and relevant equipment. The importance of recording gyro error or radar trackline error was emphasized by a number of pilots.

Other pilot recommendations which merit consideration are the addition of:

1. Location of cleats, chocks and tug push points on the existing ship outline sketch;

2. Air draft from keel as well as waterline;

3. Engine astern power;

4. Engine manufacturer;

5. Data on squat (sinkage and trim due to forward speed);

6. Steady turning diameter in a full rudder, deep water turn;

7. Original ship name;

8. Ship's agent;

9. Gross tonnage.

The first four of these items merit the greatest consideration. Items 5 and 6 will be of limited interest to many pilots, and inaccurate data for squat in shallow water, may actually be harmful. Item 7 would be used to identify a

recently renamed ship, while items 8 and 9. would be used by pilots for billing purposes.

It is recommended that strong consideration be given to adding all of these items, except squat, to the IMO Pilot Card. While accurate, squat data would be of significant potential value to pilots, it will be difficult to obtain reliable shallow water squat data and it will be difficult to present this highly speed-dependent data in the concise form required for use on a pilot card.

5.2 DELETIONS FROM PILOT CARD

Based on the response of the pilots it is recommended that the following items be deleted from the IMO Pilot Card:

1. Anchor chain data;
2. Mooring rope data;
3. Rudder angle for neutral effect;
4. Year built;
5. Displacement;
6. "Aboard and Ready" table.

As noted above, it is recommended that the "Aboard and Ready" table be replaced with a comparable " Equipment Problem and Error" table. It is not recommended that any items other than those listed above be deleted from the pilot card.

5.3 MODIFICATION OF PILOT CARD FORMAT AND SIZE

Various pilots made comments on the format or arrangement and on the size of the pilot card. Some of these comments, particularly those relating to the need to be able to rapidly find the most important information and the need for good nighttime legibility or visibility of data, warrant careful consideration.

5.3.1 General Format of Card

Pilots generally found the format and arrangement of the IMO Pilot Card to be satisfactory. One specific recommendation suggested by many pilots was the placing of thruster data under ship's particulars rather than under steering characteristics.

Several pilots expressed reservations about placing information on both sides of the card. Based on all of the comments received, it is considered desirable to put all information on one side of the card if this can be done without adversely effecting legibility.

5.3.2 Card Size and Format

Pilots expressed widely divergent opinions about the best size for the pilot card. Many pilots felt it was important to be able to put a pilot card in a shirt or jacket pocket, while others clearly preferred a full size sheet to facilitate card use at night with only flashlight illumination. A few pilots suggested an intermediate size card, such as that shown in Figure 6.

Many pilots expressed strong concerns about the small size of the card and print used in the sample IMO format card shown in Figure 1, and about their ability to read this card at night. This response indicated that it was almost certainly desirable to make the card significantly larger than the 9 by 16 cm size of Figure 1.

One pilot proposed a card the size of a No 10 envelope (10 by 24 cm) as a compromise between the requirement for large print size and pocketability. Figure 10 shows the front of an IMO Pilot Card of about this size (9 by 24 cm). The 9 cm width was selected to insure that the card would fit in standard size shirt and jacket pockets. The format of this card is similar to the front of the IMO Card, Figure 1, although it does reflect several of the changes recommended above. The increased print size and legibility provided by the 50 percent increase in card length is clear when this card is compared with that of Figure 1.

Figure 11 shows a single-sided pilot card of similar size (9 by 25 1/2 cm) which incorporates all of the changes recommended above. Card length was increased to accommodate a short section on "Status of Ship's Equipment" on the front side of the card. This card is felt to best reflect the overall comments of the pilots interviewed. If this card were made into a two-sided card, its length could be significantly decreased. A logical division of material would be to place all ship characteristics and particulars on the front and to place all performance data on the back, as shown in Figure 12.

PILOT CARD

Ship's Name _____ Year Built _____

Draft Aft _____ m. Draft Forward _____ m.

Deadweight _____ tonnes
Displacement _____ tonnes

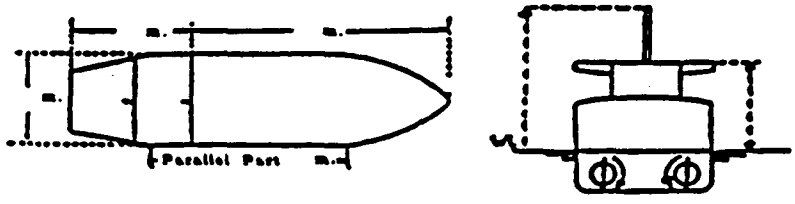
SHIP'S PARTICULARS

Length overall ____ m. Breadth _____ m.

Increase of draught, per degree heel: ___ m.

Thruster Power Available	Bow:	_____ kW	(_____ HP)
	Stern:	_____ kW	(_____ HP)
	Combined	_____ kW	(_____ HP)

Bulbous bow yes/no



Type of engine _____ Maximum power ___kW (___HP)

Manoeuvring engine order	RPM/Pitch	Speed, knots Loaded	Ballast
Full ahead Half ahead Slow ahead Dead slow ahead			
Dead slow astern Slow astern Half astern Full astern		Time limit astern ___ sec Full ahead to full astern ___ sec Max cont. no. starts ___ Critical RPM ___	

Maximum revolutions available: Ahead ____ Astern ____

STEERING CHARACTERISTICS

Type of rudder _____ Max. Angle _____

Hard-over to hard-over ____ sec

Rudder angle for neutral effect ____°

Figure 10. Front Side of Increased Length Version of IMO Pilot Card - Pocket Width

PILOT CARD

Ship's Name _____ Original Name _____

Flag _____ Call sign _____ Agent _____

Tonnage: Gross _____ Net _____
Deadweight _____ tonnes

Draft Aft _____ m. Draft Forward _____ m.

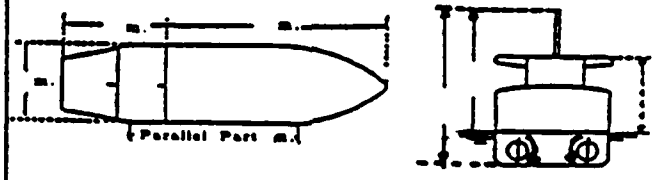
SHIP'S PARTICULARS

Length overall ____ m. Breadth _____ m.

Increase of draught, per degree heel: ___ m.

Thruster Power Available
Bow: _____ kW (_____ HP)
Stern: _____ kW (_____ HP)
Combined _____ kW (_____ HP)

Bulbous bow yes/no
Controllable Pitch Prop yes/no



Type of engine _____ Manufacturer _____

Maximum power: Ahead ___kW (___HP) Astern ___kW (___HP)

Manoeuvring engine order	RPM/Pitch	Speed, knots Loaded	Ballast
Full ahead Half ahead Slow ahead Dead slow ahead			
Dead slow astern Slow astern Half astern Full astern		Time limit astern ___ sec Full ahead to full astern ___ sec Max cont. no. starts ___ Critical RPM ___	

Maximum revolutions available: Ahead _____ Astern _____

STEERING CHARACTERISTICS

Rudder rate ____°/sec Maximum angle ___°

Steady turn diameter ____ ship lengths
(deep water)

STATUS OF SHIP'S EQUIPMENT

Anchor manned and ready to let go yes/no

Gyro error ___ to port/starboard

Problems with any other equipment

Figure 11. Single Sided, Pocket Width, Modified Version of IMO Pilot Card

PILOT CARD

Ship's Name _____ Original Name _____

Flag _____ Call sign _____ Agent _____

Tonnage: Gross _____ Net _____
Deadweight _____ tonnes

Draft Aft _____ m. Draft Forward _____ m.

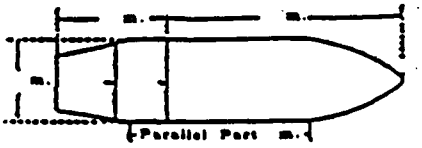
SHIP'S PARTICULARS

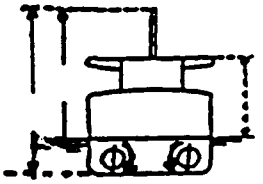
Length overall ____ m. Breadth _____ m.

Increase of draught, per degree heel: ___ m.

Thruster Power Available	Bow:	_____ kW	(_____ HP)
	Stern:	_____ kW	(_____ HP)
	Combined	_____ kW	(_____ HP)

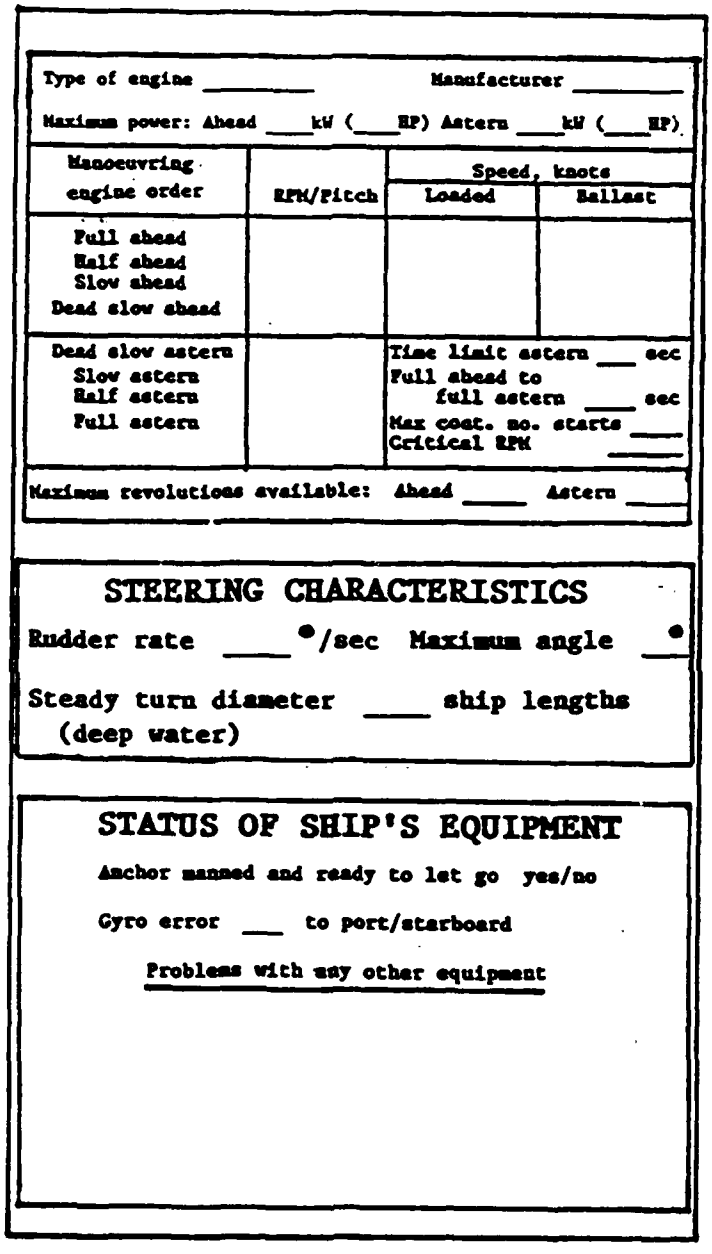
Bulbous bow yes/no
Controllable Pitch Prop yes/no





A. FRONT SIDE OF CARD

Figure 12. Two Sided, Pocket Size Version of Modified IMO Pilot Card



Type of engine _____ Manufacturer _____

Maximum power: Ahead ____kW (____HP) Astern ____kW (____HP)

Manoeuvring engine order	RPM/Pitch	Speed, knots	
		Loaded	Ballast
Full ahead Half ahead Slow ahead Dead slow ahead			
Dead slow astern Slow astern Half astern Full astern		Time limit astern ___ sec Full ahead to full astern ____ sec Max cont. no. starts ____ Critical RPM _____	

Maximum revolutions available: Ahead _____ Astern _____

STEERING CHARACTERISTICS

Rudder rate ____°/sec Maximum angle __°

Steady turn diameter ____ ship lengths (deep water)

STATUS OF SHIP'S EQUIPMENT

Anchor manned and ready to let go yes/no

Gyro error ___ to port/starboard

Problems with any other equipment

B. BACK SIDE OF CARD

Figure 12. Two Sided, Pocket Size Version of Modified IMO Pilot Card (Concluded)

Section 6

RECOMMENDED CHANGES TO WHEELHOUSE POSTER FROM PILOT INTERVIEWS

Overall, pilots indicated only moderate use of the wheelhouse poster and indicated that they would use a poster far less than a pilot card, if the latter was available. There was a widespread feeling that the poster was primarily for use by the crew and that its open water maneuvering data was of limited or no value to pilots. As a result, pilots had far fewer comments on the content or format of the poster than on those of the card.

6.1 ACCURACY AND APPLICABILITY OF MANEUVERING DATA

One widely recurring comments of pilot was lack of confidence in, or applicability to piloting of, maneuvering data presented on the wheelhouse poster. Specific reasons for these conclusions were:

1. Data were typically provided only for deep, unrestricted water with no indication of effects of finite water depth or banks;

2. Data, and particularly turning data, are typically for full sea speed or speeds higher than typical maneuvering speeds;

3. Data provided do not reflect the effects of trim, hull fouling, wind, current or other operating conditions.

Some pilots also expressed concerns about the inherent accuracy of all trials data for some ships, and many expressed the opinion that no data would be better than inaccurate or potentially misleading data.

A study of shipboard maneuvering data carried out by the Sandy Hook Pilots Association supported concerns about the accuracy of the data presented on typical wheelhouse posters. A summary of this study; Reference 6, is presented in Appendix D. The stated objective of this study, which led to collection of data from 85 ships, was to:

> "... survey the bridge data, required by 33 CFR 164.35, on stopping distances, advance and transfer; then to compile a booklet with the data on vessels which frequently call on the Port of New York."

The results of this study were summarized in Reference 6 as follows:

> "Pilots indicated that the data, as called for by 33 CFR 164.35, was not helpful as presented, even when it was available and properly labeled. Stopping distances were from "full speed" and "slow speed" or some other speed, but actual speed in knots was seldom given. Distances were given in meters, feet, yards and only occasionally in miles and tenths of miles (the way most radars read distances). Turning data was similarly given in a

variety of systems of measurements. Several pilots indicated that the tactical diameter (not required by 33 CFR 164.35) would be a more helpful statistic than the other two items, advance and transfer (which are required). A commonplace complaint expressed by the pilots was the lack of time to study data when coming aboard a vessel at the sea buoy and promptly taking the con, as is proper. The raw data itself does not give the pilot an idea as to what to expect relative to other vessels which he has piloted."

As a result of these rather discouraging results, the Sandy Hook Pilots decided not to prepare the maneuvering data booklet.

Based on these concerns, it is recommended that the Coast Guard carefully consider, in developing new regulations, the requirements for and allowable sources of posted maneuvering data. This is particularly important if it is intended or desired that these data be used by pilots. While open water maneuvering is important, critical ship maneuvering most often occurs in the restricted water conditions regularly encountered by pilots.

6.2 ADDITIONS TO AND DELETIONS FROM IMO WHEELHOUSE POSTER

Few pilots requested additions to the basic information contained on the poster. No pilots requested specific deletions of data from the IMO Wheelhouse Poster, although many noted that much of the poster data duplicated that on the IMO Pilot Card or was data which they had no occasion to use (emergency maneuvers, etc.).

A significant number of pilots expressed a desire that maneuvering data presented on the poster:

1. Be for relevant operating conditions (water depths and speeds);

2. Include data for shallow water operation.

A lesser, but still significant, number of pilots requested that:

1. Data be given in tabular as well as, or instead of, graphical form;

2. Data be provided for maneuvers such as kick turns or zigzags.

The Sandy Hook Pilots Association study, Reference 6, proposed that the following maneuvering data should be provided:

1. Non-dimensional tactical diameter (in ship lengths);

2. Non-dimensional stopping distance or head reach (in ship lengths) for a specific speed such as 12 knots;

3. "How well the vessel can come out of a turn. In other words, what is the directional stability (or instability) of the vessel relative to the last vessel handled."

A number of interviewed pilots also indicated that non-dimensional measures of turning and stopping would be preferable to dimensional values. In view of the general lack of pilot agreement over the most appropriate units for maneuvering performance data, it is recommended that both dimensional values (in meters or in tenths of nautical miles) and non-dimensional values (in ship lengths) be required.

Pilots indicated a widespread lack of confidence in and use of available turning data (typically advance and transfer). As a number of pilots felt that tactical or steady turning diameter was a more useful measure of turning ability than was advance or transfer, it is recommended that turning diameter also be required.

Most pilots maintained that good piloting eliminated any need to execute crash stops and that they therefore had no use for posted crash stopping data. In the rare emergency situation requiring a crash stop, pilots indicated that they would order full astern and make no use of posted data. Despite the low stated interest in stopping data, there was a strong preference among the pilots for providing such data for half sea speed or for typical maneuvering speeds.

Item 3., above, from Reference 6, really involves two separate ideas, recovery from a turn and dynamic coursekeeping stability. Recovery from a turn is most frequently characterized by overshoot angle in a zig-zag maneuver. It is generally not possible to directly relate recovery from a turn to coursekeeping stability, since a highly unstable ship may have good ability to come out of a turn, particularly if it has a large rudder.

From pilot interviews it was concluded that few pilots currently understand or would know how to use information such as zig-zag overshoot angle or degree of directional stability. However, based on discussions with pilots who are familiar with trials maneuvers and the quantitative measures derived from these maneuvers, it appears highly desirable to "educate" pilots about the meaning and use of such information.

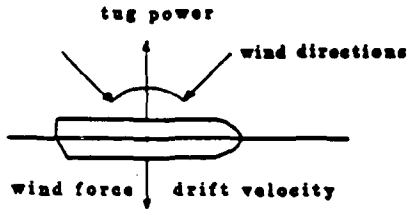
A number of pilots indicated the need for data on the effect of wind. One example of wind effects data, provided by an interviewed pilot, is presented in Figure 13. It is recommended that this type of wind effect data be required and that these data be placed on the wheelhouse poster.

6.3 CHANGES IN POSTER FORMAT AND LOCATION

Pilots made relatively few comments about the basic format or the arrangement of the IMO Wheelhouse Poster. Most pilots felt that the information on the poster was presented in a clear manner. Pilots had widely varying opinions about current poster locations and accessibility or visibility when piloting the ship.

A number of pilots indicated that poster information was often divided by function, and found in several different documents and locations. For

APPROXIMATE
-TRANSVERSE WIND FORCE
-CORRESPONDING TUG HORSEPOWERS
-DRIFT VELOCITIES
FOR WIND DIRECTIONS RANGING
FROM 45-135 DEGREES



WIND SPEED	TRANSVERSE WIND FORCE		TRANSVERSE DRIFT VELOCITY	
m/s	tonnes	corr. tug hp	knots	m/min
5	7	—	1,	30
10	28	3000	2,	60
15	63	6500	2,5	75
20	110	11500	3,	90
30	250	26000	4,5	130
40	440	46000	6,	180

APPROXIMATE DRIFT ANGLE IN TRANSVERSE WIND

FOR WIND ON BOW APPROXIMATE SAME CONDITIONS, WIND ON AFT QUARTER SOMEWHAT SMALLER ANGLES.

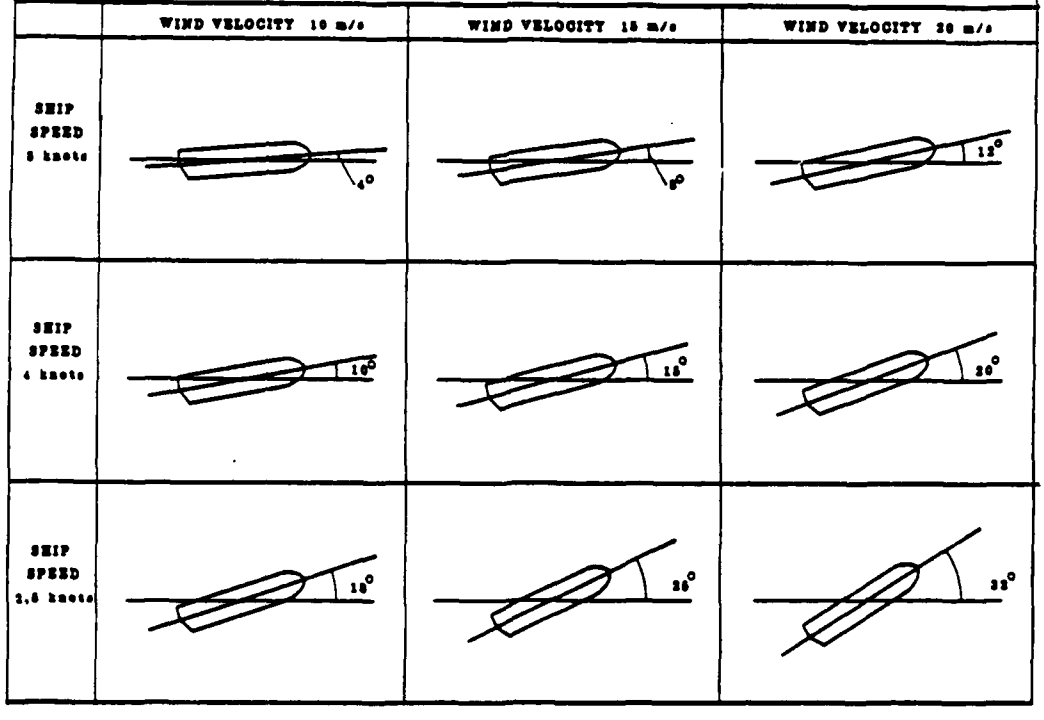


Figure 13. Existing Wind Effect Data

example, engine RPM and speed data were often found on a placard next to the engine telegraph or controls, and thruster performance data were often placed on a placard adjacent to the thruster controls. Pilots generally considered this division of information both helpful and desirable. It is therefore strongly recommended that such a division of information not be prohibited or discouraged, and that new regulations permit the placing of some required poster data adjacent to related controls rather than on the poster. This division of data should also facilitate rapid access to data on the poster.

While the poster is not currently widely used by pilots, its use by pilots should be encouraged and it therefore should be placed in a location which permits rapid access at all times by the pilot. In some ships this may require placing more than one poster in the wheelhouse.

Section 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Based on the analysis of the results of the pilot interviews and the comments made by pilots during the interviews, a number of conclusions were drawn about the nature and use of pilot cards and wheelhouse posters. These conclusions are presented below.

7.1.1 Current and Projected Use of Pilot Cards and Wheelhouse Posters

1. Pilots currently receive pilot cards infrequently, and the cards received are typically less extensive than the IMO recommended card;

2. Most ships currently have wheelhouse posters and/or placards which contain most of the data recommended by the IMO, but in many ships poster location inhibits or prevents poster use by pilots;

3. Most pilots felt that the IMO recommended Pilot Card would be much more useful to them than the IMO recommended Wheelhouse Poster;

7.1.2 Pilot Desires for Pilot Card

1. Pilots found the data on the IMO Pilot Card generally useful;

2. Most widely recommended deletions from the IMO Pilot Card included number of anchor shackles and number and type of mooring ropes;

3. The most widely recommended addition to the IMO Pilot Card was propeller type (CRP or fixed pitch);

4. Pilots felt that the use of any pilot card would be greatly increased if its overall size and print size were increased to permit it to be easily read at night using only flashlight illumination;

5. A number of pilots wanted all of the information found on the IMO Pilot Card.

7.1.3 Pilot Desires for Wheelhouse Poster

1. Maneuvering performance data for full ship speed and deep water are of little relevance to piloting and are thus rarely used by pilots;

2. Maneuvering performance data would be more useful and more used if they were for maneuvering speed or half sea speed;

3. Pilots seem unlikely to use posted maneuvering performance data unless they have confidence in the data's accuracy - data such as current shallow water turning data are not trusted by pilots;

4. There was little consensus on other aspects of the wheelhouse poster, except that it was considered far less useful than the IMO Pilot Card by most pilots.

7.1.4 Pilot Reservations about Maneuvering Data

1. Many pilots expressed serious reservations about the maneuvering performance found on wheelhouse posters - the most widely expressed reservations related to:

   - Data primarily for deep, unrestricted water
   - Turning data for full sea speed rather than maneuvering speeds
   - Presentation of performance measures in meters rather than in ship lengths or nautical miles and tenths of miles
   - The source and accuracy of all data;

2. A maneuvering performance data collection effort conducted by the Sandy Hook Pilots also raised serious questions about the accuracy and utility of such data.

7.2 RECOMMENDATIONS

Several important recommendations for future Coast Guard action can be drawn from the pilot interviews. These include recommendations for further contacts with pilots and for possible changes from current IMO recommendations in the drafting of new requirements or guidance.

7.2.1 Future Courses of Regulatory Action

Based on the results of this study it is recommended that the Coast Guard strongly consider seeking IMO modifications of its current recommendations for pilot cards and wheelhouse posters before initiating any new requirements or guidance related to pilot cards or wheelhouse posters. In particular, it is recommended that the Coast Guard consider the following actions:

1. Develop a proposed pilot card which is based on the IMO recommended card, with modifications proposed in Section 5 of this report;

2. Develop a proposed wheelhouse poster which is based on IMO recommendations and on current U.S. Coast Guard requirements and whose content and manner of presentation of maneuvering data reflect results of this study and potential utility of such data to pilots;

3. Present the results of this study and proposed modifications to the IMO recommended Pilot Card and Wheelhouse Poster to the IMO.

7.2.2 Future Contacts with Pilots

There appear to be at least two important reasons for new contacts with pilot associations and individual pilots:

1. Presentation to pilots for their review and comment of any proposed pilot card which is based on, but different from, the recommended IMO Pilot Card;

2. Presentation to pilots of a "white paper" on the potential relevance and utility of maneuvering performance data currently required by Federal Regulations or recommended by the IMO, or data the Coast Guard may recommended to the IMO for inclusion on the poster. Panel H-10, Ship Controllability, of the Society of Naval Architects and Marine Engineers might assist the Coast Guard in the preparation of such a "white paper."

Section 8

ACKNOWLEDGEMENT

Many individuals and organizations made important contributed to this effort. The contributions of the five participating pilot associations, the San Francisco Bar Pilots, the Los Angeles Pilots, the Jacobsen Pilots of Long Beach, the Sandy Hook Pilots of New York and New Jersey and the Association of Maryland Pilots of Baltimore, and their Presidents and Boards, are gratefully acknowledged. The efforts of Captains Jack Going, Jackson Pearson, Kenneth Graham, Vince Black and Richard Owen of these pilot associations, and Captain Jim Card of the U.S. Coast Guard, in arranging the visits and the interviews with individual pilots was particularly important. Finally, the interested participation and helpful comments of each of the 25 interviewed pilots is appreciated.

Section 9

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2. Landsburg, A., J. Card, T. Knierim, H. Eda and H. Von Breitenfeld, "Proposed Shipboard Maneuvering Data," Proceedings of 1980 SNAME STAR Symposium/Spring Meeting.

3. IMO Subcommittee on Safety of Navigation, 32nd Session, "Information to be Included in Maneuvering Booklets," NAV 32/7, February 1986.

4. IMO Subcommittee on Safety of Navigation, 31st Session, "Recommendation on Information to be Included in Maneuvering Booklets," NAV 31/WP7, July 1985.

5. IMO Subcommittee on Design and Equipment, 26th Session, Draft Assembly Resolution, "Code for Maneuvering Trials and Bridge Display Data," December 1982.

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INTERNATIONAL MARITIME
ORGANIZATION

A 15/Res.601
4 January 1988
Original: ENGLISH

ASSEMBLY - 15th session
Agenda item 12

IMO

RESOLUTION A.601(15)

adopted on 19 November 1987

PROVISION AND DISPLAY OF MANOEUVRING INFORMATION ON BOARD SHIPS

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO that it adopted by resolution A.209(VII). the Recommendation on Information to be Included in the Manoeuvring Booklets in order to ensure uniformity of such information on board ship,

NOTING the importance attached to further enhancement of the safety of navigation,

RECOGNIZING the need to achieve a uniform format and content of the pilot card and the wheelhouse poster, and to establish a framework for the manoeuvring booklet which provides navigators with more detailed information on the manoeuvring characteristics of the ship,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its fifty-third session:

1. ADOPTS the Recommendation on the Provision and the Display of Manoeuvring Information on Board Ships, as set out in the Annex to the present resolution, which supersedes the Recommendation adopted by resolution A.209(VII);

2. INVITES all Governments concerned to take steps to give effect to the Recommendation as soon as possible;

3. REQUESTS the Maritime Safety Committee to keep the Recommendation under review for the purpose of improvement based on new developments in techniques and in the light of experience gained in its application.

ANNEX

RECOMMENDATION ON THE PROVISION AND THE DISPLAY OF MANOEUVRING INFORMATION ON BOARD SHIPS

1 INTRODUCTION

1.1 In pursuance of the Recommendation on Data Concerning Manoeuvring Capabilities and Stopping Distances of Ships, adopted by resolution A.160(ES.IV), and paragraph 10 of regulation II/1 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, Administrations are recommended to require that the manoeuvring information given herewith is on board and available to navigators.

1.2 The manoeuvring information should be presented as follows:

.1 Pilot card
.2 Wheelhouse poster
.3 Manoeuvring booklet.

2 APPLICATION

2.1 The Administration should recommend that manoeuvring information, in the form of the models contained in the appendices, should be provided as follows:

.1 for all new ships to which the requirements of the 1974 SOLAS Convention, as amended, apply, the pilot card should be provided;

.2 for all new ships of 100 metres in length and over, and all new chemical tankers and gas carriers regardless of size, the pilot card, wheelhouse poster and manoeuvring booklet should be provided.

2.2 The Administration should encourage the provision of manoeuvring information on existing ships, and ships that may pose a hazard due to unusual dimensions or characteristics.

2.3 The manoeuvring information should be amended after modification or conversion of the ship which may alter its manoeuvring characteristics or extreme dimensions.

3 MANOEUVRING INFORMATION

3.1 Pilot card (appendix 1)

The pilot card, to be filled in by the master, is intended to provide information to the pilot on boarding the ship. This information should describe the current condition of the ship, with regard to its loading, propulsion and manoeuvring equipment, and other relevant equipment. The contents of the pilot card are available for use without the necessity of conducting special manoeuvring trials.

3.2 Wheelhouse poster (appendix 2)

The wheelhouse poster should be permanently displayed in the wheelhouse. It should contain general particulars and detailed information describing the manoeuvring characteristics of the ship, and be of such a size to ensure ease of use. The manoeuvring performance of the ship may differ from that shown on the poster due to environmental, hull and loading conditions.

3.3 Manoeuvring booklet (appendix 3)

The manoeuvring booklet should be available on board and should contain comprehensive details of the ship's manoeuvring characteristics and other relevant data. The manoeuvring booklet should include the information shown on the wheelhouse poster together with other available manoeuvring information. Most of the manoeuvring information in the booklet can be estimated but some should be obtained from trials. The information in the booklet may be supplemented in the course of the ship's life.

APPENDIX 1

PILOT CARD

Ship's name_____ Date_____

Call sign_____ Deadweight_____tonnes Year built_____

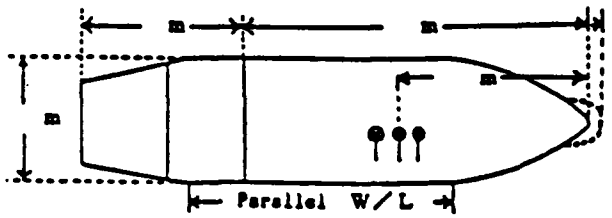
Draught Aft_____m/__ft__in. Forward_____m/__ft__in. Displacement_____tonnes

SHIP'S PARTICULARS

Length overall_____m. Anchor chain : Port _____shackles, Starboard _____shackles.

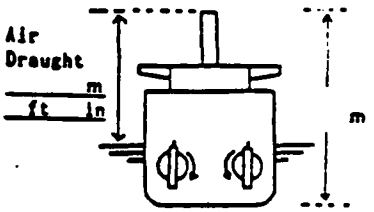
Breadth _____m Stern _____shackles

Bulbous bow Yes/No (1 Shackle = _____m/_____fathoms)



Loaded m

Ballast m



Type of engine _____ Maximum power _____kw (_____HP)

Manoeuvring Engine order	Rpm/pitch	Speed (knots)	
		Loaded	Ballast
Full ahead			
Half ahead			
Slow ahead			
Dead slow ahead			
Dead slow astern		Time limit astern _____min	
Slow astern		Full ahead to full astern _____sec	
Half astern		Max. no. of consec. starts _____	
Full astern		Minimum RPM _____, _____knots	
		Astern power _____% ahead	

STEERING PARTICULARS

Type of rudder _____, Maximum angle _____° , Hard-over to hard-over _____sec

Rudder angle for neutral effect _____°

Thruster : Bow _____kW(_____HP), Stern _____kW(_____HP)

CHECKED IF ABOARD AND READY

Anchors ☐

Whistle ☐

Radar ☐3cm ☐10cm

ARPA ☐

Speed log ☐ Doppler:Yes/No

Water speed ☐

Ground speed ☐

Dual-Axis ☐

Engine telegraphs ☐

Steering gear ☐

Number of power units operating ☐

Indicators : Rudder ☐

Rpm/Pitch ☐

Rate of Turn ☐

Compass System ☐

Constant Gyro Error ± ____°

VHF ☐

Elec. Pos. Fix. System ☐

Type _____

OTHER INFORMATION :

APPENDIX 2

WHEELHOUSE POSTER

Ship's name _____. Call Sign _____. Gross tonnage _____. Net tonnage _____

Max. displacement _____ tonnes. and Deadweight _____ tonnes. and Block coefficient _____ at summer full load draught

Draught at which the manoeuvring data were obtained

Loaded	Ballast
Trial/Estimated	Trial/Estimated
_____ m forward	_____ m forward
_____ m aft	_____ m aft

STEERING PARTICULARS

Type of rudder (s)	
Maximum rudder angle	°
Time taken over to taken over with one power unit	_____ sec
with two power units	_____ sec
Minimum speed to maintain control propeller stopped	_____ knots
Rudder angle for control effect	°

ANCHOR CHAIN

	No. of shackles	Max. Rate of heaving (min/shackle)
Port		
Starboard		
Stern		

(1 shackle = _____ m / _____ fathoms)

PROPULSION PARTICULARS

Type of engine _____. _____ bhp(_____ HP). Type of propeller _____

Engine order	Rpm/pitch setting	Speed (knots) Loaded	Ballast
Full ahead			
Full ahead			
Half ahead			
Slow ahead			
Dead slow ahead			
Dead slow astern		Critical revolutions _____ rpm	
		Minimum RPM _____	_____ knots
Slow astern		Time limit astern _____ min	
		Time limit at min. revs. _____ min	
Half astern		Emergency full ahead to full astern _____ sec	
		Stop to full astern _____ sec	
Full astern		Astern power _____ % ahead	
		Max. no. of consecutive starts _____	

TRANSFER EFFECT at trial conditions

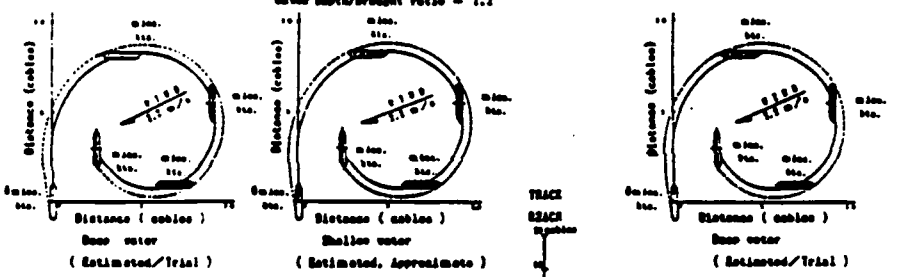
Thruster	bhp(HP)	Time delay for full thrust	Turning rate at zero speed	Time delay to reverse full thrust	Net effective at zero speed
Bow		sec	°/min	min sec	knots
Stern		sec	°/min	min sec	knots
Combined		sec	°/min	min sec	knots

DRAUGHT INCREASE (LOADED)

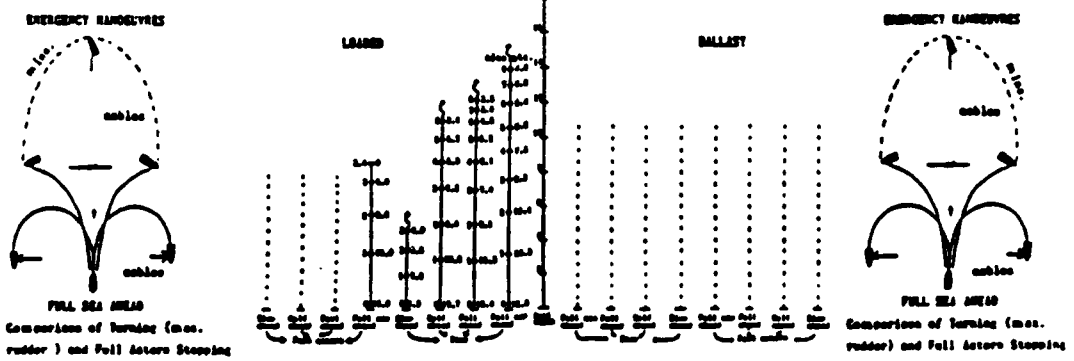
Under keel clearance	Estimated Squat Effect: Ship's speed (knots)	Max. bow squat estimated (m)	Heel Effect: Heel angle (degrees)	Draft increase (m)
m			2	
			4	
			8	
m			12	
			16	

TURNING CIRCLES AT MAX. RUDDER ANGLE

LOADED — Water Depth/Draught ratio = 1.2 — BALLAST



EMERGENCY MANOEUVRES — LOADED — BALLAST — EMERGENCY MANOEUVRES

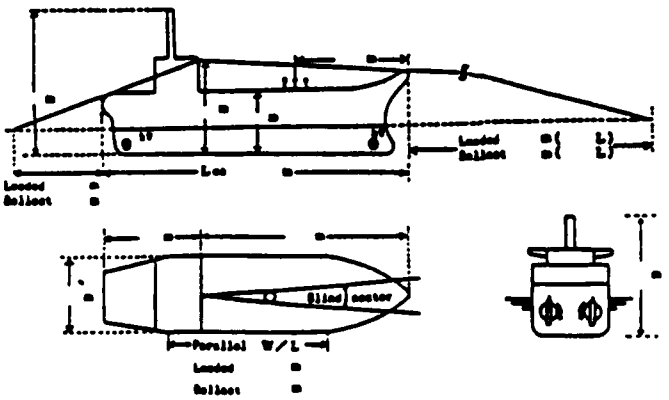


FULL SEA AHEAD

Comparison of Turning (max. rudder) and Full Astern Stopping Ability (rudder amidships)

FULL SEA AHEAD

Comparison of Turning (max. rudder) and Full Astern Stopping Ability (rudder amidships)



MAN OVERBOARD RESCUE MANOEUVRE

SEQUENCE OF ACTIONS TO BE TAKEN:

- TO CAST A LIFE BUOY
- TO GIVE THE HELM ORDER
- TO SOUND THE ALARM
- TO KEEP THE LOOK-OUT

Insert a recommended turn

PERFORMANCE MAY DIFFER FROM THIS RECORD DUE TO ENVIRONMENTAL, HULL AND LOADING CONDITIONS

Prepared by _____

Date _____

APPENDIX 3

RECOMMENDED INFORMATION TO BE INCLUDED IN THE MANOEUVRING BOOKLET

CONTENTS

1 General description

1.1 Ship's particulars

1.1.1 General

Ship's name, distinctive number or letters, year of build

1.1.2 Gross tonnage and other information

Gross tonnage, deadweight and displacement (at summer draught)

1.1.3 Principal dimensions and coefficients

Length overall, length between perpendiculars, breadth (moulded), depth (moulded), summer draught, normal ballast draught, hull coefficients at summer load and normal ballast condition

Extreme height of the ship's structure above the keel

1.1.4 Main engine

Type, number of units and power output

1.1.5 Propeller

Type, number of units, diameter, pitch, direction of rotation, propeller immersion

1.1.6 Rudder

Type, number of units, total rudder area, rudder area ratio (full load and normal ballast)

1.1.7 Bow and stern thrusters

Type, number of units, capacities and location

1.1.8 Bow and stern profiles

1.1.9 Forward and after blind zones with dimensions specified (full load and normal ballast)

1.1.10 Other hull particulars

Projected areas of longitudinal and lateral above-water profiles (full load and normal ballast)

Length of parallel middle body for berthing (full load and normal ballast)

1.2 Characteristics of main engine

1.2.1 Manoeuvring speed tables (trial or estimated, at the full load and ballast conditions)

Engine revolutions, ship speed and thrust (at ahead) corresponding to engine orders

1.2.2 Critical revolutions

1.2.3 Time for effecting changes in engine telegraph settings as in 3.1.2 for both routine and emergency conditions

1.2.4 Time limit astern

1.2.5 Minimum operating revolutions (for diesel engines) and corresponding ship speed

1.2.6 Maximum number of consecutive starts (for diesel engines)

2 Manoeuvring characteristics in deep water

2.1 Course change performance

2.1.1 Initial turning test results (trial or estimated, at the full load and ballast conditions), test conditions, diagrams of heading angle versus time and ship's track

2.1.2 Course change test results (trial or estimated, at full load and ballast conditions)

Curves of course change distance and point of initiation of counter rudder for the necessary course change angle (for both full load and ballast conditions)

2.2 Turning circles in deep water (trial or estimated, at the full load and ballast conditions)

2.2.1 Turning circle test results

Test conditions, test results (advance and transfer) and turning track at full sea speed ahead

2.2.1.1 Turning circles in both full load and ballast conditions (stern track should be shown)

2.2.1.2 The data presented should refer to the case of starboard turn only (unless there is significant difference for port turn)

2.2.1.3 The initial speed of the ship should be full sea speed ahead

2.2.1.4 Times and speeds at 90°, 180°, 270° and 360° turning should be specifically shown together with an outline of the ship

2.2.1.5 The rudder angle used in the test should be the maximum rudder angle

2.3 Accelerating turn (trial or estimated)

Data are to be presented for both full load and ballast conditions in the same manner as 2.2 for turning circles. The ship accelerates from rest with the engine full manoeuvring speed ahead and the maximum rudder angle

2.4 Yaw checking tests (trial or estimated)

2.4.1 Results of the zig-zag and pull-out manoeuvre tests at the full load or ballast condition shown as diagrams of the heading changes and rudder angle

2.5 Man-overboard and parallel course manoeuvres

2.5.1 Man-overboard manoeuvre (trial)
Diagrams for cases of both starboard and port turns should be shown for both full load and ballast conditions

2.5.2 Parallel course manoeuvre (estimated)

Diagrams showing lateral shift to a parallel course using maximum rudder angle

2.6 Lateral thruster capabilities (trial or estimated)

2.6.1 Diagrams of turning performance at zero forward speed in the full load or ballast condition should be shown, for bow and stern thrusters acting separately and in combination

2.6.2 Diagrams showing the effect of forward speed on turning performance should be included

2.6.3 Information on the effect of wind on turning performance should be given

3 Stopping and speed control characteristics in deep water

3.1 Stopping ability

3.1.1 Stopping test results (trial)

Test conditions, ship's tracks, rpm, speed, track reach, head reach and side reach

Two or more tests should be carried out including a test of full astern from full sea speed ahead and a test of full astern from full ahead speed.

3.1.2 Stopping ability (estimated)

Information and diagrams should be given of the track reach, head reach, side reach, time required and track reach deceleration factor (distance/one knot reduction) of a ship in

both full load and ballast conditions covering the following modes of stopping manoeuvres:

full astern from full sea speed ahead
full astern from full ahead speed
full astern from half ahead speed
full astern from slow ahead speed
stop engine from full sea speed ahead
stop engine from full ahead speed
stop engine from half ahead speed
stop engine from slow ahead speed

3.2 Deceleration performance (estimated)

3.2.1 Deceleration ability (estimated)

Information and diagrams should be given concerning the track reach, time required and deceleration factor of the ship in both full load and ballast conditions for the following engine orders:

full sea speed to "stand by engines"

full ahead to half ahead

half ahead to slow ahead

slow ahead to dead slow ahead

3.3 Acceleration performance (estimated)

3.3.1 Information and diagrams should be given for track reach and time for the ship to achieve full sea speed ahead, from zero speed

4 Manoeuvring characteristics in shallow water

4.1 Turning circle in shallow water (estimated)

4.1.1 Turning circle in the full load condition (stern track to be shown)

4.1.2 The initial speed of the ship should be half ahead

4.1.3 Times and speeds at 90°, 180°, 270° and 360° turning should be specifically shown, together with an outline of the ship

4.1.4 The rudder angle should be the maximum and the water depth to draught ratio should be 1.2

4.2 Squat (estimated)

4.2.1 Curves should be drawn for shallow water and infinite width of channel, indicating the maximum squat versus ship speed for various water depth/draught ratios

4.2.2 Curves should be drawn for shallow and confined water, indicating the maximum squat versus speed for different blockage factors

5 Manoeuvring characteristics in wind

5.1 Wind forces and moments (estimated)

5.1.1 Information should be given on the wind forces and moments acting on the ship for different relative wind speeds and directions in both full load and ballast conditions, to assist in berthing

5.2 Course-keeping limitation (estimated)

5.2.1 Information should be given for both full load and ballast conditions, showing the effect of wind on the ability of the ship to maintain course

5.3 Drifting under wind influence (estimated)

5.3.1 Information should be given on the drifting behaviour under wind influence with no engine power available

6 Manoeuvring characteristics at low speed (trial or estimated)

6.1 Information on the minimum operating revolutions of the main engine and corresponding ship's speed should be given

6.2 Information on the minimum speed at which the ship can maintain course while still making headway after stopping engines

7 Additional information

7.1 Any other relevant additional information should be added to the contents of the booklet, particularly information concerned with the operation of the bridge manoeuvring controls.

Appendix B

INITIAL PILOT INTERVIEW FORM

NOTE TO RECIPIENTS: This questionnaire is designed to aid the U.S. Coast Guard in assessing pilot's experience with, use of and need for the data provided in Pilot Cards and Wheelhouse Posters. The purposes of this effort include the familiarization of pilots with the IMO format for these shipboard maneuvering documents, and the determination of how these documents provide or can in the future provide information needed by pilots.

I. CURRENT AND FUTURE USE OF POSTING DATA

1. What percent of time are you given a pilot card upon arrival? ____ %

2. Do you request a pilot card if you are not given on? Yes ___ No ___

3. On what percentage of ships is a wheelhouse poster? Available ___ %
   Easily Visible ___ %

4. Do you regularly use? The Pilot Card Yes ___ No ___
   The Wheelhouse Poster Yes ___ No ___

5. Upon arrival on bridge do you review? Pilot Card Yes ___ No ___
   Poster Yes ___ No ___

6. During normal pilotage do you use? Pilot Card Yes ___ No ___
   Poster Yes ___ No ___

7. During critical situations do you use? Pilot Card Yes ___ No ___
   Poster Yes ___ No ___

8. Which is most useful? Pilot Card ___ Wheelhouse Poster ___

9. If you do not regularly receive a Pilot Card, how could you make best use of one if available?

   _____

10. If ships you pilot do not regularly have Wheelhouse Posters, how could you make best use of one if available?

    _____

II. IMO MANEUVERING DATA

Attachments 1 and 2 present a Pilot Card and a Wheelhouse Poster in the formats agreed to by the International Maritime Organization (IMO). The format of and the data contained in these documents may be somewhat different than those of Pilot Cards and Wheelhouse posters which you have used in the past. Please take time to familiarize yourself with these enclosures and to be certain that you understand all information to be included in these documents.

1. Are you familiar with the format of the Pilot Card in Attachment 1?

   Yes ____ No ____

2. Have you used Pilot Cards in this or a similar format?

   Yes ___ No ___ If yes, how frequently _____

3. Are you familiar with the format of the Wheelhouse Poster of Attachment 2?

   Yes ____ No ____

4. Have you used Wheelhouse Posters of this or a similar format?

   Yes ___ No ___ If yes, how frequently _____

III. IMO PILOT CARD FORMAT

A. Ship Characteristics

1. What data do you consider most useful? (in decreasing order of value)
   1. _____
   2. _____
   3. _____

2. Which, if any, do you consider not useful? (in increasing order of value)
   1. _____
   2. _____
   3. _____

3. Should additional information be added? Yes ____ No ____

   If yes, what information? _____

4. Should information be deleted to improve clarity? Yes ____ No ____

   If yes, what information? _____

5. Is information presented in an unclear manner? Yes ____ No ____

   If yes, what information? _____

B. Ship Performance

1. Are powering/vessel speed data adequate ? Yes ____ No ____

   If not, what data should be given? _____

2. What additional data would be desirable? _____

IV. IMO WHEELHOUSE POSTER FORMAT

A. Ship Characteristics

1. What information do you consider most useful? (in decreasing order of value)
   1. _____
   2. _____
   3. _____

2. What, if any, do you consider not valuable (in increasing order of value)?
   1. _____
   2. _____
   3. _____

3. Should additional information be added? Yes ____ No ____

   If so, what information? _____

4. Should information be deleted to improve clarity? Yes ___ No ___

   If so, what information? _____

5. Is information presented in an unclear manner? Yes ____ No ____

   If so, what information? _____

6. How useful are data on limits of visibility?
   Very ____; Somewhat ____; Not very ____

B. Ship Performance (Powering and Maneuvering Data)

1. What data do you consider most useful? (in decreasing order of value)
   1. _____
   2. _____

2. What data do you consider least useful? (in increasing order of value)
   1. _____
   2. _____

3. Preferred format(s) for turning data? Turning circle diagrams _____
   Mushroom diagrams ____; Comb diagrams ____; Tabular data ____

4. Should turning data be provided for? Full Ahead _____
   Half Ahead ____; Full and Half Ahead ____; Astern _____

5. Should astern stopping data be provided? Yes ____ No ____

6. Are shallow water turning data important? Yes ____ No ____

7. Should data from other maneuvers be provided? Yes ____ No ____

   If yes, which maneuvers? _____

V. OVERALL ASSESSMENT OF AVAILABLE MANEUVERING DATA

1. Do you find the Pilot Card?
   - Very useful ____
   - Somewhat useful ____
   - Of limited use ____

2. Do you find the Wheelhouse Poster?
   - Very useful ____
   - Somewhat useful ____
   - Of limited use ____

3. Was ship speed as expected from data? Yes ____ No ____

4. Did ship stop as expected from data? Yes ____ No ____

5. Did ship turn as expected from data? Yes ____ No ____

6. Did ship experience shallow water effects? Yes ____ No ____

   If so, was turning as expected from data? Yes ____ No ____

7. What should be added to: Wheelhouse Poster? _____

   Pilot Card? _____

Appendix C

MODIFIED PILOT INTERVIEW FORM

NOTE TO RECIPIENTS: This questionnaire is designed to aid the U.S. Coast Guard in assessing pilot's experience with, use of and need for the data provided in Pilot Cards and Wheelhouse Posters. The purposes of this effort include the familiarization of pilots with the IMO format for these shipboard maneuvering documents, and the determination of how these documents provide or can in the future provide information needed by pilots.

I. CURRENT AND FUTURE USE OF POSTING DATA

1. What percent of time are you given a pilot card upon arrival? ____ %

2. Do you request a pilot card if you are not given on? Yes ___ No ___

3. On what percentage of ships is a wheelhouse poster? Available ___ %
   Easily Visible ___ %

4. Do you regularly use? The Pilot Card Yes ___ No ___
   The Wheelhouse Poster Yes ___ No ___

5. Upon arrival on bridge or as soon as possible after arrival do you review? Pilot Card Yes ___ No ___
   Poster Yes ___ No ___

6. During critical situations do you use? Pilot Card Yes ___ No ___
   Poster Yes ___ No ___

7. Which is most useful? Pilot Card ___ Wheelhouse Poster ___

II. FAMILIARITY WITH IMO DATA FORMATS

Attachments 1 and 2 present a Pilot Card and a Wheelhouse Poster in the formats agreed to by the International Maritime Organization (IMO). The format of and the data contained in these documents may be somewhat different than those of Pilot Cards and Wheelhouse posters which you have used in the past. Please take time to familiarize yourself with these enclosures and to be certain that you understand all information to be included in these documents.

1. Have you used Pilot Cards of the IMO or similar format?

   Yes ___ No ___ If yes, how frequently _____

2. Have you used Wheelhouse Posters of the IMO or similar format?

   Yes ___ No ___ If yes, how frequently _____

3. Have most Wheelhouse Posters you have seen contain essentially the same information contained in the IMO Wheelhouse Poster?

   Tes ___ No ___

III. IMO PILOT CARD FORMAT

1. What data do you consider most useful? (in decreasing order of value)
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____

2. Which, if any, do you consider not useful? (in increasing order of value)
   1. _____
   2. _____
   3. _____
   4. _____

3. Should additional information be added? Yes ____ No ____

   If yes, what information? _____

4. Should information be deleted to improve clarity? Yes ____ No ____

   If yes, what information? _____

5. Are powering/vessel speed data adequate ? Yes ____ No ____

   If not, what data should be given? _____

6. Is information presented in an unclear manner? Yes ____ No ____

   If yes, what information? _____

IV. IMO WHEELHOUSE POSTER FORMAT

A. Ship Characteristics

1. What information beyond pilot card do you consider most useful (in order of value)? 1. _____ 2. _____

2. What, if any, do you consider not valuable (in increasing order of value)? 1. _____ 2. _____

3. Should additional information be added? Yes ____ No ____

   If so, what information? _____

4. Should information be deleted to improve clarity? Yes ___ No ___

   If so, what information? _____

5. Is information presented in a clear manner? Yes ____ No ____

   If not, what is unclear? _____

6. How useful are data on limits of visibility?
   Very ____; Somewhat ____; Not very ____

B. Ship Performance (Powering and Maneuvering Data)

1. What data do you consider most useful? (in decreasing order of value) 1. _____ 2. _____

2. What data do you consider least useful? (in increasing order of value) 1. _____ 2. _____

3. Preferred format(s) for turning data?
   Turning circle diagrams _____ Tabular data _____

4. Preferred format(s) for stopping data:
   Mushroom diagrams ____; Comb diagrams ____; Tabular data ____

5. Should turning data be provided for? Full Ahead _____
   Half Ahead ____; Full and Half Ahead ____; Astern _____

6. Should astern stopping data be provided? Yes ____ No ____

7. Should shallow water turning data be provided? Yes ____ No ____

8. Should data from other maneuvers be provided? Yes ____ No ____

   If yes, which maneuvers? _____

V. OVERALL ASSESSMENT OF AVAILABLE MANEUVERING DATA

1. Do you find the Pilot Card?
   Very useful ____
   Somewhat useful ____
   Of limited use ____

2. Do you find the Wheelhouse Poster?
   Very useful ____
   Somewhat useful ____
   Of limited use ____

3. Has ship speed been as expected from data? Yes ___ No ___ ? ___

4. Has ship stopped as expected from data? Yes ___ No ___ ? ___

5. Has ship turned as expected from data? Yes ___ No ___ ? ___

6. Has shallow water turning been as expected from any available Poster data? Yes ___ No ___ ? ___

7. What should be added to: Wheelhouse Poster? _____

   Pilot Card? _____

Appendix D

SUMMARY OF SANDY HOOK PILOTS DATA COLLECTION EFFORT

A survey of shipboard shiphandling data conducted from December 1988 to April 1989 by the Director of Training, Sandy Hook Pilots Assn.

Survey Objectives:

The intention was to survey the bridge data, required by 33 CFR 164.35, on stopping distances, advance and transfer; then to compile a booklet with the data on vessels which frequently call on the port of New York. The National Transportation Safety Board has urged pilots to become more aware of, and to utilize this information in piloting ships.

Data:

Please see attached copies of the original and the slightly modified data sheet. Pilots were given these data sheets prior to boarding vessels. They either filled them out themselves or had the ship's officers fill them out. At first, we only asked for data on stopping distances and advance and transfer. Later on, we began asking for tactical diameter when it became apparent that this data could be useful. Cooperation from both the pilots and the ships was good.

Data was gathered on 85 ships. Many of the data forms were submitted incomplete due to the lack of available data . Some vessels had copies, or made copies, of their actual trials data. Sometimes even this information was incomplete and did not comply with 33 CFR 164.35. The most common and glaring mistake was confusing "transfer" with "tactical diameter". A total of 27 ships submitted data with this mistake. Even some shipyard prepared forms confused the terms. Twenty-two data forms lacked a substantial amount of data. Another 28 forms lacked some data. Complete data, including the tactical diameter, was submitted on only 9 ships.

Results:

Pilots indicated that the data, as called for by 33 CFR 164.35, was not helpful as presented, even when it was available and properly labled. Stopping distances were from "full speed" or "slow speed" or some other speed, but actual speed in knots was seldom given. Distances were given in meters, feet, yards and only occasionally in miles and tenths of miles. (The way that most radars read distances.) Turning data was similarly given in a variety of systems of measurements. Several pilots indicated that the tactical diameter (not required by 33 CFR 164.35) would be a more helpful statistic than the two items, advance and transfer (which are required). A common complaint expressed by the pilots was the lack of time to study data when coming aboard a vessel at the sea buoy and promptly taking the con, as is proper. The raw data itself does not give the pilot an idea as to what to expect relative to other vessels which he has piloted.

A maneuvering data booklet will not be prepared at this time.

Suggestions:

Maneuvering data should be non-dimensional and cover at least these three characteristics: (1) "Non-dimensional tactical diameter" or NTD. Average handling vessels seemed to have an NTD of 3.0 to 3.3. Numbers below this indicated a vessel would turn more handily. Larger numbers would indicate that the pilot would have be very careful on certain turns. (2) The stopping distance could be given in relation to length and for a specific speed, say from 12 knots. (3) How well can vessel come out of a turn. In other words, what is the directional stability (or instability) of this vessel relative to the last ship handled. Perhaps a time in seconds could be given for a vessel to complete a specific maneuver. This maneuvering characteristic is not addressed at all in 33 CFR 164.35.

Definitions:

Tactical diameter - The perpendicular distance from the original course to the position where a ship has turned through 180 degrees , after the helm is put over. (from *International Maritime Dictionary,* De Kerchove.)

Non-dimensional tactical diameter - Tactical diameter divided by the vessels length.

Advance - The distance gained in the direction of the original course when the vessel has turned 90 degrees.

Transfer - The distance gained at a right angle to the original course. (The above three definitions from the Marine Accident Report NTSB/MAR-88/03, The Ramming of the Sidney Lanier Bridge by the Zeimia Bialostocka.)

Submitted,

V. A. Black

Capt. V.A. Black
Director of Training
Sandy Hook Pilots Assn.
5-15-89

DATE: _____

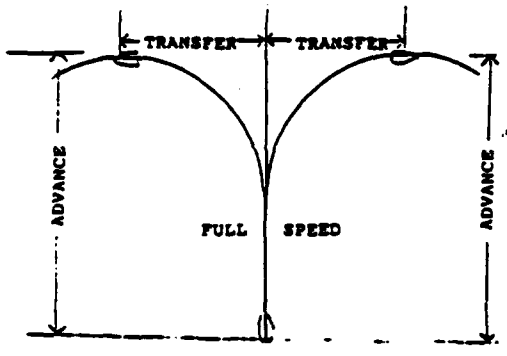
MANEUVERING CHARACTERISTICS
OF THE _____
L.O.A. _____
BEAM _____

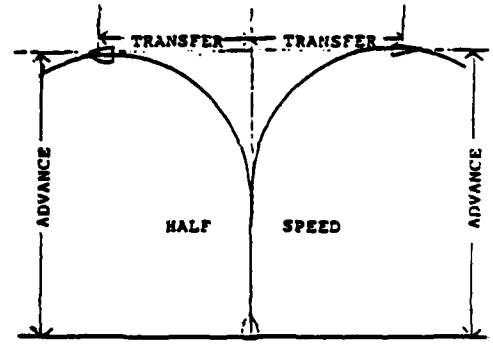
Please fill in the blanks, TIME and DISTANCE TO STOP, using engines full astern and with minimum rudder applied.

	NORMAL LOADED COND.		NORMAL BALLAST COND.	
	TIME	DISTANCE	TIME	DISTANCE
FULL SEA AHEAD				
FULL AHEAD				
HALF AHEAD				
SLOW AHEAD				

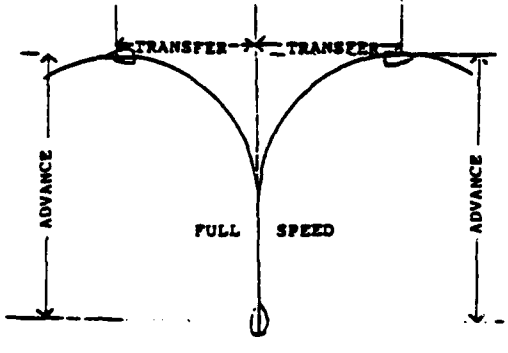
Please fill in the ADVANCE and TRANSFER distances

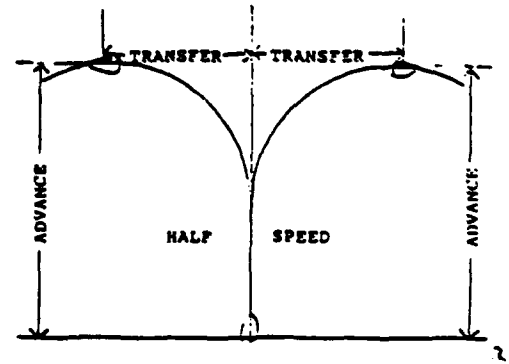
NORMAL LOADED CONDITION





NORMAL BALLAST CONDITION





REMARKS:

_____

_____

_____

_____

DATE: _____

MANEUVERING CHARACTERISTICS
OF THE _____
L.O.A. _____
BEAM _____

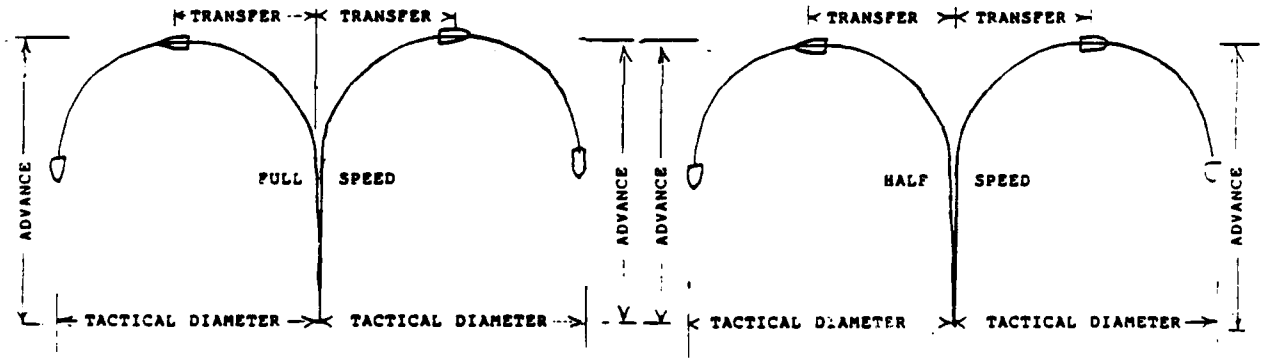
Please fill in the blanks, TIME and DISTANCE TO STOP, using engines full astern and with minimum rudder applied.

	NORMAL LOADED COND.		NORMAL BALLAST COND.	
	TIME	DISTANCE	TIME	DISTANCE
FULL SEA AHEAD				
FULL AHEAD				
HALF AHEAD				
SLOW AHEAD				

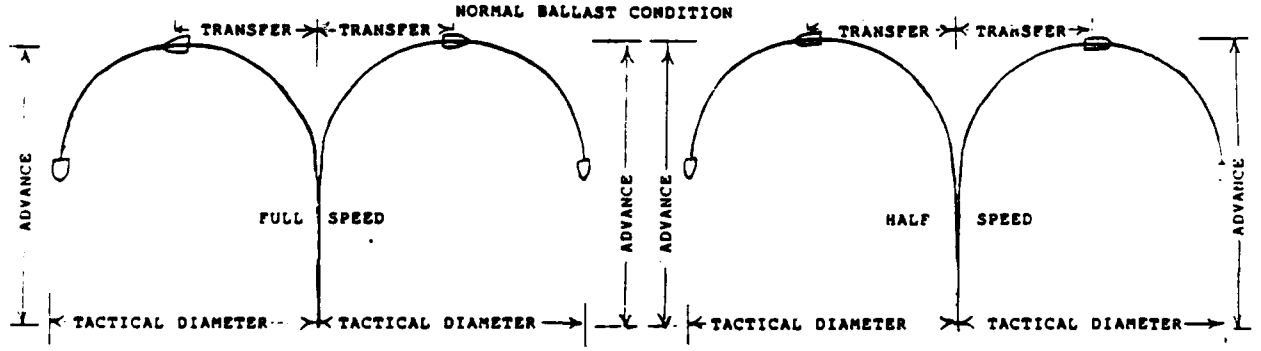
REMARKS: _____

Please fill in ADVANCE, TRANSFER, & TACTICAL DIAMETER distances.

NORMAL LOADED CONDITION



NORMAL BALLAST CONDITION



REMARKS: _____

_____

_____

_____

§ 164.35 Equipment: All vessels.

Each vessel must have the following:

(a) A marine radar system for surface navigation.

(b) An illuminated magnetic steering compass, mounted in a binnacle, that can be read at the vessel's main steering stand.

(c) A current magnetic compass deviation table or graph or compass comparison record for the steering compass, in the wheelhouse.

(d) A gyrocompass.

(e) An illuminated repeater for the gyrocompass required by paragraph (d) of this section that is at the main steering stand, unless that gyrocompass is illuminated and is at the main steering stand.

(f) An illuminated rudder angle indicator in the wheelhouse.

(g) The following maneuvering information prominently displayed on a fact sheet in the wheelhouse:

(1) A turning circle diagram to port and starboard that shows the time and distance and advance and transfer required to alter course 90 degrees with maximum rudder angle and constant power settings, for either full and half speeds, or for full and slow speeds. For vessels whose turning circles are essentially the same for both directions, a diagram showing a turning circle in one direction, with a note on the diagram stating that turns to port and starboard are essentially the same, may be substituted.

(2) The time and distance to stop the vessel from either full and half speeds, or from full and slow speeds, while maintaining approximately the initial heading with minimum application of the rudder.

(3) For each vessel with a fixed propeller, a table of shaft revolutions per minute for a representative range of speeds.

(4) For each vessel with a controllable pitch propeller, a table of control settings for a representative range of speeds.

(5) For each vessel that is fitted with an auxiliary device to assist in maneuvering, such as a bow thruster, a table of vessel speeds at which the auxiliary device is effective in maneuvering the vessel.

(6) The maneuvering information for the normal load and normal ballast condition for:

(i) Calm weather—wind 10 knots or less, calm sea;

(ii) No current;

(iii) Deep water conditions—water depth twice the vessel's draft or greater; and

(iv) Clean hull.

(7) At the bottom of the fact sheet, the following statement:

WARNING

The response of the (name of the vessel) may be different from that listed above if any of the following conditions, upon which the maneuvering information is based, are varied:

(1) Calm weather—wind 10 knots or less, calm sea;

(2) No current;

(3) Water depth twice the vessel's draft or greater;

(4) Clean hull; and

(5) Intermediate drafts or unusual trim.

(h) An echo depth sounding device.

(i) A device that can continuously record the depth readings of the vessel's echo depth sounding device, except when operating on the Great Lakes and their connecting and tributary waters.