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LEVEL II

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IMPACT OF THE FUTURE MERCHANT FLEET ON COAST GUARD OPERATING AND SUPPORT PROGRAMS OVER THE NEXT 25 YEARS

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16. Abstract The objectives of this study were to assemble a forecast of the composition of the future merchant fleet; to conduct a macro-level assessment of Coast Guard program requirements over the next 25 years; and to evaluate program action options. The study began by identifying Coast Guard operating and support programs likely to be affected by future merchant ships. Clientele which these programs serve were also identified and grouped. Merchant ship/fleet parameters were identified and evaluated for importance to Coast Guard programs by a panel of Maritime Administration and Coast Guard personnel. Each of 12 parameters was projected under conditions imposed by 3 different future scenarios. This analysis produced a list of issues of significance to the programs; profiles of the future fleet resulted from quantifying the assumptions, causes, and effects implied by the scenarios. Relationships among the issues, programs, and clientele groups were analyzed program by program to determine their combined effect. Program action options were recommended as a result of this analysis, and major implications for support programs not directly affected by the future fleet were identified. The study concluded that many Coast Guard programs (principally Commercial Vessel Safety and Port Safety and Security) will be affected and that hazardous materials and terrorism will result in major impacts on the Coast Guard.

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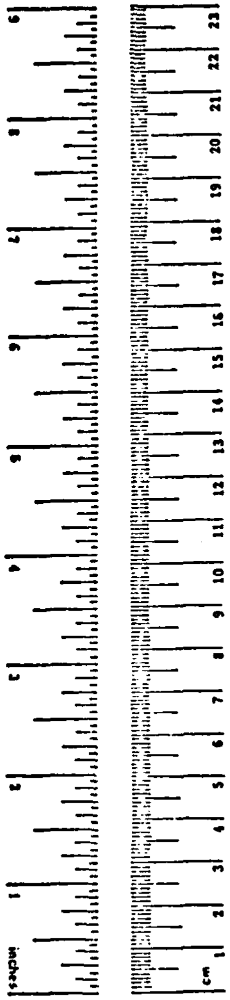
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

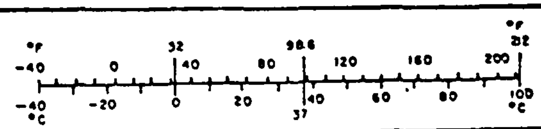
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	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	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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CHAPTER 1

INTRODUCTION

1.1 Background

Throughout history man has been engaged not only in trade but in waterborne trade. From its earliest beginnings to the present day the pattern of waterborne trade has remained the same; only trading partners, the commodities traded, and the vessels employed have changed. Furthermore, the rate of change has accelerated since World War II. Recent examples include the emergence of OPEC, enormous traffic in oil, super tankers, container ships, and barge carriers. Accompanying these developments, environmental concerns, intermodal systems, and growing interdependency among nations have become major socio-economic influences on the nature of trade and shipping. Moreover, these socio-economic influences are subject to political and economic vicissitudes, as the current energy crisis illustrates. Consequently, the relationships among trade, shipping, and socio-economic variables, and their implications for government agencies with public responsibilities in the maritime regime, have become much more difficult to recognize and predict.

The Maritime Administration and the US Coast Guard are two government agencies with major interests in the development of the future merchant fleet and the socio-economic environment within which the fleet will operate. Maritime Administration research and development programs and most Coast Guard operating and support programs will be affected as the future merchant fleet evolves. It is the purpose of this jointly-sponsored study to investigate these effects over the next 25 years so that the Maritime Administration and the Coast Guard may accommodate and be responsive to the needs and demands of the future merchant fleet.

1.2 Objectives of the Study

The objectives of the study are to:

- o Assemble a forecast of the composition of the future merchant fleet;
- o Conduct a macro-level assessment of Maritime Administration objectives and evaluate future MarAd R&D program options; and
- o Conduct a macro-level assessment of Coast Guard program requirements and evaluate future Coast Guard action options.

1.3 Major Assumptions

Several major assumptions have been made which provide a framework for the entire study. These assumptions are:

- o A general war will not occur.
- o An economic collapse of the West will not occur.
- o The Coast Guard will continue as a single organizational entity.
- o The Coast Guard's primary functions will remain centered around civil maritime matters.

1.4 Outline of the Study

The study outline and flow chart is illustrated in Figure 1-1. Because the study was jointly sponsored by MarAd and Coast Guard, two separate reports have been produced. Chapters 1 through 5 are common to both reports (as may be seen in the Figure), but the reports differ in Chapters 6 and 7, which have been tailored to each sponsor.

Chapter 2 discusses the identification of MarAd and Coast Guard programs and clientele. The interactive process by which a manageable number of parameters (merchant fleet-related trends) were selected and evaluated for importance by participating MarAd and Coast Guard personnel is explained as well. The final list of parameters collectively describes and characterizes the future

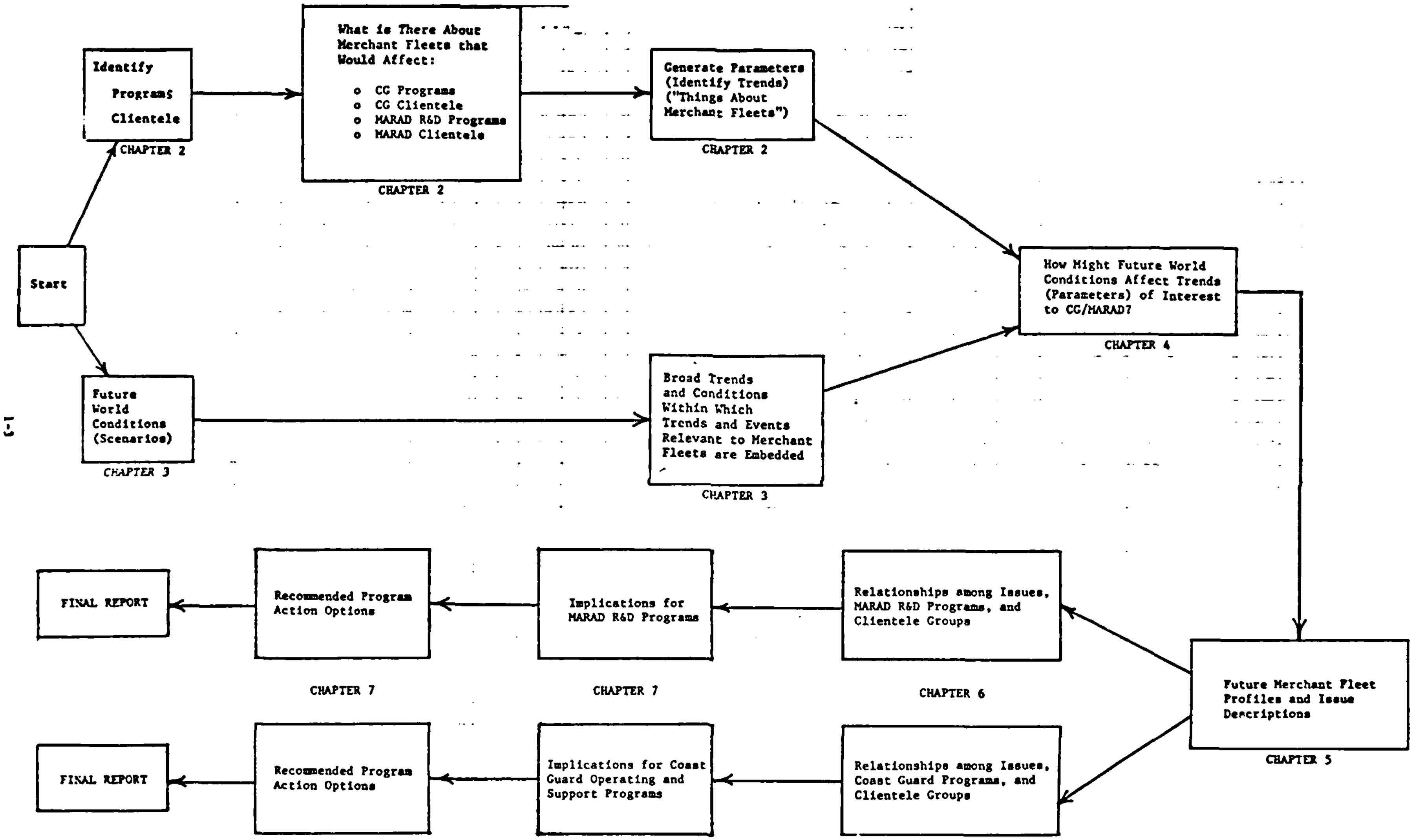


FIGURE 1-1. STUDY OUTLINE AND FLOW CHART

merchant fleet for the purposes of this study.

Drawing on an antecedent study,[1] three alternative scenarios describing possible future national and world conditions are summarized in Chapter 3. None of the scenarios is an extrapolation of recent history; they represent plausible but extreme directions of future development.

Extrapolations of the parameters are developed in Chapter 4 by analyzing parameter behavior under the influence of each of the scenarios. Since the parameters are time series trends, it is in this chapter that quantification of assumptions, causes, and effects produced definitive descriptions of the future merchant fleet.

Chapter 5 summarizes profiles of the future merchant fleet and issues of concern to MarAd and Coast Guard programs. These summaries are based on the analyses performed in Chapter 4.

Chapter 6 investigates the relationships among issues, programs, and clientele. The analysis describes the common interests shared by these three elements.

Each program is analyzed in Chapter 7 by considering the pertinent common interests, scenario influences, and program implications. Conclusions and recommendations are presented.

Detailed information and substantiating data are contained in numerous appendices. Footnotes appear at the end of the chapter wherein they are cited.

FOOTNOTE FOR CHAPTER 1

1. References A-8 and A-9.

CHAPTER 2
PARAMETER GENERATION AND SELECTION

2.1 Introduction

In order to assess the impact of future merchant fleets on the Coast Guard and the Maritime Administration, it is first necessary to develop a concept of what constitutes the future merchant fleet. A number of recent studies[1] have dealt with projections of merchant ship and merchant fleet characteristics, features, and related trends. None, however, has been performed with the express purpose of evaluating merchant ship/fleet implications for Coast Guard and Maritime Administration programs.

The initial task, therefore, has been to identify and evaluate, in terms of potential importance to CG and MarAd programs, a manageable number of significant characteristics or aspects of future merchant ships/fleets. A two-phase approach to this task, parameter generation and parameter selection, has been undertaken. Participation by knowledgeable Coast Guard and Maritime Administration personnel has been the key element in the process.

2.2 Parameter Generation

2.2.1 Process. To accomplish Phase 1, a Parameter Generation Workshop was convened to produce a list of "things about merchant ships/fleets." A small group technique known as "brainwriting" was employed by the participants listed in Table 2-1. Brainwriting is a creative exercise for generating lists of items; it is similar to the familiar "brainstorming" technique, except that it is performed in silence, with ideas being written rather than voiced. In order not to constrain the generation process, no evaluation of ideas is permitted.

TABLE 2-1

PARAMETER GENERATION WORKSHOP PARTICIPANTS

August 16, 1979

Name	FI/CG/MarAd	Office/Staff Symbol
C. F. McFadden	FI	
A. K. Nelsen	FI	
M. Ditto	CG	G-MP-3/MSM
F. J. Riemer	CG	G-MP-3///MSM
J. Feldman	CG	G-DP-2
T. J. Marhevko	CG	G-DSA-3
J. F. VerPlanck	CG	WLE-3
G. P. Wisnesky	CG	WLE-4
J. F. Kursbaun	CG	G-CPE
J. D. Bannan	CG	G-WLE-4
V. W. Rinehart	MarAd	M-940
J. E. Margeson, Jr.	CG	G-CPE

Five brainwriting sessions were performed; the sessions focused in turn on Ocean Usage, Ship Operations, Ship Characteristics, Land-Sea Interface, and Environmental, Safety, Legal Constraints. These five broad areas were intended to assure that participants would consider the whole range of the subject. Between sessions, participants had an opportunity to peruse the outline of each broad area (Table 2-2) and associated lists of CG/MarAd clientele. This information served to focus participants' thinking and stimulate ideas. Details of the Parameter Generation Workshop are contained in Appendix A.

2.2.2 Results. The 12 Parameter Generation Workshop participants, in the five brainwriting sessions, produced a list of 634 items (in less than two hours). The list (given in Appendix B, Table B-1), contains a wide variety of items with many identical, or nearly identical entries. An iterative process of reviewing, sorting, and aggregating under new descriptive headings was then undertaken. The 72 headings given in Appendix B, Table B-2, emerged.

Many of these headings address subjects which relate to the economic, societal, or political environment within which future merchant ships/fleets will exist or operate. In other words, many of these subjects are at a higher level or perspective than future merchant ships/fleets. Reasoning that these higher level concerns should be considered in conjunction with the scenarios (Chapter 3), it was possible to again reduce the list to the 34 candidate merchant ship/fleet parameters shown in Tables 2-3 through 2-5.

2.3 Parameter Selection

2.3.1 Process. Phase 2 of the parameter selection process, evaluation, began with the list of 34 candidate parameters. Coast Guard and Maritime Administration personnel were asked to judge the relative importance of each candidate parameter to their respective programs, first by ranking and then by magnitude estimation. Ranking

TABLE 2-2

BROAD AREAS OF CONCERN

A. OCEAN USAGE (100)

110 Marine Resource Exploration and Exploitation

111 Energy Extraction
112 Energy Production
113 Mineral Extraction
114 Food Hunting
115 Food Production (Mariculture)

120 Trade

121 Trade Routes (Origins/Destinations)

130 Trade Goods (Cargo Types)

131 Liquid Bulk
132 Dry Bulk
133 Ore
134 Slurry
135 Unitized
136 Manufactures/Semi-Manufactures
137 Quantities of Trade Goods
138 Shipping Information Processing

150 Defense

160 Oceanographic Research

161 Cartography

170 Recreation (Boating-Related)

180 Ecology Preservation, Development and Management

B. SHIP OPERATIONS (200)

210 Ship Movement/Routing/Navigation

211 Harbor
212 Coastal (Including Great Lakes)
213 High Seas

220 Weather Reporting and Dissemination

221 Ice Reporting and Dissemination

230 Ship Communication

231 Harbor
232 Coastal (Including Great Lakes)
233 High Seas

240 Ship Fueling and Revictualling

250 Cargo Allocation

260 Ships Manpower

261 Licensing of Officers
262 Certificating of Seamen
263 Training

270 Ship Operating Costs

C. SHIP CHARACTERISTICS (300)

310 Ship Documentation

311 Registry and Ownership
312 Certification
313 Admeasurement

320 Ship Construction and Repair

321 Construction Standards
322 Shipbuilding Practices (Including Research)
323 Main and Auxiliary Equipment (Including Research)

330 Ship Size

331 Tonnage
332 Draft
333 Beam
334 Length
335 Height

340 Ship Maneuverability

350 Basic Ship Designs

351 Conventional
352 Catamaran
353 Swath
354 Submersible
355 Surface Skimmer

360 Cargo Carrier Configuration

361 Hull-Borne
362 Towed
363 Lighter Aboard

364 Roll-On Roll-Off

D. LAND-SEA INTERFACE (400)

410 Inter-Modal Cargo Movement

420 Cargo Handling

421 Ship Operations
422 Terminal Operations

430 Port/Terminal

431 Cargo Throughput Capacity
432 Cargo Storage Capacity

440 Port/Terminal Manpower

441 Licensing/Certification
442 Training

E. ENVIRONMENTAL, SAFETY, LEGAL CONSTRAINTS (500)

510 Water Pollution Control

511 Deballasting/Tank Cleaning and Stripping
512 Port/Terminal Waste Transfer, Storage, Disposal
513 Oil Spill Prevention and Abatement
514 Ocean Dumping

520 Air Pollution Control

530 Hazardous Material Handling

540 Safety

541 Intra-Ship (Ship Operating Standards)
542 Inter-Ship
543 Land-Ship
544 Shipborne Cargo
545 Cargo Transfer
546 Terminal Storage
547 Personnel

560 Maritime Law Enforcement

561 Customs and Smuggling
562 Admiralty Law
565 Piracy, Barratry, Hijacking

570 Protection of Offshore Assets

is a simple, commonly used technique for establishing priorities. Manipulation of the resulting ordinal data is difficult, however. Magnitude estimation, on the other hand, produces information on a ratio scale (like most relationships in the physical sciences) to which all mathematical and statistical procedures may be applied. In magnitude estimation, the respondent is asked to express the value of some item in terms of a multiple or fraction of the value of some other item: "If A is worth 100, what is B worth?" Ranking of items is a useful preliminary step to magnitude estimation. Details of the parameter evaluations are contained in Appendices C, D, and E.

2.3.2 Results. Summaries of parameter importance estimates are given in Tables 2-3 through 2-5 for Maritime Administration, Coast Guard, and combined responses, respectively.[2] The combined summary represents responses from five MarAd and 11 CG participants, with MarAd responses double-weighted in order to achieve a balanced view of MarAd/CG importance estimates.

2.3.3 Parameter Selection Criteria. The following criteria have been used in selecting parameters for further analysis in the study:

1. The candidate parameter should be relatively important to MarAd, CG, or both.

2. The candidate parameter should be expressible as a trend, i.e., as time series data.

3. Historical data for the candidate parameter should be reasonably available.

4. The final list should include approximately 12 parameters.

To satisfy Criteria 1 and 4, parameters were tentatively selected as summarized in Appendix B, Table B-3, by considering the seven candidates highest-ranked by MarAd and by CG. (The distribution of candidate parameter weights may be seen in Appendix B, Figure B-1.)

TABLE 2-3

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

MEAN NORMALIZED RESPONSES BY THE GROUP OF 5 RESPONDENTS	MEAN SCORE	STANDARD DEV	RANK
1 190: TRAFFIC CONTROL AND PILOTAGE	0.03874	0.18052	10
2 210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	0.03298	0.01544	18
3 220: COLLISION/GROUNDING AVOIDANCE	0.05074	0.14512	4
4 240: COMMUNICATIONS	0.03971	0.01040	9
5 270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	0.02448	0.00976	26
6 280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	0.01913	0.01869	29
7 290: SHIP MANNING LEVELS	0.03538	0.01470	14
8 300: SHIP OPERATING COSTS	0.06072	0.01467	2
9 320: SPECIALIZATION OF SHIP TYPES	0.03584	0.01611	13
10 350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	0.06622	0.04199	1
11 350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	0.02652	0.01120	24
12 370: HULL FEATURES	0.00802	0.00551	33
13 390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	0.05753	0.01852	3
14 390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	0.03355	0.00679	16
15 400: SHIP CONSTRUCTION, GENERAL	0.04489	0.02217	6
16 410A: SHIP PROPULSION (TYPE OF PLANT)	0.03783	0.01479	11
17 410B: SHIP PROPULSION (FUEL CONSUMPTION)	0.04736	0.00611	5
18 410C: SHIP PROPULSION (HORSEPOWER)	0.02407	0.01389	27
19 420: SHIP SIZE	0.04099	0.02321	8
20 430: SHIP MANEUVERABILITY	0.02770	0.01935	23
21 440: SHIP DESIGNS, GENERAL	0.02857	0.03111	22
22 490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	0.03625	0.01551	12
23 490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	0.01753	0.00752	31
24 490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	0.01820	0.01954	30
25 520: CARGO HANDLING, SHIP	0.02927	0.02582	21
26 530: CARGO HANDLING, TERMINAL	0.03302	0.01729	17
27 540: PORT FACILITIES, GENERAL	0.03036	0.01769	19
28 550: SHIP TURN-AROUND TIME	0.04295	0.01594	7
29 560: HARBOR/CHANNEL IMPROVEMENT	0.03527	0.04160	15
30 570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	0.02162	0.01604	28
31 600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	0.02541	0.02293	25
32 600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	0.03025	0.01961	20
33 610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	0.01029	0.00394	32
34 610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	0.00527	0.00289	34

TABLE 2-4

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

MEAN NORMALIZED RESPONSES BY THE GROUP OF 11 RESPONDENTS	MEAN SCORE	STANDARD DEV	RANK
➡1 190: TRAFFIC CONTROL AND PILOTAGE	0.06216	0.02659	4
➡2 210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	0.05228	0.04294	6
➡3 220: COLLISION/GROUNDING AVOIDANCE	0.09827	0.07582	1
4 240: COMMUNICATIONS	0.06149	0.07991	5
5 270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	0.04131	0.09520	14
➡6 280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	0.05038	0.04459	8
7 290: SHIP MANNING LEVELS	0.04502	0.06498	12
➡8 300: SHIP OPERATING COSTS	0.03776	0.30390	17
9 320: SPECIALIZATION OF SHIP TYPES	0.03371	0.08587	23
➡10 350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	0.04377	0.23698	13
11 350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	0.02867	0.13165	26
12 370: HULL FEATURES	0.03851	0.10411	16
13 390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	0.08937	0.89724	3
14 390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	0.03574	0.11392	20
➡15 400: SHIP CONSTRUCTION, GENERAL	0.03242	0.10522	24
16 410A: SHIP PROPULSION (TYPE OF PLANT)	0.02620	0.07962	28
➡17 410B: SHIP PROPULSION (FUEL CONSUMPTION)	0.03517	0.16098	21
18 410C: SHIP PROPULSION (HORSEPOWER)	0.02252	0.05466	30
➡19 420: SHIP SIZE	0.04576	0.04423	11
➡20 430: SHIP MANEUVERABILITY	0.05190	0.05028	7
21 440: SHIP DESIGNS, GENERAL	0.03671	0.03074	19
22 490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	0.03457	0.15840	22
23 490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	0.03146	0.07115	25
24 490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	0.04001	0.18063	15
25 520: CARGO HANDLING, SHIP	0.04764	0.16523	9
26 530: CARGO HANDLING, TERMINAL	0.04744	0.20344	10
27 540: PORT FACILITIES, GENERAL	0.02816	0.05670	27
➡28 550: SHIP TURN-AROUND TIME	0.01974	0.06838	32
29 560: HARBOR/CHANNEL IMPROVEMENT	0.03774	0.05586	18
➡30 570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	0.08968	0.11023	2
31 600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	0.00841	0.02870	34
32 600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	0.01071	0.05453	33
33 610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	0.02041	0.06793	31
34 610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	0.02335	0.08582	29

TABLE 2-5

PARAMETER IMPORTANCE ESTIMATES

COMBINED MARAD/COAST GUARD RESPONSES

	MEAN NORMALIZED RESPONSES BY THE GROUP OF 21 RESPONDENTS	MEAN SCORE	STANDARD DEV	RANK
➡1	190: TRAFFIC CONTROL AND PILOTAGE	0.07231	0.19501	5
➡2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	0.04294	0.02900	13
➡3	220: COLLISION/GROUNDING AVOIDANCE	0.09095	0.18147	3
4	240: COMMUNICATIONS	0.04923	0.04072	8
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	0.03176	0.04188	26
➡6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	0.03690	0.04119	22
7	290: SHIP MANNING LEVELS	0.03967	0.03764	18
➡8	300: SHIP OPERATING COSTS	0.10564	0.66482	1
9	320: SPECIALIZATION OF SHIP TYPES	0.03812	0.06357	19
➡10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	0.08318	0.33356	4
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	0.03405	0.09206	24
12	370: HULL FEATURES	0.02033	0.03631	32
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	0.10550	0.51717	2
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	0.03969	0.07657	17
➡15	400: SHIP CONSTRUCTION, GENERAL	0.04783	0.11088	9
16	410A: SHIP PROPULSION (TYPE OF PLANT)	0.03990	0.08844	16
➡17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	0.06096	0.18828	6
18	410C: SHIP PROPULSION (HORSEPOWER)	0.02491	0.04034	29
➡19	420: SHIP SIZE	0.04266	0.03185	14
➡20	430: SHIP MANEUVERABILITY	0.04010	0.03488	15
21	440: SHIP DESIGNS, GENERAL	0.03201	0.02952	25
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	0.04562	0.12989	11
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	0.02332	0.03027	31
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	0.02558	0.05775	28
25	520: CARGO HANDLING, SHIP	0.03708	0.07288	21
26	530: CARGO HANDLING, TERMINAL	0.04351	0.10018	12
27	540: PORT FACILITIES, GENERAL	0.03042	0.04210	27
➡28	550: SHIP TURN-AROUND TIME	0.04728	0.14294	10
29	560: HARBOR/CHANNEL IMPROVEMENT	0.03489	0.04324	23
➡30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	0.05722	0.07602	7
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	0.02376	0.08564	30
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	0.03793	0.20789	20
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	0.01523	0.02628	33
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	0.01208	0.02392	34

It was subsequently found that most of the candidates also satisfied Criteria 2 and 3. Candidates 240 (Communications) and 390A (Construction Technologies: Shipbuilding Productivity) gave trouble, however. The Parameter Generation Workshop indicated interest primarily in short range (ship-to-ship, voice) communications. As a result of the Vessel Bridge-to-Bridge Radiotelephone Act of 1971 (PL 92-63), virtually all commercial vessels are required to have VHF capability. Since 99.71% of active marine radiotelephone station licenses had VHF allocations by October 1979,[3] this trend is no longer very interesting. There is probably some relationship between VHF capability and the incidence of collisions, but no quantifiable time series data could be found.

Shipbuilding productivity, as measured by compensated gross registered tonnage (CGRT) per average monthly ship construction employment, was investigated. (CGRT attempts to standardize the measure of effort required to build ships of different types and sizes). However, this ratio, applied to 1970-1978 data, varied so wildly (21.2 to 42.7) that its validity was suspect, corroborating earlier MarAd findings that "No method for its [shipbuilding productivity] accurate measurement has been found, nor has one been devised."[4]

Since Candidates 240 and 390A did not satisfy all criteria, a second selection was made. This second selection consisted of the eight candidates highest-ranked by MarAd and by CG, thereby adding Candidates 280 (Licensing/Certification of Ship Personnel) and 420 (Ship Size) to the initial list. By deleting Candidates 240 and 390A, a final list of 12 parameters which satisfied all selection criteria was obtained (see Table 2-6).

Up to this point the parameters had been stated in descriptive but imprecise terms. More precise parameter statements have evolved during the quantification process (which is discussed in detail in Appendices F-Q), and are given in Chapter 4.

TABLE 2-6

FINAL PARAMETER LIST

Traffic Control and Pilotage (Parameter 190)

Shipboard Navigation (Voyage Duration, Port-to-Port) (Parameter 210)

Collision/Grounding Avoidance (Parameter 220)

Licensing/Certification of Ship Personnel (Parameter 280)

Ship Operating Costs (Parameter 300)

Registry, Ownership and Certification of Ships (U.S. Fleet) (Parameter 350A)

Ship Construction, General (Parameter 400)

Ship Propulsion (Fuel Consumption) (Parameter 410B)

Ship Size (Parameter 420)

Ship Maneuverability (Parameter 430)

Ship Turn-Around Time (Parameter 550)

Harbor/Channel/Terminal Traffic (Traffic Density) (Parameter 570)

2.4 Summary

The parameter generation and selection process began by eliciting a long list of items of importance about future merchant ships/fleets from MarAd/CG participants. The list was reviewed, sorted, and aggregated under a shorter list of subject headings. High level subjects were then reserved for consideration with the scenarios (Chapter 3); the remaining, merchant fleet-oriented subjects (candidate parameters) were referred again to MarAd/CG participants for estimates of relative importance, and those candidates which satisfied the selection criteria have been adopted as the parameters. These 12 parameters collectively describe and characterize the future merchant fleet for the purposes of this study.

FOOTNOTES FOR CHAPTER 2

1. See References A-4 through A-7, A-19, A-20.

2. The summary importance estimates have been produced on the assumption that the group responses for each parameter should approximate a two-parameter log-normal distribution, i.e., that the distribution is unimodal and postively skew with a minimum value of zero (since minimum importance estimates greater than zero were required of the respondents). While a normal distribution might have been selected, skewness is apparent in the results (since mean scores are frequently less than 4 or 5 times the standard deviation), hence a log-normal distribution appears to be appropriate, although no statistical tests have been applied. See Reference F-10.

3. Reference F-11.

4. References B-21 and B-22.

CHAPTER 3

SCENARIO SUMMARIES

3.1 Introduction and Overview

Having identified merchant fleet parameters to be investigated in Chapter 2, the future conditions which would affect them were then postulated. To do this the three alternative future scenarios (Resource Allocation, Hardship, Expansive Growth) developed in the antecedent study[1] were employed. Each scenario represents a plausible chain of future developments and internally consistent relationships. The scenarios differ or diverge according to the themes suggested by their titles. None of the scenarios is an extrapolation of recent history. In a sense the scenarios delineate three extreme courses of future history. Actual developments may wend a course in the middle ground among these extremes.

Descriptions of the three scenarios are presented in this chapter. The original scenarios have been extended to 2005 (from 2000) and slightly modified to address those aspects of particular relevance to merchant fleets. Fundamental assumptions are given in Table 3-1. Charts and tables describing some of the important trends are also included at the end of the chapter. Many events have been considered in the development of the scenarios, and their occurrence or non-occurrence may be inferred from the scenario descriptions. In addition, a number of explicit merchant fleet-related events (Table 3-2) have been woven into the scenarios.

Each description concludes with a list of Major Problem Areas (MPAs) which succinctly summarize the scenario. Although two or more scenarios may imply some of

TABLE 3-1

FUNDAMENTAL SCENARIO ASSUMPTIONS

Characteristics	Resource Allocation	Hardship	Expansive Growth
Population Growth	Moderate (2.1 births per woman)	High (2.7 births per woman)	Low (1.7 births per woman
Gross National Product Growth	Moderate (3.4 percent average annual growth rate)	Low (1.9 percent average annual growth rate)	High (4.9 percent average annual growth rate)
Government Role	Substantial regulation for planned growth	Ineffective and incapable of any sustained policy direction	Little control, favoring a laissez faire economy
Unemployment Rate*	Moderate (6.5 percent	Very high (9 percent)	Low (6 percent)
Raw Materials	Emphasis on domestic sources and conservation	Limited exploitation of domestic resources	Full exploitation of domestic resources
International Relations	After a period of retrenchment, the United States provides a stabilizing influence in the last half of the period	The United States is isolationist and fortress-like	The United States is a dominant world power

*Five percent is assumed to be the unemployment rate at full employment.

TABLE 3-2

MARITIME EVENTS CONSIDERED

1. Waterborne transport develops a sharp competitive edge in the domestic transport of non-perishable bulk items.

2. Rebating in some form is permitted.

3. American carriers, ports and harbors are plagued by terrorists or pirates.

4. Numbers of jobs decline in traditional maritime occupations.

5. LNG terminal building program continues to expand.

6. Soviet merchant marine triples its carriage in the U.S. liner trades.

7. There is a major initiative from business or government (or both) to revitalize U.S. shipping and/or shipbuilding.

8. There is a global slump in the shipbuilding industry.

9. One or more American carriers declares bankruptcy.

10. Operating subsidies are increased to cover up to 100% of foreign levels.

11. U.S. liner trade conferences remain open.

12. Carriers are permitted to compete on the basis of rates as well as service, schedules.

13. Regulatory powers of the Federal Maritime Commission are expanded.

14. Limitations on subsidized lines are relaxed.

15. User taxes are applied to shipping, other forms of surface transportation.

16. U.S. Navy embarks on major building program to achieve numerical superiority over the Soviets in its non-carrier fleet.

17. Year-round shipping becomes feasible on the Great Lakes.

the same MPAs, this is not generally the case because the scenario themes are so different. Each scenario is therefore described by a unique set of MPAs which could affect the parameters. Chapter 4 analyzes the MPA influences on the parameters.

3.2 Summary of the Resource Allocation Scenario

3.2.1 Resource Allocation: 1980-1985. The background scenario assumes a major commitment to a federally coordinated effort to assist resource allocation and economic development. The emphasis is on moderation in energy use and the rate of economic growth and on cooperation among business, government and the citizenry. Urban revitalization and individual self-realization are also elements in the scenario. The new policies create some problems for the U.S. in its relations with a number of developing countries and with the European Community. Concern over global resource scarcities provides the basis for much of the conflict between the developing countries and the advanced industrial nations.

In the maritime environment, the 1980s open with continuing slumps in the shipbuilding industry and persistent problems within the American shipping industry, which is plagued with high costs, labor disputes and tough competition from state-supported carriers. At the same time, conflict over the regulation of the conferences continues between the Federal Maritime Commission and the Justice Department.

Against this background, in the early 1980s the U.S. formulates a new maritime policy, which is characterized by a strong bias toward federal regulation and a continuing concern about possible antitrust violations. The new policy includes open conferences, prohibition of rebates, a strengthened Federal Maritime Commission, competition on the basis of rates within the conferences, increased ceilings on operating and construction subsidies, and a somewhat greater permissiveness in allowing subsidized ships to operate in the foreign-to-foreign trades at least on a temporary basis.

There is relatively little immediate relief derived from the new policy, primarily because of the heavy demands being made on existing federal funds by other elements of the resource allocation policy. Internationally, the often strained relations between the U.S. and its trading partners do little to aid the U.S. shipping industry. In spite of numerous rearrangements which occur in international trade patterns during this period, the net effect on U.S. flag ships is relatively slight. Domestic development of resources serves to increase domestic waterborne traffic, however, and intensify the demand for port and harbor development. The shipyards remain depressed, labor unrest prevails, and the federal government finally initiates a retraining program aimed at enhancing the flexibility of the maritime labor force.

In sum, by 1985 the United States has a new maritime policy, but the maritime industries have as yet experienced little relief. The national preoccupation with resource management and urban development has left little time or funds for addressing the special problems of the maritime industries.

3.2.2 Resource Allocation: 1985-2005. During this period the economy seems to be running smoothly, although the country has developed a certain dependence on federally planned initiatives. Coordinated planning is benefiting business and municipal governments and helping to provide the nation with a well-coordinated transportation system, supported by an advanced telecommunications system. The national success with resource allocation is gradually restoring the U.S. to its former prominence in world politics, as the U.S. is viewed as a model for developed country resource management. This period witnesses a steady improvement in the relationships between developed and developing countries and the formulation of a united developed-country policy on petroleum development, which effectively reduces the power of OPEC.

The smooth functioning of the national economy after 1985 enables the Congress to turn its attention to previously neglected problem areas, including the state of the U.S. merchant marine. At this time the federal government allocates increased subsidy funds and also commits itself to substantially increasing the size of the Navy. Both of these policies have an immediate impact on the U.S. shipyards, which find themselves deluged with orders. The new orders, however, bring to the surface some of the underlying tensions within the shipbuilding industry, and new agreements, which call for stepped-up automation of the yards and retraining programs for superfluous workers, are worked out among the yards, the affected unions, and the federal government.

In general, the merchant marine is prospering, though subsidized ships in particular still find it difficult to compete in many instances. As the U.S. takes the lead in recognizing Third World claims for more equitable price levels for non-renewable resources, there are often side-effects, including the negotiation of bilateral agreements and the opening of new markets to U.S. goods, that increase the trade share of U.S. flag ships.

Domestically, the shipping industry continues to enjoy an enhanced competitive position as the waterborne mode is favored for the shipment of raw materials and hazardous substances. As shipping levels increase in every sector of waterborne trade, the demands for port development, harbor improvement, and the creation of deepwater ports place a heavy burden on available funding sources.

3.2.3 Major Problem Areas. Table 3-3 is a concise list of Major Problem Areas arising in Scenario R. These MPAs were identified in the antecedent study[2] which serves as a basis for this more detailed analysis.

TABLE 3-3

MAJOR PROBLEM AREAS IN THE RESOURCE ALLOCATION SCENARIO

1. Generally depressed U.S. shipbuilding industry, some recovery after 1990.

2. Conflicts between the navy and the merchant marine over utilization of available shipbuilding capacity.

3. Shortage of funds for construction subsidies, eases somewhat after 1990.

4. Shifting trade routes, demand for fleet flexibility.

5. Upward cost pressures on building, labor, safety, energy (averaging 4-5% a year).

6. Lagging port development (including deepwater) because of resistance or lack of funds.

7. Security problems in foreign ports, especially in the 1980s.

8. Unemployment in the traditional maritime trades because of depressed trade in the 1980s.

9. Concentration of liner traffic in a small number of major ports.

10. Growth in the non-liner trades.

11. Increased demand for waterborne transport of energy-raw materials domestically.

12. Heavy demand on waterborne mode for transportation of hazardous cargo.

13. Demand for increased use of alternative fuels in waterborne shipping.

14. Demand for rapid, extensive introduction of automation and computer-controlled production procedures and use of advanced design in the shipbuilding industry.

15. Demand for intermodal coordination.

3.3 Summary of Hardship Scenario

3.3.1 Hardship Scenario: 1980-1985. In this background scenario, the economic problems of the late 1970s persist into the early 1980s. Problems of reconciling resource demands and supplies, rising inflation and low economic growth remain as neither the public nor the private sector seems capable of coping with the gathering crisis.

Government initiatives, though usually inadequate or even counter-productive, keep government spending high. Industry, on the other hand, finds itself facing capital shortages and crippling strikes. Recurrent scarcities of raw materials lead the government to attempt energy and resource rationing by 1985, but this only compounds the economic disorientation. As unemployment continues to be high, the public's demands for jobs thwart the progress of automation. All modes of transportation are strained to the limit as revenues prove inadequate to meet maintenance and capital needs.

Internationally, the U.S. becomes increasingly isolationist during the early 1980s. U.S. capacity for effective action in international relations is reduced by domestic social unrest and economic stagnation, even as the military capabilities and diplomatic and economic influence of America's adversaries are increasing. American relations with traditional trading partners among the developed countries are strained.

Although by the early 1930s the problems of the maritime industries are of major proportions, with mortgage defaults, overtonnaging, and high unemployment common, neither the public nor the private sector seems capable of providing relief. The federal agencies primarily concerned with the regulatiion of the maritime industries seem almost totally immersed in internal struggles for control of maritime policy. Just as the carriers and shippers blame their troubles on the federal government, the agencies blame the carriers themselves for overtonnaging and ascribe industry losses to poor management, ineffective planning and general inefficiency. Piecemeal legislation attempted by the Congress to relieve some of the most serious problems merely exacerbates the difficulties.

As bilateral agreements proliferate in international trade, the U.S. is frequently the loser. The U.S. finds itself frozen out of many markets and left with little leverage for negotiating equal access agreements for American carriers. At the same time, continued dependence on imported oil and on transshipping imports from the Caribbean lead to increasing port congestion in some gulf ports. Despite the fact that domestic trade fails to reach anticipated levels, delays are frequent and intermodal connections difficult at best. Smaller ships and smaller ports gain new importance in the coastwise trade. Insufficient funds for port development and other maritime-related industries impede efforts to retrain the growing ranks of unemployed maritime workers.

3.3.2 Hardship: 1985-2005. Following years of sluggish growth, the economy is hit by a serious recession in the early 1990s. Increased government spending fails to provide the spark needed to bring the recovery of private industry. Unemployment, inflation and popular discontent are growing apace. Capital shortages persist, as does lagging technological development. Energy and raw materials shortages, municipal bankruptcies, and the raising of prohibitive barriers against U.S. exports all preoccupy the government. Unfortunately, no consensus on appropriate domestic economic policy apears to exist.

Because of deteriorating economic conditions at home, the federal government is forced to play an enlarged role in the management of the transportation system. Nationalization of all public interstate transportation occurs in the mid-1990s. Multi-state regional authorities are used to further intermodal coordination.

The general decline of the U.S. and its withdrawal or exclusion from major world markets depresses international trade and investment. The dollar is no longer the major international currency. International cooperative efforts dwindle to a low unprecedented in modern times.

In spite of spasmodic efforts to improve the American share of U.S. waterborne foreign trade through cargo preferences, the lack of a unified policy initiative actually results in a declining share of trade being carried in U.S. bottoms. The port and harbor facilities of the U.S. are progressively deteriorating, again in the face of insufficient funds and a lack of concerted effort to overcome deficiencies. American shipyards, unable to compete for orders despite existing subsidies, are closing down. By the late 1980s, American foreign trade, particularly exports, is considerably short of projected levels, and the total dependence of the U.S. on foreign carriers seems the likely outcome of converging trends.

After more sporadic legislation again fails to alleviate the problems of the merchant marine, it finally becomes the first of the transport elements to be nationalized in the mid-1990s. Although this marks the beginning of a desperate effort to upgrade the oceangoing transportation system, funds remain limited. Efforts are made to institute automation in shipbuilding and plans are laid to begin updating the aging merchant fleet. Nationalization does not benefit the inland waterway system. Since the railroads are in more immediate need of upgrading, available funds are channeled to them rather than to the waterway system. Generally no great improvement is in sight.

3.3.3 Major Problem Areas. Table 3-4 is a concise list of Major Problem Areas arising in Scenario H. These MPAs were identified in the antecedent study[2] which serves as a basis for this more detailed analysis.

TABLE 3-4

MAJOR PROBLEM AREAS IN THE HARDSHIP SCENARIO

1. Prolonged depression in the U.S. shipbuilding industry results in aging U.S. merchant fleet.

2. Severe capital shortages in all areas (R&D, ports, shipping, etc.).

3. Deteriorated/congested port and harbor facilities; inadequate port development, including LNG, deepwater.

4. Depressed trade levels, both import/export and domestic.

5. Poorly coordinated intermodal networks.

6. Growing significance of the small port leads to strong demand for RoRos, small break-bulk carriers in the coastal trades.

7. Persistent unemployment in traditional maritime trades leads to labor opposition to automation.

8. Severe energy problems, including rising energy costs, rationing, uncertain sources of supply.

9. Security problems at U.S. docks, shipyards, harbors.

10. Security problems at foreign ports.

11. Growing dependence on foreign carriers.

12. Fluctuating levels of military preference cargo.

13. Diplomatic problems over U.S. maritime and economic policies.

3.4 Summary of the Expansive Growth Scenario

3.4.1 Expansive Growth: 1980-1985. The background scenario is one of confident free enterprise and relatively rapid economic growth. The role of government is a supportive one. Funds for research and development are expanded as the nation renews its confidence in technological innovation to solve many of the nation's problems. Production of domestic resources of energy is expanded. At the same time, the decentralization process continues as the suburbs proliferate, placing special demands on the mass transportation networks. Internationally, U.S. policy is noticeably imperialistic, as short-term self-interest increasingly defines the relationship of the U.S. with other countries.

By 1980, the depression in the shipbuilding industry, the sliding share of foreign trade enjoyed by the U.S. flag fleet, and continuing conflict over regulation have made it clear that the time for reevaluation of the status of the American merchant marine is at hand. In reaffirming the national commitment to the existence of a merchant marine, the federal government accepts the idea of long-term financial support for the industry. Congress enacts legislation permitting closed conferences, pooling among U.S. carriers, tying devices and a degree of self-policing, at the same time empowering the Federal Maritime Commission to establish "reasonable" rate limits. Rates are to be based on the actual cost of transport; restrictions on dividends that can be paid by subsidized carriers will be eliminated. Unsubsidized carriers will qualify for general tax advantages and will continue to enjoy cargo preference and somewhat greater flexibility in trade. The new legislation also includes minimum crew size goals. Efforts will be made to alleviate the problems of the American shipyards by expanding available R&D funds and the Construction Differential Subsidy.

Although U.S. efforts to expand export trade do not meet with immediate success, ongoing efforts to establish bilateral agreements with a number of suppliers of raw materials lead to shipping agreements favorable to U.S. flag ships. The U.S. also moves to protect its access to foreign supplies by encouraging the expansion of the fleet of dry bulk carriers and supertankers and the rapid completion of the necessary deepwater ports to handle the supertankers.

During this period a number of problems are developing which affect the ports. Decentralization of industry and population increases the demand for efficient intermodal networks. Ports are becoming increasingly congested. At the request of affected businesses, the U.S. undertakes a study to determine how best to marshal the necessary efforts for upgrading the port system. Internally, the demand for the waterborne mode for transporting raw materials and energy and various hazardous substances grows rapidly.

3.4.2 Expansive Growth: 1985-2005. Domestically, the American economy is booming, as private sector initiatives, supported by federal cooperation, lead to high rates of growth. There is a high demand for labor and for all types of transportation. Energy requirements are also high, but delivery systems are adequate and supplies are no problem. Internationally, the U.S. continues its imperialistic policies and becomes more and more distrusted, even as trade continues to grow. Terrorism becomes an ever-present problem.

As the U.S. opts for affluence and pursues policies that increasingly isolate it from its allies, the nation comes to view the merchant marine as a vital industry, designed to serve American business and the larger national interest. Because of this definition, the merchant marine is treated in a much different way from most other major American businesses. It continues to be subject to a substantial amount of control, though this is more because major export businesses demand it than because of a strong regulatory posture on the part of the federal government. By the end of the century the shipping industry is relatively profitable. A policy of expanding both the naval and merchant fleets maintains U.S. shipyards operating at capacity levels.

Automation increases rapidly in the shipyards; workers in the traditional maritime industries are found new jobs in related industries. Because of the growing problem of terrorism, however, crew sizes cannot be reduced as drastically as planned. Domestic shipping is thriving, though both trucks and railroads are more competitive than previously. Both security requirements and competition complicate efficient intermodal coordination. Port and harbor development appears to be keeping pace with demand.

3.4.3 Major Problem Areas. Table 3-5 is a concise list of Major Problem Areas arising in Scenario E. These MPAs were identified in the antecedent study[2] which serves as a basis for this more detailed analysis.

3.5 Key Trends

The following pages contain the tabular and graphic displays of key trends utilized in constructing the original scenarios. Trend titles are listed below for ease of reference.

Table	Figure	
3-6	3-1	Total U.S. Population Including Armed Forces Overseas
3-7	3-2	Gross National Product of the United States
3-8	3-3	U.S. Inflation Rate
3-9	3-4	Index of Industrial Production
3-10	3-5	U.S. Business Expenditures for New Plant and Equipment
3-11	3-6	Total Government (Federal, State, Local) Expenditures as a Percentage of Gross National Product

TABLE 3-5

MAJOR PROBLEM AREAS IN THE EXPANSIVE GROWTH SCENARIO

1. Strong demand for technologically advanced ship designs.

2. Need to be able to import energy and raw materials in U.S. ships (supertankers, dry bulk carriers).

3. Demand for port development, redesign, including deepwater ports, LNG terminals.

4. Soaring energy costs lead to demand for nuclear-powered vessels.

5. Need for improvement of intermodal systems spurred by decentralization of industry and population and increased competition among major modes of domestic transport.

6. Rapid growth in demand for domestic, including Great Lakes, waterborne transportation.

7. Shifting trade routes, import patterns, but overall strong growth in volume.

8. Overlapping agency jurisdictions in ports and harbors.

9. Security problems in foreign ports.

10. Security problems in U.S. ports and offshore installations.

11. Heavy demand on existing shipyards from both naval and merchant marine orders.

12. Increased demand for convertibility of skills in the maritime industry labor force.

13. Diplomatic difficulties over U.S. maritime and economic policies.

3-12	3-7	Total Labor Force Participation Rate
3-13	3-8	Ratio of Domestic Production of Crude Oil and Natural Gas Liquids to Domestic Demand for Refined Products
3-14	3-9	Foreign Waterborne Commerce of the United States
3-15	3-10	Fraction of U..S. Waterborne Foreign Trade Carried in U.S. Ships (Imports and Exports by Tonnage for all Services)

TABLE 3-6

TOTAL U.S. POPULATION INCLUDING ARMED FORCES OVERSEAS

(Millions)

HISTORICAL DATA

1950	152.3	1964	191.9
1951	154.9	1965	194.3
1952	157.6	1966	196.6
1953	160.2	1967	198.7
1954	163.0	1969	202.7
1955	165.9	1970	204.9
1956	168.9	1971	207.1
1957	172.0	1972	208.8
1958	174.9	1973	210.4
1959	177.8	1974	211.9
1960	180.7	1975	213.6
1961	183.7	1976	215.1
1962	186.5	1977	216.9
1963	189.2	1978	218.5

PROJECTED DATA

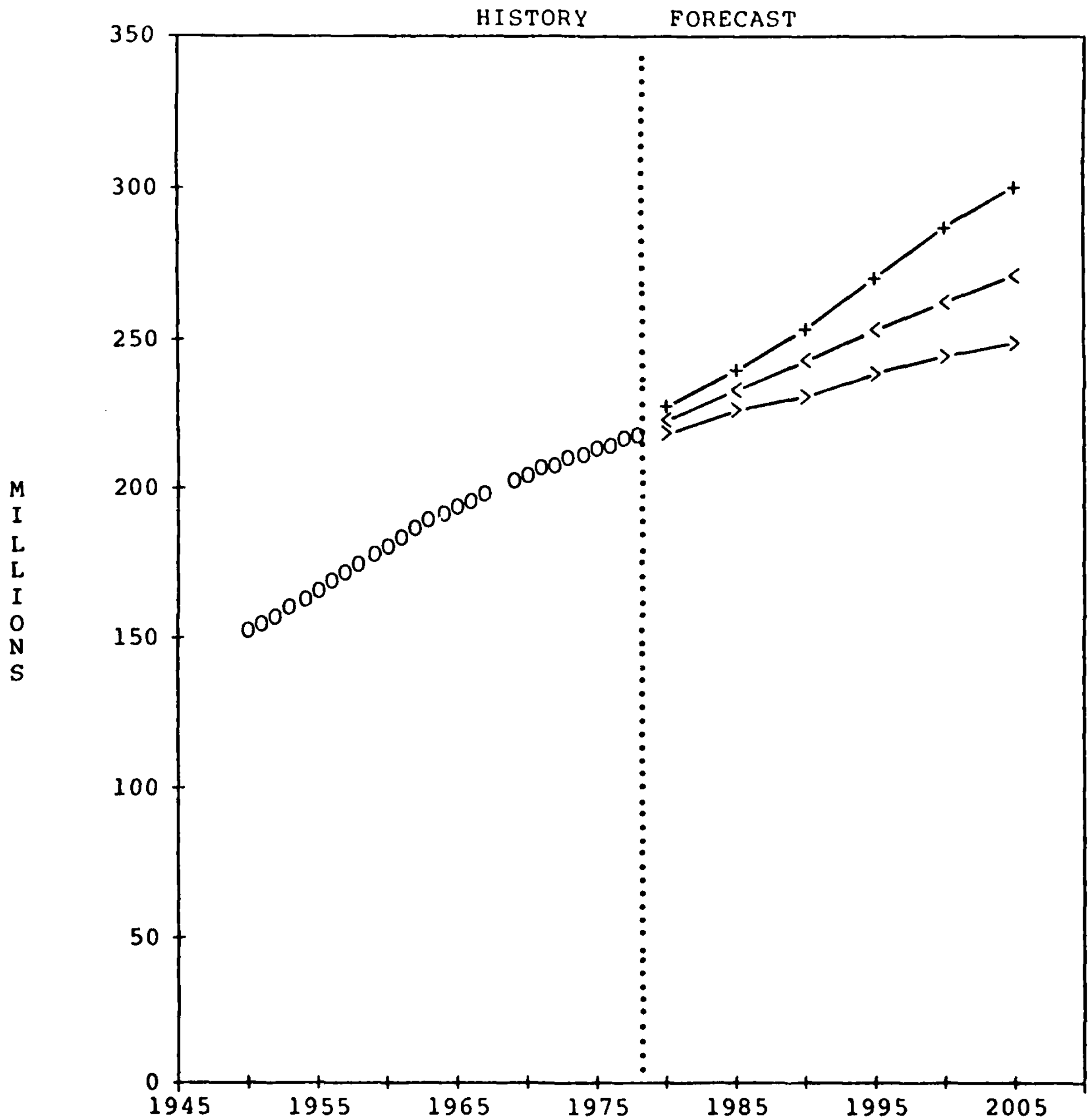
	SCENARIO		
	R	H	E
1980	224	228	220
1985	234	241	227
1990	244	253	232
1995	253	271	239
2000	262	287	245
2005	272	301	250

SOURCE 1

U.S. Department of Commerce. Bureau of Economic Analysis. Business Statistics, 1977. Washington, D.C.: Government Printing Office, March, 1978.

SOURCE 2

U.S. President. Economic Report of the President; Transmitted to the Congress January 1979. Washington, D.C.: Government Printing Office, 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-6: SOURCE 1 (p.68) and SOURCE 2 (p.6)

FIGURE 3-1. TOTAL U.S. POPULATION INCLUDING ARMED FORCES OVERSEAS

TABLE 3-7

GROSS NATIONAL PRODUCT OF THE UNITED STATES
(CONSTANT 1978 DOLLARS)

(Billions)

HISTORICAL DATA

1950	811.4	1965	1408.2
1951	876.8	1966	1492.1
1952	910.3	1967	1532.7
1953	945.7	1968	1599.7
1954	933.4	1969	1640.8
1955	995.9	1970	1635.0
1956	1017.2	1971	1683.7
1957	1035.6	1972	1781.1
1958	1033.5	1973	1878.4
1959	1095.7	1974	1852.2
1960	1120.6	1975	1828.6
1961	1148.8	1976	1933.2
1962	1215.4	1977	2027.0
1963	1263.4	1978	2106.7
1964	1329.8		

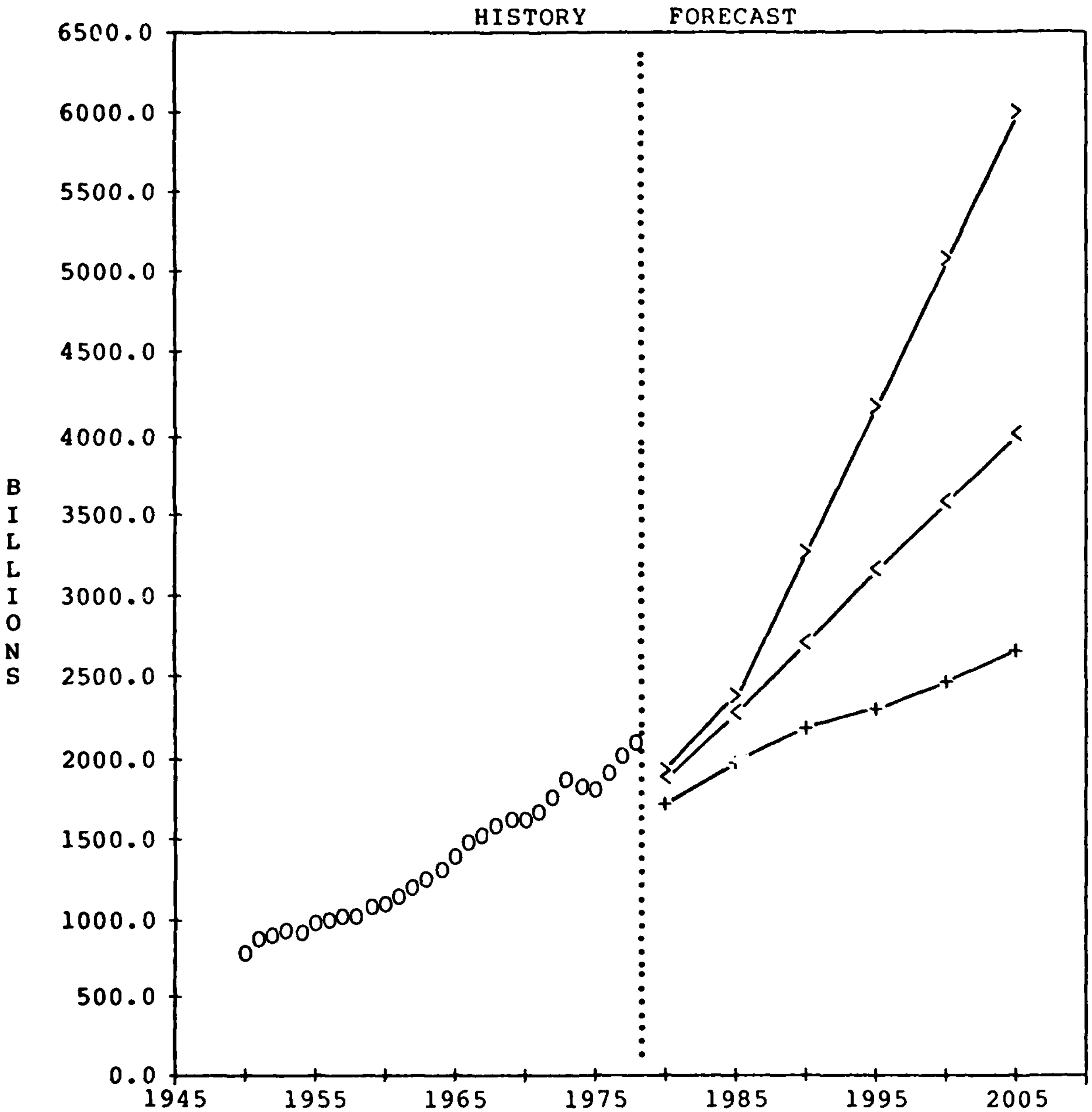
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	1900.0	1750.0	1950.0
1985	2300.0	2000.0	2400.0
1990	2740.0	2170.0	3300.0
1995	3170.0	2330.0	4200.0
2000	3600.0	2500.0	5100.0
2005	4040.0	2670.0	6010.0

Figures were calculated from constant 1972 dollars using a conversion factor of 1.5209.

SOURCE

U.S. President. Economic Report of the President; Transmitted to the Congress January 1979. Washington, D.C.: Government Printing Office, 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-7: SOURCE CITED (p.184)

FIGURE 3-2. GROSS NATIONAL PRODUCT OF THE UNITED STATES (CONSTANT 1978 DOLLARS)

TABLE 3-8

U.S. INFLATION RATE
(ANNUAL CHANGE IN GNP PRICE DEFLATOR)

(Percent)

HISTORICAL DATA

1930	-2.2	1947	11.7	1964	1.4
1931	-9.5	1948	6.9	1965	0.4
1932	-10.0	1949	-0.6	1966	4.7
1933	-2.2	1950	1.1	1967	1.2
1934	7.3	1951	7.0	1968	4.6
1935	0.5	1952	2.1	1969	5.0
1936	0.5	1953	1.0	1970	5.4
1937	4.2	1954	1.5	1971	5.0
1938	-1.5	1955	1.7	1972	4.1
1939	-1.5	1956	3.2	1973	5.9
1940	1.5	1957	3.5	1974	9.6
1941	7.6	1958	2.7	1975	9.6
1942	12.3	1959	1.6	1976	5.3
1943	7.1	1960	1.8	1977	5.8
1944	2.7	1961	1.3	1978	7.4
1945	2.3	1962	1.1		
1946	11.9	1963	1.5		

PROJECTED DATA

SCENARIO

	R	H	E		R	H	E
1980	7.0	9.0	5.0	1995	3.5	9.0	5.0
1985	7.0	9.0	5.0	2000	3.5	9.0	5.0
1990	7.0	9.0	5.0	2005	3.5	9.0	5.0

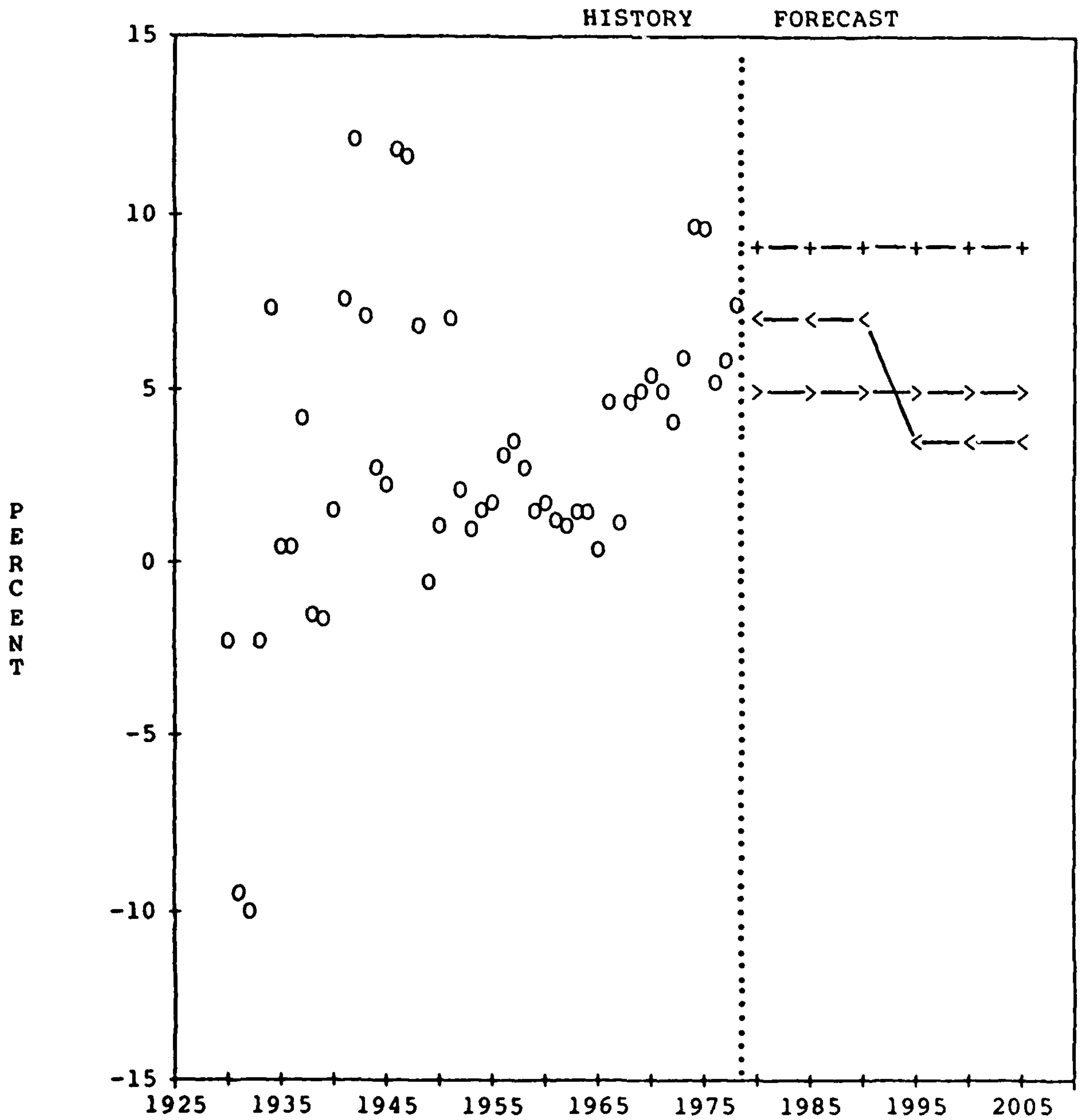
Data before 1965, based on the GNP of 1958, and data for 1965-1977, based on the GNP of 1972, has been converted to 1978 as a base year using conversion factors of 222.2 and 152.1, respectively.

SOURCE 1

U.S. Department of Commerce. Bureau of the Census. Statistical Abstracts of the United States. Washington, D.C.: Government Printing Office, annual.

SOURCE 2

U.S. Department of Commerce. Bureau of the Census. Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition, pt. I. Washington, D.C.: Government Printing Office, 1975.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-8: SOURCE 1 (Issues for 1970-1979)
and SOURCE 2 (Part I)

FIGURE 3-3. U.S. INFLATION RATE
(ANNUAL CHANGE IN GNP PRICE DEFLATOR)

TABLE 3-9

INDEX OF INDUSTRIAL PRODUCTION

(Index (1967 = 100))

HISTORICAL DATA

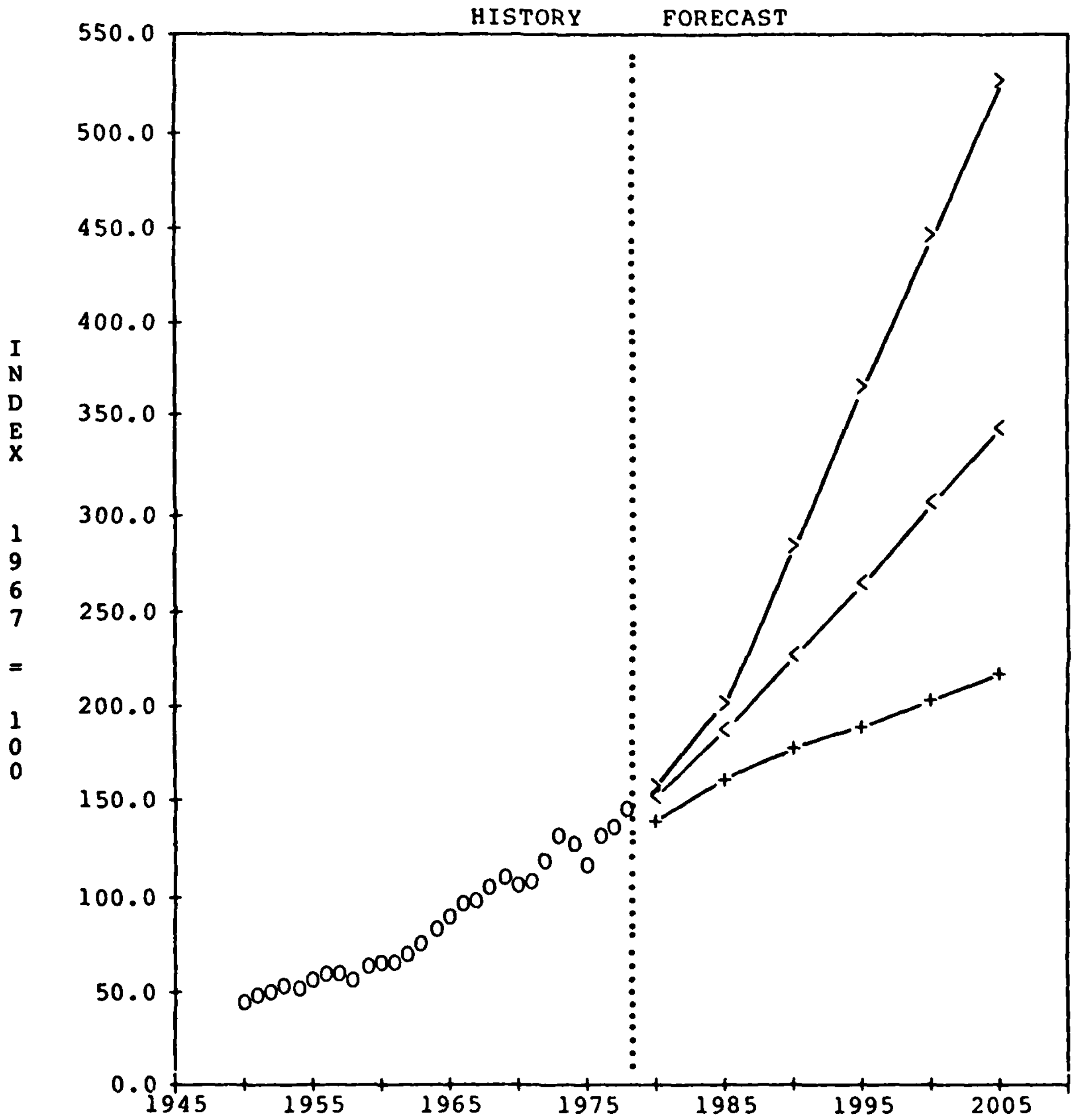
1950	44.9	1965	89.8
1951	48.7	1966	97.8
1952	50.6	1967	100.0
1953	54.8	1968	106.3
1954	51.9	1969	111.1
1955	58.5	1970	107.8
1956	61.1	1971	109.6
1957	61.9	1972	119.7
1958	57.9	1973	129.8
1959	64.8	1974	129.3
1960	66.2	1975	117.8
1961	66.7	1976	129.8
1962	72.2	1977	137.1
1963	76.5	1978	145.1
1964	81.7		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	152.0	141.0	160.0
1985	188.0	163.0	202.0
1990	227.0	178.0	285.0
1995	267.0	191.0	368.0
2000	308.0	204.0	448.0
2005	346.0	218.0	528.0

SOURCE

U.S. Department of Commerce. Bureau of Economic Analysis. Business Statistics, 1977. Washington, D.C.: Government Printing Office, March, 1978.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-9: SOURCE CITED (p.19)

FIGURE 3-4. INDEX OF INDUSTRIAL PRODUCTION

TABLE 3-10

U.S. BUSINESS EXPENDITURES FOR NEW PLANT AND EQUIPMENT

(Billions of dollars)

HISTORICAL DATA

1950	20.21	1971	81.21
1955	29.53	1972	88.44
1960	36.75	1973	99.74
1965	54.42	1974	112.40
1966	63.51	1975	112.78
1967	65.47	1976	120.49
1968	67.76	1977	135.80
1969	75.56	1978	153.82
1970	79.71	1979	173.33

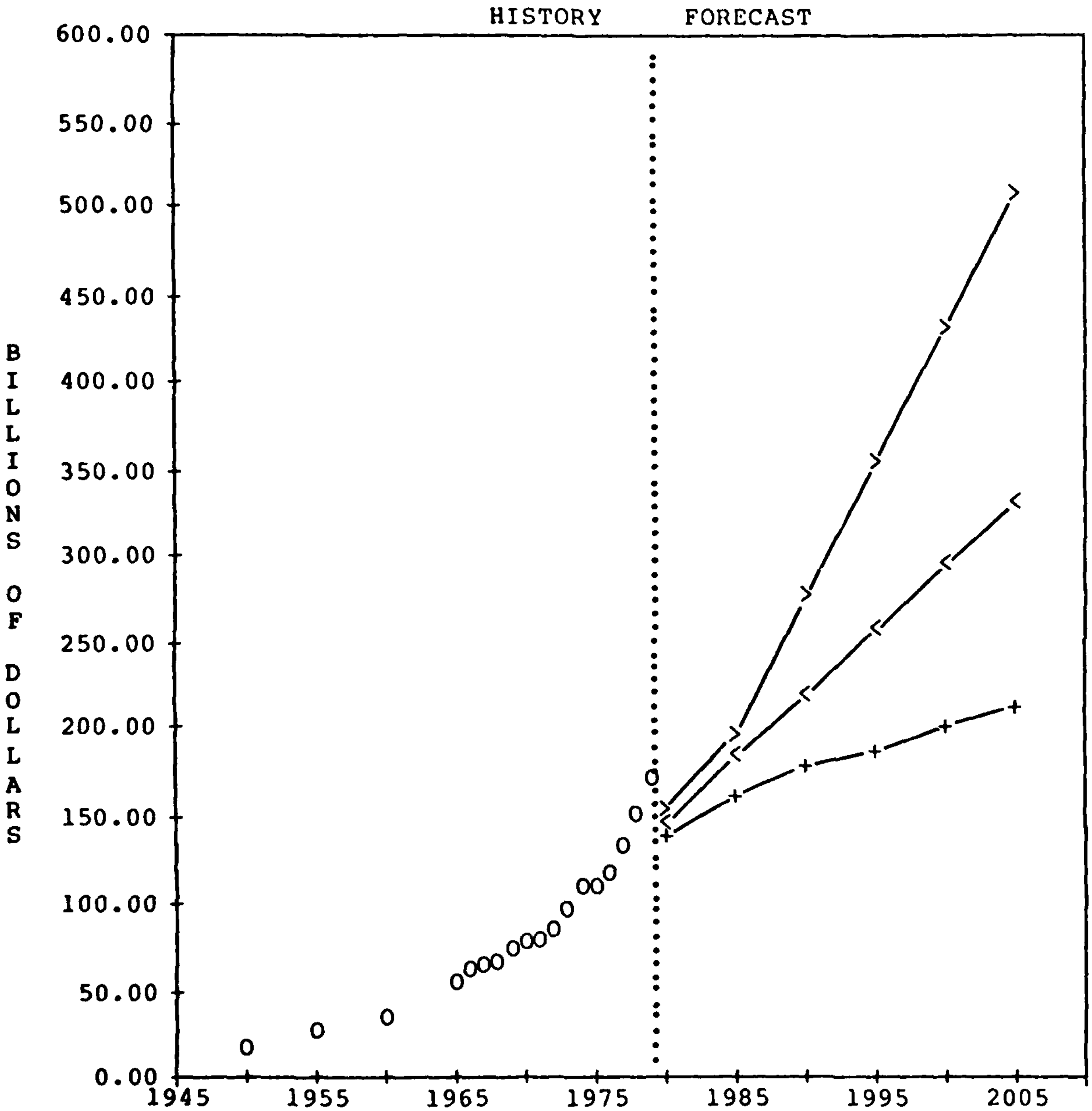
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	150.00	139.00	157.00
1985	187.00	164.00	200.00
1990	222.00	178.00	278.00
1995	260.00	190.00	355.00
2000	298.00	201.00	431.00
2005	332.00	214.00	510.00

Data exclude expenditures of agricultural business, professionals, institutions, and real estate firms, and current account outlays.

SOURCE

U.S. Department of Commerce. Bureau of the Census. Statistical Abstracts of the United States. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-10: SOURCE CITED (Issues for 1970,74,79)

FIGURE 3-5. U.S. BUSINESS EXPENDITURES FOR NEW PLANT AND EQUIPMENT

TABLE 3-11

TOTAL GOVERNMENT (FEDERAL, STATE, LOCAL) EXPENDITURES AS A PERCENTAGE OF GROSS NATIONAL PRODUCT

(Percent)

HISTORICAL DATA

1950	21.0	1960	26.0	1970	31.7
1951	23.9	1961	28.4	1971	32.0
1952	27.0	1962	28.4	1972	31.6
1953	27.7	1963	28.2	1973	30.9
1954	26.4	1964	27.7	1974	32.4
1955	24.5	1965	27.2	1975	34.8
1956	24.8	1966	28.3	1976	33.4
1957	26.0	1967	30.4	1977	32.9
1958	28.4	1968	30.9	1978	32.4
1959	26.9	1969	30.5		

PROJECTED DATA

	SCENARIO R	SCENARIO H	SCENARIO E
1980	38.5	38.5	38.5
1985	42.0	42.0	38.0
1990	47.0	47.0	40.0
1995	52.0	52.0	43.2
2000	57.0	57.0	46.0
2005	62.0	62.0	48.9

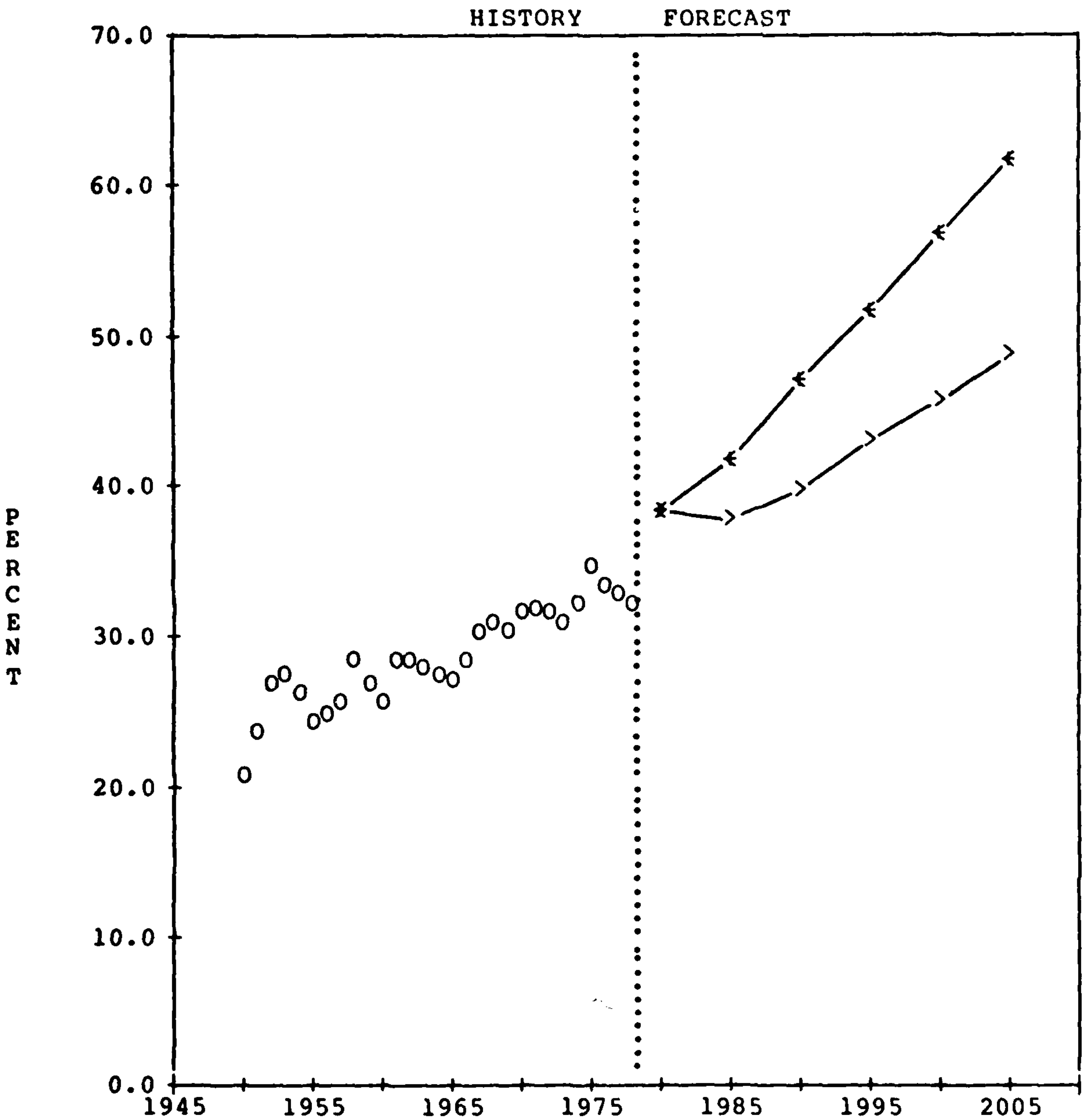
Calculated by dividing total government expenditures by GNP.

SOURCE 1

U.S. Department of Commerce. Bureau of Economic Analysis. Business Statistics, 1977. Washington, D.C.: Government Printing Office, March, 1978.

SOURCE 2

U.S. President. Economic Report of the President; Transmitted to the Congress January 1979. Washington, D.C.: Government Printing Office, 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-11: SOURCE 1 (p.1) and SOURCE 2 (p.267)

FIGURE 3-6. TOTAL GOVERNMENT (FEDERAL, STATE, LOCAL) EXPENDITURES AS A PERCENTAGE OF GROSS NATIONAL PRODUCT

TABLE 3-12

TOTAL LABOR FORCE PARTICIPATION RATE

(Percent)

HISTORICAL DATA

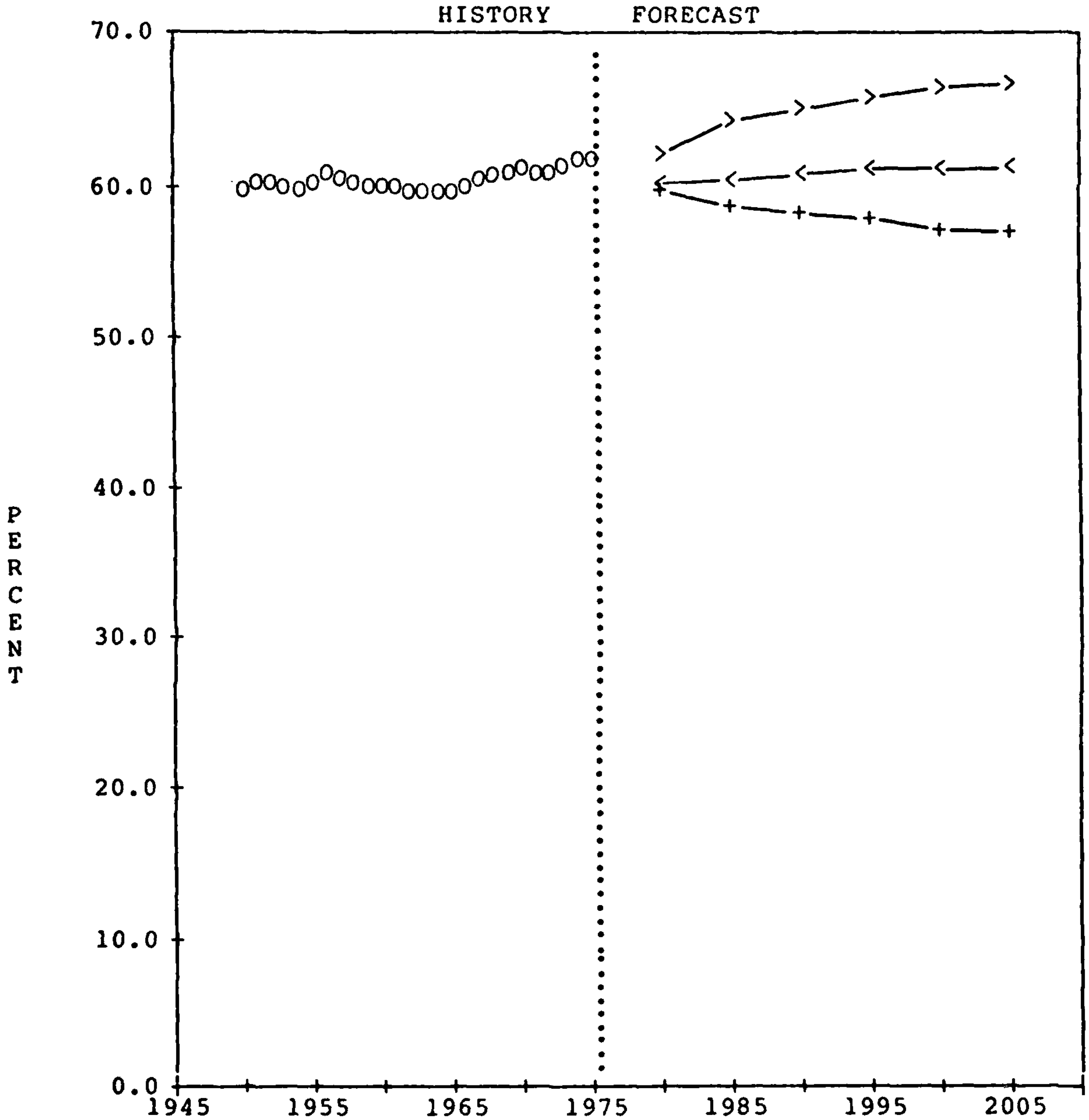
1950	59.9	1963	59.6
1951	60.4	1964	59.6
1952	60.4	1965	59.7
1953	60.2	1966	60.1
1954	60.0	1967	60.6
1955	60.4	1968	60.7
1956	61.0	1969	61.1
1957	60.6	1970	61.3
1958	60.4	1971	61.0
1959	60.2	1972	61.0
1960	60.2	1973	61.4
1961	60.2	1974	61.8
1962	59.7	1975	61.8

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	60.4	59.8	62.1
1985	60.6	58.5	64.5
1990	61.0	58.4	65.5
1995	61.2	57.9	66.2
2000	61.3	57.2	66.8
2005	61.4	57.0	67.0

SOURCE

U.S. Department of Labor. Bureau of Labor Statistics. Employment and Earnings, Vol. 23, No. 3. Washington, D.C.: Government Printing Office, September 1976.



LEGEND: HISTORICAL DATA:O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-12: SOURCE CITED (Table A-1)

FIGURE 3-7. TOTAL LABOR FORCE PARTICIPATION RATE

TABLE 3-13

RATIO OF DOMESTIC PRODUCTION OF CRUDE OIL AND NATURAL GAS LIQUIDS TO DOMESTIC DEMAND FOR REFINED PRODUCTS

(Percent)

HISTORICAL DATA

1950	91.4	1964	79.5
1951	95.7	1965	78.2
1952	94.4	1966	79.2
1953	93.6	1967	81.3
1954	90.6	1968	79.2
1955	89.5	1969	76.6
1956	90.6	1970	76.9
1957	90.5	1971	73.4
1958	82.4	1972	68.4
1959	83.2	1973	63.4
1960	81.2	1974	62.8
1961	81.9	1975	61.5
1962	80.2	1976	55.9
1963	80.4		

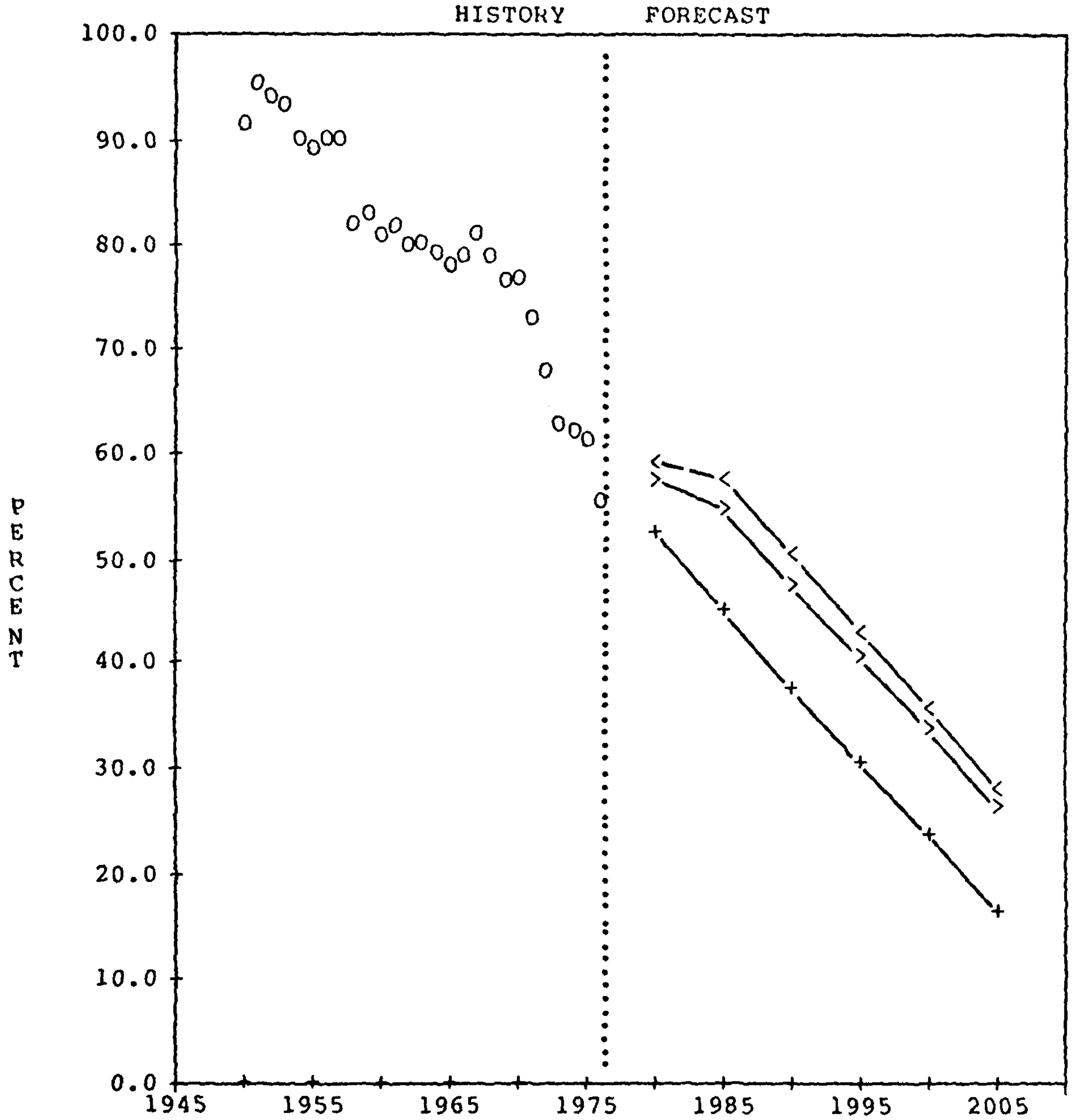
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	59.5	53.0	58.0
1985	58.0	45.0	55.0
1990	50.7	38.0	48.0
1995	43.2	31.0	41.0
2000	36.0	24.0	34.0
2005	28.5	17.0	27.0

Calculated by dividing crude petroleum production, natural gas plant liquids, and crude petroleum and unfinished oils imported by total product demand.

SOURCE

U.S. Department of Commerce. Bureau of Economic Analysis. Business Statistics, 1977. Washington, D.C.: Government Printing Office, March, 1978.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-13: SOURCE CITED (p.159)

FIGURE 3-8

RATIO OF DOMESTIC PRODUCTION OF CRUDE OIL AND NATURAL GAS LIQUIDS TO DOMESTIC DEMAND FOR REFINED PRODUCTS

TABLE 3-14

FOREIGN WATERBORNE COMMERCE OF THE UNITED STATES

(Millions of short tons)

HISTORICAL DATA

1965	443.7	1972	630.0
1966	471.4	1973	767.4
1967	466.0	1974	764.1
1968	508.0	1975	748.7
1969	521.3	1976	856.0
1970	581.0	1977	935.3
1971	566.0		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	970.0	970.0	970.0
1985	1090.0	870.0	1200.0
1990	1210.0	780.0	1550.0
1995	1380.0	710.0	1960.0
2000	1590.0	650.0	2520.0
2005	1900.0	580.0	3220.0

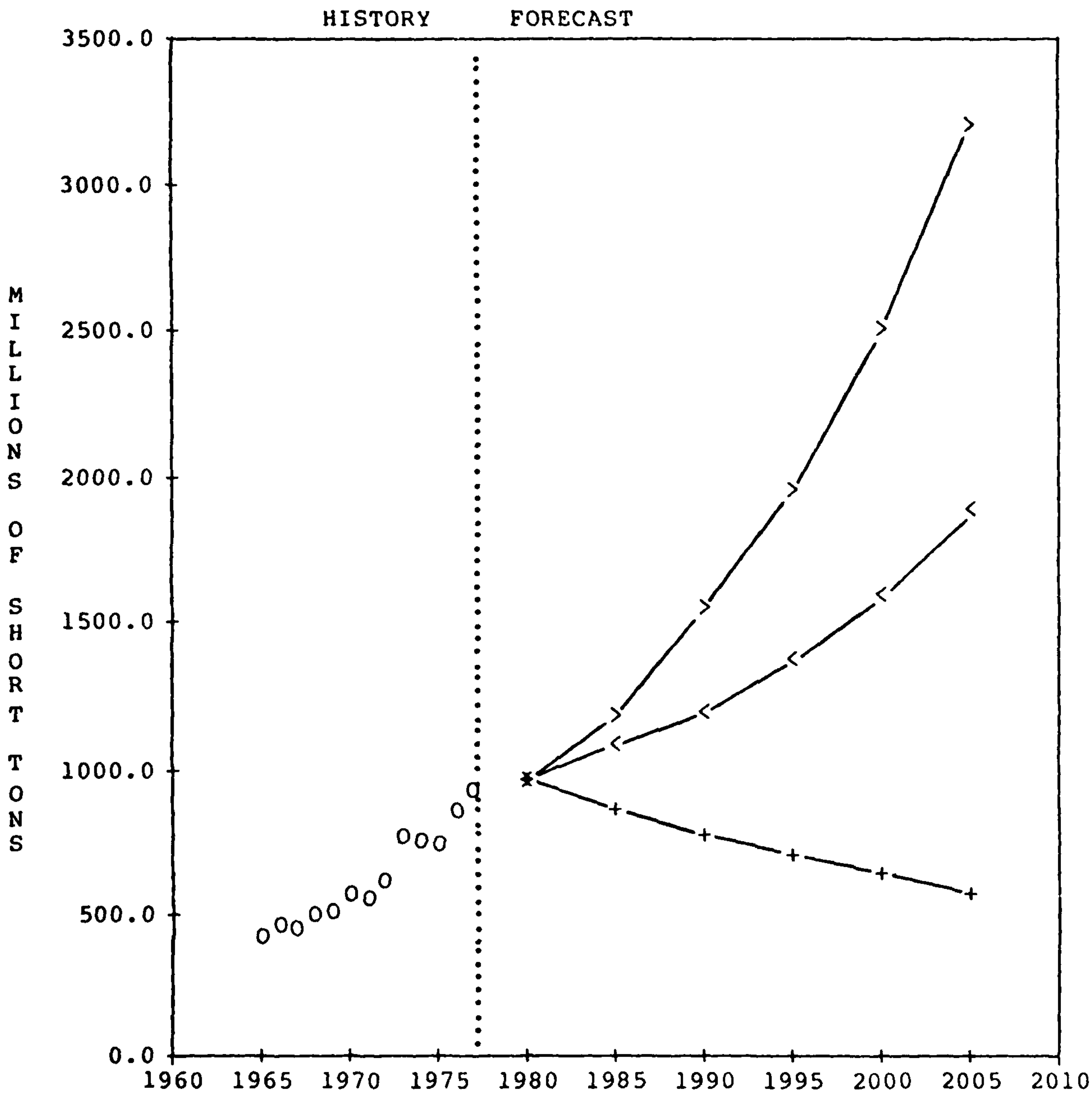
Data provided to the Maritime Administration by the U.S. Army Corps of Engineers.

SOURCE 1

U.S. Department of Commerce. Maritime Administration. Domestic Waterborne Commerce of the United States 1965-1972. Washington, D.C.: Government Printing Office, 1973.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. Domestic Waterborne Commerce of the United States 1973-1977. Washington, D.C.: Government Printing Office, 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-14: SOURCE 1 (p.11) and SOURCE 2 (p.12)

FIGURE 3-9. FOREIGN WATERBORNE COMMERCE OF THE UNITED STATES

TABLE 3-15

FRACTION OF U.S. WATERBORNE FOREIGN TRADE CARRIED IN U.S. SHIPS
(IMPORTS AND EXPORTS BY TONNAGE FOR ALL SERVICES)

(Percent)

HISTORICAL DATA

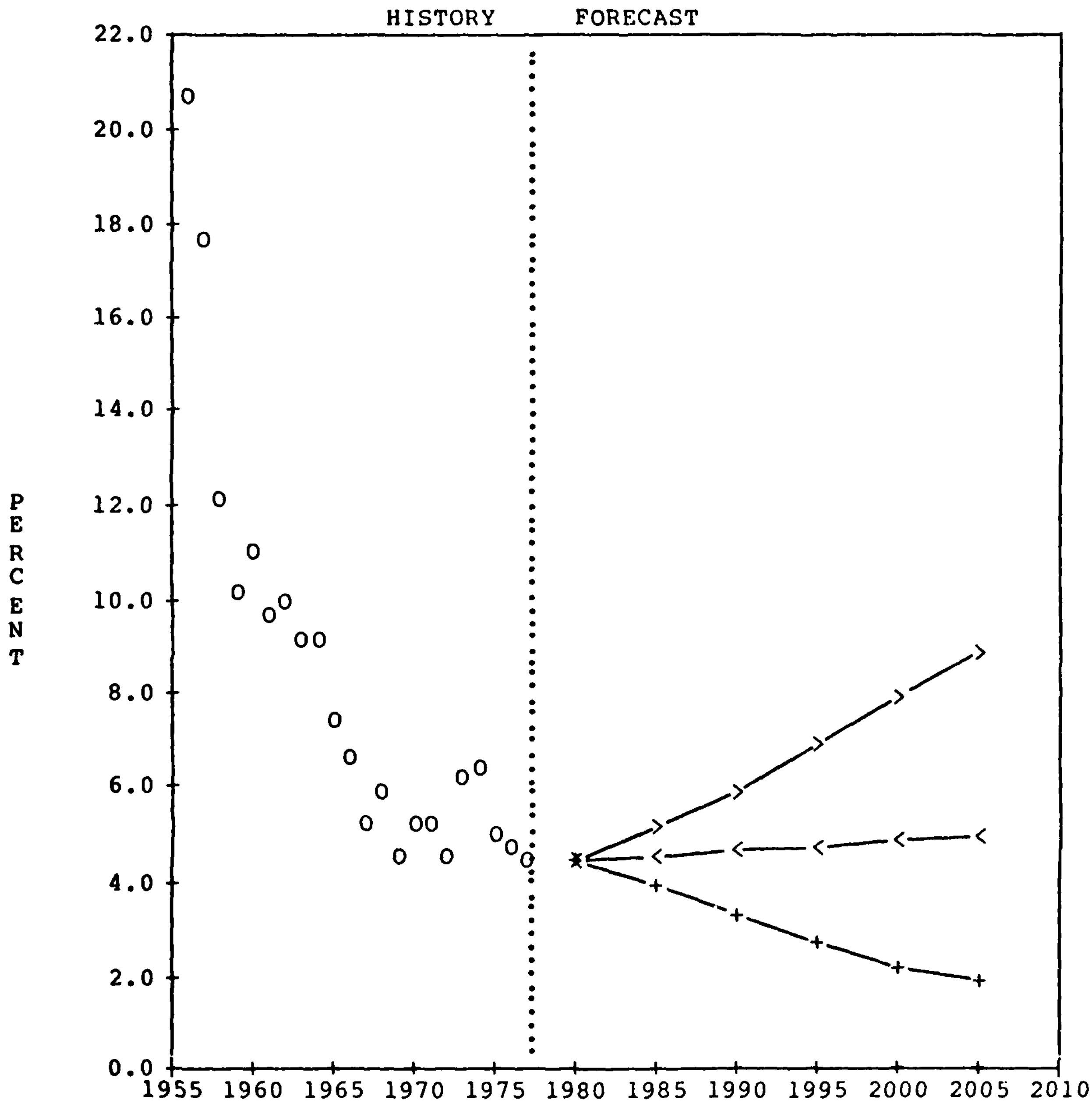
1956	20.7	1967	5.3
1957	17.6	1968	6.0
1958	12.2	1969	4.6
1959	10.2	1970	5.3
1960	11.1	1971	5.3
1961	9.7	1972	4.6
1962	10.0	1973	6.3
1963	9.2	1974	6.5
1964	9.2	1975	5.1
1965	7.5	1976	4.8
1966	6.7	1977	4.5

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	4.5	4.5	4.5
1985	4.6	4.0	5.2
1990	4.7	3.3	6.0
1995	4.8	2.7	7.0
2000	4.9	2.2	8.0
2005	5.0	2.0	8.9

SOURCE

U.S. Department of Commerce. Maritime Administration. United States Oceanborne Foreign Trade Routes. Washington, D.C.: Government Printing Office, October 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 3-15: SOURCE CITED (Appendix A, Table 1)

FIGURE 3-10

FRACTION OF U.S. WATERBORNE FOREIGN TRADE CARRIED IN U.S. SHIPS
(IMPORTS AND EXPORTS BY TONNAGE FOR ALL SERVICES)

FOOTNOTES TO CHAPTER 3

1. References A-8 and A-9.
2. Reference A-9.

CHAPTER 4
PARAMETER PROJECTIONS

4.1 Introduction

The purpose of Chapter 4 is to present the parameter projections for each of the three scenarios and to describe briefly the factors supporting each of these projections.

The process of quantifying the parameters (fully described in Appendices F through Q) has frequently required that a parameter be expressed in terms of several variables or constituent elements. A list of the parameters and their principal constituent elements is given in Table 4-1. The parameters are arranged in a logical and useful fashion, from general to specific.

At the conclusion of the study for MarAd, on which this analysis is based, a number of Major Problem Areas (MPA) were identified. In evaluating the selected parameters, FI considered the impacts and implications of the trends and problems emerging from the Maritime Scenarios on the parameters. Tables 4-2 through 4-4 summarize the impacts of Major Problem Areas on parameters for each of the three scenarios in cross-relevance matrices. A "1" at any intersection implies that MPA i would affect parameter j. In making this judgment it was often necessary to consider not the parameter, but one or more of its constituent elements. A discussion of the MPA-parameter interactions is given for each parameter in the paragraphs which follow. Parameter (or element) values have then been adjusted or estimated based on these judgments. The resulting projections are displayed graphically with the discussion of each parameter.

TABLE 4-1

LIST OF PARAMETERS AND PRINCIPAL CONSTITUENT ELEMENTS

Average DWT of Ships of All Types of 1000 GRT or More in the World Fleet. (Parameter 420)*

- World Fleet DWT
- Number of Ships

Average Stopping Distance for Tankers of 6000 DWT or More. (Parameter 430)

- DWT/Displacement Ratio
- Power Plant Type
- Average Tanker Length
- Average Tanker DWT

Index of US Shipbuilding Capability. (Parameter 400)

- Number and Size of Shipways

DWT of the US Privately-owned Merchant Fleet (Ships of 1000 GRT or More). (Parameter 350A)

- US Fleet DWT
- Number of Ships

Number of US Casualties (Collisions, Rammings, Groundings) Per Thousand Ship Operating Days Per Year. (Parameter 220)

- Number of Ships in Casualties
- Number of Annual Operating Days

Index of Annual Port Time Per Round Trip. (Parameter 550)

- Average Ship DWT
- Cargo Handling Rates
- Delays by Trade Route Group

Ratio of Speed of Advance to Design Speed for US Privately-owned Merchant Ships of 1000 GRT or More. (Parameter 210)

- Volume of Waterborne US Foreign Trade
- Portion of Trade Carried in US Ships
- Effective Trade Route Distance
- Fleet Carrying Capacity
- Number of Annual At-sea Days
- Ship Design Speed

*Parameter numbers are codings for computer cataloging and have no other significance.

Index of US Merchant Ship Daily Fuel Consumption. (Parameter 410B)

- Average Ship DWT
- Specific Fuel Consumption, Diesel/Turbine
- Number of Annual Operating Days: At Sea, In Port

Index of US Merchant Ship Daily Operating Cost. (Parameter 300)

- Fuel Cost
- Personnel Cost
- Supply and Other Costs
- Maintenance Cost
- Insurance Cost
- Number and DWT of US Ships

US Merchant Marine Licenses and Documents Issued. (Parameter 280)

- Number Issued

Index of Marine Traffic Density for Selected US Ports. (Parameter 570)

- Number of Vessel Transits
- Active Port Area
- Volume of Trade Handled

Growth of US Vessel Traffic Management Systems (Based on a 20-Port Sample). (Parameter 190)

- Number of VTSs
- Number of TSSs

TABLE 4-2

CROSS-RELEVANCE MATRIX: MAJOR PROBLEM AREAS VS PARAMETERS
RESOURCE ALLOCATION SCENARIO (R)

MAJOR PROBLEM AREAS	420: AVG DWT WORLD FLEET	430: STOPPING DISTANCE	400: SHIPBLDG CAPABILITY	350A: U.S. FLEET DWT	220: CASUALTY RATE	550: PORT TIME	210: SOA VS SPEED RATIO	410B: FUEL CONSUMPTION	300: SHIP OPERATING COST	280: LICENSES & DOCUMENTS	570: TRAFFIC DENSITY	190: VTS AND TSS
1. Generally depressed U.S. shipbuilding industry, some recovery after 1990.			1	1		1	1	1	1	1		
2. Conflicts between the navy and the merchant marine over utilization of available shipbuilding capacity.			1									
3. Shortage of funds for construction subsidies, eases somewhat after 1990.			1	1				1				
4. Shifting trade routes, demand for fleet flexibility.						1	1				1	1
5. Upward cost pressures on building, labor, safety, energy (averaging 4-5% a year).			1	1				1	1	1		1
6. Lagging port development (including deepwater) because of resistance or lack of funds.		1			1	1		1	1		1	1
7. Security problems in foreign ports, especially in the 1980s.						1			1			
8. Unemployment in the traditional maritime trades because of depressed trade in the 1980s.						1			1	1	1	
9. Concentration of liner traffic in a small number of major ports.					1	1		1			1	1
10. Growth in the non-liner trades.						1	1	1			1	1
11. Increased demand for waterborne transport of energy-raw materials domestically.			1	1	1			1	1	1	1	1
12. Heavy demand on waterborne mode for transportation of hazardous cargo.			1	1				1	1	1	1	1
13. Demand for increased use of alternative fuels in waterborne shipping.		1					1	1	1			
14. Demand for rapid, extensive introduction of automation and computer-controlled production procedures and use of advanced design in the shipbuilding industry.		1	1			1		1				
15. Demand for intermodal coordination.				1		1	1	1			1	

TABLE 4-3

CROSS-RELEVANCE MATRIX: MAJOR PROBLEM AREAS VS PARAMETERS
HARDSHIP SCENARIO (H)

PARAMETERS

	MAJOR PROBLEM AREAS	420: AVG DWT WORLD FLEET	430: STOPPING DISTANCE	400: SHIPBLDG CAPABILITY	350A: U.S. FLEET DWT	220: CASUALTY RATE	550: PORT TIME	210: SOA VS SPEED RATIO	410B: FUEL CONSUMPTION	300: SHIP OP-ERATING COST	280: LICENSES & DOCUMENTS	570: TRAFFIC DENSITY	190: VTS AND TSS
1.	Prolonged depression in the U.S. shipbuilding industry results in aging U.S. merchant fleet.			1	1	1	1	1	1	1	1		
2.	Severe capital shortages in all areas (R&D, ports, shipping, etc.).			1			1					1	1
3.	Deteriorated/congested port and harbor facilities; inadequate port development, including LNG, deepwater.		1			1	1		1	1		1	1
4.	Depressed trade levels, both import/export and domestic.	1						1			1	1	
5.	Poorly coordinated intermodal networks.				1		1	1	1	1		1	
6.	Growing significance of the small port leads to strong demand for RoRos, small break-bulk carriers in the coastal trades.				1	1	1		1			1	1
7.	Persistent unemployment in traditional maritime trades leads to labor opposition to automation.						1			1	1	1	
8.	Severe energy problems, including rising energy costs, rationing, uncertain sources of supply.		1				1	1	1	1		1	
9.	Security problems at U.S. docks, shipyards, harbors.						1	1		1		1	
10.	Security problems at foreign ports.						1			1			
11.	Growing dependence of foreign carriers.				1	1		1			1		
12.	Fluctuating levels of military preference cargo.							1					
13.	Diplomatic problems over U.S. maritime and economic policies.		1	1			1	1	1	1			

TABLE 4-4

CROSS-RELEVANCE MATRIX: MAJOR PROBLEM AREAS VS PARAMETERS
EXPANSIVE GROWTH SCENARIO (E)

	MAJOR PROBLEM AREAS	420: AVG DWT WORLD FLEET	430: STOPPING DISTANCE	400: SHIPBLDG CAPABILITY	350A: U.S. FLEET DWT	220: CASUALTY RATE	550: PORT TIME	210: SOA VS SPEED RATIO	410B: FUEL CONSUMPTION	300: SHIP OPERATING COST	280: LICENSES & DOCUMENTS	570: TRAFFIC DENSITY	190: VTS AND TSS
1.	Strong demand for technologically advanced ship designs.		1		1		1	1	1	1			
2.	Need to be able to import energy and raw materials in U.S. ships (supertankers, dry bulk carriers).		1	1	1	1	1	1	1		1		
3.	Demand for port development, redesign, including deepwater ports, LNG terminals.					1	1		1	1		1	1
4.	Soaring energy costs lead to demand for nuclear-powered vessels.							1	1	1			
5.	Need for improvement of intermodal systems spurred by decentralization of industry and population and increased competition among major modes of domestic transport.				1		1		1			1	1
6.	Rapid growth in demand for domestic, including Great Lakes, waterborne transportation.			1	1	1	1		1	1	1	1	1
7.	Shifting trade routes, import patterns, but overall strong growth in volume.						1	1				1	1
8.	Overlapping agency jurisdictions in ports and harbors.						1		1			1	1
9.	Security problems in foreign ports.						1		1	1			
10.	Security problems in U.S. ports and offshore installations.						1		1	1		1	1
11.	Heavy demand on existing shipyards from both naval and merchant marine orders.			1									
12.	Increased demand for convertibility of skills in the maritime industry labor force.									1	1		
13.	Diplomatic difficulties over U.S. maritime and economic policies.		1	1			1	1	1	1			

4.2 Average DWT of Ships of All Types of 1000 GRT or More in the World Fleet (Parameter #420)

4.2.1 Introduction. This parameter is a measure of the size of world merchant ships. Over the last two decades, the average DWT (fleet DWT/number of ships) has risen steadily, and rapidly in the 1970s. To determine the average DWT of the world fleet it was necessary to determine the DWT of the world fleet and the number of ships in that fleet. Projections of the average DWT in each scenario are shown in Table 4-5 and Figure 4-1. Details are contained in Appendix F.

4.2.2 Projection in Scenario R. Scenario R average DWT is postulated to show slow growth as a result of modest increases in US foreign trade; toward the end of the period both US foreign trade and average DWT are projected to rise.

4.2.3 Projection in Scenario H. Trade is depressed in Scenario H, particularly oil trade. This should result in a reduction in the number of the largest ships in the fleet (tankers), hence a marked reduction in average DWT.

4.2.4 Projection in Scenario E. The projection for Scenario E is simply a straight line which results in a doubling of the 1977 average DWT by 2005 in an expanding trade situation.

4.3 Average Stopping Distance for Tankers of 6000 DWT or More (Parameter #430)

4.3.1 Introduction. With the advent of very large ships the time and sea room necessary to execute simple maneuvers (such as stopping and turning) have increased to the point where the safety of vessels, large and not-so-large, has become a major concern of the mariner. This parameter focuses on a worst-case situation, namely bringing a large, fully laden ship to a stop from its design speed. A tanker has been chosen since they are the largest ships and requisite data are available. In order to evaluate this parameter and develop projections, several constituent

TABLE 4-5

AVERAGE DEADWEIGHT TONNAGE OF ALL SHIPS OF 1000 GRT OR MORE IN THE WORLD FLEET (TOTAL DWT/TOTAL NUMBER OF SHIPS)

(Thousands of long tons)

HISTORICAL DATA

1939	6.30	1966	12.60
1946	7.97	1967	13.32
1951	8.11	1968	14.11
1953	8.31	1969	15.20
1955	8.58	1970	16.37
1956	8.77	1971	17.61
1957	9.04	1972	19.02
1958	9.32	1973	20.67
1959	9.66	1974	22.42
1960	9.93	1975	24.33
1961	10.17	1976	25.71
1962	10.40	1977	26.61

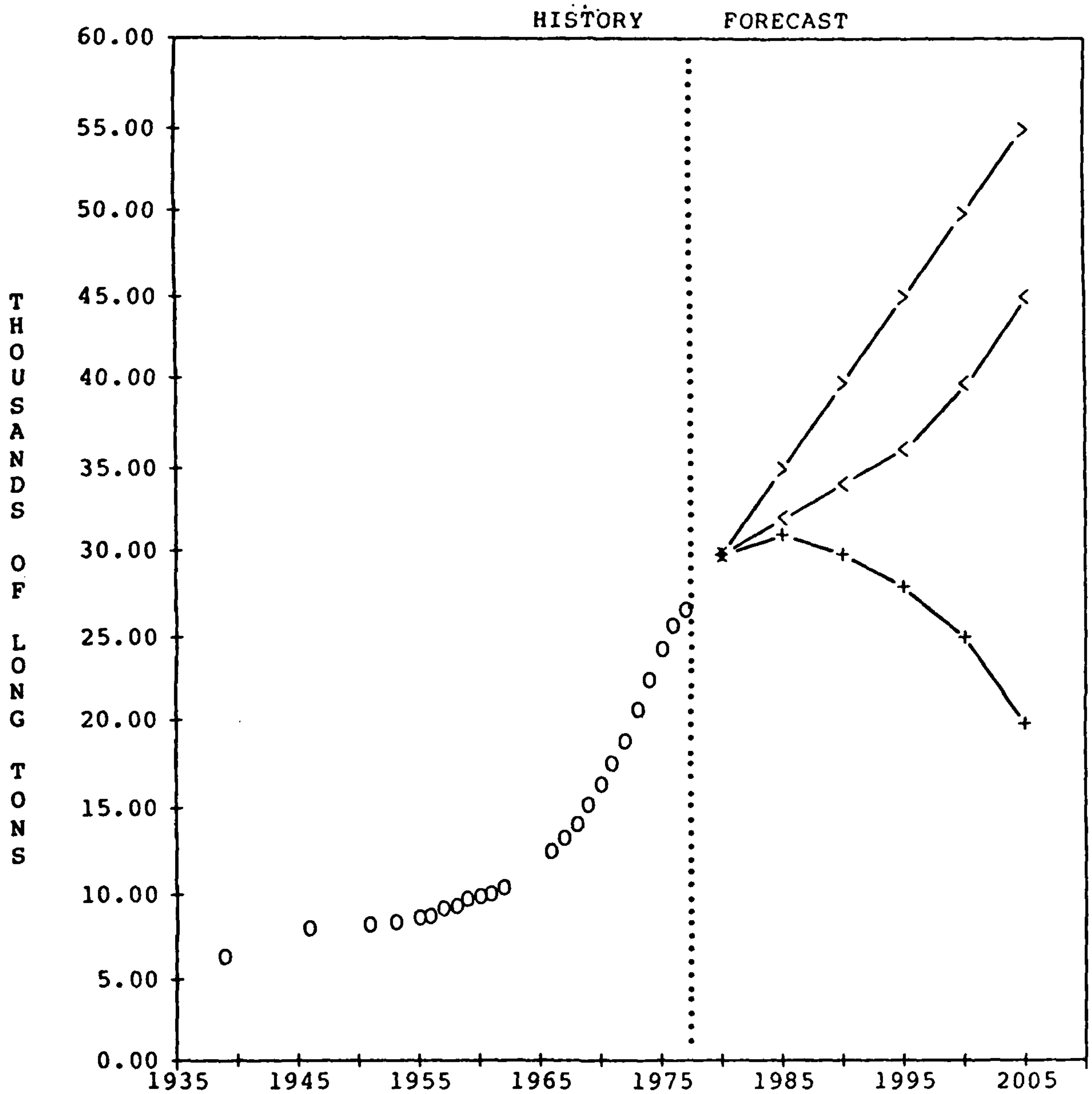
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	30.00	30.00	30.00
1985	32.00	31.00	35.00
1990	34.00	30.00	40.00
1995	36.00	28.00	45.00
2000	40.00	25.00	50.00
2005	45.00	20.00	55.00

Data as of 31 December except 1939 (1 September) and 1946 (30 June). Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

...rtment of Commerce. Maritime Administration. Merchant ... the World. Washington, D.C.: Government Printing Office,



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-5: SOURCE CITED (Issues for 1952-1977)

FIGURE 4-1

AVERAGE DEADWEIGHT TONNAGE OF ALL SHIPS OF 1000 GRT OR MORE IN THE WORLD FLEET (TOTAL DWT/TOTAL NUMBER OF SHIPS)

TABLE 4-6

AVERAGE STOPPING DISTANCE FOR TANKERS OF 6000 DWT OR MORE

(Feet)

HISTORICAL DATA

1972	7280	1976	8277
1973	7499	1977	8504
1974	7725	1978	8592
1975	8003		

PROJECTED DATA

	SCENARIO R	SCENARIO H	SCENARIO E
1980	9125	9125	9125
1985	9259	9259	9974
1990	9480	9480	11003
1995	9753	9753	11756
2000	10022	10022	12705
2005	10215	10215	13474

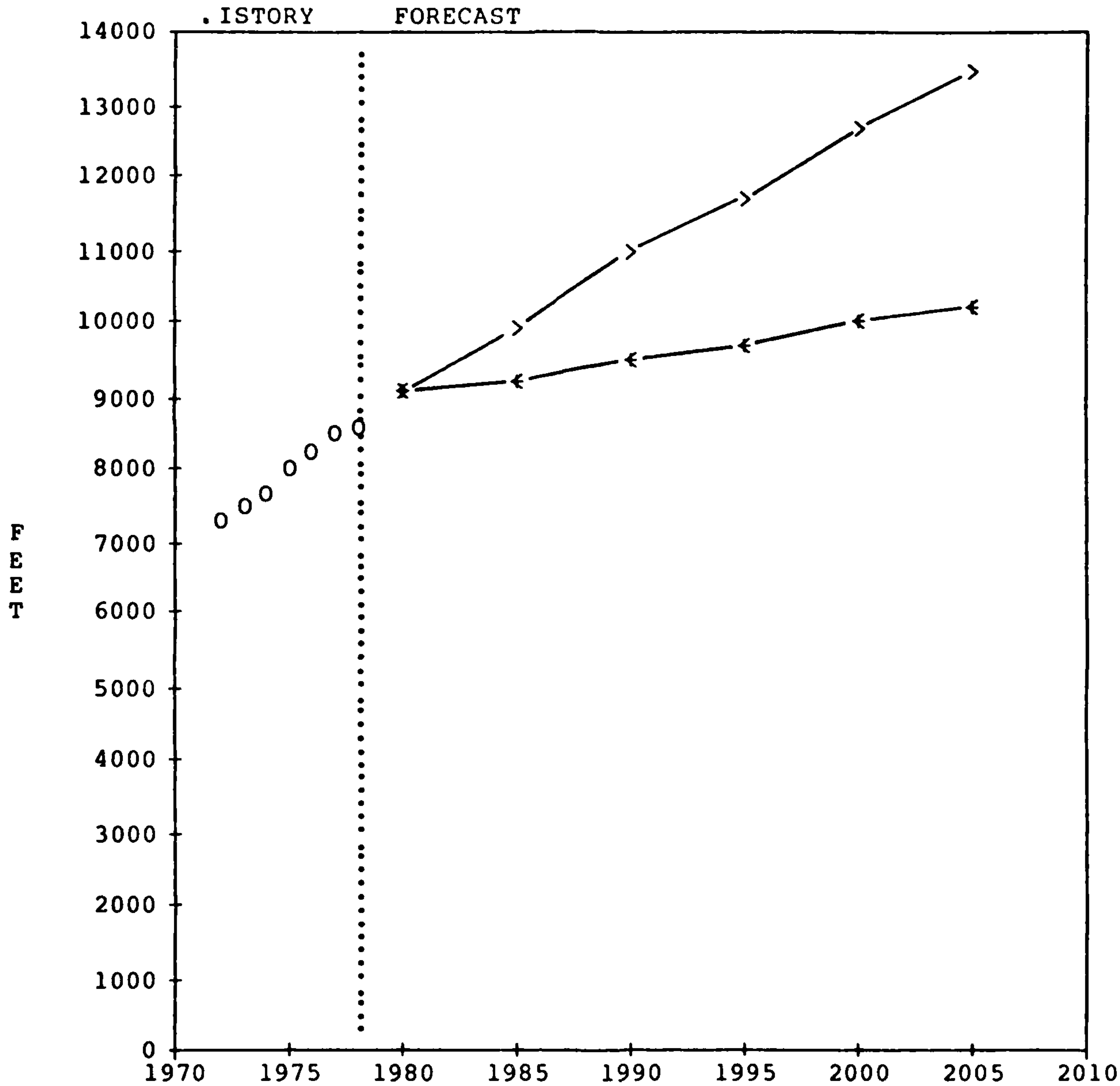
Developed from average tanker DWT and length, and projections of stopping distance per ship length. A weighted average of motor and steam propelled ships is calculated.

SOURCE 1

The Tanker Register. London: H. Clarkson & Co., Ltd., annual.

SOURCE 2

Blackman, A. W. *U.S. Ocean Shipping Technology Forecast and Assessment*. Vol. III: *State of Maritime Technology*. Report prepared for the Maritime Administration. East Hartford, Conn.: United Aircraft Research Laboratories, July 1974.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-6: SOURCE 1 (Issues for 1972-1978)
and SOURCE 2 (Figures III-72, 89, 90)

FIGURE 4-2

AVERAGE STOPPING DISTANCE FOR TANKERS OF 6000 DWT OR MORE elements were considered including: DWT/displacement ratio, power plant type, average tanker length and average tanker DWT. The stopping distance is calculated for historical data, for 1980, and at subsequent five-year intervals for each scenario, using appropriate values of average DWT and length, for both motor and turbine-powered ships. An average, weighted by the percentages of motor or turbine-powered ships, is plotted in Table 4-6 and Figure 4-2 for each scenario. (Note that the details of calculating the value of this parameter are explained more fully in Appendix G).

4.3.2 Projection in Scenario R. Under Scenario R, the value of this parameter is expected to increase very gradually over the period. In Scenario R, lagging port and offshore terminal development could inhibit transit of US waters by the largest tankers. Energy would continue to be a worldwide concern, although its impact on stopping distance would be minimal since most foreign tankers are driven by slow or medium speed diesel engines, which are relatively efficient compared to steam turbine plants. Coal-fired or nuclear plants could be introduced, but because of the reduced backing power of turbine plants, stopping distance would increase.

4.3.3 Projection in Scenario H. In Scenario H this parameter is projected to rise very gradually as well. The same conditions noted in the discussion of the projection in Scenario R are significant under Scenario H, but here they are aggravated, in the United States if not elsewhere, by a lack of capital with which to implement the changes.

4.3.4 Projection in Scenario E. In concert with the assumptions in Scenario E, average stopping distance would increase very rapidly. Under Scenario E there is sufficient capital, several US deepwater ports to accommodate large ships, and a strong demand for technologically advanced designs. These conditions, collectively, support a continued increase in average stopping distance. However, new ship designs, which could include ducted or contra-rotating propellers (either of which would result in a 7-12% decrease in stopping distance), or emergency devices (side flaps, bow ducts, or drogues), would reduce stopping distances dramatically.

4.4 Index of Shipbuilding Capability (Parameter 400)

4.4.1 Introduction. Shipbuilding capability was examined because it can impose constraints on the ability to replace and/or expand the commercial as well as the naval fleet. To develop an analysis of this parameter the number and size of US shipways was examined. Since it was not feasible to include all US shipyards, an estimate of shipbuilding is given for major US shipyards. (A major shipyard is defined as one having at least one building position with the capability to accommodate a minimum ship size of 475 feet length overall and a beam of 68 feet). Projections of this parameter are included in Table 4-7 and Figure 4-3; details are given in Appendix H.

4.4.2 Projection in Scenario R. In Scenario R, shipbuilding capability is expected to decline until the mid-80s, and to increase at a moderate rate from 1990 on. In Scenario R the shipbuilding industry is generally depressed (although there is some recovery after 1990) due to a shortage of funds for construction subsidies coupled with generally rising costs. There is an increased demand for waterborne transport of energy and other raw materials domestically and a heavy demand on the waterborne mode for transportation of hazardous cargo. The combined demands for domestic carriers (barges and small ships), ocean-going ships, and new naval vessels result in conflicts over available shipbuilding capacity.

4.4.3 Projection in Scenario H. US shipbuilding capability exhibits a steady decline throughout the period. Scenario H is characterized by a prolonged depression in the US shipbuilding industry which results in very little ship construction. Severe capital shortages in all areas

TABLE 4-7

INDEX OF U.S. SHIPBUILDING CAPABILITY

(Index (1974 = 100))

HISTORICAL DATA

1973	106.1	1977	103.5
1974	100.0	1978	102.8
1975	95.8	1979	89.4
1976	96.9		

PROJECTED DATA

	SCENARIO R	SCENARIO H	SCENARIO E
1980	94.0	94.0	94.0
1985	82.0	79.0	105.0
1990	87.0	68.0	124.0
1995	93.0	58.0	155.0
2000	122.0	54.0	182.0
2005	135.0	50.0	200.0

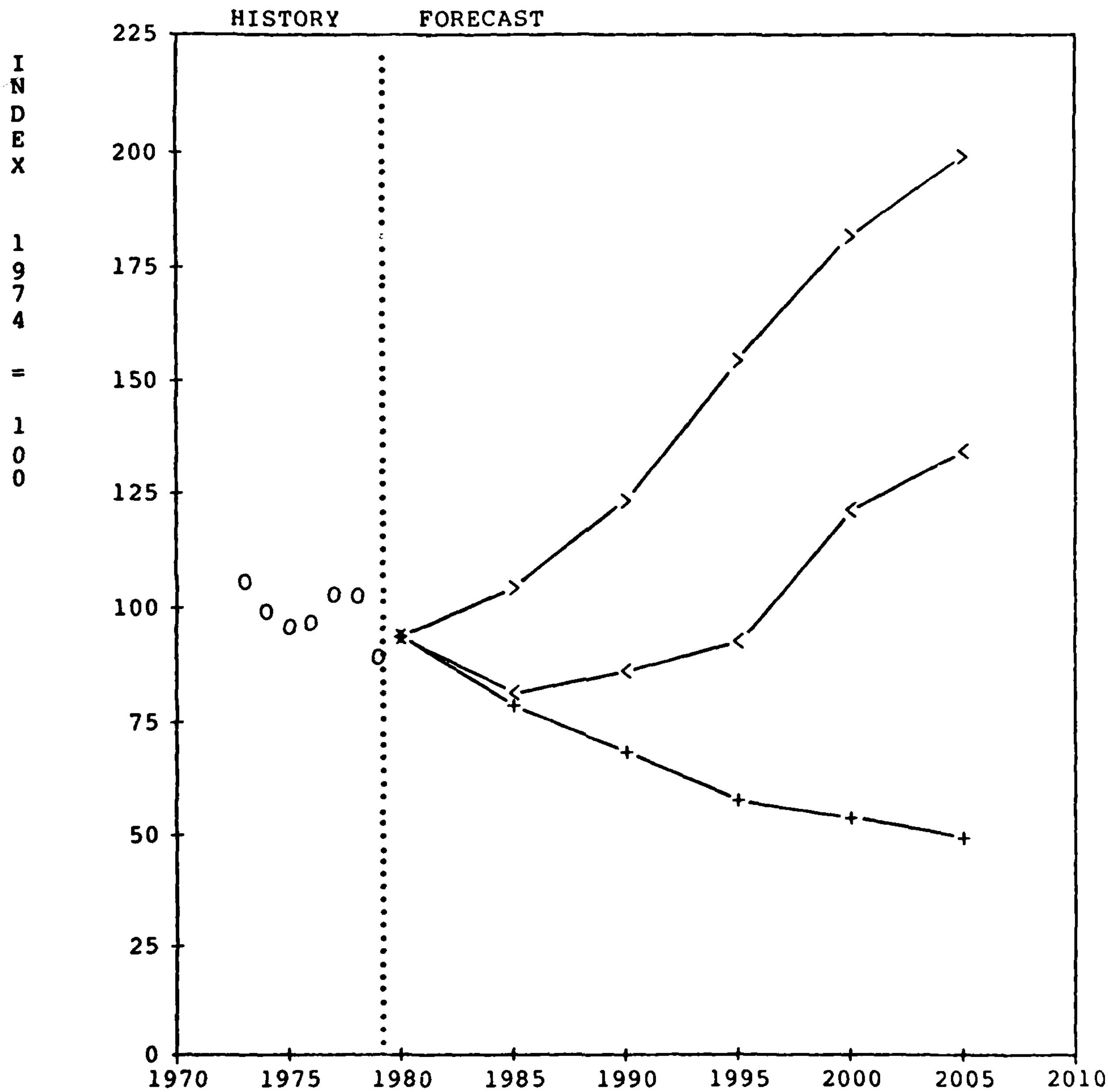
Index is applicable to commercial shipyards having facilities to build vessels 475 by 68 feet or larger. A composite, average of relatives index is given based on the number of ships of 3 types (610-foot container ship, 600-foot dry bulk carrier, or 920-foot tanker) which could be built concurrently, weighted by the percentage of each ship type constructed in U.S. yards in the 1970-1978 period.

SOURCE 1

U.S. Department of Commerce. Maritime Administration. Report on Survey of U.S. Shipbuilding and Repair Facilities. Washington, D.C.: Government Printing Office, annual.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. U.S. Merchant Marine Data Sheet, monthly.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-7: SOURCE 1 (Issues for 1973-1979)
and SOURCE 2 (Issues for 1970-1978)

FIGURE 4-3. INDEX OF U.S. SHIPBUILDING CAPABILITY aggravate the shipbuilders' plight. These hard times result in a steady erosion of shipbuilding capability as facilities are dismantled and the land given over to other uses.

4.4.4 Projection in Scenario E. As with other industries, shipbuilding enjoys significant, steady growth under Scenario E. Supertanker and dry bulk carrier construction booms in the effort to import raw materials in US bottoms. Demands for vessels employed in the domestic trades grow rapidly. Naval construction, too, keeps the orderbooks at consistently high levels.

4.5 DWT of the US Privately-Owned Merchant Fleet (Ships of 1000 GRT or More) (Parameter 350A)

4.5.1 Introduction. This parameter is the fundamental measure of US fleet size used in the study. To develop this parameter, FI looked at the constituent elements: US Fleet DWT and the number of ships. Projections are presented in Table 4-8 and Figure 4-4 and described below. Appendix I contains a more detailed description of the calculations and projections of this parameter.

4.5.2 Projection in Scenario R. The DWT of the US privately owned merchant fleet is expected to remain static until after 1990 when moderate growth begins. By 2005 fleet DWT is expected to reach nearly 21 million tons, a 20% increase over the 1977 level. A number of factors support this projection. Shipbuilding is depressed in Scenario R and there is a shortage of funds for construction subsidies, particularly early in the period. The inflation rate is approximately 7%. Throughout the period there is a heavy demand on the waterborne mode for transportation of hazardous cargoes and an increased demand for waterborne transport of energy-raw materials domestically. There is also a demand for intermodal coordination of transportation systems. These factors support a fleet which gradually increases in numbers and an opting to add large ships to the fleet.

TABLE 4-8

DEADWEIGHT TONNAGE OF U.S. PRIVATELY-OWNED MERCHANT FLEET (INCLUDES SHIPS OF ALL TYPES OF 1000 GRT OR MORE)

(Millions of long tons)

HISTORICAL DATA

1956	13.54	1968	15.35
1957	13.13	1969	15.45
1958	13.43	1970	14.41
1959	13.98	1971	13.89
1960	14.09	1972	13.64
1961	14.10	1973	13.72
1962	14.57	1974	14.45
1965	14.65	1975	15.03
1966	14.96	1976	16.02
1967	15.12	1977	17.32

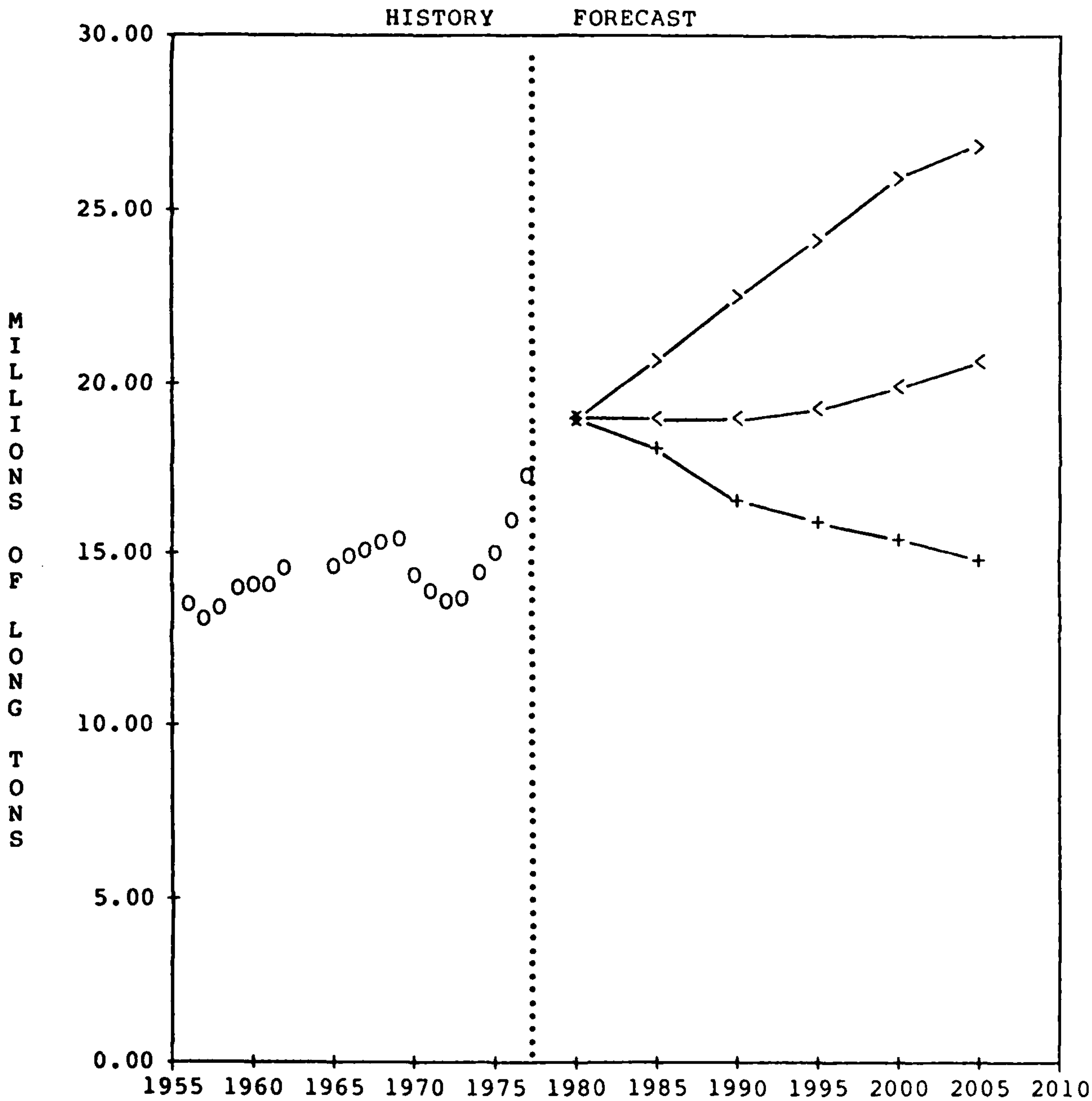
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	19.00	19.00	19.00
1985	19.00	18.19	20.70
1990	19.00	16.60	22.50
1995	19.30	15.90	24.20
2000	20.00	15.38	25.90
2005	20.70	14.84	26.90

Data as of 31 December. Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-8: SOURCE CITED (Issues for 1952-1977)

FIGURE 4-4

DEADWEIGHT TONNAGE OF U.S. PRIVATELY-OWNED MERCHANT FLEET
(INCLUDES SHIPS OF ALL TYPES OF 1000 GRT OR MORE)

4.5.3 Projection in Scenario H. In Scenario H, fleet DWT declines steadily (to 85% of the 1977 level) as the most ancient vessels are retired, usually without replacement. Scenario H is devastating to the merchant fleet. Its average age increases rapidly because of the prolonged depression of the shipbuilding industry. Growing dependence on foreign carriers results. With depressed trade levels, intermodal network coordination suffers, although there is a strong demand for RoRo and small break-bulk carriers in the coastal service as small ports acquire a larger share of foreign and domestic trade. These conditions result in shipbuilding which is limited to construction of small vessels, repair and conversion.

4.5.4 Projection in Scenario E. A number of factors converge in Scenario E to support a growth rate similar to that experienced in the 1972-79 period. By the year 2005 a 50% increase in fleet DWT over 1977 is expected. The expansionist spirit exemplified in Scenario E includes the need for viable transportation systems to support economic growth. This is manifested in a strong demand for technologically advanced ship designs and the need to improve intermodal systems to serve decentralized industry and population. There is increased competition among major domestic transport modes and rapid growth in demand for domestic, including Great Lakes, waterborne transportation. The need to be able to import energy and other raw materials in US ships spurs construction of supertankers and dry bulk carriers. These conditions are reflected in the growth curve for DWT.

4.6 Number of US Casualties (Collisions, Rammings, Groundings) Per Thousand Ship Operating Days Per Year (Parameter 220)

4.6.1 Introduction. This parameter is intended to gauge the casualty rate for US ships to be inferred from the scenarios. It is dependent upon the number and total deadweight tonnage of US ships, the quantity of US foreign trade (and the portion carried in US ships), and the

TABLE 4-9

CASUALTY RATE FOR U.S. COMMERCIAL VESSELS
(COLLISIONS, RAMMINGS, AND GROUNDINGS)

(See comment below)

HISTORICAL DATA

1959	1.117	1969	2.202
1960	1.180	1970	2.184
1961	1.266	1971	2.127
1962	0.756	1972	1.895
1963	1.031	1973	1.961
1964	1.469	1974	2.083
1965	1.556	1975	2.062
1966	1.583	1976	2.048
1967	1.677	1977	2.158
1968	1.902	1978	2.399

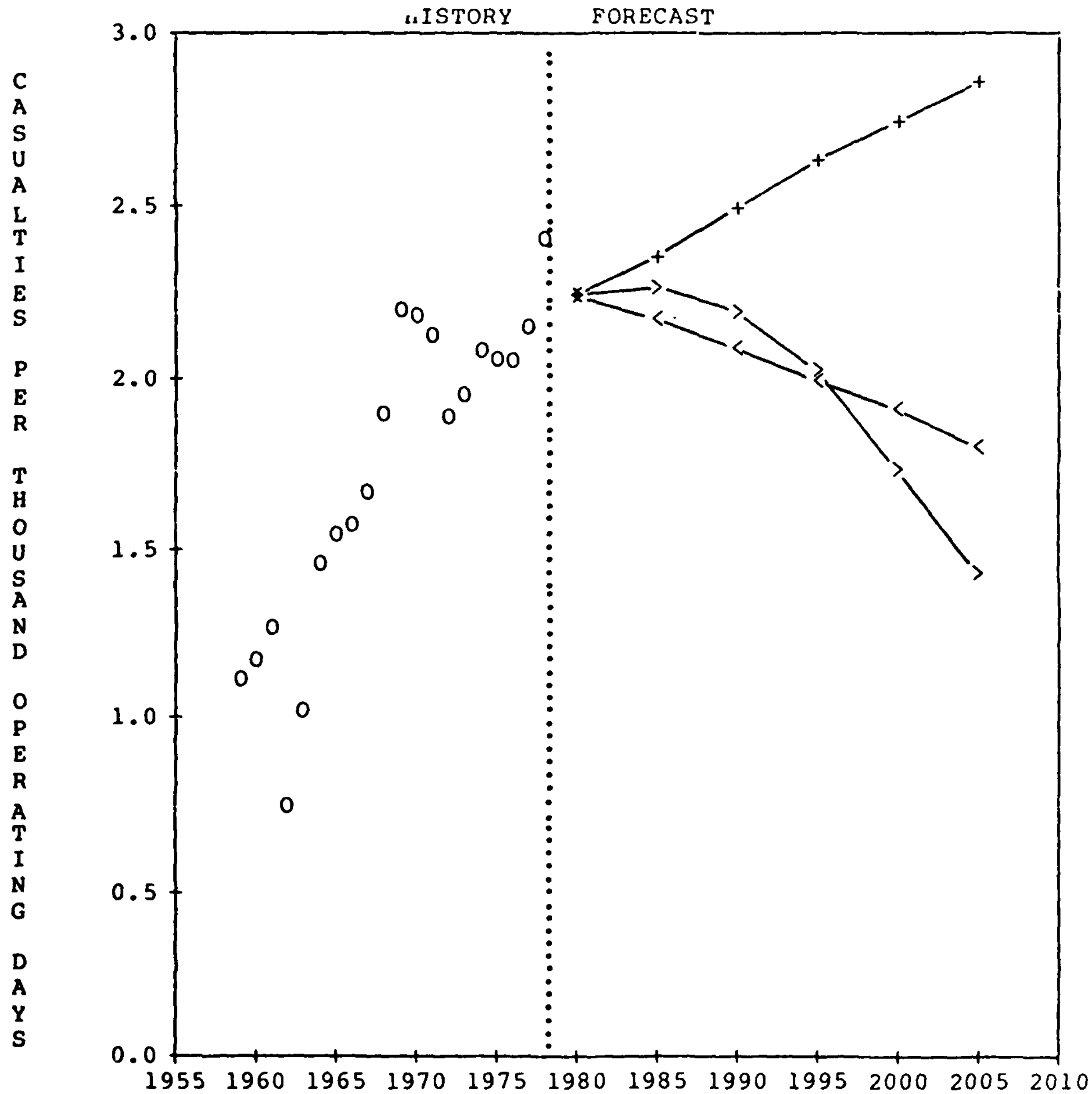
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	2.250	2.250	2.250
1985	2.170	2.350	2.270
1990	2.090	2.500	2.190
1995	2.000	2.630	2.020
2000	1.910	2.740	1.740
2005	1.800	2.850	1.440

Data tabulate number of ships involved in casualties per thousand ship operating days per year. Based on U.S. commercial vessel casualties investigated by Coast Guard Marine Inspectors where physical damage to property exceeded $1500. Casualties to barges and commercial and recreational motorboats are not included. All U.S. ships of 100 GRT or more are included except sailing vessels and non-propelled craft. Based on 337 operating days annually per ship in the period 1955-59. This figure is increased by 2 days annually each succeeding 5-year period. Projections reflect scenario conditions.

SOURCE

Forecasting International, Ltd.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-9

FIGURE 4-5. CASUALTY RATE FOR U.S. COMMERCIAL VESSELS (COLLISIONS, RAMMINGS, AND GROUNDINGS)

AD-A106 095 FORECASTING INTERNATIONAL LTD ARLINGTON VA F/G 13/10
IMPACT OF THE FUTURE MERCHANT FLEET ON COAST GUARD OPERATING AN--ETC(U)
APR 81 M J CETRON, C F MCFADDEN, A K NELSEN DO-78-3023
UNCLASSIFIED USCG-D-44-81 NL

2 OF 5
AD A
106095

average annual operational time available. An examination of the casualty rate has implications for safety concerns, insurance rates and a host of other factors to marine-oriented organizations. Projections of the parameter values are contained in Table 4-9 and Figure 4-5; details are given in Appendix J.

4.6.2 Projections in Scenario R. Under the conditions of Scenario R, the ship casualty rate is expected to decline only gradually. Scenario R envisages increased foreign trade and concentration of liner trade in a small number of major ports. There is also an increased demand for waterborne transport of energy and other raw materials domestically. As a result, traffic increases generally and may become congested in liner ports. Port development and the building of deepwater ports, however, lags the demand imposed by foreign and domestic trade because of cost pressures and other resistance. Consequently, navigation and maneuvering conditions are not as free of hazards as they might be.

4.6.3 Projection in Scenario H. The conditions in Scenario H result in a significant increase in ship casualty rates. Under Scenario H the aging US fleet requires more and more maintenance, reducing operational time. There is growing dependence on foreign carriers and inadequate port development, including deepwater ports and LNG terminals. Port and harbor facilities become deteriorated and congestion increases, making maneuvering hazardous. The growing significance of smaller ports leads to a strong demand for RoRo and small break-bulk carriers in the coastal trades. While the ocean-going fleet diminishes in size, the domestic fleet of smaller ships increases. This activity, combined with navigational and maneuvering hazards, results in a steadily increasing casualty rate for US ships.

4.6.4 Projection in Scenario E. The ship casualty rate declines steadily in this scenario as the modern domestic fleet grows in response to the demand for waterborne transportation. The average DWT of the ocean-going fleet increases significantly as a result of the need to import energy and raw materials in US bottoms. Harbors are improved and deepwater ports are built to facilitate transportation needs so that the casualty rate shows notable improvement.

4.7 Index of Annual Port Time Per Round Trip (Parameter 550)

4.7.1 Introduction. This parameter is included as an indication of efficiency; commercial efficiency will be improved as the time a ship spends in port is reduced. This parameter takes into account the sizes and types of ships and their activities in port. Activities in port fall into the "cargo-handling" and "additional" categories. Cargo handling includes both loading and unloading; all other activities which keep an operational ship in port are termed "additional." Projections of this parameter are shown in Table 4-10 and Figure 4-6 (see Appendix K for details).

4.7.2 Projection in Scenario R. The effects of resource management are evident under Scenario R and a dramatic reduction in port time per round trip is projected. While new ships are acquired slowly, because of a generally depressed shipbuilding industry, those that are delivered incorporate the latest cargo handling improvements. Harbors are improved and deepwater ports are built, although development lags demand because of a scarcity of funds and other resistance. To satisfy demands for intermodal coordination, improvements are concentrated in a small number of major ports; traffic density increases and some delays are experienced (in obtaining a berth, for instance) as a result. Labor unrest and work slow-downs, occasioned by significant unemployment in the maritime trades, tends to cause loading/unloading and other delays. Outside the United States port operations exhibit steady improvement,

TABLE 4-10

INDEX OF ANNUAL PORT TIME PER ROUND TRIP
FOR THE U.S. PRIVATELY-OWNED MERCHANT FLEET

(Index (1974 = 100))

HISTORICAL DATA

1971	104.7	1974	100.0
1972	101.8	1975	100.4
1973	101.7	1976	98.9

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	93.4	93.4	93.4
1985	82.9	87.9	86.6
1990	76.1	83.0	83.7
1995	70.6	81.9	79.9
2000	65.2	79.4	76.7
2005	64.8	77.9	77.7

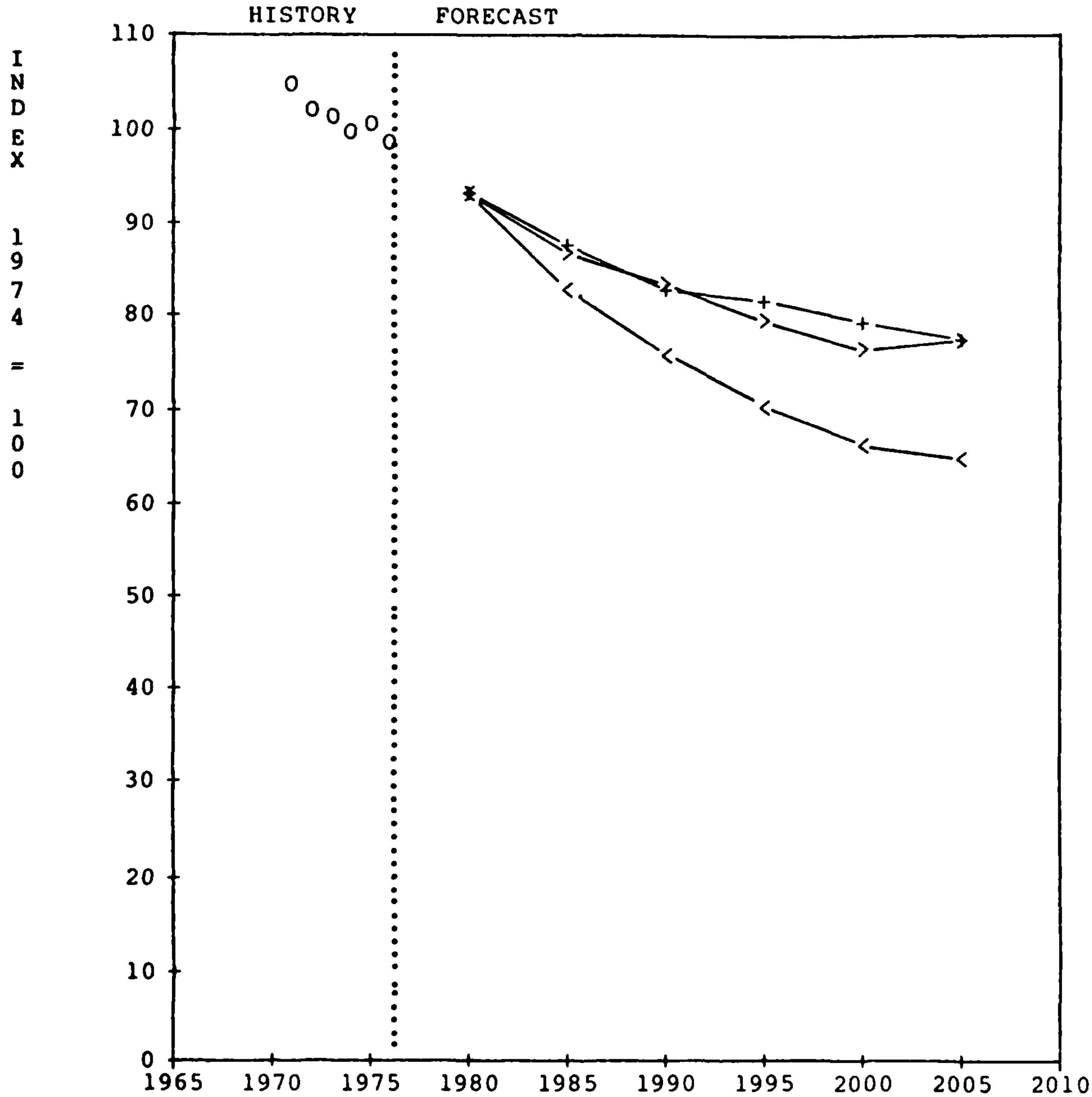
A composite, average of relatives index is given as an indication of ship turn-around time in port. Estimates of cargo handling time and additional port time have been developed using Temple, Barker and Sloane methodology, U.S. foreign trade statistics for 1975, and U.S. fleet composition (for ships of 1000 GRT or more).

SOURCE 1

Temple, Barker & Sloane, Inc. Merchant Fleet Forecast of Vessels in U.S.-Foreign Trade. Vol. II Final Report. Report prepared for the Maritime Administration. Wellesley Hills, Mass.: Temple, Barker & Sloane, Inc., January 2, 1978.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-10: SOURCE 1 (Chapter VIII)
and SOURCE 2 (Issues for 1972-1976)

FIGURE 4-6. INDEX OF ANNUAL PORT TIME PER ROUND TRIP FOR THE U.S. PRIVATELY-OWNED MERCHANT FLEET but increases in cargo handling and additional time occur as trade routes are shifted to resource-rich areas (such as Africa and South America) with primitive port facilities. The threat of terrorist attacks also causes delays in some ports. In sum, Scenario R envisages a gradual reduction in cargo handling and additional time achieved by coordinating ship and port operations.

4.7.3 Projection in Scenario H. Under Scenario H the recent trend toward reducing port time is reversed. In Scenario H severe capital shortages contribute to a depressed shipbuilding industry (slowing introduction of shipboard cargo handling improvements) and inadequate port development which retards pierside cargo handling improvements and complicates intermodal coordination. Smaller ports assume greater importance; delays incident to the unaccustomed traffic sometimes result, although cargo handling delays tend to be mitigated by the use of small break-bulk and RoRo ships requiring less pierside support. Persistent unemployment leads to opposition to automation of cargo handling facilities. Security problems at home and abroad contribute to delays. Uncertain energy supplies also result in delays (in bunkering, for instance). Diplomatic problems over US maritime and economic policies sometimes result in delays to shipping.

4.7.4 Projection in Scenario E. In Scenario E, this parameter is expected to show substantial improvement until late in the period when a slight deterioration is experienced. Decentralization of industry and population, which characterizes Scenario E, and increased competition among major modes of domestic transport spur a need for improvement of intermodal systems, and harbor and deepwater port development. There is also a heavy demand for advanced ship designs and a fleet capable of importing energy and other raw materials to feed the booming economy. With a high volume of trade comes increased demand for domestic waterborne transportation. Trade routes to areas exporting raw materials (Africa, Southwest Asia, South America) carry an increasing volume of trade. Security problems in US ports and overlapping agency jurisdictions result in shipping delays, as do security problems in foreign ports and diplomatic difficulties over US maritime and economic policies. The net effect on port time in Scenario E is essentially a continuation of the recent historical trend. Improvements tending to reduce port time are made but on an ad hoc basis which frequently lags demand. Toward the end of the period the impact of a significant bulk carrier fleet calling at ports with primitive servicing facilities (with resultant delays) may be seen as a rise in the index.

4.8 Ratio of Speed of Advance to Design Speed for US Privately-owned Merchant Ships of 1000 GRT or More (Parameter 210)

4.8.1 Introduction. This parameter is intended to depict changes in transit time (i.e., port-to-port time at sea) independent of the routes taken or the distances involved. Speed of advance (SOA) is the speed calculated by dividing the distance traversed by the transit time. It is postulatd that the efficiency of at-sea movement is diminished to the extent that SOA is less than the ship's design speed, or that the SOA/speed ratio is less than 1. The variables involved in calculating the ratio are the volume of US foreign trade, the portion of that trade carried in US ships, effective trade route distance, fleet DWT and carrying capacity, annual at-sea days available, and ship design speed. Projections are presented in Table 4-11 and Figure 4-7 and a detailed discussion of the parameter and its elements is provided in Appendix L.

4.8.2 Projection in Scenario R. Under the conditions specified in Scenario R, the SOA/speed ratio is expected to improve slowly. US foreign trade and the share carried in US ships gradually rises in Scenario R. A large portion of it is energy and other raw materials. The volume of trade shifts among the trade routes in the quest for resources. There is growth in the non-liner trades and a demand for

TABLE 4-11

RATIO OF SPEED OF ADVANCE TO DESIGN SPEED FOR U.S. PRIVATELY-OWNED MERCHANT SHIPS OF 1000 GRT OR MORE

(Ratio)

HISTORICAL DATA

1971	0.34	1974	0.42
1972	0.33	1975	0.32
1973	0.40	1976	0.35

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	0.36	0.36	0.36
1985	0.40	0.27	0.47
1990	0.42	0.22	0.55
1995	0.47	0.16	0.69
2000	0.56	0.12	0.80
2005	0.63	0.11	0.96

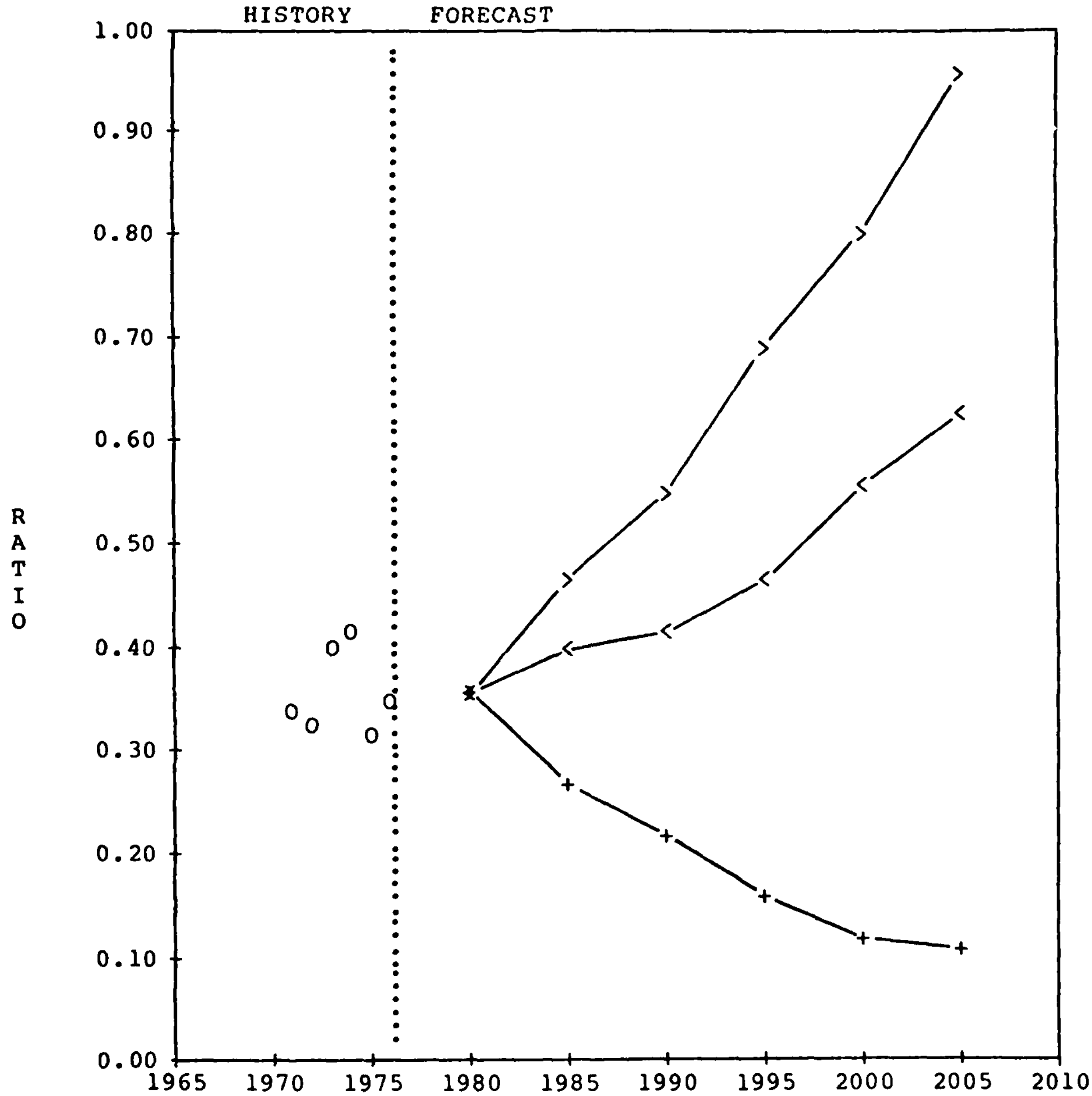
Speed of advance necessary to transport U.S. waterborne trade via the U.S. privately-owned fleet is calculated using the carrying capacity and operating time availability algorithms developed by Temple, Barker and Sloane. Fleet composition, and U.S. trade volume by trade route and trade route distances are taken from Maritime Administration documents.

SOURCE 1

Temple, Barker & Sloane, Inc. Merchant Fleet Forecast of Vessels in U.S.-Foreign Trade. Vol. II Final Report. Report prepared for the Maritime Administration. Wellesley Hills, Mass.: Temple, Barker & Sloane, Inc., January 2, 1978.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. United States Oceanborne Foreign Trade Routes. Washington, D.C.: Government Printing Office, October 1979.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-11: SOURCE 1 (Chapter VIII)
and SOURCE 2 (Appendix B)

FIGURE 4-7

RATIO OF SPEED OF ADVANCE TO DESIGN SPEED FOR U.S. PRIVATELY-OWNED MERCHANT SHIPS OF 1000 GRT OR MORE fleet flexibility and intermodal coordination. There is also a demand for increased use of alternative fuels for ships. The shipbuilding industry is generally depressed so that improvements in fleet carrying capacity, cargo handling and speed progress slowly. This situation improves somewhat toward the end of the period. Under these conditions US foreign trade rises at about 2.7% per year with 4-5% carried in US bottoms. Effective trade route distance falls 22% while fleet carrying capacity drops and then recovers. At-sea time increases about 4% by 2005; ship speeds increase about 3% every five years. The resulting SOA/speed ratio improves slowly.

4.8.3 <u>Projection in Scenario H</u>. In Scenario H, the SOA/speed ratio is projected to decline substantially due to a number of adverse factors. Trade is depressed in Scenario H; foreign trade decreases at about 2% per year. Intermodal networks are poorly coordinated. The shipbuilding industry is also depressed, resulting in an aging US fleet with diminishing carrying capacity. Average ship speed increases (about 5% by 2005) as older (slower) ships are retired. Fluctuating levels of military preference cargoes also contribute to a reduction in the portion of foreign trade carried in US ships (to 2% by 2005) and growing dependence on foreign carriers. Uncertain sources of energy supplies affect the volume of trade and trade route distances, and cause ships to sail at economical (reduced) speeds. The trade situation is complicated by security problems in US harbors and diplomatic problems abroad over US maritime and economic policies. Under these conditions the SOA/speed ratio deteriorates to about half the 1980 value.

4.8.4 <u>Projection in Scenario E</u>. The conditions in Scenario E are conducive to a rapid improvement in SOA/speed ratio. In Scenario E, US foreign trade grows at about 5% per year. The share carried in US ships rises to nearly 9% and is limited by the fleet carrying capacity.

The need to be able to import energy and other raw materials in US bottoms is a major contributing factor. Advanced ship designs significantly increase carrying capacity and speed. Effective trade route distances are also altered. Soaring energy costs lead to demand for nuclear-powered ships which begin to be introduced late in the period. Shipping operations are occasionally hampered by diplomatic difficulties over US maritime and economic policies. The net effect of these conditions is a rapid rise in the SOA/speed ratio to its maximum limit.

4.9 Index of US Merchant Ship Daily Fuel Consumption (Parameter 410B)

4.9.1 Introduction. Fuel has become the largest single component in the cost of operating a ship, and to the extent tnat fuel consumption can be reduced, cost can be reduced. The measurement of daily fuel consumption of the merchant fleet is developed considering three key constituents: average ship DWT, specific fuel consumption (diesel/turbine) and the number of annual operating days at sea and in port. Projections of this parameter are shown in Table 4-12 and Figure 4-8 and details are provided in Appendix M.

4.9.2 Projection in Scenario R. Under the conditions discussed below, the daily fuel consumption of the merchant ship is expected to rise gradualy in Scenario R. A shortage of construction subsidy funds and a generally depressed shipbuilding industry in Scenario R result in a low ship delivery rate. Growth in non-liner trades and an increased demand for domestic waterborne transportation of hazardous cargoes, energy and other raw materials collectively favor smaller ships; average DWT increases very slowly, especially early in the period. Although there is a demand for energy conservation and increased use of alternative fuels in waterborne shipping, the US fleet continues to lag the world trend in adopting fuel-efficient diesel powerplants. However, introduction of efficient gas turbine

TABLE 4-12

INDEX OF U.S. MERCHANT SHIP DAILY FUEL CONSUMPTION

(Index (1974 = 100))

HISTORICAL DATA

1970	107.2	1976	103.3
1971	103.6	1977	105.0
1974	100.0	1978	106.6

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	123.1	123.1	123.1
1985	130.5	126.9	143.0
1990	138.4	130.9	160.9
1995	146.4	134.8	178.7
2000	155.7	138.7	198.4
2005	164.1	141.5	216.9

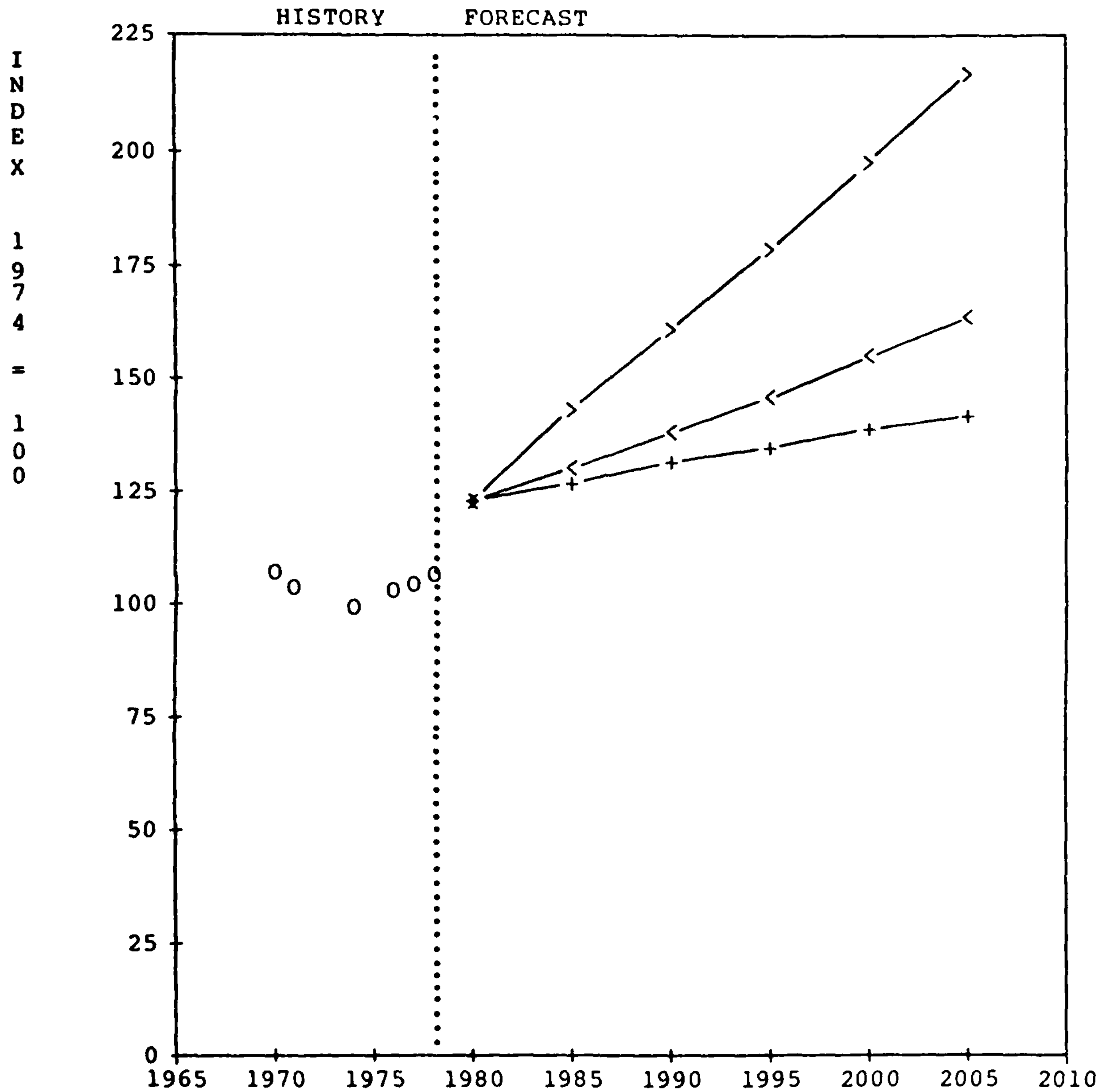
A composite, average of relatives index is given. The index accounts for daily fuel usage (at sea and in port) of steam-driven general cargo ships, bulk carriers and tankers of 1000 GRT or more. Average DWT, and fleet size and composition are considered.

SOURCE 1

U.S. Department of Commerce. Maritime Administration. Estimated Vessel Operating Expenses. Washington, D.C.: Government Printing Office, annual.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-12: SOURCE 1 (Issues for 1970-1978)
and SOURCE 2 (Issues for 1970-1978)

FIGURE 4-8. INDEX OF U.S. MERCHANT SHIP DAILY FUEL CONSUMPTION plants begins late in the period. An aging fleet and growth in the non-liner trades tend to increase the time a ship spends in port, thereby reducing average daily fuel consumption. On the other hand, upward cost pressures on energy, lagging port development and intermodal coordination, and concentration of liner traffic in a small number of major ports tend to increase at-sea time and fuel consumption. Combined, the index shows a slow, steady increase.

4.9.3 Projection in Scenario H. Due to several factors the index of fuel consumption is expected to rise very slowly in Scenario H. Under Scenario H, a prolonged depression in the shipbuilding industry results in few new ships so that the fleet specific fuel consumption remains essentially static. The average DWT slowly rises as older, smaller ships are retired. The few fleet additions favor small break-bulk and RoRo vessels to serve small ports, which are growing in significance, particularly in the coastal trade. Poorly coordinated intermodal networks also favor ships of the smaller sizes and tend to increase time in port. Deteriorated port facilities and severe energy problems, including fuel scarcity, as well as the growing maintenance requirements associated with an aging fleet also tend to increase port time and reduce fuel consumption. Diplomatic problems over US maritime and economic policies sometimes delay arrivals or departures or require vessel re-routing, with unpredictable influences on fuel consumption. The net effect of these conditions is a very slow rise in the index.

4.9.4 Projection in Scenario E. Under Scenario E there are many influences which tend to result in higher fuel consumption. The strong demand for technologically advanced designs and the need to import energy and other raw materials in US ships favor larger, faster ships with improved cargo handling equipment. Improvements in intermodal systems and port facilities, and establishment of deepwater ports reduce port time. Soaring energy costs lead to more efficient power plants (gas turbine, slow speed diesel, and late in the period, nuclear). Security problems at home and abroad and diplomatic difficulties over US maritime and economic policies sometimes result in increases in port time, sometimes in re-routing, with opposite effects on fuel consumption. Taken together, however, the index rises rapidly under these influences.

4.10 Index of US Merchant Ship Daily Operating Cost (Parameter 300)

4.10.1 Introduction. Operating costs are a key factor in evaluating the profitability and economic viability of the US merchant fleet. Relative operating costs for the nominal US, privately-owned merchant ship of 1000 GRT or more have been developed considering the following cost categories: fuel, personnel, subsistence, supply, maintenance and repair, insurance and other costs. Projections are shown in Table 4-13 and Figure 4-9 on the basis of current dollars (i.e., including an allowance for inflation) while Table 4-14 and Figure 4-10 shows these projections in constant (1978) dollars. More detailed discussions of the calculations involved are included in Appendix N.

4.10.2 Projection in Scenario R. Due to conditions outlined below, operating costs are projected to rise moderately throughout the period. Although there is a demand for increased use of alternative fuels for ships in Scenario R, introduction or increased application of coal, diesel, or gas turbine power plants into the fleet is inhibited until late in the period by a generally depressed shipbuilding industry. Introduction of automated systems aboard ship is also inhibited for this reason and because significant unemployment, due to sluggish trade, induces resistance to automation by organized maritime labor. Maintenance costs slowly rise with the advancing age of the fleet, and insurance costs fall. In addition to inflationary pressures (6-7% annual rate, diminishing later

TABLE 4-13

INDEX OF U.S. MERCHANT SHIP DAILY OPERATING COSTS
(IN CURRENT DOLLARS)

(Index (1974 = 100))

HISTORICAL DATA

1970	71.5	1976	106.0
1971	73.5	1977	112.9
1974	100.0		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	143.6	143.6	143.6
1985	211.3	250.5	212.8
1990	304.1	428.5	307.6
1995	367.6	735.4	461.4
2000	445.6	1255.2	693.8
2005	538.6	2138.4	1041.4

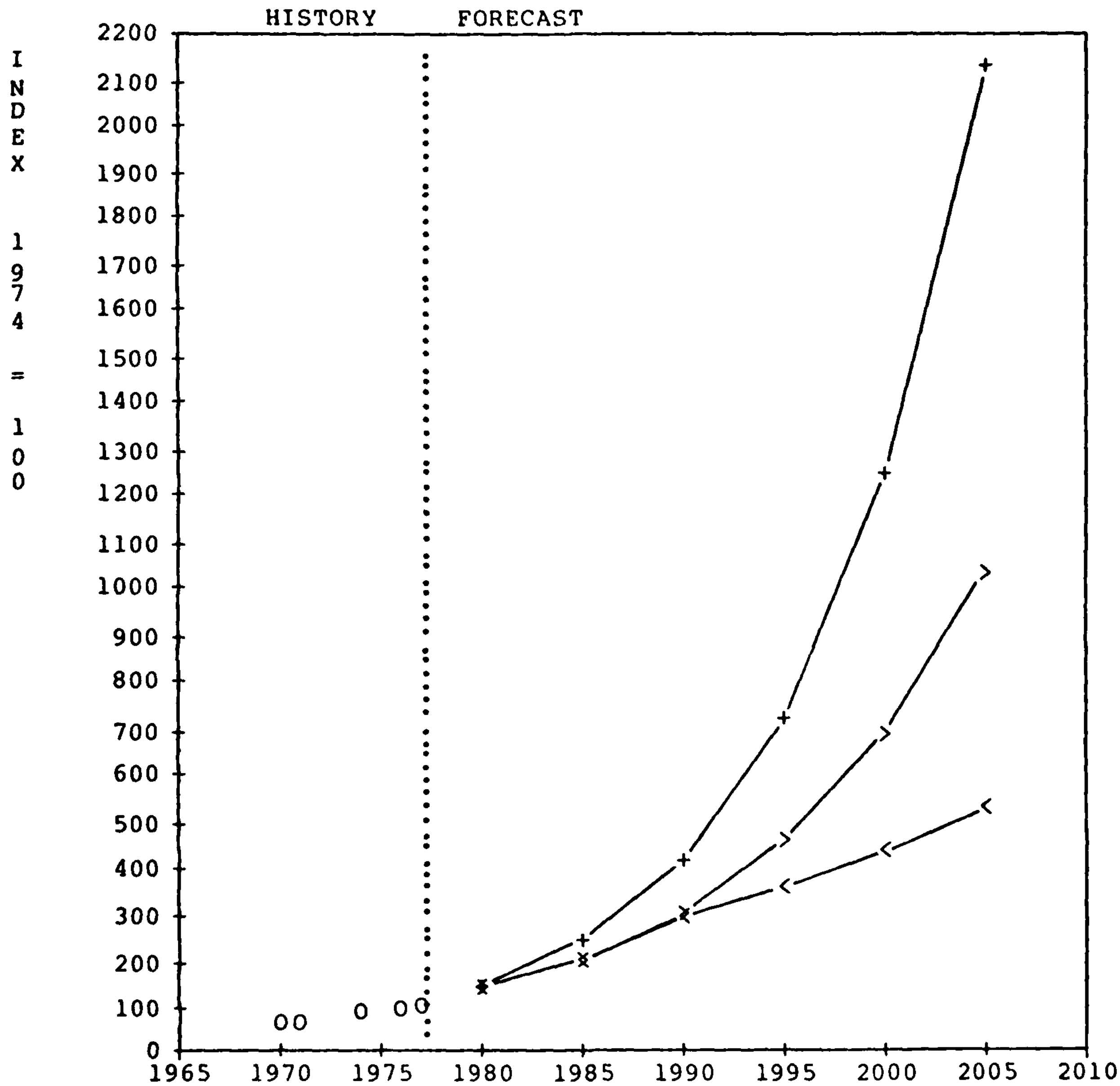
A composite, average of relatives index is given. The index accounts for fuel, personnel, supply, maintenance, insurance and other costs for general cargo ships, bulk carriers and tankers of 1000 GRT or more. Average DWT, fleet size and composition are considered. Fuel oil prices at New York are used.

SOURCE 1

U.S. Department of Commerce. Maritime Administration. Estimated Vessel Operating Expenses. Washington, D.C.: Government Printing Office, annual.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-13: SOURCE 1 (Issues for 1970-1978)
and SOURCE 2 (Issues for 1970-1978)

FIGURE 4-9. INDEX OF U.S. MERCHANT SHIP DAILY OPERATING COSTS
(IN CURRENT DOLLARS)

TABLE 4-14

INDEX OF U.S. MERCHANT SHIP DAILY OPERATING COSTS
(IN CONSTANT 1978 DOLLARS)

(Index (1974 = 100))

HISTORICAL DATA

1970	56.3	1976	122.2
1971	60.7	1977	139.8
1974	100.0		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	157.5	157.5	157.5
1985	161.9	175.0	179.3
1990	166.1	194.5	202.9
1995	169.1	216.9	238.4
2000	172.7	240.7	281.1
2005	175.6	266.6	330.4

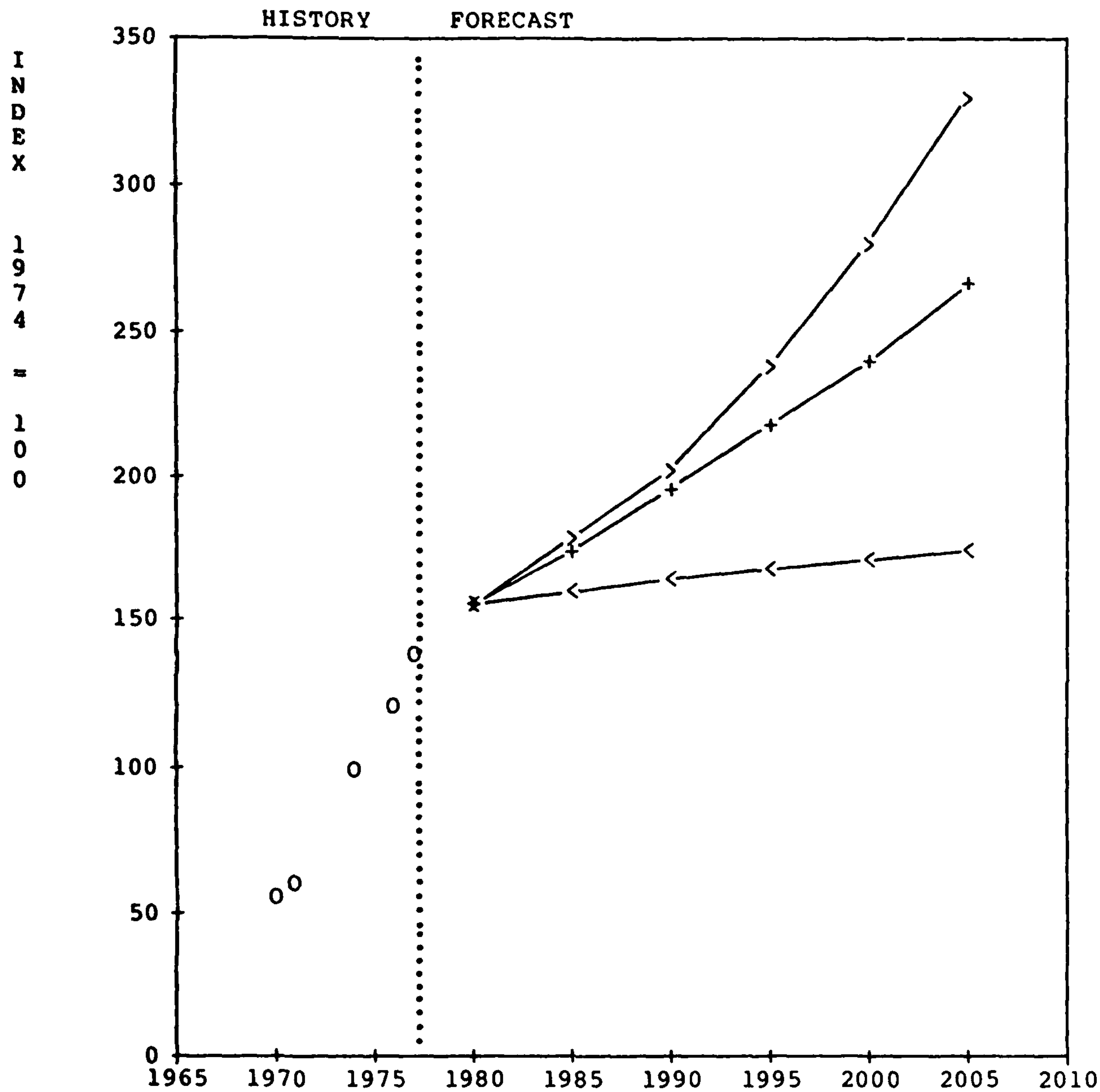
A composite, average of relatives index is given. The index accounts for fuel, personnel, supply, maintenance, insurance and other costs for general cargo ships, bulk carriers and tankers of 1000 GRT or more. Average DWT, fleet size and composition are considered. Fuel oil prices at New York are used. Historical costs have been indexed to 1978 constant dollars using the implicit GNP price deflator.

SOURCE 1

U.S. Department of Commerce. Maritime Administration. Estimated Vessel Operating Expenses. Washington, D.C.: Government Printing Office, annual.

SOURCE 2

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-14: SOURCE 1 (Issues for 1970-1978)
and SOURCE 2 (Issues for 1970-1978)

FIGURE 4-10. INDEX OF U.S. MERCHANT SHIP DAILY OPERATING COSTS
(IN CONSTANT 1978 DOLLARS)

in the period), which affect all cost elements, insurance costs would tend to increase due to lagging US port development and ship and cargo security problems in foreign ports. Increased domestic demand for waterborne transport of hazardous cargoes, and energy and other raw materials would also tend to raise insurance costs. The combined effect of these influences causes the index to rise at a steady, moderate rate.

4.10.3 Projection in Scenario H. In this scenario, operating costs (in current dollars) escalate rapidly due to a number of factors. In Scenario H, prolonged depression in the US shipbuilding industry effectively terminates new ship deliveries and the introduction of more fuel-efficient power plants. With rapidly rising energy prices, bunker fuel costs rise dramatically. Manning levels rise slowly; shipboard labor-saving automation is strongly inhibited by labor pressures (due to persistent unemployment) and the lack of new ship deliveries. All operating costs are affected by a high (9%) inflation rate. Insurance costs are pushed upward by security problems in US ports, and in foreign ports as a consequence of diplomatic problems over US maritime and economic policies. Deteriorated and congested ports and the age of the increasingly ancient fleet also contribute to insurance costs. Under these conditions the cost index rises exponentially to 20 times 1974 costs (in current dollars).

4.10.4 Projection in Scenario E. Under the conditions in Scenario E, operating costs rise at a steady and rapid rate. In Scenario E ships of advanced design (including fuel-efficient power plants) are steadily delivered to the fleet. A few nuclear-powered ships become available late in the period, but their fuel economies are masked by increased consumption associated with the larger, faster ships being built. Crew sizes, hence personnel costs, increase but slowly as automation becomes more widely employed. Maintenance costs, which increase toward the end of the period, reflect the increased sophistication of the newer vessels. Moderate inflation (5%) affects all operating cost elements. Insurance costs climb steeply due to increased ship size and rapid growth in demand for domestic waterborne transportation, factors which contribute to port congestion. Security problems in US harbors and deepwater ports and in foreign ports also increase insurance costs, as do diplomatic difficulties over US maritime and economic policies. All these factors combine to force operating costs up at a steady pace.

4.11 US Merchant Marine Licenses and Documents Issued (Parameter 280)

4.11.1 Introduction. This parameter shows the relative magnitude of the number of officers' licenses and seamen's documents to be issued under the three scenarios and reflects manpower availability. The number of US ships of 100 or more GRT were used to predict the number of licenses and documents issued. Projections of the numbers of licenses and documents issued are shown in Table 4-15 and Figure 4-11; details are included in Appendix O.

4.11.2 Projection in Scenario R. Over the period the number of licenses and documents issued are expected to range between 40 and 50 thousand, the range experienced in 1977-1978.

Upward cost pressures and a generally depressed shipbuilding industry in Scenario R result in a slow increase in the number of ocean-going ships. With sluggish growth in foreign trade, the need for licensed/documented crews remains nearly static. There is, however, a heavy domestic demand for waterborne transportation of hazardous cargoes, and energy and other raw materials. Under this scenario, the number of document issues rises slightly.

4.11.3 Projection in Scenario H. There are a number of factors and conditions in Scenario H which indicate a steady decrease in the number of documents and licenses to be issued over the period. Scenario H is characterized by a

TABLE 4-15

U.S. MERCHANT MARINE LICENSES AND DOCUMENTS ISSUED FOR OCEAN AND COASTWISE NAVIGATION

(Thousands)

HISTORICAL DATA

1966	57.0	1973	43.1
1967	84.1	1974	43.9
1968	70.1	1975	45.7
1969	70.7	1976	41.5
1970	64.2	1977	45.4
1972	48.7	1978	56.0

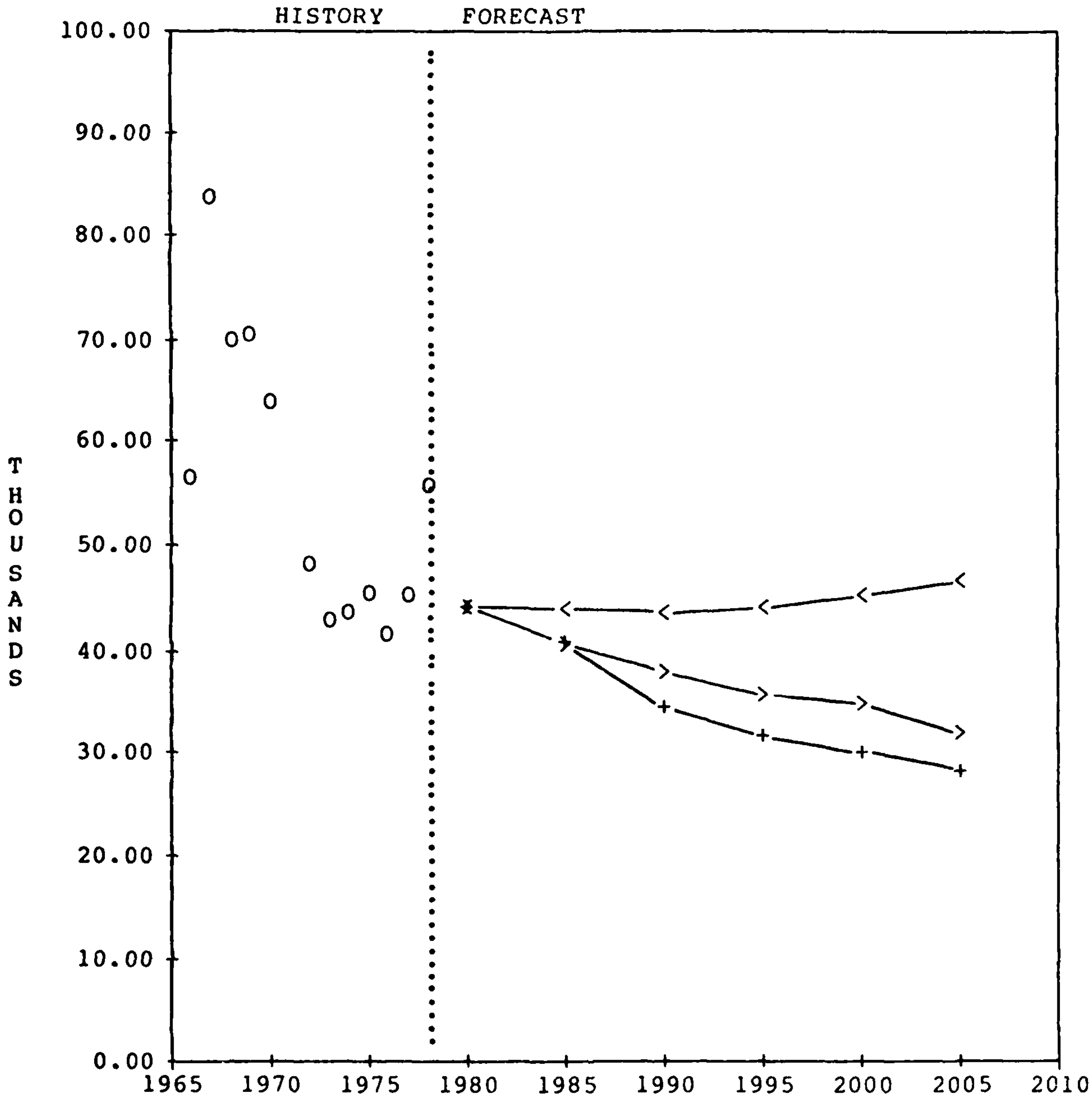
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	44.5	44.5	44.5
1985	44.2	41.1	40.8
1990	43.9	34.8	38.3
1995	44.4	32.0	36.2
2000	45.6	30.3	35.2
2005	47.0	28.5	32.2

Officers' licenses (deck and engineer), and seamen's documents are included, both original issues and renewals/endorsements. Staff officer certificates of registry and licenses for pilots, uninspected vessels, and towboat and motorboat operators are excluded. Data are given by fiscal year; the transition quarter (July-September 1976) is excluded.

SOURCE

U.S. Department of Transportation. U.S. Coast Guard. Proceedings of the Marine Safety Council. Washington, D.C.: Government Printing Office, monthly.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-15: SOURCE CITED (Issues for 1966-1978)

FIGURE 4-11. U.S. MERCHANT MARINE LICENSES AND DOCUMENTS ISSUED FOR OCEAN AND COASTWISE NAVIGATION prolonged depression in the shipbuilding industry and depressed trade levels, both import/export and domestic. There is growing dependence on foreign carriers and persistent maritime unemployment as the size of the oceangoing fleet shrinks. Under these conditions the number of licenses and documents to be issued can be expected to diminish significantly.

4.11.4 Projection in Scenario E. Prospects for seafaring employment are brighter in Scenario E. New ships are delivered steadily to meet the demands imposed by expanding foreign and domestic waterborne trade coupled with the desire to be able to import energy and other raw materials in US bottoms. While crew size generally declines as automation becomes increasingly widespread in the fleet, other maritime-related jobs are gradually created for which existing licenses/documents are prerequisite. It is also likely that the domain for which maritime licenses or documents will be required will expand. New licensing applications notwithstanding, the number of licenses and documents to be issued under Scenario E can be expected to decline steadily.

4.12 Index of Marine Traffic Density for Selected US Ports (Parameter 570)

4.12.1 Introduction. This parameter is intended to guage relative marine traffic density over the forecast period. Marine traffic density is of concern for a number of reasons, not the least of which is an indication of potential safety problems. In developing the parameter, constituent elements considered included the number of vessel transits, the active port area and the volume of trade handled, for a representative set of 20 ports. The sample includes the top 16 ports (in terms of the volume of foreign trade handled in 1977) and all ports in which vessel traffic management systems have been established or proposed. Projections for this parameter are shown in Table 4-16 and Figure 4-12, with a detailed presentation in

TABLE 4-16

INDEX OF MARINE TRAFFIC DENSITY FOR SELECTED U.S. PORTS

(Index (1974 = 100))

HISTORICAL DATA

1969	79.4	1974	100.0
1970	87.4	1975	96.1
1971	87.4	1976	102.8
1972	91.1	1977	126.8
1973	100.5		

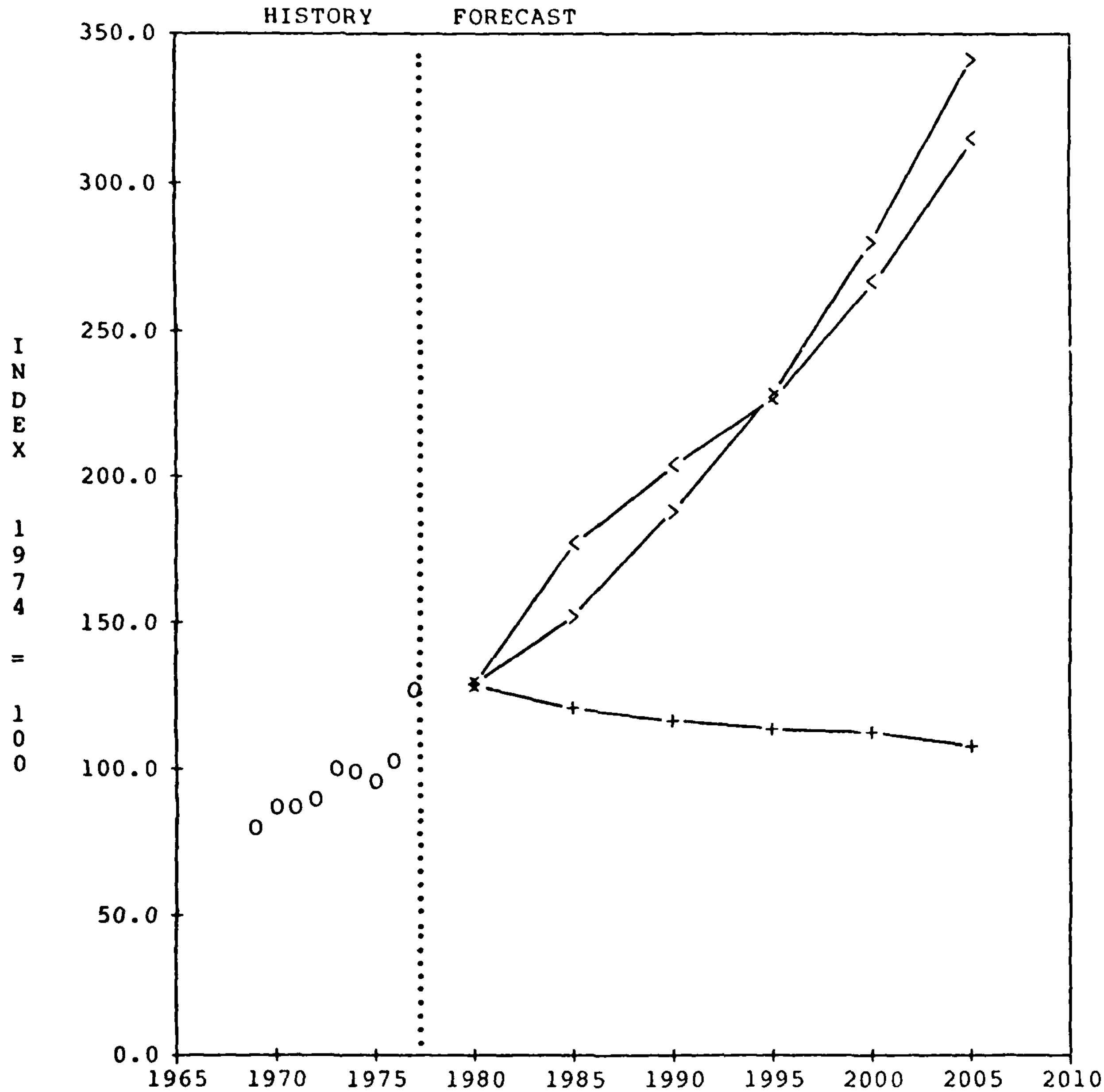
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	129.5	129.5	129.5
1985	177.6	122.2	153.3
1990	203.9	116.8	188.8
1995	227.5	113.9	228.3
2000	265.7	112.8	280.5
2005	315.6	108.4	341.7

A composite, average of relatives index is given. The index samples the following ports: Portland (Me.), Boston, New York, Philadelphia, Baltimore, Norfolk, Tampa, Mobile, New Orleans, Baton Rouge, Port Arthur, Beaumont, Texas City, Houston, Corpus Christi, Long Beach, Los Angeles, San Francisco, Seattle, and Valdez. Traffic density in a port is the number of inbound and outbound trips (by both ships and barges) divided by the area of the port. Port indices are then weighted in proportion to the volume of foreign and domestic trade handled by each port to produce the composite index.

SOURCE

U.S. Department of Defense. U.S. Army Corps of Engineers. Waterborne Commerce of the United States. Pts 1, 2 and 4. New Orleans, La., annual.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-16: SOURCE CITED (Volumes for 1969-1977)

FIGURE 4-12

INDEX OF MARINE TRAFFIC DENSITY FOR SELECTED U.S. PORTS

Appendix P.

4.12.2 <u>Projection in Scenario R</u>. Port congestion, as measured by this parameter, is expected to increase substantially in Scenario R. Port development lags in Scenario R because of a lack of funds and other resistance. Nearly static foreign trade levels and unemployment in the 1980s also hamper port development. Liner traffic becomes concentrated in a few major ports while trade routes shift and there is growth in non-liner trades. Demand for intermodal coordination follows increased demand for waterborne transport of hazardous cargoes, and energy and other raw materials domestically. The period is marked generally by an increase in total (foreign and domestic) trade handled, changes in the distribution of trade among the ports, and an increase in the number of vessel transits. Late in the period, port improvements result in a slow increase in active port area. The net effect is a rapid rise in the index, indicating increasing congestion.

4.12.3 <u>Projection in Scenario H</u>. In this scenario, port congestion is projected to remain at about the level currently experienced, declining only slightly during the period. In Scenario H, depressed foreign and domestic trade levels, capital shortages, and persistent unemployment result in security problems, deteriorated ports and poorly coordinated intermodal networks. Small ports grow in significance in the coastal trade. Energy shortages and uncertain sources of supply affect vessel movements. Conditions do not favor harbor improvements to accommodate larger vessels (hence fewer transits). The volume of trade is down, but its distribution among the ports changes. The index remains nearly static.

4.12.4 <u>Projection in Scenario E</u>. Port congestion is expected to increase rapidly in Scenario E. There is strong growth in US foreign trade in Scenario E as well as rapid growth in domestic waterborne transportation. Decentralization of industry spurs the need to improve intermodal systems (especially for domestic transport) and a demand for port improvement and redesign. The number of vessel transits generally increases but is occasionally inhibited by jurisdictional disputes among port agencies and by security concerns/terrorist activity in some ports. The relative volumes of trade handled by the 20 ports, which are quite uniformly distributed geographically, remain essentially unchanged. The density index rises rapidly under these influences.

4.13 Growth of US Vessel Traffic Management Systems (Parameter 190)

4.13.1 Introduction. VTSs play an important role in assuring safe and efficient movement of ships through congested areas. This parameter is intended to illustrate the growth of VTSs which may be inferred from the scenarios. To do this, a sample of 20 ports is examined. The sample includes 16 of the largest ports (by foreign trade volume in 1977) and all ports in which VTSs have been established or proposed. (This is the same sample of ports that was used in the preceding parameter, 570). The measure employed is the active port area of ports with VTSs compared to the total active area of the 20 ports. The discussion which follows also considers offshore Traffic Separation Schemes close to the United States, although TSS areas are not explicitly part of the calculations. (Worldwide, TSSs account for less than 1% of the total VTS+TSS area). Projections are displayed in Table 4-17 and Figure 4-13; details are provided in Appendix Q.

4.13.2 Projection in Scenario R. In Scenario R, the expansion of port area covered by VTS is very small until after 1990 when area covered increases at a moderate and steady rate. Under Scenario R there is increased demand for waterborne transport of hazardous cargoes, and energy and other raw materials. While foreign trade increases steadily, port development lags demand because of upward cost pressures, scarce capital or other resistance. The

TABLE 4-17

AREA OF 20-PORT SAMPLE SERVED BY VESSEL TRAFFIC MANAGEMENT SYSTEMS

(Percent of Total Area)

HISTORICAL DATA

1970	0.0
1972	31.1
1975	32.2
1977	38.7

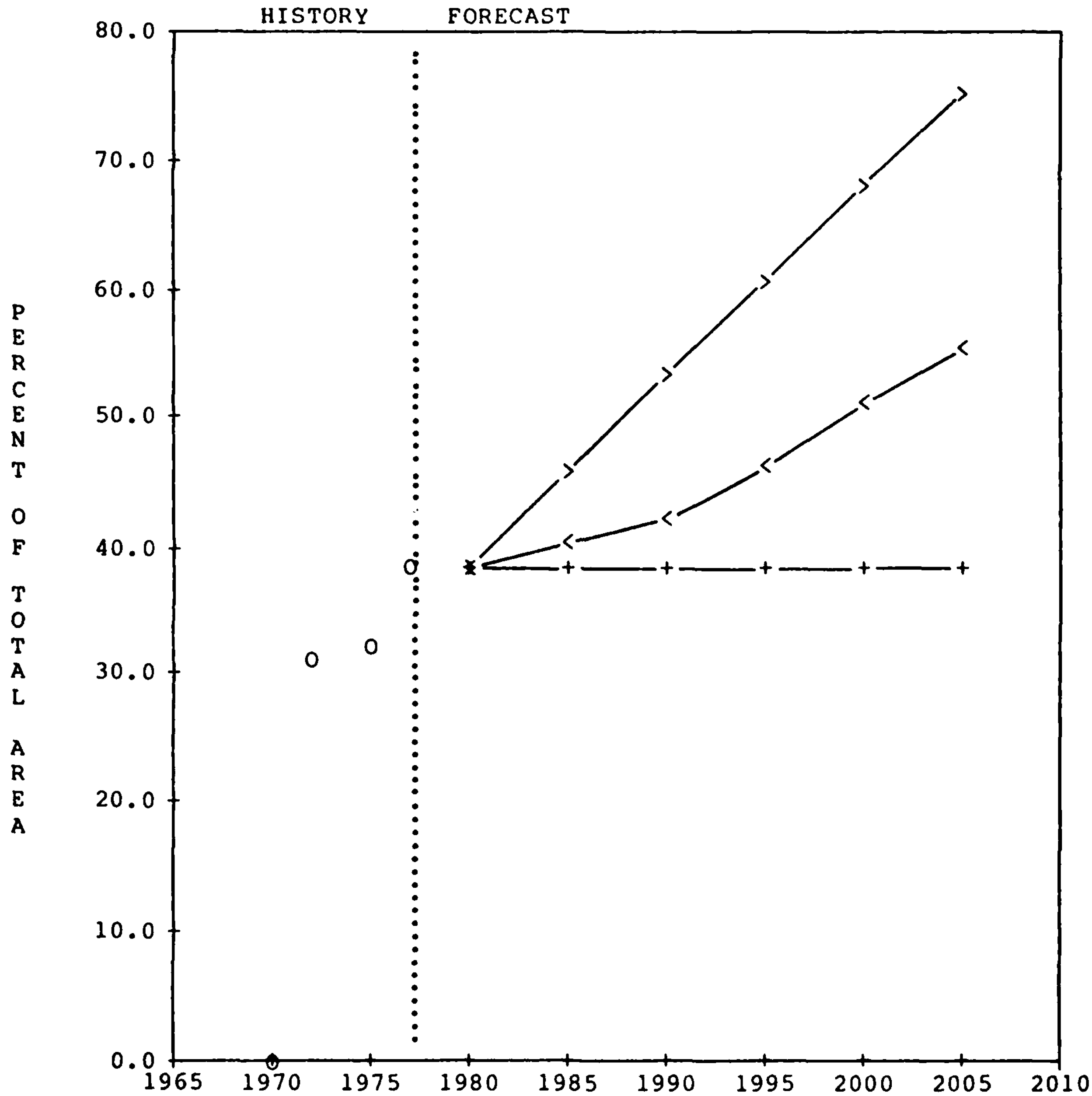
PROJECTED DATA

	SCENARIO		
	R	H	E
1980	38.7	38.7	38.7
1985	40.5	38.7	46.1
1990	42.0	38.7	53.5
1995	46.5	38.7	60.8
2000	51.0	38.7	68.2
2005	55.5	38.7	75.6

The following ports are included: Portland (Me.), Boston, New York, Philadelphia, Baltimore, Norfolk, Tampa, Mobile, New Orleans, Baton Rouge, Port Arthur, Beaumont, Texas City, Houston, Corpus Christi, Long Beach, Los Angeles, San Francisco, Seattle, and Valdez. Total port area is 1635 square miles.

SOURCE

Forecasting International, Ltd.



LEGEND: HISTORICAL DATA: O, SCENARIO PROJECTIONS: R: <, H: +, E: >

ORIGIN: TABLE 4-17

FIGURE 4-13

AREA OF 20-PORT SAMPLE SERVED BY VESSEL TRAFFIC MANAGEMENT SYSTEMS port development situation improves later in the period and a number of deepwater ports are built. Liner traffic becomes concentrated in a few major ports. Non-liner trades expand, with some shifting of trade routes. VTS expansion is slow until about 1990, after which the VTS area increases at a moderate rate. By 2005 the augmented VTS area includes New York, Baltimore and Norfolk/Hampton Roads, or equivalent area. TSSs may also be established in the approaches to deepwater ports.

4.13.3 Projection in Scenario H. In Scenario H, costly VTS systems are projected to remain static, covering only that port area covered today. Scenario H is characterized by severe capital shortages in all industries, diminishing foreign trade, and deteriorating ports and harbors. Smaller ports assume growing significance and traffic density (Parameter 570) remains essentially static. Under Scenario H, no VTS increases are projected.

4.13.4 Projection in Scenario E. In this scenario VTS is expected to be a high priority and the area covered by VTSs is expected to increase rapidly. Increasing foreign trade and rapid growth in demand for domestic waterborne transportation result in the need for LNG terminals and deepwater ports, and port development generally. Decentralized industry, increased competition among major domestic transport modes, and security problems in US ports create a demand for improved (safer, more efficient) intermodal systems. Although jurisdictional disputes may arise among port agencies, delaying VTS implementation, there are strong reasons for expanding the VTS and TSS areas, and sufficient capital to do it. Growth is projected to include New York, Baltimore, Norfolk/Hampton Roads, and Mobile, or equivalent areas, in the total VTS area.

CHAPTER 5

FUTURE FLEET PROFILES AND ISSUE IDENTIFICATION

5.1 Introduction

The purpose of this chapter is to summarize and organize the results of the Chapter 4 analysis wherein each parameter was subjected to the conditions prevailing in each of the scenarios. The analysis yields two categories of conclusions, namely, information concerning the ships of the future merchant fleet, and identification of the issues embedded in the scenarios which are pertinent to the future merchant fleet, the Maritime Administration and the Coast Guard.

5.2 Profiles of the Future Merchant Fleet

Development of profiles of the future merchant fleet, and the ships that comprise it, began with fundamental scenario assumptions regarding the volume of US foreign trade, the percentage of that trade carried in US ships, and projections of fleet size, i.e., total deadweight tonnage. Fleet composition and DWT for 1980 are essentially extrapolations of historical data. Numbers of ships by type (freighter, bulker, tanker) have been estimated from historical data and the scenarios. Within each type the distribution of ships by sub-type has been estimated based on the scenarios. (The sub-types are: freighters - general cargo, partial container, full container and RoRo, barge carrier; bulkers - dry bulk carriers, combination carriers; tankers - liquid bulk carriers, gas carriers). Estimates of average DWT by ship type have been derived from these calculations. Fleet age by ship type has been derived from historical age distributions modified by deleting appropriate numbers of the oldest ships and adding the new construction envisaged under the scenarios. Average ship speed estimates have been calculated by extrapolating historical data for Scenario E and by assuming a 3% and 1% increase per 5-year period for Scenarios R and H, respectively. These rates are consistent with the scenarios. Fleet profiles are summarized in Tables 5-1 through 5-3. Details are given in the appendices, particularly Appendices H, I, and L.

The fleet profiles thus developed are internally consistent; the ship construction requirement implied by these profiles can also be met. The requirement is greatest under Scenario E, where the entire 2005 fleet would have to be built after 1977 (409 new ships are postulated). Such a construction program is feasible under the shipbuilding capabilities projected for this scenario (see Parameter 400). Assuming three years to build a ship and comparing required vs. available shipway-years, freighter and bulker requirements can easily be met. Tanker requirements can, too, but tanker construction could absorb 37% of tanker shipway capacity. Concurrent naval construction demands (also envisaged in this scenario) could over-tax the largest shipways.

5.3 Issues

The second category of conclusions to be drawn from the parameter analysis deals with the issues which would significantly affect the development of the future merchant fleet. An issue is defined as a condition or trend, present (to some degree) in all scenarios, which would affect the Maritime Administration, the Coast Guard, or the clientele of either organization. The effect of the issue might take the form of a problem for MarAd/CG, or it might represent an opportunity for action.

A list of issues is given in Table 5-4 together with a brief description for each scenario. For most issues the intensity and direction of change vary with the scenario. For instance, the volume of US foreign trade, upon which the health of the shipping industry ultimately rests, is projected differently among the scenarios. For other issues, such as ship and cargo security (both foreign and domestic), a common direction is perceived, but intensities vary. Some aspects of a few issues appear to be relatively insensitive to scenario conditions; the building of small vessels for the domestic trades is recognized in all three scenarios, for instance. For still other issues, conditions under only two scenarios may be similar. Naval-merchant competition for available shipbuilding capability under Scenarios R and E is an example.

The issues summarized in Table 5-4 are examined in Chapter 6 to determine which MarAd/CG programs, and which clientele groups, they affect.

TABLE 5-1

US MERCHANT FLEET PROFILES

PROJECTIONS FOR SHIPS OF 1000 GRT OR MORE

		TOTAL FLEET			FREIGHTERS					BULK CARRIERS					TANKERS				
Scenario	Year	No.	DWT (kLT)	AVG DWT (kLT)	No.	% Total	DWT (kLT)	% Total	AVG DWT (kLT)	No.	% Total	DWT (kLT)	% Total	AVG DWT (kLT)	No.	% Total	DWT (kLT)	% Total	AVG DWT (kLT)
ALL	1980	556	19000	34.2	260	47	4420	23	17.0	16	3	580	3	36.2	280	50	14000	74	50.0
RESOURCE	1985	556	19000	34.2	260	47	4420	23	17.0	16	3	580	3	36.2	280	50	14000	74	50.0
ALLOCA-	1990	556	19000	34.2	260	47	4420	23	17.0	16	3	580	3	36.2	280	50	14000	74	50.0
TION	1995	565	19300	34.2	265	47	4500	23	17.0	16	3	600	3	37.5	284	50	14200	74	50.0
(R)	2000	580	20000	34.5	272	47	4700	24	17.3	16	3	620	3	38.8	292	50	14680	73	50.3
	2005	600	20700	34.5	280	47	5000	24	17.8	17	3	650	3	38.2	303	50	15050	73	49.7
HARDSHIP	1985	515	18193	35.3	242	47	4163	23	17.2	14	3	530	3	37.8	259	50	13500	74	52.1
(H)	1990	441	16595	37.6	210	48	3675	22	17.5	7	2	365	2	52.1	224	50	12555	76	56.0
	1995	407	15904	39.1	195	48	3444	22	17.7	2	1	260	2	130.0	210	51	12200	76	58.1
	2000	387	15376	39.7	189	49	3326	22	17.6	2	1	260	2	130.0	196	50	11790	76	60.2
	2005	365	14843	40.7	182	50	3208	22	17.6	2	1	260	2	130.0	181	49	11395	76	63.0
EXPANSIVE	1985	505	20700	41.0	238	47	4230	20	17.8	15	3	670	3	44.5	252	50	15800	77	62.5
GROWTH	1990	472	22500	47.7	217	46	4020	18	18.5	28	6	1450	6	52.8	227	48	17020	76	75.0
(E)	1995	445	24200	54.4	200	45	3850	16	19.2	40	9	2450	10	61.2	205	46	17900	74	87.5
	2000	432	25900	60.0	195	45	3900	15	20.0	56	13	3900	15	69.6	181	42	18100	70	100.0
	2005	398	26900	67.6	175	44	3640	14	20.8	52	13	4020	15	77.8	171	43	19240	71	112.5

TABLE 5-2

US MERCHANT FLEET PROFILES

DETAILED PROJECTIONS OF THE NUMBERS OF SHIPS OF 1000 GRT OR MORE

SHIP TYPE	SHIP SUB-TYPE*	ALL SCENARIOS	SCENARIO R					SCENARIO H					SCENARIO E				
		1980	1985	1990	1995	2000	2005	1985	1990	1995	2000	2005	1985	1990	1995	2000	2005
FREIGHTER	GC	117	78	52	48	35	28	73	55	47	42	36	71	43	36	25	18
	PC	23	39	52	40	41	42	36	25	25	26	26	36	43	30	30	26
	FC	99	117	130	145	158	168	109	105	100	98	96	107	109	110	113	105
	BC	21	26	26	32	38	42	24	25	23.	23	24	24	22	24	27	26
TOTAL		260	260	260	265	272	280	242	210	195	189	182	238	217	200	195	175
BULKER	DB	14	14	14	14	14	15	12	6	2	2	2	13	25	36	50	46
	CC	2	2	2	2	2	2	2	1	0	0	0	2	3	4	6	6
TOTAL		16	16	16	16	16	17	14	7	2	2	2	15	28	40	56	52
TANKER	LB	277	266	260	264	272	282	246	211	195	181	166	237	211	189	165	154
	LG	3	14	20	20	20	21	13	13	15	15	15	15	16	16	16	17
TOTAL		280	280	280	284	292	303	259	224	210	196	181	252	227	205	181	171
GRAND TOTAL		556	556	556	565	580	600	515	441	407	387	365	505	472	445	432	398

*SHIP SUB-TYPES:
GC - General Cargo
PC - Partial Container
FC - Full Container
BC - Barge Carrier
DB - Dry Bulk Carrier
CC - Combination Carrier
LB - Liquid Bulk Carrier
LG - Liquified Gas Carrier

TABLE 5-3

US MERCHANT FLEET PROFILES

PROJECTIONS FOR SHIPS OF 1000 GRT OR MORE
AVERAGE AGE AND SPEED

SCENARIO	YEAR	TOTAL FLEET			FREIGHTERS			BULK CARRIERS			TANKERS		
		NO.	AVERAGE AGE (YR)	AVERAGE SPEED (KT)	NO.	AVERAGE AGE (YR)	AVERAGE SPEED (KT)	NO.	AVERAGE AGE (YR)	AVERAGE SPEED (KT)	NO.	AVERAGE AGE (YR)	AVERAGE SPEED (KT)
HISTORICAL	1977	565	16.7	18.0	285	15.4	20.0	18	25.9	15.0	262	17.4	16.0
ALL SCENARIOS	1980	556	17.6	18.7	260	16.0	21.3	16	15.6	15.9	280	19.1	16.5
RESOURCE ALLOCATION (R)	1985	556	19.8	19.3	260	18.8	21.9	16	14.1	16.4	280	21.0	17.0
	1990	556	21.7	19.8	260	21.5	22.6	16	11.6	16.9	280	22.5	17.5
	1995	565	23.8	20.4	265	25.2	23.3	16	12.2	17.4	284	23.1	18.0
	2000	580	26.0	21.0	272	29.0	24.0	16	13.1	17.9	292	24.0	18.6
	2005	600	28.0	21.7	280	32.8	24.7	17	14.3	18.4	303	24.3	19.1
HARDSHIP (H)	1985	515	21.1	18.9	242	19.6	21.5	14	18.2	16.1	259	22.6	16.7
	1990	441	23.5	19.1	210	22.4	21.7	7	13.2	16.2	224	24.9	16.8
	1995	407	27.8	19.3	195	27.0	21.9	2	17.5	16.4	210	28.7	17.0
	2000	387	32.2	19.5	189	31.8	22.2	2	22.5	16.5	196	32.8	17.2
	2005	365	36.5	19.7	182	36.6	22.4	2	27.5	16.7	181	36.6	17.3
EXPANSIVE GROWTH (E)	1985	505	15.4	19.9	238	15.0	23.1	15	7.8	16.7	252	16.3	17.1
	1990	472	14.2	21.0	217	15.3	24.9	28	7.2	17.5	227	14.1	17.6
	1995	445	13.4	22.0	200	14.9	26.7	40	8.8	18.2	205	12.8	18.1
	2000	432	13.8	23.1	195	14.6	28.5	56	10.1	19.0	181	14.1	18.7
	2005	398	14.0	24.2	175	12.5	30.4	52	14.0	19.8	171	15.6	19.2

TABLE 5-4 ISSUE DESCRIPTIONS

ISSUE	R (RESOURCE ALLOCATION)	H (HARDSHIP)	E (EXPANSIVE GROWTH)
A. US Foreign Trade and Portion Carried in US Ships	US portion 4-5% of US foreign trade, which rises slowly. Growth in non-liner service.	US foreign trade decreases 2% annually. Portion in US ships falls to 2% by 2005.	US foreign trade rises 5% annually. Portion in US ships increases to 9% by 2005, limited by fleet carrying capacity and US shipbuilding capacity. Increase in dry and liquid bulk trades.
B. Foreign Trade Patterns	Trade routes to resource-rich areas (Africa, South America) carry increasing volume of trade. Growth in US non-liner service.	Trade patterns shift as energy sources become uncertain. Bunker fuel scarcity becomes a factor in ship routing.	Heavy increase in trade volume from resource-rich areas (Africa, Southwest Asia, South America). Trade inhibited periodically by foreign reaction to US maritime/economic policies.
C. Domestic Trade Patterns	Growth in US non-liner service. Liner trade becomes concentrated in a few major ports. A few deepwater ports become operational, domestic waterborne transportation of hazardous cargoes, and energy and other raw materials increases.	Small ports assume greater relative importance in domestic and foreign trade.	Several US DWP and LNG terminals in operation. US foreign trade served by ever larger ships. Decentralization of US industry and population. Strong growth in domestic waterborne transport.
D. US Shipbuilding Capability	Industry generally depressed, shortage of capital, construction subsidies; some improvement late in period. The few delivered oceangoing ships are modern, fuel efficient. Considerable new building of smaller ships for domestic transport of energy, other raw materials, hazardous cargo. Competition/conflict with naval construction for available yard capacity. Strong demand but slow growth in shipbuilding modernization and automation.	Severe capital shortage, prolonged deression in shipbuilding, little new building, activity limited to ship repair and conversion. Some construction of small RoRo and break-bulk carriers for coastal trade. High unemployment. Eroding shipbuilding capability.	Extensive modernization of shipbuilding facilities during period. Significant, steady construction of naval and merchant vessels (domestic and oceangoing), especially supertankers and bulk carriers. Merchant/naval competition for available large shipways late in period. Modern, automated, fuel efficient ships delivered, including some nuclear vessels late in period.

TABLE 5-4, continued

ISSUE	R (RESOURCE ALLOCATION)	H (HARDSHIP)	E (EXPANSIVE GROWTH)
E. Energy Efficiency of Ships	Demand for energy conservation, use of alternative fuels. Relatively few new ships delivered. These are fuel-efficient but US lags in adopting slow/medium speed diesels. Late in period diesels, gas turbines, coal-fired plants are introduced at accelerating rate.	Virtually no new ship deliveries except small vessels for coastal service. Little improvement in fuel efficiency.	New, modern ships steadily delivered. Ships generally larger and faster. Slow/medium speed diesel, gas turbine, and coal-fired plants introduced at increasing rate. A few nuclear-powered ships operational by 2005.
F. Shipboard Labor and Automation	Rising shipbuilding costs and capital scarcity. Low ship delivery rate. Automation slowly becomes more common but growth is inhibited by labor due to significant unemployment.	Very few new ship deliveries. Persistent unemployment. Little growth in shipboard automation.	Steady ship delivery rate. Most of fleet built after 1980. Strong competition among major domestic transport modes. Widespread application of shipboard automation.
G. Efficient Port-to-Port Transit	Slow increase in US foreign trade and portion carried in US ships. Slow increases in shipboard automation, average DWT, and ship speed. US non-liner service expands. Increasing trade with resource-rich regions (Africa, South America). Extension of VTS and TSS systems at moderate rate late in period. Slow decline in US ship casualties. Average speed of advance tends moderately upward.	US foreign trade and portion carried in US ships declines. Virtually no expansion of shipboard automation. Slow increases in average DWT and speed as US fleet shrinks. Ships sail at economical speed to conserve fuel. No VTS/TSS expansion. Average speed of advance declines markedly. Ship casualty rate rises.	Expanding US foreign trade and portion in US ships. Significant increases in shipboard automation, average DWT and ship speed. Marked increase in US bulk trade with resource-rich regions (Africa, Southwest Asia, South America). Significant expansion of VTS/TSS coverage. Ship casualty rate drops dramatically. Average speed of advance approaches maximum.

TABLE 5-4, continued

ISSUE	R (RESOURCE ALLOCATION)	H (HARDSHIP)	E (EXPANSIVE GROWTH)
H. Shipping Operations in Port	Slow increase in US foreign trade. Significant increase in domestic waterborne transport, especially for hazardous cargo, energy and other raw materials. Limited capital availability. Port development lags demand limiting the size of calling ships. DWP and LNG terminals added slowly. Liner service becomes concentrated in a few major ports. Growth in non-liner service. Traffic density increases. Average port time decreases markedly. VTS and TSS applications increase moderately. US ship casualty rate declines slightly.	Declining US foreign trade. Oil is scarce, supplies uncertain. Severe capital shortage. Depressed shipbuilding industry. Oceangoing fleet diminishing, aging. Slow introduction of modern shipboard cargo handling gear. Dependence on foreign carriers increasing. Port development arrested. No DWP. Persistent unemployment. Strikes, slow-downs, security problems. Resistance to automation, modern cargo handling equipment in ports. Poor intermodal coordination. Greater share of trade to small ports. Some increase in number of smaller ships, especially RoRo and break-bulk carriers. Little change in traffic density. Average port time decreases slowly. No VTS/TSS expansion. Rising ship casualty rate.	Rapidly expanding US foreign and domestic trade. Fleet modernization with faster, larger ships, especially tankers and bulk carriers. Expanding domestic fleet. Keen competition among domestic transport modes. Improving intermodal coordination and systems. Port development advances on Ad Hoc basis, lags demand. DWP and LNG terminals established. Anti-US sentiment results in security problems, terrorism in US ports. Increased employment flexibility among maritime trades through worker re-training. Jurisdictional disputes among port authorities. Rising traffic density. Average port time decreases slowly. VTS/TSS applications expand. Ship casualty rate declines significantly.
I. Ship and Cargo Security in US Ports	Moderate increases in foreign trade levels and in the number, size, average stopping distance of ships. Port improvement lags demand. Increasing traffic density in port but some DWP operational. US ship casualty rate slowly decreasing. Significant unemployment. Labor unrest. Work slow-downs. Some violent acts.	Declining foreign and domestic trade. Small ports handle proportionally more trade. Little change in traffic density. Inadequate port development. No DWP. Rising ship casualty rate. Persistent high unemployment. Labor unrest. Frequent acts of violence.	Increasing US foreign trade. Several DWP in operation. Port development reduces navigation/maneuvering hazards. Average DWT and stopping distance increase. Increased traffic density. Expanded VTS and TSS applications. Ship casualty rate declines. Foreign antagonism to strident US expansion. Terrorist activities in US ports by foreign interests.

TABLE 5-4, continued

ISSUE	R (RESOURCE ALLOCATION)	H (HARDSHIP)	E (EXPANSIVE GROWTH)
J. Ship and Cargo Security Outside the US	Increasing trade protectionism and deteriorating relationships with Third World nations initially. Apparent indifference to criminal acts by some foreign authorities. Piracy and terrorist activity in some foreign ports. Improvement in foreign relations during the period. Terrorist activity much reduced by 2005.	Isolationist US foreign policy. Trade protectionism. Proliferation of bilateral trade agreements. International and inter-regional political and economic tensions. Terrorist activities in foreign ports sometimes involving US ships as third parties.	Foreign resentment of reckless pursuit of self-interest by US. Strained US relations with developed and developing nations. Frequent anti-American terrorist attacks in foreign ports.

CHAPTER 6

PROGRAM AND CLIENTELE IDENTIFICATION AND ANALYSIS

6.1 Introduction

In the preceding chapters Major Problem Areas for the maritime commmunity have been derived from the three scenarios. Issues (conditions or trends of concern to the Coast Guard and its clientele) have been distilled in the course of examining parameter projections under the influence of the MPAs. The purpose of this chapter is to identify the Coast Guard programs and clientele groups potentially affected by the issues, and to specify more precisely the nature of these effects.

6.2 Program Identification

The Coast Guard Planning and Programming Manual (CG-411) provides descriptions of operating and support programs which could be affected by the issues. The programs selected for analysis are given in Table 6-1. Only operating programs and those support programs which would be directly affected by the issues have been selected for analysis in this chapter.

6.3 Clientele Identification

CG-411 also provides an extensive list of clientele for each program. These relationships are contained in Appendix R. Since the clientele list is too voluminous to be manageable, the clientele have been organized into 13 groups representing interests germane to the present study. Table 6-2 summarizes these groups and their interests; greater detail is given in Appendix S.

6.4 Analysis of Issue, Program, Clientele Group Relationships

The issues may affect Coast Guard programs directly.

TABLE 6-1

COAST GUARD OPERATING AND SUPPORT PROGRAMS

Operating Programs

Short Range Aids to Navigation (AN)

Bridge Administration (BA)

Commercial Vessel Safety (CVS)

Enforcement of Laws and Treaties (ELT)

Ice Operations (IO)

Marine Environmental Protection (MEP)

Military Operations (MO)

Military Preparedness (MP)

Marine Science Activities (MSA)

Port Safety and Security (PSS)

Radionavigation Aids (RA)

Boating Safety (RBS)

Search and Rescue (SAR)

Support Programs

Communication Services (GAC)

Intelligence and Security (GAOI)

*Personnel (GAP)

*Hazard Control Safety (GAS)

*Research and Development (R&D)

*These support programs are not directly affected by future merchant fleets.

TABLE 6-2

INTERESTS AND CONCERNS OF CLIENTELE GROUPS

A. Recreational Boating: Boaters and marinas, manufacturers and distributors of boating equipment, and other private and commercial groups which encourage recreational boating in the United States. Private and public organizations which promote boating safety.

B. Port Operations and Development: State and local Port Authorities, commercial associations, and governmental agencies which are concerned with the efficient and profitable operation of US ports and with well-planned port development.

C. Maritime Personnel: Private and public organizations or institutions which represent or train individuals in the maritime industry, including associations of seamen, masters, mates, and pilots, longshoremen, shipyard unions, and marine educational facilities.

D. Weather Services and Navigation: Governmental agencies and commercial groups which engage in weather forecasting and furnish assistance in the conduct of ice operations. Private associations cconcerned with the promotion of improved navigation through educational and technological advances.

E. Environmental Protection, Conservation and Usage: Private organizations and government agencies concerned with the protection of the environment, the preservation of national wildlife and the management of the nation's natural resources, in both their legislative and regulatory aspects.

F. Insurance Industry: Commercial firms involved in the insurance-related aspects of merchant shipping, including cargo loss prevention and the investigation and issuance of reports on marine disasters.

G. Shipbuilding and Ship Propulsion: Associations of shipbuilders, shipyards, marine engineers and ship designers which are concerned with the health and competiveness of the nation's shipbuilding and ship-repair industry, and with the more efficient design and operation of marine craft.

H. Marine Science: Governmental institutions and private foundations engaged in the conduct of marine research and the advancement of marine sciences through the sponsorship of educational programs, the funding of scientific research in areas relating to marine science.

I. Commercial Shipping: Associations of shippers and vessel operators which lobby the government on matters of concern to the commercial shipping industry, such as government regulations and foreign competition. Federal agencies charged with regulating the US shipping industry by rate setting, issuance of licenses, granting of ship construction and ship operation subsidies, and similar matters.

J. Military and Emergency Services: The three main branches of the armed forces of the United States, together with other related military services, particularly the US Coast Guard, which are charged with preserving the security of the nation. Organizations concerned with military preparedness and which furnish assistance to the government in disaster relief operations.

K. Safety and Port Security: Governmental, commercial and private organizations concerned with the safety and security of US ports, in both technical and law enforcement matters, including the safe transportation of hazardous materials and the proper management of intra-port vessel traffic.

L. International Bodies: International organizations, both private and public, which are concerned with the conduct and regulation of international marine affairs in their commercial and political-military aspects.

M. Maritime Communications: Private, commercial and governmental associations engaged in the regulation of marine communications and the promotion of the development and use of improved radionavigation aids.

They may also affect the clientele groups which, in turn, influence Coast Guard programs. The following simple model illustrates the relationships:

```
                     (Table 6-4)
Issues  ----------------------->  CG Programs
     \                           ^
      \                         /
   (Table 6-5)           (Table 6-3)
         \                   /
          \                 /
           v               /
            Clientele Groups
```

A matrix relating clientele groups to Coast Guard programs is presented as Table 6-3. In this matrix a "1" indicates that a common interest exists. Since clientele groups and programs may have several interests, the matrix provides only a rough indication of relationships.

Table 6-4 shows the direct relationships of issues to Coast Guard programs by a "1" in each matrix cell where a relationship exists. The multifaceted nature of the issues frequently impacts several programs. In similar fashion, Table 6-5 shows the relationships of issues to clientele groups.

6.5 Common Interests Among Clientele Groups and Coast Guard Programs

The relationships shown in the foregoing tables are summarized in Table 6-6. In this table (which is a 2-dimensional representation of 3-dimensional relationships) the letters in the cells signify the related clientele groups. For instance, a "D" (Weather Services and Navigation Clientele Group) appears in the third row (Dom. Trade Patterns), in the first column (AN Program), indicating that these three elements share a common interest. The nature of the relationships and common interests implied by the Table 6-6 cell entries are specified in the following sections, which are arranged by Coast Guard program.

TABLE 6-3

CROSS-RELEVANCE MATRIX: CLIENTELE GROUPS VS COAST GUARD PROGRAMS

CG PROGRAMS

	CLIENTELE GROUPS	AN	BA	CVS	ELT	IO	MEP	MO	MP	MSA	PSS	RA	RBS	SAR	GAC	GAO
A	RECREATIONAL BOATING												1	1		
B	PORT DEVLPMNT & OPERATIONS		1	1		1	1				1				1	
C	MARITIME PERSONNEL			1							1					1
D	WEATHER SVCS & NAVIGATION	1				1				1		1			1	
E	ENVIRONMENTAL PROTECTION						1									1
F	INSURANCE INDUSTRY			1			1				1					1
G	SHIPBUILDING & PROPULSION			1												
H	MARINE SCIENCE									1						
I	COMMERCIAL SHIPPING			1							1				1	
J	MILITARY AND EMERGENCY SVC							1	1					1	1	
K	SAFETY & PORT SECURITY			1							1			1	1	1
L	INTERNATIONAL BODIES			1								1				
M	MARITIME COMMUNICATION														1	

TABLE 6-4

CROSS-RELEVANCE MATRIX: ISSUES VS COAST GUARD PROGRAMS

CG PROGRAMS

ISSUES	AN	BA	CVS	ELT	IO	MEP	MO	MP	MSA	PSS	RA	RBS	SAR	GAC	GAOI
US FOREIGN TRADE			1		1						1				
FOREIGN TRADE PATTERNS					1									1	
DOM. TRADE PATTERNS	1	1			1	1				1					
SHIPBUILDING INDUSTRY			1												
ENERGY EFFICIENCY			1							1					
SHIP LABOR & AUTOMATION			1							1			1		
EFFICIENT TRANSIT					1				1		1			1	
SHIPPING OPS IN PORT	1	1			1	1				1				1	
SHIP & CARGO SECURITY - US										1					1
SHIP SECURITY OUTSIDE US				1										1	1

TABLE 6-5

CROSS-RELEVANCE MATRIX: ISSUES VS CLIENTELE GROUPS

CLIENTELE GROUPS

ISSUES	A RECREATIONAL BOATING	B PORT DEVLPMNT & OPERATIONS	C MARITIME PERSONNEL	D WEATHER SVCS & NAVIGATION	E ENVIRONMENTAL PROTECTION	F INSURANCE INDUSTRY	G SHIPBUILDING & PROPULSION	H MARINE SCIENCE	I COMMERCIAL SHIPPING	J MILITARY AND EMERGENCY SVC	K SAFETY & PORT SECURITY	L INTERNATIONAL BODIES	M MARITIME COMMUNICATION
US FOREIGN TRADE		1				1	1		1			1	
FOREIGN TRADE PATTERNS				1		1			1			1	1
DOM. TRADE PATTERNS		1	1	1			1		1		1		
SHIPBUILDING INDUSTRY			1				1		1				
ENERGY EFFICIENCY					1	1	1		1		1	1	
SHIP LABOR & AUTOMATION			1			1	1				1		1
EFFICIENT TRANSIT				1		1		1	1		1	1	1
SHIPPING OPS IN PORT		1	1	1	1	1			1		1		1
SHIP & CARGO SECURITY - US		1	1			1			1		1		
SHIP SECURITY OUTSIDE US			1			1			1		1	1	1

TABLE 6-6

CROSS-RELEVANCE MATRIX: ISSUES VS COAST GUARD PROGRAMS
WITH CLIENTELE GROUPS IDENTIFIED

CG PROGRAMS

ISSUES	AN	BA	CVS	ELT	IO	MEP	MO	MP	MSA	PSS	RA	RBS	SAR	GAC	GAOI
US FOREIGN TRADE			1 BFGIL		1 B	1 F				1 BFI	1 L				
FOREIGN TRADE PATTERNS					1 D				1 DL		1 DL			1 M	
DOM. TRADE PATTERNS	1 D	1 B			1 BD	1 B			1 D	1 BIK	1 D		1 K		
SHIPBUILDING INDUSTRY			1 CFGI												
ENERGY EFFICIENCY			1 FGIKL			1 EF				1 FK					
SHIP LABOR & AUTOMATION			1 CFGK							1 FK			1 K	1 K	
EFFICIENT TRANSIT			1 FIKL		1 D				1 DHL	1 KL	1 DL		1 K	1 DKLM	
SHIPPING OPS IN PORT	1 D	1 B	1 CFIK		1 B	1 EF			1 D	1 BFIK	1 D			1 BDK	
SHIP & CARGO SECURITY - US			1 CFIK							1 CFIK					1 CEFK
SHIP SECURITY OUTSIDE US			1 CFIKL	1 FKL										1 JK	1 CEFK

Clientele Group	Common Interest
Program: AN	
D - Weather Services and Navigation	Short range aids to accommodate changing vessel types/sizes where needed.
Program: BA	
B - Port Development and Operations	Bridge regulations which do not hinder harbor/waterway usage.
Program: CVS	
B - Port Development and Operations	Harbor and terminal facilities to handle new ships/more ships.
C - Maritime Personnel	Employment and qualification of shipbuilding personnel.
	Employment, licensing, certification of shipboard personnel.
	Employment, licensing, certification of dockside personnel.
	Employment, licensing, certification of shipboard security personnel.
	Employment, licensing, certification of harbor security personnel.
F - Insurance Industry	Ship and cargo hazards.
	Marine accident claims.
	Environmental hazards: water, air (using coal), nuclear.
	Risk to vessel; reliability of automation.
	Transit risks: weather, ice, traffic.
	Risk to vessel and cargo in port (navigation, cargo handling).
	Terrorism in US harbors.
	Piracy, terrorism outside US.

Clientele Group	Common Interest
G - Shipbuilding and Propulsion	New ships - type, size, etc.
	Promote/protect/improve ship-building industry.
	Power plant development/ construction.
	Development/construction of automated shipboard features
I - Commercial Shipping	Trade economics.
	Attractiveness of new ports as foreign trade terminals.
	New ships for fleet.
	Fuel cost, availability.
	Rapid turn-around in port.
	Delays and risk to vessel and cargo due to piracy, terrorism.
K - Safety and Port Security	Nuclear hazard to ports.
	Equipment systems reliability.
	Sufficient crew to handle ship.
	Transit risks: weather, ice, traffic.
	Marine accident investigation.
	Vessel/cargo/personnel/port safety.
L - International Bodies (IMCO, SOLAS)	Vessel safety, especially foreign vessels in US waters.
	International safety standards and agreements: nuclear, TSS.
	Suppression of terrorism, piracy by political/legal means.

Clientele Group	Common Interest
	Program: ELT
F - Insurance Industries	Damage claims, terrorism, piracy
K - Safety and Port Security	Suppression of piracy in US waters and on high seas.
L - International Bodies	Suppression of terrorism, piracy through political/legal means.
	Program: IO
B - Port Development and Operations	Icebreaking in harbors and inland waterways, including Great Lakes.
D - Weather Services and Navigation	Ice forecasting/ship routing on Arctic trade routes.
	Ice forecasting/ship routing on inland waterways, including Great Lakes.
	Program: MEP
F - Insurance Industry	Environmental risk: oil/hazardous cargo, pollution liability, damage and claims.
E - Environmental Protection, Conservation and Use	Pollution (especially oil) in harbors and US coastal waters.
	Pollution emanating from ships: bunker fuel (oil), smoke, nuclear.
	Pollution incident investigation, law enforcement.
	Program: MSA
D - Weather Services and Navigation	Weather and ice forecasting/ship routing on high seas, coastal and inland waters.
H - Marine Science	Weather, ice, current research and forecasting in coastal waters and high seas.
L - International Bodies	Agreements regarding weather and ice research and forecasting/ship warning and routing.

Clientele Group	Common Interest
	Program: PSS
B - Port Development and Operations	Harbor and terminal facilities to handle new ships/more ships.
	Port development/expansion to accommodate changing trade patterns.
	Port development for safe, efficient vessel movement.
F - Insurance Industry	Risk to vessel (navigational hazards), cargo (cargo handling), port facilities.
	Environmental risk: oil (water pollution), coal (air pollution), nuclear.
	Risk to vessel: reliability of ship control systems, cargo control systems, adequacy of crew.
	Sabotage, terrorism.
I - Commercial Shipping	Trade economics, commercial attractiveness of new ports.
	Short turn-around time in port.
	Delays/damage to ship or cargo due to terrorism.
K - Safety and Port Security	Cargo safety, especially hazardous cargo.
	Risk to vessel/cargo/port due to fuel (oil: fire; nuclear: contamination).
	Risk to vessel: reliability of ship control systems, cargo handling systems, adequacy of crew and dockside personnel.
	Rules of the nautical road.
	Safe vessel movement, cargo handling.
	Sabotage, terrorism.
L - International Bodies	Rules of the nautical road.

Clientele Group	Common Interest
Program: RA	
D - Weather Services and Navigation	Efficient radio navigation aids to serve US commerce in US waters and on high seas.
L - International Bodies	Efficient radio navigation aids to serve US commerce in US waters and on high seas.
Program: SAR	
K - Safety and Port Security	Safety of life and property in US coastal waters and on high seas. Adequacy of ship's crew to provide assistance to another vessel in distress.
Program: GAC	
K - Safety and Port Security	Calling/distress/locating systems for US ships anywhere.
L - International Bodies (WAARC)	Calling/distress/locating systems for US ships anywhere.
M - Maritime Communications	Calling/distress/locating systems for US ships anywhere.
Program: GAOI	
C - Maritime Personnel	Employment of shipboard personnel who are low security risks. Employment of port workers who are low security risks.
E - Environmental Protection, Conservation and Use	Identification of ships and waterfront facilities intentionally polluting the marine environment.
F - Insurance Industry	Environmental hazards: water, air, nuclear. Sabotage, terrorism. Marine accident claims.
K - Safety and Port Security	Sabotage, terrorism.

6.6 Summary

This completes the analysis of the relationships among the issues, clientele groups, and Coast Guard programs. The common interests identified above provide the basis for examining the aggregate impacts of future merchant fleets on each affected Coast Guard program in Chapter 7.

CHAPTER 7

ANALYSIS OF PROGRAM IMPLICATIONS

7.1 Introduction

Relationships among merchant fleet-related issues, Coast Guard programs, and clientele groups were explored in Chapter 6. The purpose of this chapter is to investigate the collective direct impacts of future merchant fleets on each affected Coast Guard operating and support program. Three programs (MO, MP, and RBS) were found in Chapter 6 not to be directly affected by future merchant fleets; discussion of these programs is therefore omitted in Chapter 7.

In the sections which follow, discussion of each program is arranged in a standard format (Description of the Impact, Scenario Influence, Program Implications, Recommended Action Options). The action options are derived directly from the discussion of each program. Generally, current program actions are assumed to continue and are not stated; only new actions, or current actions which warrant increased emphasis, are stated in the lists of Recommended Action Options.

In the final section, conclusions of a general nature are highlighted, together with some observations pertinent to the support programs (Personnel, Hazard Control Safety, and Research and Development) which future merchant fleets will affect indirectly but significantly. In this regard, it is noteworthy that none of the conclusions or program action options is at opposition to the trends given in the Coast Guard Planning and Programming Manual, Chapter V (CG-411) although the emphasis on specific points may differ. This is not surprising because the program descriptions in CG-411 are knowledgeable and forward-looking, and because merchant ships are capital intensive and long-lived, hence changes in the fleet will generally occur gradually.

7.2 Program: Short Range Aids to Navigation (AN)

7.2.1 Description. The impact of the Future Merchant Fleet on the AN program occurs with changes in domestic trade patterns, i.e., changes in the US terminal ports engaged in foreign trade. A sensitivity to changes in the sizes, types, and configurations of the carrier vessels to serve this trade is also implied.

7.2.2 Scenario Influence. Domestic trade patterns inferred from the scenarios differ principally in degree. The ascendency of smaller ports (due to industrial decentralization) and deepwater terminals under Scenario E represents the greatest change. The use of small ports also increases under Scenario H, but the volume of trade concurrently diminishes; the effect of these two contrary conditions tends to minimize the net demand for changes in the AN system.

Changes in ship types and sizes also vary in degree among the scenarios. Increases in the size of ships calling at US ports will continue to be limited by channel depths in US harbors and waterways, and the number and type of US deepwater ports established.

7.2.3 Program Implications. The implications for the AN program are twofold: to provide visual/audible aids where needed geographically, and to assure that the aids established are suitable for the vessels which rely upon them. There is nothing new in these requirements; they have been fundamental considerations for centuries. The appropriate future policy for the AN program, regardless of scenario, appears to be a continuation of the practices which have produced the highly effective system in existence today. Close coordination with AN clientele will be essential in order to plan for AN services to support

port development and expansion. This is especially true where significant increases in channel controlling depths (to accommodate VLCCs and ULCCs) are contemplated.

Verification of the adequacy of existing visual/audible aids to serve very large ships is also implied. Many existing lighted aids, such as buoys and minor lights, are designed for the mariner who is quite close to the surface. The usefulness of these lights to a mariner 70 or more feet above the water, whose view of the adjacent water is obscured by the enormous hull, would appear to be marginal. Audible aids would be nearly useless. Since smaller vessels will continue to require the existing AN systems, new or augmented systems to serve large vessels may become necessary.

7.2.4 Recommended Action Options

- o Continue to monitor port development plans and proposals of clientele, especially plans to accommodate large ships in US ports.
- o Investigate the adequacy of the existing AN system to serve large ships calling at US harbors and deepwater ports.

7.3 Program: Bridge Administration (BA)

7.3.1 Description. Seaports are situated at the interface of land and sea transportation modes. Bridges over navigable waterways carrying foreign and domestic trade are frequently necessary for the efficient flow of trade by land transport vehicles and to facilitate the commercial and social life of the seaport city. The siting and characteristics of bridges is a dynamic problem which seeks to satisfy the current and projected needs of both transportation modes.

7.3.2 Scenario Influence. The volume of foreign trade is projected to vary widely among the scenarios while domestic waterborne trade is generally expected to increase. Intermodal connections are particularly important in Scenario E where trade volumes are high. Port development (expansion, modernization) to accommodate larger ships is also a characteristic of Scenario E. Funding limitations cause intermodal improvements and port development to suffer in Scenarios R and H; in Scenario R improvements are concentrated in a few ports while facilities simply deteriorate in Scenario H.

7.3.3 Program Implications. Bridges are generally an impediment to marine transportation but they provide indispensible land-mode links in the flow of trade to and from the hinterland. Bridges are also long-lived and expensive to build and maintain. Bridges originally of adequate capacity and which are relatively unobtrusive to marine traffic can prove inadequate on both counts long before the end of their life cycles. The BA program will be required to continue to deal with the marine hazards embodied in existing bridges, and with the issuance of construction permits for new bridges. Compromises between the legitimate demands of land and water transport modes will have to be sought in the siting and characteristics of bridges. In a larger sense, however, bridges are but a part of the inter-related transportation networks and geography which characterize any port, and there are alternatives to bridges, such as pipelines, tunnels, and geographical/hydrographical modifications of the port. Under a coherent, well-conceived port development plan, these alternatives could result in a safer, more productive port.

7.3.4 Recommended Action Options

- Continue close liaison with program clientele to assure equitable treatment of the legitimate interests of the land and water transportation modes.

- Participate actively in all phases of port development planning.

7.4 Program: Commercial Vessel Safety (CVS)

7.4.1 Description. Not surprisingly, the future merchant fleet will have major impacts on the CVS program. The impacts will be felt in three broad areas: the ship itself (designs, types and sizes of vessels built, and their major subsystems); the environment within which the ship operates (physical, ecological, socio-political); and the personnel involved in ship operation (crew, dockside personnel).

7.4.2 Scenario Influence. While significant building of small ships for domestic trade is envisaged under all scenarios, new ship deliveries for foreign trade range from near zero (Scenario H) to a whole new fleet (Scenario E) reflecting the foreign trade and capital availability situations. A mix of freighters, tankers, and bulk carriers is projected; under Scenario E there is a marked increase in the number of bulk carriers and in the sizes of all ships. Those ships which are built will tend to continue the trend in automation of systems for ship control and cargo handling. New fuel-efficient power plants (gas turbine, slow/medium speed diesel, coal-fired, and, in Scenario E, nuclear) will also be introduced, paced by fuel cost and capital availability.

Environmental protection is a significant concern across all scenarios; concurrently, increases in the volume of hazardous cargoes are projected (especially in Scenarios R and E), further complicating the impact of ships and their cargoes on the marine environment. Ship casualty rates rise in Scenario H but decline in Scenarios R and E. Arctic trade routes may evolve in Scenario E, with attendant structure and ice damage implications for ship designs. Piracy and acts of terrorism involving US ships at home or abroad are projected for all scenarios, especially Scenario E.

Changes in the qualifications, licensing, and certification of shipboard personnel evolve as increases are experienced in the volume/type of hazardous cargo carried and in the extent of shipboard automation. Automation will generally require smaller, but more highly qualified, crews; minimum safe manning levels, irrespective of automation, will also become an issue. Labor pressures to keep manning levels high will be strongest under Scenario H, in which maritime unemployment is highest. Crew members specially qualified to deal with terrorists may be required, especially under Scenario E.

7.4.3 Program Implications. The CVS program is concerned with vessels and their personnel. Laws, regulations, and standards relating to the design and construction of seaworthy ships will, of course, continue to be applicable. Ships of all types constructed in US shipyards can be expected to increase in size and new shipbuilding materials and techniques will require regulations and standards to be revised accordingly. New laws, regulations, and standards will also be required for the design and construction of vessels for the carriage of hazardous cargoes. LNG carriers and double bottoms for tankers are current examples of implications of this type.

Merchant ships, particularly large ones with small crews, are extremely vulnerable to terrorist attacks in port. It is possible that features to minimize the risk or effects of a terrorist attack could be incorporated in the design of a vessel. It also appears that such features might serve to minimize environmental damage. For instance, double bottoms tend to preserve both the integrity of the cargo and the marine environment, should the outer hull be ruptured by any means.

Regulations, standards, inspection techniques, and possibly legislation will be required for the design and construction of major ship systems, such as power plants. Slow and medium speed diesel engines, long used in Europe, will find increasing application to US ships, as will gas turbine technology. Modernized coal-burning and nuclear plants are additional possibilities.

Other ship systems will also change the scope of CVS activities. Automation of ship control, communication, and navigation systems will continue to evolve with a consequent reduction in the number of required watchstanders. Automated shipboard cargo handling equipment will become more widespread, particularly for handling bulk cargoes (liquid, dry, and slurried). Stringent design regulations and standards will be required to assure the safety of the ship, its cargo, the evironment, and facilities and other ships in the vicinity.

The activities of the CVS program with respect to maritime personnel will undergo significant changes in the future. Qualification, licensing, and certification standards and procedures will be affected by the addition of VLCCs and ULCCs to the US fleet and the automated features, such as ship control and cargo handling systems, incorporated in the designs of new ships. Just as radar, for example, provided the mariner with a powerful new tool, its proper use required an increased level of operator competence. With larger ships frequently laden with hazardous cargo, the consequences of system failure or operator error becomes enormous. Special qualifications and certification of personnel will very likely be required for those on board ship responsible for loading, stowage, transfer, unloading and associated cargo emergency operations. To the extent that US merchant ships become targets for terrorists, the need for shipboard personnel with special training, qualification, and certification in ship defense and anti-terrorist activities may become necessary.

Apart from the external demands on the CVS program briefly discussed above, the internal demands on Coast Guard inspectors will also grow. The Coast Guard will have to expand its inspector training program to keep pace with new marine technologies, and with the requirements which new ship and system designs impose on operating personnel.

7.4.4 Recommended Action Options

The following are action options recommended for inclusion in the Coast Guard's planning of the CVS program. These action options address the emerging issues and problems that the Coast Guard's CVS program will face over the next twenty-five years.

Ships

- Develop regulations and evaluation criteria for new types of ship power plants:

  a) slow and medium speed diesels
  b) gas turbines
  c) coal fired power plants
  d) nuclear power plants

- Develop regulations and evaluation criteria for the employment of automated ship subsystems including back-up emergency requirements.

- Develop regulations governing the design and construction of ships and shipboard containers to be used for transporting various types of hazardous materials.

- Investigate the feasibility of incorporating features which would make ships less vulnerable to terrorist assaults or which would minimize potential damage to the ship, its cargo and its personnel.

Environmental

- In all aspects of CVS program activities, incorporate considerations responsive to environmental protection objectives.

- Foster cooperation and coordination of environmental protection activities among CVS, MEP, PSS and other USCG programs.

- Determine vulnerabilities of existing fleet to terrorist assaults and investigate ways to lessen these vulnerabilities.

Personnel

- Modify existing personnel qualifications, licensing and certification procedures, or design new ones responsive to:

a) increased sophistication of ships and shipboard systems

b) shipboard handling of hazardous cargoes

c) terrorist threat.

7.5 Program: Enforcement of Laws and Treaties (ELT)

7.5.1 Description. The impact of the future merchant fleet on the ELT program will be felt principally in the realms of illegal acts of a socio-political nature, namely piracy and terrorism in US coastal waters and on the high seas. Terrorism is seen as any illegal act of violence undertaken to serve the political purposes of any US or foreign interest and includes acts of piracy.

7.5.2 Scenario Influence. Terrorism involving US ships is a significant concern across all scenarios. The likelihood of terrorist incidents increases as US policy (i.e., foreign policy and some controversial aspects of domestic policy, such as environmental practices) is perceived to be inimical to the goals or interests of certain groups. The headlong pursuit of self-interest by the United States (Scenario E), for instance, could be expected to antagonize Third World nations, especially their more radical factions.

7.5.3 Program Implications. Because of the relative difficulty of molesting a ship at sea, most terrorist acts will probably occur (or be initiated) in port, where any Coast Guard response would probably be undertaken under the aegis of the PSS program (q.v.). However, incidents which occur offshore, or which move offshore (as in a highjacking, for instance) could involve the ELT program. Further, enforcement of international law, in cases of piracy involving foreign vessels on the high seas, could be required. Close coordination within the Coast Guard will be necessary, both by the ELT-PSS program planning level and among the operational commands which may become involved.

7.5.4 Recommended Action Options

1. Develop counterterrorist contingency plans, including inter-agency coordination arrangements, and trained personnel.

2. Establish mechanisms and procedures to facilitate close cooperation between ELT and PSS at the planning and operational levels.

7.6 Program. Ice Operations (IO)

7.6.1 Description. The impact of the future merchant fleet on the IO program will be for the purpose of facilitating commerce on US inland waterways (including the Great Lakes) and in the western Arctic region. Icebreaking, ice forecasting, and ship routing activities are envisaged.

7.6.2 Scenario Influence. Domestic waterborne commerce is projected to grow under all scenarios, especially Scenarios R and E. A major and increasing portion of this commerce will be energy and other raw materials, and hazardous cargoes. The Great Lakes will be opened to inter-lake traffic year-round under Scenarios R and E. Oil and gas traffic to the western Arctic is likely under Scenarios R and E; a trans-Arctic (Northwest Passage) trade route is a distinct possibility under Scenario E.

7.6.3 Program Implications. The traditional IO activities (icebreaking to free beset vessels and to keep selected waterways navigable) will continue in the future. Depending on the volume of trade in particular areas, and the prevailing economic conditions, the need and/or demand for ice forecasting services can be expected to increase. The Coast Guard may find ice forecasting, supplemented by icebreaking services only as needed, to be an effective way to minimize program costs. Commercial shipping interests may come to rely on timely, accurate ice predictions in their daily operations. In some areas (e.g., the Great Lakes or western Arctic) a ship routing system based on current and forecast ice conditions may become desirable or necessary from the standpoint of vessel, cargo, or environmental safety. The spectre of a major Arctic oil spill resulting from ice damage, for instance, may warrant the effort and expense of establishing effective preventative measures. The development of ice forecasting and ship routing activities will require inter-program coordination or re-allocation of tasks within programs. The IO and MSA (and possibly MEP) programs are involved.

7.6.4 Recommended Action Options

- Investigate methods to improve ice forecasting.
- Continue participation in the Great Lakes Winter Navigation Demonstration Program.
- Explore, in conjunction with all interested parties, the economic and technological feasibility of a western Arctic transportation system.

7.7 Program. Marine Environmental Protection (MEP)

7.7.1 Description. The impact of the future merchant fleet on the MEP program will depend principally on the volume of trade and the types of vessel power plants in use. The numbers and sizes of ships, and volume and type of cargo comprising US foreign and domestic trade will be important factors.

7.7.2 Scenario Influence. While the volume of US foreign trade (hence the number of ships calling at US ports) varies widely across the scenarios, domestic trade generally increases, markedly so in Scenario E. Waterborne transport of oil and other hazardous cargoes is projected to increase. Average ship size also generally increases. In all scenarios, therefore, the hazard to the environment tends upward; it is in the rate of increase that the scenarios differ, with Scenario E representing the greatest marine activity, hence greatest risk.

Ship bunker fuels are projected to change under Scenarios R and E where the use of oil is supplemented by coal. The use of nuclear power becomes significant late in the period under Scenario E.

Geographical changes also occur. Under Scenario H smaller ports handle relatively more foreign trade. Decentralization under Scenario E also spreads the environmental risk geographically. Deep water ports, which come into use in Scenarios R and E, and the use of the western Arctic by commercial shipping have the same effect.

7.7.3 Program Implications. The functional activities of the MEP program (Response, Enforcement, Prevention, Monitoring and Surveillance, Impact Assessment) will continue to be appropriate and the levels of effort can also be expected to increase commensurate with increases in the numbers, average DWT, and average age of ships plying US waters. Program emphasis will have to be applied geographically to match changing patterns of marine activity (to smaller ports or deepwater ports, for instance). The current program focus on water pollution by oil will also have to be expanded to include water pollution by other hazardous materials and air pollution because of the increased use of coal. Air and water contamination by nuclear particles is a contingency which will require preparation. MEP activities in the Arctic will require inter-program coordination (with IO and MSA).

7.7.4 Recommended Action Options

- Develop procedures for responding to, containing and cleaning up spills of hazardous cargoes other than oil.

- Investigate the implications of increased use of nuclear power and transport of radioactive materials for the marine environment. Develop contingency plans for dealing with the hazards posed.

- Assess impact of potential environmental damage in Arctic environments due to increased ship operations as well as potential accidental spills of hazardous cargoes, including oil.

7.8 Program: Marine Science Activities (MSA)

7.8.1 Description. The impact of the future merchant fleet on the MSA program will be felt in the need to better understand natural phenomena which affect the safe and efficient movement of ships, namely weather, ice, and current.

7.8.2 Scenario Influence. The importance of weather, ice, and current information depends fundamentally on the number of US ships (i.e., potential users), the trade routes which those ships ply, and the benefit to be derived from efficient shipping operations, particularly with regard to fuel economy. Under Scenario H, the fleet size shrinks as the US withdraws from foreign trade. Hence, the number of users decreases. While aged ships may be more susceptible to weather damage (hence a demand for weather forecasting services), general economic conditions would probably not support weather routing schemes.

In Scenario R the number of ships also diminishes, but as a necessary step in creating a shipping industry which is in economic balance. Under these conditions, considerable interest in efficient ship routing could develop. Ice forecasting and possibly ship routing will be important in supporting year-round Great Lakes operations.

Maximum impact on MSA can be expected under Scenario E where the fleet size increases and the US is deeply involved the carriage of its foreign trade. With stiff competition, efficiency of operations becomes a major concern. The Great Lakes are open to inter-lake shipping year round and Arctic trade routes become increasingly probable.

The use of wind to power merchant ships is a possibility under Scenarios R and E, either by introducing modern sailing vessels or by installing wind-driven generators aboard ship. In order for sailing vessels to compete with powered vessels, accurate and timely weather and current forecasts would be vital.

7.8.3 <u>Program Implications</u>. The need for knowledge of the marine environment (weather, ice, and current phenomena) will not diminish in the future. Knowledge of the marine environment can serve man in three overlapping aspects or types of application:

- It enables man to defend himself against the effects of nature, e.g., storm warnings, storm behavior, the intrusion of icebergs into the sea lanes.
- It enables man to minimize risk and uncertainty associated with marine activities, e.g., prediction of the drift of disabled boats or oil slicks, passage through ice fields.
- It enables man to harness the forces of nature to his own use, e.g., energy conversion/power generation, sailing vessels.

Demands for applications of the first type can be expected to continue in the interest of preserving life and property. Environmental protection interests will increase demands for applications of the second type. Regular commercial transit of ice-infested waters will be largely contingent upon the availability of frequent, accurate ice and current forecasts in particular geographical regions. Advisory ship routing follows naturally from the ability to predict ice conditions; mandatory ship routing may be warranted where independent sailings are considered unacceptably hazardous.

Weather routing on the high seas, stemming from applications of the second or third type, will depend on economic conditions and the benefit to be derived as perceived by potential users, e.g., shipping companies. A return to sailing vessels, while a low probability event, could create a significant demand for frequent and accurate weather and current forecasts in regions where such ships operate.

A common thread which runs through all the impacts on the MSA program, regardless of scenario, is the need for

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coordination, both within the Coast Guard and with other organizations and government agencies. Within the Coast Guard the MSA, IO, SAR, and MEP programs are principally concerned with weather, ice, and current forecasting. Coordination with external agencies, such as NOAA (which has primary government responsibility for weather forecasting), for instance, is also essential in order to assure effective contributions and information exchanges in these areas and to facilitate efficient utilization of organizational and governmental resources.

7.8.4 Recommended Action Options

- Continue to develop methods to provide accurate and timely forecasts of environmental conditions (e.g., weather, ice, currents).

- Strengthen mechanisms for coordination and cooperation within USCG and with other government agencies concerned with environmental forecasting.

7.9 Program: Port Safety and Security (PSS)

7.9.1 Description. The future merchant fleet will affect the PSS program in all its aspects. Principally, these involve consideration of ship movement in port, port facilities, cargo handling, treatment of hazardous cargo, terrorism and sabotage, and rules of the nautical road. Environmental impacts, which are also important, have been dealt with under the MEP program.

7.9.2 Scenario Influence. In port ship movement involves the maneuvering, navigation, and control of vessels in restricted waterways. In Scenario H improvements in the geographic and hydrographic features of ports are precluded because of declining foreign trade and adverse economic conditions. No deepwater ports (DWP) are introduced. Port facilities deteriorate and there is increased use of smaller ports. Capital is scarce in Scenario R, limiting hydrographic improvements (e.g., channel straightening, widening, deepening) to a few ports; improvements in port facilities and development of DWPs is slow. Under Scenario E port development is more general and several DWPs become operational by 2005. Traffic density tends upward in Scenarios R and E, but remains static in Scenario H. VTS systems expand markedly in Scenario E, moderately in Scenario R, and not at all in Scenario H. Average port time slowly decreases in Scenarios H and E, and drops dramatically in Scenario R.

Improvements in cargo handling operations, cargo storage, and intermodal systems range from nil in Scenario H, to moderate in Scenario R, to major in Scenario E. Labor opposition to automated cargo handling systems, resulting from unemployment and uncertain economic conditions, is a major factor in Scenario H, and to some extent in Scenario R. Waterborne movement of hazardous cargoes increases in all scenarios, especially Scenario R.

Terrorism and sabotage (i.e., the intentional act or threat of destruction, damage, loss, or injury to vessels, property, or persons in a port area) are significant factors in all scenarios. Austere domestic economic conditions (with associated labor unrest or political dissatisfaction, for instance) are the principal source of terrorism in Scenario H and the early phase of Scenario R. Under Scenario E, however, the source stems from foreign reaction, in US ports and elsewhere, to strident US expansion which is perceived to be at the expense of foreign nations or interests.

Ships of increasing size will ply US waters under all scenarios, regardless of the condition of the US fleet. The current impetus to modify the rules of the nautical road to accommodate large vessels (i.e., to enable all marine traffic to flow safely) will continue in the future.

7.9.3 Program Implications. Under its responsibilities for port safety, security and efficiency, there is scarcely any facet of port operations which escapes the legitimate notice of the PSS program. Further, any seaport is a dynamic, living thing; conditions, and Coast Guard concerns, continually change. The physical configuration of a port (its geography and hydrography) is a fundamental attribute affecting the safe and expeditious movement of vessels. Changing the physical configuration of a port is an expensive undertaking and not always feasible. Any channel widening, straightening, or deepening improvements which are undertaken, however, would be a direct concern to the PSS program with respect to designation of anchorage areas, speed limits, and VTS requirements, for instance. Wholesale channel deepening will probably not be warranted, but in those ports where it is, the newly admitted deep draft ships will require a re-evaluation of the safety/efficiency regulations and requirements associated with the movement of vessels of all sizes within the port.

Port development will not be limited to existing major ports, as might be inferred from the discussion above. With industrial decentralization, some of today's minor ports could begin to handle a much larger share of US foreign trade, or certain commodities of trade (note, for example, the number of Gulf ports dedicated to the oil trade). Deepwater ports present yet another aspect of port development where the need for safe and efficient vessel movement generates PSS involvement. The focus of PSS involvement should not, therefore, be limited geographically to the current centers of marine activity; the Coast Guard must be sensitive and informed regarding port development outside these centers.

Ship service facilities within a port, such as maintenance and waste disposal facilities, will change to accommodate the new types of ships calling. Facilities for coal and nuclear fuel handling may also evolve. New types of facilities and equipment could place demands on the PSS program for safety regulations, supervision of hazardous operations, and qualification/certification of dockside personnel.

All aspects of cargo handling operations will affect the PSS program. The development of containerized cargo over the past 20 years provides a clear example of the kind of changes in store. RoRo vessels, barge carriers, and integrated tug-barge systems will have potential for quantum changes in the way cargo is loaded/unloaded, stored, and transferred to land transport modes. The emphasis on efficient intermodal movement of cargo from shipper to consignee will not diminish, and the concept is not limited to containerized/unitized cargo, as advances in slurried cargo handling and self-unloading dry bulk carriers will attest. Regulations and procedures to assure safe, secure, and efficient cargo flow will require increasing awareness and involvement in the total intermodal system by PSS program personnel at the planning and functional levels.

Increases in the number of commodities designated as hazardous cargo, and in the volume of these cargoes moved in domestic and foreign trade, portend further increases in PSS program emphasis. The handling of LNG imports and the siting of LNG terminals are but one example of this important issue. The safe movement of hazardous cargoes in the port area, and the competence of personnel involved in movement and handling of these cargoes, are key aspects of PSS concern. Since the degree of risk varies according to the specific material, quantity, type of vessel, traffic conditions, etc., and since the consequences of an accident also vary, movement procedures and regulations will have to be both effective and flexible. It will be equally important to assure that the people responsible for transferring and storing hazardous material know their business and perform properly. Qualification/certification standards for dockside personnel, as well as Coast Guard supervisory and monitoring personnel, will assume increasing importance to the PSS program.

The security of vessels, cargoes, and facilities in a port complex from intentional destructive acts is a difficult and growing responsibility of the PSS program. A large part of the problem lies in threat identification and evaluation. The Special Interest Vessel (SIV) Program focuses on a particular Communist threat; the threat posed by terrorism for sundry (and often obscure) political purposes is much more diffuse. A high level of vigilance based both on observation and on effective and timely intelligence will be required, as will procedures for special precautions and surveillance (like the SIV program) when warranted.

If a vessel or port facility were to be seized, coordination among the various federal, state, and local law enforcement authorities would obviously be required, with a single authority in charge. To be effective, especially in ports (such as New York) where many authorities are involved, prior planning by all concerned (including the Coast Guard) will be essential.

If a terrorist incident culminates in a destructive act (e.g., fire or explosion), with or without warning, the usual emergency firefighting measures would, of course, be invoked, with direct impact on PSS program planning and operations. While firefighting and other harbor emergency measures are usually the result of accidents and not unique to terrorism, the potential effects of accidental plus intentional causes, increased volumes of hazardous (frequently flammable, explosive, or toxic) materials, and increased port activity combine to create incipient disasters of grave proportions. Clearly, responsibilities for port safety and security will continue to grow heavier. Standards, regulations, and procedures, necessary for the discharge of these responsibilities, will appear burdensome to some elements of the maritime community, and an impediment to economically efficient port operation. The cost of precautionary measures (regulations) will have to be carefully and periodically evaluated against the cost of disaster.

The PSS program is responsible, within the Coast Guard, for promoting the unification and consolidation of the rules of the nautical road. A single, universal set of rules is, and will continue to be, a worthy goal as a means reducing uncertainty in the mind of the mariner and promoting traffic safety. That is not to say that the rules, once unified, should remain static; they (i.e., the International Rules) change as ships change and as new technologies are introduced. The advent of marine radar is a case in point. A current problem, and one for the future, involves rules which are compatible with the characteristics of very large ships. As average ship sizes and minimum stopping distances continue to increase, the need for resolution will also increase. Establishment of deepwater ports and/or channel deepening in US harbors will render the problem more acute from a US point of view.

Protection of the marine environment in ports and waterways is also an important responsibility of the PSS program. As stated at the beginning of this section, however, the PSS program implications may be inferred from the MEP program discussion, Section 7.7.

7.9.4 Recommended Action Options

- Participate actively in all phases of planning for port development, modification, and construction, including deepwater ports.

- Expand scope of interest to include more detailed participation in the development and operation of small US ports, recognizing the changing importance of these ports.

- Develop plans and procedures to accommodate, and assure the safety and security of, the increasing volume and types of hazardous materials.

- Participate in the design and development of port facilities for bunkering ships and to accommodate ship-generated wastes associated with new types of fuels, such as coal and nuclear.

- Participate, in conjunction with all interested parties, in the planning and implementation of anti-terrorist operations involving US ports. Coordinate security and intelligence planning with the GAOI program.

- Continue efforts to consolidate and simplify the Rules of the Nautical Road; explore modifications to the rules necessitated by changing sizes and types of vessels.

- Work closely with MEP and other USCG programs in the environmental protection arena.

7.10 Program: Radio Navigation Aids (RA)

7.10.1 Description. Ships of the future US merchant fleet will require the means to navigate with precision in US waters and on the US foreign trade routes which they ply.

7.10.2 Scenario Influence. The volume of US foreign trade and the portion carried in US ships varies widely among the scenarios. Foreign trade patterns (i.e., the volume of trade and the numbers of US ships sailing on the various trade routes) also varies among the scenarios. There is a general trend toward increased trade with resource-rich areas (South America, Africa, Southwest Asia). Oil is a major import commodity. Non-liner service increases in Scenario R, implying a diffusion of US carriers over many trade routes. Arctic trade routes may become important in Scenarios R and E.

Efficient transoceanic transit will depend in large measure on accurate navigation over the routes traversed. This is especially true if weather routing or ice routing schemes are put into effect. Accurate navigation in harbors and restricted waterways (including approaches to deepwater ports) will assume greater importance, particularly in Scenarios R and E, as traffic density increases and as the ships become larger and less maneuverable.

7.10.3 Program Implications. The need to provide accurate, continuous, all-weather position fixing capability to US merchant ships on a global basis will become more acute with the passage of time. The demand for such service will be commensurate with the number of US merchant ships, the trade routes utilized, and the value of efficient transit as perceived by the shipping industry. Considerations of increased safety will also be important in US waters as well as on the high seas. Internationally agreed Traffic Separation Schemes are predicated on the general availability of navigational capability sufficiently precise to permit the mariner to comply with the TSS. For this reason global navigation systems should be developed in concert with other maritime nations. Where weather and ice routing schemes are contemplated, inter-program coordination (with IO and MSA) will be necessary.

7.10.4 Recommended Action Options

- Continue active participation in the design and installation of global navigation systems and traffic separation schemes.
- Establish effective mechanisms for inter-program coordination among RA, IO and MSA in the development of weather and ice-routing schemes.

7.11 Program: Search and Rescue (SAR)

7.11.1 Description. Ships of the future merchant fleet (US and foreign) will affect the SAR program with respect to the ships themselves, the deepwater ports which service them, and the areas in which they operate. Since merchant ships account for only a fraction of the total number of calls for assistance, changes engendered by the future merchant fleet will be subtle.

7.11.2 Scenario Influence. The number of ships (US and foreign) located in waters of immediate concern to the SAR program will be dependent on the volume of US foreign trade, which varies widely among the scenarios. While the average DWT of US ships also varies by scenario, the average size of foreign ships calling at US ports does not; average DWT can be expected to increase, constrained principally by channel depths in US ports. Under Scenarios

R and E deepwater ports are established, effectively relaxing the draft constraint in a gradual manner. US ship casualty rates (for collisions, groundings, and rammings). rise in Scenario H, fall slowly in Scenario R, and fall markedly in Scenario E. Since most of the historical casualty data reflected conditions in US coastal waters, projections of foreign casualty rates in the same waters should approximate estimates for US ships. Expansion of commercial traffic into the western Arctic is probable under Scenarios R and E; a trans-Arctic trade route is possible late in Scenario E. Except in Scenario H, shipboard automation will progressively reduce manning levels.

7.11.3 Program Implications. It is not expected that SAR cases involving merchant ships will show a dramatic change in the future, at least in comparison with the total SAR workload. Merchant ship SAR cases which do occur, however, could pose significant problems as the size of the stricken ship increases. For instance, emergency towing by Coast Guard cutters (i.e., to prevent aggravation of the situation pending arrival of commercial assistance) presents the problem of passing the largest towline carried; it is doubtful if the connection could be made without manpower and mechanical assistance (e.g., power to the captain) from the merchant ship because of the height of the forecastle. Evacuation of personnel from the ship in medical emergencies, however, should be relatively simple by helicopter, since the ship constitutes a stable platform, usually with ample unobstructed deck areas. Boarding a large, high-sided merchant ship from a boat becomes progressively more difficult and laborious as ship size increases.

The Automated Mutual Vessel Assistance Rescue System (AMVER), through which participating merchant ships provide assistance to ships in distress, could be affected as ship sizes increase and manning levels decrease. Safely maneuvering a 200,000 DWT ship in close quarters, and launching and recovering a boat in even moderate seas, could require heroic feats of seamanship. (Such a ship should provide a good lee, however). Furthermore, AMVER medical assistance capability can be expected to diminish as doctor billets disappear with reductions in manning levels. As a consequence, the usefulness of AMVER should tend to decline. Standing against this projection, however, is the concurrent trend toward increased numbers of ships, not all of which will be behemoths.

Coast Guard responses to merchant ship (and other) SAR cases should gradually be facilitated by the emergence of deepwater ports (i.e., those which are more substantial than single point moorings). Deepwater ports and other offshore structures could provide convenient staging and helicopter refueling sites.

Arctic SAR operations will become a permanent requirement at some time in the future, depending on the energy and trade situations, and the states of technology and the general economy. The Coast Guard SAR posture in the Arctic will have to be expanded when regular shipping and other commercial operations are undertaken with limited Coast Guard icebreaker support.

7.11.4 Recommended Action Options

- Investigate new procedures, techniques, equipment needs and training required by the SAR program in responding to accidents involving ships carrying various types of hazardous materials.
- Assess the impacts of reduced ship manning levels on AMVER effectiveness.
- Coordinate Arctic SAR planning with the IO program.

7.12 Program: Communication Services (GAC)

7.12.1 Description. Communications are essential to the operation of the merchant fleet. Both short range and long range communications capability will continue to be required for safe and efficient ship movement.

7.12.2 Scenario Influence. US foreign trade and the portion carried in US ships expands in Scenario E; expansion is more modest in Scenario R but US non-liner service increases. Automation of ship systems, including communication systems, generally follows the new ship delivery rate in all scenarios, which is high in Scenario E, low in Scenario R, and nil in Scenario H. Traffic density in restricted waterways increases in Scenarios R and E; VTS coverage expands significantly in Scenario E, moderately in Scenario R. Terrorist activity involving US ships occurs in all scenarios. Outside US ports the threat is greatest in Scenario E.

7.12.3 Program Implications. Provision of basic telecommunications services to US ships outside the United States implies global coverage for distress, calling, and locating frequency bands. While US ships today are predominantly engaged in liner service, thereby limiting the area of radio coverage in a predictable fashion, expansion of non-liner service could take significant numbers of US ships to any part of the world.

In developing communication systems to serve the US fleet, user capabilities (in terms of existing and planned shipboard equipment and systems) must be taken into account. Improved shipboard systems become attractive when economically justified. The commercial advantages of rapid, reliable, worldwide communications between the shipping companies and their ships could provide that justification, especially if the volume of US foreign trade in US ships were increasing. Weather (and possibly ice) routing of ships to reduce transit times could also influence the acquisition of modern shipboard systems. Developments such as these would necessarily influence the nature of the systems (in terms of frequency allocations, bandwidths, use of satellites and automatic equipment, etc.) by which the GAC program provides basic telecommunications services and could enable more effective systems to be established.

Improvements in the reliability and timeliness of distress message traffic could be expected as a consequence; implementation of distress alerting and locating systems would also be facilitated.

The impact of short range communication conditions on the GAC program will depend on vessel traffic density in restricted waterways and the degree of VTS expansion. The number of vessels engaged in domestic trade can be expected to continue to rise; to this number would be added the vessels engaged in US foreign trade (which is scenario-dependent). Since virtually all commercial vessels in US waters are required to have bridge-to-bridge voice capability, congestion on VHF-FM channels can be expected to develop. Language problems are inevitable. Situations where the mariner is required to guard more channels than he can manage exist today; with more vessels, more communications, and more communication requirements (e.g., regulations), it is likely that the future mariner's ability to utilize the information received and to respond appropriately may be exceeded, unless communication systems are planned, developed, and operated in the context of their total impact on each potential user. The Coast Guard does not unilaterally control maritime communications but, through its GAC program, it can be an influential participant in the management of effective maritime communications.

7.12.4 Recommended Action Options

- Periodically review the effectiveness of long range communication services provided by the GAC program, with particular emphasis on the adequacy of geographical coverage and on the equipment and personnel capabilities of using ships.

- Periodically review the effectiveness of short range maritime communications with respect to total user needs and capabilities and the combined effect of communication requirements on particular user groups.

- Explore the language problem inherent in voice communications to assure communication reliability and accuracy commensurate with the speed and convenience of voice systems.

- Coordinate communications planning with appropriate clientele and with affected Coast Guard programs (IO, MSA, PSS, RA, SAR).

7.13 Program: Intelligence and Security Support (GAOI)

7.13.1 Description. The impact of the future merchant fleet on the GAOI program falls on measures aimed at minimizing the risk of sabotage and forewarning Coast Guard and other authorities of potential or impending illegal acts. GAOI involvement does not stem from the merchant ships themselves, but rather from the economic, social, and political conditions surrounding merchant ship operations.

7.13.2 Scenario Influence. In Scenario H and the early years of Scenario R, adverse economic conditions and labor unrest result in acts of violence in US ports. Terrorist activity in US ports by foreign interests (i.e., activity spawned in the international arena by anti-American feelings) occurs but is relatively rare in Scenarios R and H. Terrorist activity, both foreign and domestic, diminishes in the later years under Scenario R. Under Scenario E, however, terrorism in US ports, by foreign interests and groups, increases steadily as US expansion comes to be viewed as imperialistic.

Outside the United States terrorism, and sometimes piracy, is a threat under all scenarios. The risk is least in Scenario H because US foreign trade stagnates and the US fleet diminishes. Strained foreign relations early in Scenario R increase the risk to US ships in Third World nations where some governments fail (through reluctance or inability) to restrain criminal activities. Foreign relations and the terrorist situation improve later in Scenario R. The trend is reversed in Scenario E, however;

foreign relations deteriorate and terrorist activity involving US ships becomes frequent.

7.13.3 Program Implications. Scenario influences most pertinent to the GAOI program deal with criminal acts committed in US ports, US waters, and adjacent areas of the high seas. Defense against terrorist activity rests on the two aspects of the GAOI program, intelligence and security. Knowledge of the identity, capability, and intentions of terrorist groups is an essential element of defense; this information, however, is extremely difficult to obtain because of the diffuse nature of the threat (number of possible terrorist groups, for instance). For program effectiveness, Coast Guard involvement and coordination with other members of the intelligence community will be vital. Equally important will be intra-Coast Guard coordination among GAOI and the programs it supports (notably ELT and PSS).

Implications for security, the other aspect of the GAOI program, center on personnel. While personnel security measures cannot guarantee security from criminal acts, they can reduce the risk by identifying dangerous individuals or excluding them from sensitive areas or activities. In peacetime, however, statutory authority for such an undertaking is limited. A general peacetime personnel security program (for all port workers, for instance) appears to be neither desirable (on the basis of threat magnitude, Coast Guard workload, or cost) nor possible (since it may be successfully argued that any enabling legislation would infringe the constitutional rights of citizens). More modest programs, to deal with specific activities of demonstrably high risk (such as LNG terminal operations, for instance), might be warranted and the necessary enabling authority might be obtainable. Intra-Coast Guard coordination with the CVS and PSS programs would be required in planning and implementing any personnel security undertaking.

7.13.4 Recommended Action Options

- Continue to coordinate intelligence gathering, evaluation, and dissemination efforts with other members of the intelligence community, with particular emphasis on terrorist activity involving US ships and ports.

- Investigate, in conjunction with the CVS and PSS Program Managers, the circumstances under which establishment of an extraordinary personnel security program in US ports might be warranted.

7.14 General Conclusions

7.14.1 Overview. That Coast Guard responsibilities are many and varied is abundantly clear from the foregoing analysis even though the scope of this study is limited to direct inpacts of future merchant fleets. While these impacts have been discussed in conjunction with each affected program, there are two pervasive, major developments which warrant special recognition, namely, hazardous materials and terrorism. These developments and general implications for the Coast Guard support programs which will feel the impact of future merchant fleets indirectly through the programs they support are highlighted in the following sections.

7.14.2 Major Developments

7.14.2.1 Hazardous Materials. The list of hazardous materials has grown markedly in recent years, and the list can be expected to lengthen as new toxic, flammable and/or explosive materials are introduced in significant volumes. As waterborne bulk transport of hazardous materials increases, so will the responsibilities and workload of the CVS, MEP, and PSS programs. The handling, storage, stowage, and transfer of hazardous materials will require not only qualified and certified personnel ashore and aboard ship, but also significant numbers of trained Coast Guard monitors, supervisors, and inspectors. Regulations, standards, design approval, and construction certification of hazardous material carriers (ships, barges, and containers) will similarly impose new or expanded personnel requirements on the Coast Guard. The safety problem is rendered even more complex when it is considered that the precautions cannot be applied blindly to all hazardous materials; appropriate precautions must be devised for several classes of hazardous materials.

7.14.2.2 Terrorism. Acts of terrorism constitute a growing threat to the maritime community. While ships at sea may be relatively safe, port facilities and ships in port are relatively vulnerable. Depending on the causes espoused by terrorist groups, certain port facilities or ships could become very attractive targets. The problem will become increasingly acute for the Coast Guard (i.e., the PSS, GAOI and, to a lesser extent, ELT programs) because prevention or defense is very difficult, and because the consequences of a successful terrorist attack could be exceedingly grave. Although anti-terrorist responsibilities are shared with other federal, state, and local authorities, it is clear that the associated Coast Guard workload and personnel requirements will rise.

7.14.3 General Implications for Support Programs

7.14.3.1 Personnel Support Program (GAP). The GAP program is charged with providing personnel in sufficient numbers and with appropriate training to support other Coast Guard programs. Impacts of future merchant fleets on the GAP program, as inferred from the foregoing discussions of supported programs, are generally toward greater complexity (i.e., higher levels of qualification) but the changes will be gradual or evolutionary in nature. Personnel requirements generated by the CVS, MEP, PSS, and GAOI programs, however, are fundamentally different in that greater numbers of personnel may be needed relatively soon, and training and qualification to perform new functions will be required. Training requirements for these programs are currently extensive and highly specialized; a long lead time is necessary to fill the personnel pipeline. For instance, the officer training/indoctrination process to fill CVS billets (which currently requires three years plus several years of seagoing experience) becomes increasingly difficult. It is therefore important that the GAP program take particular notice of these conditions in planning and managing the total Coast Guard personnel system.

7.14.3.2 Hazard Control Safety Program (GAS). The GAS program is responsible for minimizing occupational health hazards to Coast Guard personnel. In light of the discussion of hazardous materials above, the implications for the GAS program are obvious. Coast Guard personnel engaged in operational CVS, PSS, and some SAR activities would be subject to the greatest risks.

7.14.3.3 Research and Development Program (R&D). Specific R&D projects cannot be identified or recommended on the basis of this macro level study. Most of the program action options do, however, imply areas of interest to the R&D program. Performance of most Coast Guard tasks is usually accomplished by some combination of "people and things." As pointed out above, personnel and training requirements can be expected to increase as the scope and nature of Coast Guard tasks evolve. Since personnel (i.e., numbers of people and training time) constitute a finite resource, improvement or expansion of technological applications will greatly assist the Coast Guard in meeting its responsibilities and will tend to ameliorate the personnel problem.

Three fruitful areas for R&D emphasis may be inferred from program discussions given earlier in this chapter. They are surveillance technologies (devices and systems to meet various program needs), ice technologies (observation, formation, and movement prediction), and environmental technologies (detection, identification, containment, removal, and disposition of pollutants including, but not limited to, oil). Expanded application of these technologies, whether adaptations of systems developed outside the Service or products of Coast Guard R&D, should make major contributions to the performance of Coast Guard operations.

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APPENDIX A

PARAMETER GENERATION WORKSHOP

FUTURE MARITIME FLEET STUDY

PARAMETER GENERATION WORKSHOP

Forecasting International, Ltd. is engaged in a study of future merchant fleets jointly sponsored by the Coast Guard and the Maritime Administration. The broad general setting for this study is based on a prior FI study for MarAd which addressed the implications of 3 possible future scenarios for the maritime industry as a whole, and MarAd R&D programs in particular.

The focus of the present study is on the nature of merchant fleets which might evolve under the broad scenarios produced in the first study. In other words, the area of concern has narrowed; it has also expanded to include both MarAd and Coast Guard interests. These interests derive from each agency's programs and from the organizations and entities (clientele) with which these programs interact.

The purpose of the workshop is to generate lists of parameters which can be used later in the study to describe or measure changes which will affect the Coast Guard and MarAd over the next 25 years. For present purposes, a parameter is defined as follows:

> A parameter is a merchant fleet-related trend of concern to Coast Guard programs, MarAd R&D programs, and/or Coast Guard and MarAd clientele.

A number of parameters immediately come to mind (such as ship size, ship speed, etc.) but others, less obvious, may be (or become) equally important. What is needed is a shopping list of candidate parameters. The workshop is intended to be an uninhibited, creative forum for generating this shopping list. The emphasis is on generating ideas; the worth of the candidate parameters produced will not be evaluated during the workshop.

A simple time-efficient technique known as Brainwriting will be employed to facilitate the generation process. This technique has proved effective on many occasions and is briefly described as follows:

- Brainwriting is similar to the familiar Brainstorming technique, except it is done in silence and in writing rather than orally.

- One or more small groups of 4-8 participants are formed.

- Each participant draws a blank sheet of paper from the center of the table (termed the "pool") on which he lists his ideas. When he runs out of ideas, he returns the paper to the pool and draws another, which has been returned to the pool by another participant.

- He reviews the ideas on the paper. This usually triggers new ideas, which he adds to the list. The paper is again returned to the pool, and another drawn, as before.

- When all participants run out of ideas (typically in about 20-30 minutes), the exercise stops.

The elimination of talking in this method allows for simultaneous participation by all the group members. Since papers are exchanged, each participant sees what others are contributing. Both of these attributes serve to minimize the problems associated with unequal verbal participation characteristic of most group processes.

A search of Coast Guard and MarAd documents has identified programs (in Appendix 1) which could be affected by future merchant fleets. Clientele associated with these programs have also been identified, reasoning that consideration of programs and clientele can serve as a focusing device for identifying candidate parameters. As a further aid, clientele have been categorized according to areas of general interest in Appendix 2. In order to direct attention to each of the 5 areas

(Ocean Usage, Ship Operations, Ship Characteristics, Land-Sea Interface, Constraints), 5 separate Brainwriting sessions will be conducted, with time to review the program/client listings and for discussion between each session. The listings are, of course, simply aids. Useful ideas only come from the knowledge, background and insights of the participants.

APPENDIX 1

Coast Guard Programs	MARAD R&D Programs
Short Range Aids to Navigation (CG-AN)	Competitive Shipbuilding (M-SBLDG)
Bridge Administration (CG-BA)	Competitive Shipping (M-SHIPG)
Commercial Vessel Safety (CG-CVS)	Ship Control (Automation) (M-SHCON)
Enforcement of Laws and Treaties (CG-ELT)	Marine Science (M-MSCI)
Ice Operations (CG-IO)	Navigation & Communication (M-NAV&C)
Marine Environmental Protection (CG-MEP)	Ports & Intermodal (M-PORTS)
Military Operations (CG-MO)	Ships Machinery (M-MACHY)
Military Preparedness (CG-MP)	Nuclear Propulsion (M-NPROP)
Marine Science Activities (CG-MSA)	Energy & Environmental (M-EN&EV)
Port Safety and Security (CG-PSS)	Advanced Ship Systems (M-ADSYS)
Radionavigation Aids (CG-RA)	Market Analysis (M-MARKA)
Boating Safety (CG-RBS)	CAORF (M-CAORF)
Search and Rescue (CG-SAR)	Cargo Handling (M-CHAND)
Communication Services (CG-GAC)	
Personnel (CG-GAP)	
Hazard Control Safety (CG-GAS)	
Research and Development (CG-R&D)	

APPENDIX 2

CLIENT/PROGRAM LISTINGS

SET 100 - OCEAN USAGE

SET 200 - SHIP OPERATIONS

SET 300 - SHIP CHARACTERISTICS

SET 400 - LAND-SEA INTERFACE

SET 500 - ENVIRONMENTAL, SAFETY, LEGAL CONSTRAINTS

SET 100

This set of programs/clients is sorted according to Ocean Usage as follows:

110 Marine Resource Exploration and Exploitation

- 111 Energy Extraction
- 112 Energy Production
- 113 Mineral Extraction
- 114 Food Hunting
- 115 Food Production (Mariculture)

120 Trade

- 121 Trade Routes (Origins/Destinations)

130 Trade Goods (Cargo Types)

- 131 Liquid Bulk
- 132 Dry Bulk
- 133 Ore
- 134 Slurry
- 135 Unitized
- 136 Manufactures/Semi-Manufactures
- 137 Quantities of Trade Goods
- 138 Shipping Information Processing

150 Defense

160 Oceanographic Research

- 161 Cartography

170 Recreation (Boating-Related)

180 Ecology Preservation, Development and Management

OCEAN USAGE, GENERAL (100)

39	National and Local Association of Port Authorities	21	CG-BA	COML	100	211	330		540
205	American Association of Port Authorities	21	CG-PSS	COML	100	211	330		540
435	American Association of Port Authorities	21	M-SHIPG	COML	100	211	330		540
436	American Association of Port Authorities	21	M-PORTS	COML	100	211	330		540
437	American Association of Port Authorities	21	M-CHAND	COML	100	211	330		540
203	American Radio Association	136	CG-PSS	COML	100	230			
219	Oil Transfer Facility Industry	146	CG-PSS	COML	100	240	300	400	500
263	American Merchant Marine Institute	165	CG-RA	COML	100	200	320	400	500
462	Marine Exchange of San Francisco Bay	221	M-SHIPG	COML	100	200	300	400	500
463	Marine Exchange of San Francisco Bay	221	M-PORTS	COML	100	200	300	400	500
466	Maritime Association of the Port of New York	221	M-SHIPG	COML	100	200	300	400	500
467	Maritime Association of the Port of New York	221	M-PORTS	COML	100	200	300	400	500
468	Maritime Association of the Port of New York	221	M-EN&EV	COML	100	200	300	400	500
469	Maritime Association of the Port of New York	221	M-CHAND	COML	100	200	300	400	500
472	Mobile Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
473	Mobile Steamship Association	221	M-PORTS	COML	100	200	300	400	500
474	Mobile Steamship Association	221	M-EN&EV	COML	100	200	300	400	500
475	Mobile Steamship Association	221	M-CHAND	COML	100	200	300	400	500
476	New Orleans Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
477	New Orleans Steamship Association	221	M-PORTS	COML	100	200	300	400	500
478	New Orleans Steamship Association	221	M-EN&EV	COML	100	200	300	400	500
479	New Orleans Steamship Association	221	M-CHAND	COML	100	200	300	400	500
480	New York Shipping Association, Inc.	221	M-Shipg	COML	100	200	300	400	500
481	New York Shipping Association, Inc.	221	M-PORTS	COML	100	200	300	400	500
482	New York Shipping Association, Inc.	221	M-EN&EV	COML	100	200	300	400	500
483	New York Shipping Association, Inc.	221	M-CHAND	COML	100	200	300	400	500
484	New York Towboat and Harbor Carriers Association	221	M-SHIPG	COML	100	200	300	400	500
485	New York Towboat and Harbor Carriers Association	221	M-PORTS	COML	100	200	300	400	500
494	Philadelphia Marine Trade Association	221	M-SHIPG	COML	100	200	300	400	500
495	Philadelphia Marine Trade Association	221	M-PORTS	COML	100	200	300	400	500
496	Philadelphia Marine Trade Association	221	M-EN&EV	COML	100	200	300	400	500
497	Philadelphia Marine Trade Association	221	M-CHAND	COML	100	200	300	400	500
503	Steamship Trade Association of Baltimore, Inc.	221	M-SHIPG	COML	100	200	300	400	500
504	Steamship Trade Association of Baltimore, Inc.	221	M-PORTS	COML	100	200	300	400	500
505	Steamship Trade Association of Baltimore, Inc.	221	M-EN&EV	COML	100	200	300	400	500
506	Steamship Trade Association of Baltimore, Inc.	221	M-CHAND	COML	100	200	300	400	500
486	Pacific Maritime Association	235	M-SHIPG	COML	100	200	300	400	500
487	Pacific Maritime Association	235	M-PORTS	COML	100	200	300	400	500
488	Pacific Maritime Association	235	M-EN&EV	COML	100	200	300	400	500
489	Pacific Maritime Association	235	M-CHAND	COML	100	200	300	400	500
490	Pacific Merchant Shippers Association	236	M-SHIPG	COML	100	200	300	400	500
491	Pacific Merchant Shippers Association	236	M-PORTS	COML	100	200	300	400	500
492	Pacific Merchant Shippers Association	236	M-EN&EV	COML	100	200	300	400	500
493	Pacific Merchant Shippers Association	236	M-CHAND	COML	100	200	300	400	500
21	Port Authorities	21	CG-AN	GOVT	100	211	330		540
65	State/Local Port Authorities	21	CG-CVS	GOVT	100	211	330		540
46	Maritime Administration	45	CG-CVS	GOVT	100	200	300	400	500
117	Maritime Administration	45	CG-MEP	GOVT	100	200	300	400	500
165	Maritime Administration	45	CG-PSS	GOVT	100	200	300	400	500

OCEAN USAGE, GENERAL (100)

230	Maritime Administration	45	CG-RA	GOVT	100	200	300	400	500
92	U.S. Coast Guard	79	CG-IO	GOVT	100	200	300	400	500
341	U. S. Coast Guard	79	M-SBLDG	GOVT	100	200	300	400	500
342	U. S. Coast Guard	79	M-SHIPG	GOVT	100	200	300	400	500
343	U. S. Coast Guard	79	M-SHCON	GOVT	100	200	300	400	500
344	U. S. Coast Guard	79	M-NSCI	GOVT	100	200	300	400	500
345	U. S. Coast Guard	79	M-NAV&C	GOVT	100	200	300	400	500
346	U. S. Coast Guard	79	M-PORTS	GOVT	100	200	300	400	500
347	U.S. Coast Guard	79	M-NPROP	GOVT	100	200	300	400	500
348	U. S. Coast Guard	79	M-ADSYS	GOVT	100	200	300	400	500
349	U. S. Coast Guard	79	M-CHAND	GOVT	100	200	300	400	500
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA	GOVT	100	220	300	400	500
223	Public Vessels	147	CG-PSS	GOVT	100	200	300		540
442	Boston Shipping Authority	221	M-SHIPG	GOVT	100	200	300	400	510
443	Boston Shipping Authority	221	M-PORTS	GOVT	100	200	300	400	500
444	Boston Shipping Authority	221	M-EN&EV	GOVT	100	200	300	400	500
445	Boston Shipping Authority	221	M-CHAND	GOVT	100	200	300	400	500
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS	INTL	100	200	300	400	500
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS	INTL	100	200	300	400	500
378	Intergovernmental Maritime Consultative Organization	57	M-SBLDG	INTL	100	200	300	400	500
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG	INTL	100	200	300	400	500
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C	INTL	100	200	300	400	500
381	Intergovernmental Maritime Consultative Organization	57	M-NPROP	INTL	100	200	300	400	500
382	Intergovernmental Maritime Consultative Organization	57	M-EN&EV	INTL	100	200	300	400	500
180	Committee on International Ocean Affairs (CIOA)	127	CG-MSA	INTL	100	210	340	400	500
184	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	127	CG-MSA	INTL	100	210	340	400	500
290	International Council of Marine Industry Association	182	CG-RBS	INTL	100				540
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG	INTL	100	200	300	400	500
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG	INTL	100	200	300	400	500
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS	INTL	100	200	300	400	500
470	International Maritime Satellite Preparatory Committee	230	M-SHIPG	INTL	100	200			540
471	International Maritime Satellite Preparatory Committee	230	M-NAV&C	INTL	100	200			540
40	Industrial Development Commissions	39	CG-BA	MFG	100	211	330		540
112	Petroleum Industry	95	CG-IO	MFG	100	270	300	400	500
125	American Petroleum Institute	95	CG-MEP	MFG	100	270	300	400	500
137	Petroleum Industry	95	CG-MEP	MFG	100	270	300	400	500
224	Petroleum Industry	95	CG-PSS	MFG	100	270	300	400	500
150	Electronics and ordnance equipment manufacturers	115	CG-MO	MFG	100	200	320	400	500
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP	MFG	100	200	320	400	500
267	Electronic Industry Association	115	CG-RA	MFG	100	200	320	400	500
264	Institute of Electrical and Electronic Engineers	166	CG-RA	MFG	100	200	320	400	500
369	American Institute of Industrial Engineers	208	M-SBLDG	MFG	100		300	400	500
370	American Institute of Industrial Engineers	208	M-MACHY	MFG	100		300	400	500
371	American Institute of Industrial Engineers	208	M-NPROP	MFG	100		300	400	500
394	American Society of Naval Engineers	211	M-SBLDG	MFG	100		300	400	500
395	American Society of Naval Engineers	211	M-SHCON	MFG	100		300	400	500
396	American Society of Naval Engineers	211	M-MACHY	MFG	100		300	400	500
397	American Society of Naval Engineers	211	M-NPROP	MFG	100		300	400	500
398	American Society of Naval Engineers	211	M-ADSYS	MFG	100		300	400	500

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399	American Society of Naval Engineers	211	M-CHAND	MFG	100		300	400	500
417	American Shipyard Unions	214	M-SBLDG	PERS	100		320		547
418	American Shipyard Unions	214	M-MACHY	PERS	100		320		547
454	Labor-Management Maritime Committee	226	M-SBLDG	PERS	100	260	310	440	547
455	Labor-Management Maritime Committee	226	M-SHIPG	PERS	100	260	310	440	547
456	Labor-Management Maritime Committee	226	M-SHCON	PERS	100	260	310	440	547
457	Labor-Management Maritime Committee	226	M-PORTS	PERS	100	260	310	440	547
458	Labor-Management Maritime Committee	226	M-CHAND	PERS	100	260	310	440	547
331	State Port Authorities	21	CG-GAC	PRIV	100	211	330		540
266	American Radio Relay League	47	CG-RA	PRIV	100	200	320	400	500
174	National Academy of Engineering	124	CG-MSA	PRIV	100		300	400	500
175	Marine Technology Society	124	CG-MSA	PRIV	100		300	400	500
177	Sea Use Foundation	126	CG-MSA	PRIV	100				500
183	Ocean Affairs Board (OAB)	127	CG-MSA	PRIV	100	210	340	400	500
199	Radio Technical Commission for Marine Services	136	CG-PSS	PRIV	100	230			
260	American Museum of Natural History	164	CG-RA	PRIV	100	200	320	400	500
	110 Marine Resource Exploration and Exploitation								
19	Commercial Offshore Exploration Firms	19	CG-AN	COML	110	210	340		
76	Commercial Diving Industry (Underwater Vessel Owners and Operators)	69	CG-CVS	COML	110	210	354	400	540
2	National Oceanic and Atmospheric Administration	2	CG-AN	GOVT	110	220	332		543
88	National Oceanic and Atmospheric Administration	2	CG-IO	GOVT	110	220	332		543
161	National Oceanic and Atmospheric Administration	2	CG-MSA	GOVT	110	220	332		543
186	National Oceanic and Atmospheric Administration	2	CG-PSS	GOVT	110	220	332		543
274	National Oceanic and Atmospheric Administration	2	CG-RES	GOVT	110	220	332		543
350	National Oceanic and Atmospheric Administration	2	M-SBLDG	GOVT	110	220	332		543
351	National Oceanic and Atmospheric Administration	2	M-MSCI	GOVT	110	220	332		543
352	National Oceanic and Atmospheric Administration	2	M-EN&EV	GOVT	110	220	332		543
526	Drug Enforcement Administration	2	CG-ELT	GOVT	110	220	300		543
9	National Aeronautics and Space Administration	9	CG-AN	GOVT	110	220			510
93	National Aeronautics and Space Administration	9	CG-IO	GOVT	110	220			510
250	National Aeronautics and Space Administration	9	CG-RA	GOVT	110	220			510
546	National Aeronautics and Space Administration	9	M-NAV&C	GOVT	110	220			510
90	Bureau of Land Management	77	CG-IO	GOVT	110			400	510
122	Department of State	97	CG-MEP	GOVT	110				
242	Department of State	97	CG-RA	GOVT	110				
529	Dept. of State (Deputy Assistant Secretary for Oceans and Fisheries Affairs)	97	CG-ELT	GOVT	110				
251	Department of Energy	159	CG-RA	GOVT	110	240	323	400	540
360	Department of Energy	159	M-PORTS	GOVT	110	240	323	400	540
361	Department of Energy	159	M-NPROP	GOVT	110	240	323	400	540
362	Department of Energy	159	M-EN&EV	GOVT	110	240	323	400	540
525	National Oceanic and Atmospheric Administration	242	CG-ELT	GOVT	110	220	300		543
68	Offshore Petroleum and Mineral Industry	61	CG-CVS	MFG	110	210	340	410	510
	112 Energy Production								
253	Nuclear Regulatory Commission	160	CG-RA	GOVT	112	260	323	420	530
376	Nuclear Regulatory Commission	160	M-PORTS	GOVT	112	260	323	420	530
377	Nuclear Regulatory Commission	160	M-NPROP	GOVT	112	260	323	420	530
	114 Food Hunting								
23	Fishermen, commercial	23	CG-AN	COML	114	210		421	540
114	Fishermen (Commercial)	23	CG-IO	COML	114	210		421	540
227	Fishermen, Commercial	23	CG-PSS	COML	114	210		421	540
315	Fishermen, Commercial	23	CG-SAR	COML	114	210		421	540
326	Fishing Vessels (U.S. and Foreign)	23	CG-GAC	COML	114	210		421	540

539	Fishermen, Commercial		23	CG-ELT	COML	114	210		421	540
533	Inter-American Tuna Commission	**114 Food Hunting**	246	CG-ELT	INTL	114	210			560
534	Internation Commission for the Conservation of Atlantic Tuna		247	CG-ELT	INTL	114	210			560
535	International North Pacific Fisheries Commission		248	CG-ELT	INTL	114	210			560
541	International Pacific Halibut Commission		251	CG-ELT	INTL	114	210		421	540
542	Sockeye Salmon Commission		252	CG-ELT	INTL	114	210		421	540
10	American Institute of Merchant Shipping		10	CG-AN	COML	120	200	310	400	500
60	American Institute of Merchant Shipping		10	CG-CVS	COML	120	200	310	400	500
126	American Institute of Merchant Shipping		10	CG-MEP	COML	120	200	310	400	500
204	American Institute of Merchant Shipping	**120 Trade**	10	CG-PSS	COML	120	200	310	400	500
257	American Institute of Merchant Shipping		10	CG-RA	COML	120	200	310	400	500
402	American Institute of Merchant Shipping		10	M-SHIPG	COML	120	200	310	400	500
403	American Institute of Merchant Shipping		10	M-MARKA	COML	120	200	310	400	500
11	American Transport Association		11	CG-AN	COML	120	250	300	400	500
12	Lake Carriers Association		12	CG-AN	COML	120	200	330	400	540
104	Lake Carriers Association		12	CG-IO	COML	120	200	330	400	540
202	(Great) Lake Carriers Association		12	CG-PSS	COML	120	200	330	400	540
459	Lake Carriers Association		12	M-SHIPG	COML	120	200	330	400	540
460	Lake Carriers Association		12	M-PORTS	COML	120	200	330	400	540
461	Lake Carriers Association		12	M-CHAND	COML	120	200	330	400	540
18	Commercial Vessel Operators, U. S. and foreign		18	CG-AN	COML	120	200	300	400	500
37	Commercial Water Transportation Firms		18	CG-BA	COML	120	200	300	400	540
33	Shippers		18	CG-BA	COML	120	200	300	400	540
64	Maritime Commerce (Owners, Operators, Shippers, Carriers, Agents)		18	CG-CVS	COML	120	200	300	400	500
138	Merchant Shipping Industry		18	CG-MEP	COML	120	200	300	400	500
216	Commercial Cargo Vessel & Dry Cargo Barge Industry		18	CG-PSS	COML	120	200	300	400	500
317	Maritime Industry		18	CG-SAR	COML	120	200	300	400	500
324	Merchant Vessels (U.S.)		18	CG-GAC	COML	120	200	300	400	500
404	U. S. Flag shipowners, operators and/or agents		18	M-SHIPG	COML	120	200	300	400	500
405	U. S. Flag shipowners, operators and/or agents		18	M-SHCON	COML	120	200	300	400	500
406	U. S. Flag shipowners, operators and/or agents		18	M-NAV&C	COML	120	200	300	400	500
407	U. S. Flag shipowners, operators and/or agents		18	M-PORTS	COML	120	200	300	400	500
408	U. S. Flag shipowners, operators and/or agents		18	M-MARKA	COML	120	200	300	400	500
409	U. S. Flag shipowners, operators and/or agents		18	M-CAORF	COML	120	200	300	400	500
446	Council of American Flag Ship Operators		18	M-SHIPG	COML	120	200	300	400	500
447	Council of North Atlantic Shipping Association		18	M-SHIPG	COML	120	200	300	400	500
22	Insurance Industry		22	CG-AN	COML	120	210	340	400	540
63	Lloyds of London		22	CG-CVS	COML	120	210	340	400	540
71	Insurance and Hull Underwriters		22	CG-CVS	COML	120	210	340	400	540
134	American Institute of Marine Underwriters		22	CG-MEP	COML	120	210	340	400	540
141	Insurance Industry		22	CG-MEP	COML	120	210	340	400	540
226	Insurance Industry		22	CG-PSS	COML	120	210	340	400	540
306	The Insurance Industry		22	CG-RBS	COML	120	210	340	400	540
31	Railroad Companies		31	CG-BA	COML	120		360	400	540
38	American Association of Railroads (AAR)		37	CG-BA	COML	120		360	400	540
42	Towing Industry Advisory Committee		41	CG-BA	COML	120	210	330	430	540
43	American Waterways Operators, Inc.		42	CG-BA	COML	120	210	330	400	540
438	American Waterways Operators, Inc.		42	M-SHIPG	COML	120	210	330	400	540
439	American Waterways Operators, Inc.		42	M-NAV&C	COML	120	210	330	400	540

120 Trade

440	American Waterways Operators, Inc.
441	American Waterways Operators, Inc.
59	American Bureau of Shipping
400	American Bureau of Shipping
401	American Bureau of Shipping
66	Foreign Commercial Vessels
321	Foreign Merchant Vessels
323	Merchant Vessels (foreign)
81	Brokers and Mortgagees (Lending and Holding Institutions)
105	Dominion Marine Association (Canada)
107	Various Chambers of Commerce
216	Terminal Operators (Port Authorities, Private Owners, Stevedoring Companies)
318	Commercial Aviation
322	Foreign Aircraft
329	Commercial Aircraft
327	Harbor and River Tugboats
368	National Maritime Council
369	National Maritime Council
390	National Maritime Council
391	National Maritime Council
392	National Maritime Council
393	National Maritime Council
448	Federation of American Controlled Shipping
449	Federation of American Controlled Shipping
450	Federation of American Controlled Shipping
509	Transportation Institute
510	Transportation Institute
511	Transportation Institute
512	Transportation Institute
513	Transportation Institute
514	Transportation Institute
515	Transportation Institute
27	State Marine Organizations
28	State Highway Departments
29	City and County Governments
30	Public Bridge Authorities and Commissions
41	National Water Resources Council
72	Classification and Certification
91	St. Lawrence Seaway Development Corporation
100	St. Lawrence Seaway Development Corporation
193	St. Lawrence Seaway Development Corporation
246	St. Lawrence Seaway Development Corporation
103	St. Lawrence Seaway Authority (Canada)
124	Federal Maritime Commission
198	Federal Maritime Commission
363	Federal Maritime Commission
144	Department of Transportation
154	Department of Transportation
531	U.S. Customs Service

42	M-PORTS	COML	120	210	330	400	540
42	M-CHAND	COML	120	210	330	400	540
56	CG-CVS	COML	120	200	300	400	540
56	M-SHIPG	COML	120	200	300	400	540
56	M-MARKA	COML	120	200	300	400	540
59	CG-CVS	COML	120	200	300	420	540
59	CG-SAR	COML	120	200	300	420	540
59	CG-GAC	COML	120	200	300	420	540
72	CG-CVS	COML	120	270	310		540
88	CG-IO	COML	120	200	330	400	500
90	CG-IO	COML	120		330	400	500
145	CG-PSS	COML	120	200	300	400	500
198	CG-SAR	COML	120	220			540
198	CG-SAR	COML	120	220			540
198	CG-GAC	COML	120	220			540
202	CG-GAC	COML	120	200	340	430	540
210	M-SBLDG	COML	120	200	300	400	500
210	M-SHIPG	COML	120	200	300	400	500
210	M-SHCON	COML	120	200	300	400	540
210	M-PORTS	COML	120	200	300	400	540
210	M-MARKA	COML	120	200	300	400	540
210	M-CHAND	COML	120	200	300	400	540
224	M-SHIPG	COML	120	200	310	400	500
224	M-PORTS	COML	120	200	310	400	500
224	M-CHAND	COML	120	200	310	400	500
241	M-SHIPG	COML	120	200	300	400	500
241	M-SHCON	COML	120	200	300	400	500
241	M-MSCI	COML	120	200	300	400	500
241	M-NAV&C	COML	120	200	300	400	500
241	M-DN&DV	COML	120	200	300	400	500
241	M-ADSYS	COML	120	200	300	400	500
241	M-CAORF	COML	120	200	300	400	500
27	CG-AN	GOVT	120	200	330	400	540
28	CG-BA	GOVT	120		335	410	543
29	CG-BA	GOVT	120			400	540
30	CG-BA	GOVT	120		335	410	543
40	CG-BA	GOVT	120	212	330	410	540
64	CG-CVS	GOVT	120		300		
78	CG-IO	GOVT	120	212	330	410	543
78	CG-IO	GOVT	120	212	330	410	543
78	CG-PSS	GOVT	120	212	330	410	543
78	CG-RA	GOVT	120	212	330	410	543
87	CG-IO	GOVT	120	212	330	410	543
99	CG-MEP	GOVT	120	250		410	510
99	CG-PSS	GOVT	120	250		410	510
99	M-SHIPG	GOVT	120	250		410	510
112	CG-MO	GOVT	120	230		410	540
112	CG-MP	GOVT	120	230		410	540
135	CG-ELT	GOVT	120		311	400	560

120 Trade

210	National Transportation Safety Board	141	CG-PSS	GOVT	120				540
194	Materials Transportation Bureau	143	CG-PSS	GOVT	120			400	530
232	U.S. Merchant Marine Academy	150	CG-RA	GOVT	120	260		440	540
233	Bureau of Census	151	CG-RA	GOVT	120	260	310	440	
243	Department of Agriculture	155	CG-RA	GOVT	120				
245	Federal Highway Administration	156	CG-RA	GOVT	120			410	530
364	Economic Development Administration	206	M-PORTS	GOVT	120	260		400	
527	U.S. Attorney's Office	243	CG-ELT	GOVT	120	200			560
530	Internal Revenue Service	244	CG-ELT	GOVT	120				560
532	Bereau of Alcohol, Tobacco and Firearms	245	CG-ELT	GOVT	120				560
294	International Standards Organization	70	CG-RBS	INTL	120		320	420	540
83	International Safety and Security Organizations	74	CG-CVS	INTL	120	210	340	430	540
106	International Association of Great Lakes Ports	89	CG-IO	INTL	120	200	330	400	500
133	International Association of Passenger Liners	106	CG-MEP	INTL	120	200	300	400	540
207	International Longshoremens Association	138	CG-PSS	INTL	120	240	300	440	540
208	International Longshoremen and Warehouse Union	138	CG-PSS	INTL	120	240	300	440	540
286	American Institute of Marine Underwriters	22	CG-RBS	MFG	120	210	340	400	540
50	Underwriter's Laboratory	48	CG-CVS	MFG	120	210	300	421	540
60	Naval Architects and Marine Engineers	48	CG-CVS	MFG	120	210	300	421	540
268	Society of Naval Architects and Marine Engineers	48	CG-RBS	MFG	120	210	300	421	540
269	Underwriter's Laboratory	48	CG-RBS	MFG	120	210	300	421	540
519	Society of Naval Architects and Marine Engineers	48	M-SBLDG	MFG	120	210	300	421	540
520	Society of Naval Architects and Marine Engineers	48	M-SHCON	MFG	120	210	300	421	540
521	Society of Naval Architects and Marine Engineers	48	M-MACHY	MFG	120	210	300	421	540
522	Society of Naval Architects and Marine Engineers	48	M-NPROP	MFG	120	210	300	421	540
523	Society of Naval Architects and Marine Engineers	48	M-ADSYS	MFG	120	210	300	421	540
524	Society of Naval Architects and Marine Engineers	48	M-CHAND	MFG	120	210	300	421	540
70	Ship and Boat Yards	63	CG-CVS	MFG	120		320	421	510
149	Shipbuilders	63	CG-MO	MFG	120		320	421	500
159	Shipbuilders	63	CG-MP	MFG	120		320	421	510
498	Shipbuilders Council of America	63	M-SBLDG	MFG	120		320	421	500
499	Shipbuilders Council of America	63	M-MACHY	MFG	120		320	421	500
500	Shipbuilders Council of America	63	M-NPROP	MFG	120		320	421	500
501	Shipbuilders Council of America	63	M-ADSYS	MFG	120		320	421	500
502	Shipbuilders Council of America	63	M-CHAND	MFG	120		320	421	500
73	Manufacturers and Venders of Marine Equipment	65	CG-CVS	MFG	120		320	420	
293	Various Marine Manufacturers, Dealers and Distributors	65	CG-RBS	MFG	120		320	420	
79	Standardization and Technical Societies	70	CG-CVS	MFG	120		320	420	540
287	American National Standards Institute	70	CG-RBS	MFG	120		320	420	540
292	Canadian Standards Association Testing Laboratories	70	CG-RBS	MFG	120		320	420	540
295	Society of Automotive Engineers	70	CG-RBS	MFG	120		320	420	540
365	American Society of Testing Materials	70	M-SBLDG	MFG	120		320	420	540
366	American Society of Testing Materials	70	M-MACHY	MFG	120		320	420	540
368	American Society of Testing Materials	70	M-CHAND	MFG	120		320	420	540
367	American Society of Testing Materials	207	M-NPROP	MFG	120		320	420	540
221	Mariners (Commercial Operators)	18	CG-PSS	PERS	120	200	300	400	500
429	Council of American Master Mariners, Inc.	18	M-SHIPG	PERS	120	200	300	400	500
430	Council of American Master Mariners, Inc.	18	M-NAV&C	PERS	120	200	300	400	500
431	Council of American Master Mariners, Inc.	18	M-PORTS	PERS	120	200	300	400	500

120 Trade

20	Pilot Associations	20	CG-AN	PERS	120	210	340		540
57	American Pilots Association	20	CG-CVS	PERS	120	210	340		540
200	National Pilot Association	20	CG-PSS	PERS	120	210	340		540
206	American Pilots Association	20	CG-PSS	PERS	120	210	340		540
262	American Pilots Association	20	CG-RA	PERS	120	210	340		540
516	American Pilots Association	20	M-SHIPG	PERS	120	210	340		540
517	American Pilots Association	20	M-SHCON	PERS	120	210	340		540
518	American Pilots Association	20	M-PORTS	PERS	120	210	340		540
61	American Waterways Operators, Inc.	42	CG-CVS	PERS	120	210	330	400	540
127	American Waterways Operators, Inc.	42	CG-MEP	PERS	120	210	330	400	540
217	American Waterways Operators, Inc.	42	CG-PSS	PERS	120	210	330	400	540
53	International Labor Organization	51	CG-CVS	PERS	120	260		440	547
54	National Maritime Union	52	CG-CVS	PERS	120	260		440	547
69	Maritime Labor Organizations	52	CG-CVS	PERS	120	260		440	547
422	Labor Organizations	52	M-SBLDG	PERS	120	260		440	547
423	Labor Organizations	52	M-SHIPG	PERS	120	260		440	547
424	Labor Organizations	52	M-SHCON	PERS	120	260		440	547
425	Labor Organizations	52	M-PORTS	PERS	120	260		440	547
426	Labor Organizations	52	M-MACHY	PERS	120	260		440	547
427	Labor Organizations	52	M-NPROP	PERS	120	260		440	547
428	Labor Organizations	52	M-CHAND	PERS	120	260		440	547
55	Seafarers International Union	53	CG-CVS	PERS	120	200	340		540
211	Seamens Union of the Pacific	53	CG-PSS	PERS	120	260		440	547
410	American Seafaring Unions	53	M-SHIPG	PERS	120	260		440	547
411	American Seafaring Unions	53	M-SHCON	PERS	120	260		440	547
412	American Seafaring Unions	53	M-ADSYS	PERS	120	260		440	547
413	American Seafaring Unions	53	M-CAORF	PERS	120	260		440	547
414	American Seafaring Unions	53	M-CHAND	PERS	120	260		440	547
419	American Independent Tanker Unions	53	M-SBLDG	PERS	120	260		440	547
420	American Independent Tanker Unions	53	M-PORTS	PERS	120	260		440	547
421	American Independent Tanker Unions	53	M-MACHY	PERS	120	260		440	547
437	United Seamen's Service, Inc.	53	M-SHIPG	PERS	120	260		440	547
433	United Seamen's Service, Inc.	53	M-PORTS	PERS	120	260		440	547
434	United Seamen's Service, Inc.	53	M-CHAND	PERS	120	260		440	547
56	Masters, Mates and Pilots Association	54	CG-CVS	PERS	120	200	340	400	540
102	Masters, Mates and Pilots Association	54	CG-IO	PERS	120	200	340	400	540
201	Masters, Mates and Pilots Association	54	CG-PSS	PERS	120	200	340	400	540
220	Pilot Associations and Masters	54	CG-PSS	PERS	120	200	340	400	540
58	Lake Carriers Pilotage Association	55	CG-CVS	PERS	120	200	340		540
67	Merchant Seamen	60	CG-CVS	PERS	120	260		440	547
415	American Longshore Unions	138	M-PORTS	PERS	120	240	300	440	540
416	American Longshore Unions	138	M-CHAND	PERS	120	240	300	440	540
464	Marine Towing and Transportation Employers Association	228	M-SHIPG	PERS	120	260	310	440	500
465	Marine Towing and Transportation Employers Association	228	M-PORTS	PERS	120	260	310	440	500
13	Institute of Navigation	13	CG-AN	PRIV	120	210			543
261	Institute of Navigation	13	CG-RA	PRIV	120	210			543
37	Association of State Highway Officials (ASHO)	36	CG-BA	PRIV	120		335	410	543
45	The Waterways Journal	44	CG-BA	PRIV	120	210	330	400	540
75	Passengers on Waterborne Vessels	67	CG-CVS	PRIV	120	210	330	430	540

116	Transportation (Commuters)		67	CG-IO	PRIV	120	210	330	430	540
96	Arctic Institute of North America	120 Trade	82	CG-IO	PRIV	120	200	360	400	500
176	Arctic Institute of North America		82	CG-MSA	PRIV	120	200	360	400	500
139	Barge Industry		109	CG-MEP	COML	130	210	360	400	500
74	Chemical Industry		66	CG-CVS	MFG	130	270		400	540
113	Chemical Industry		66	CG-IO	MFG	130	270		400	540
225	Chemical Industry	130 Trade Goods (Cargo Types)	66	CG-PSS	MFG	130	270		400	540
109	Coal Industry		92	CG-IO	MFG	130	270	330	400	540
110	Steel Industry	131 Liquid Bulk	93	CG-IO	MFG	130	270	330	400	540
111	Stone and Cement Industry		94	CG-IO	MFG	130	270	330	400	540
217	Tank Vessel and Tank Barge Industry		109	CG-PSS	MFG	130	210	360	400	500
507	Tanker Service Committee, Inc.		240	M-SHIPG	COML	131	260	300	400	500
508	Tanker Service Committee, Inc.		240	M-PORTS	COML	131	260	300	400	500
3	U.S. Air Force		3	CG-AN	GOVT	150	220			
86	U.S. Air Force		3	CG-IO	GOVT	150	220			
163	U.S. Air Force	150 Defense	3	CG-MSA	GOVT	150	220			
235	U.S. Air Force		3	CG-RA	GOVT	150	220			
312	U.S. Air Force		3	CG-SAR	GOVT	150	220			
338	U.S. Air Force		3	CG-GAS	GOVT	150	220			
4	U.S. Army		4	CG-AN	GOVT	150			410	
84	U.S. Army		4	CG-IO	GOVT	150			410	
119	U.S. Army		4	CG-MEP	GOVT	150			410	
142	U.S. Army		4	CG-MO	GOVT	150		410		
151	U.S. Army		4	CG-MP	GOVT	150			410	
188	U.S. Army		4	CG-PSS	GOVT	150			410	
236	U.S. Army		4	CG-RA	GOVT	150			410	
5	U.S. Navy		5	CG-AN	GOVT	150	200	320		540
85	U.S. Navy		5	CG-IO	GOVT	150	200	320		540
118	U.S. Navy		5	CG-MEP	GOVT	150	200	320		540
152	U.S. Navy		5	CG-MP	GOVT	150	200	320		540
187	U.S. Navy		5	CG-PSS	GOVT	150	200	320		540
237	U.S. Navy		5	CG-RA	GOVT	150	200	320		540
311	U.S. Navy		5	CG-SAR	GOVT	150	200	320		540
337	U.S. Navy		5	CG-GAS	GOVT	150	200	320		540
353	U.S. Navy		5	M-SBLDG	GOVT	150	200	320		540
354	U.S. Navy		5	M-SHIPG	GOVT	150	200	320		540
355	U.S. Navy		5	M-MSCI	GOVT	150	200	320		540
356	U.S. Navy		5	M-EN&EV	GOVT	150	200	320		540
357	U.S. Navy		5	M-ADSYS	GOVT	150	200	320		540
358	U.S. Navy		5	M-CHAND	GOVT	150	200	320		540
6	Military Sealift Command		6	CG-AN	GOVT	150	200	330	420	540
238	Military Sealift Command		6	CG-RA	GOVT	150	200	330	420	540
543	Military Sealift Command		6	M-SHIPG	GOVT	150	200	330	420	540
544	Military Sealift Command		6	M-SHCON	GOVT	150	200	330	420	540
545	Military Sealift Command		6	M-CHAND	GOVT	150	200	330	420	540
99	U.S. Army Corps of Engineers		85	CG-IO	GOVT	150	211	330	430	543
120	Corps of Engineers		85	CG-MEP	GOVT	150	211	330	430	543
189	Corps of Engineers		85	CG-PSS	GOVT	150	211	330	430	543
277	Corps of Engineers		85	CG-RBS	GOVT	150	211	330	430	543

150 Defense

145	General Services Administration (Federal Preparedness Agency)	113	CG-MO	GOVT	150			410		
155	General Services Administration (Federal Preparedness Agency)	113	CG-MP	GOVT	150			410		
234	Joint Chiefs of Staff	152	CG-RA	GOVT	150	210		400		
239	U.S. Marine Corps	153	CG-RA	GOVT	150					
339	U.S. Marine Corps	153	CG-GAS	GOVT	150					
47	Department of Defense	206	CG-CVS	GOVT	150	250		400	540	
383	North Atlantic Treaty Organization	209	M-SHIPG	INTL	150	200	300	400	500	
384	North Atlantic Treaty Organization	209	M-PORTS	INTL	150	200	300	400	500	
385	North Atlantic Treaty Organization	209	M-CHAND	INTL	150	200	300	400	500	

160 Oceanographic Research

161 Cartography

162	U.S. Navy	5	CG-MSA	GOVT	160	200	320		540	
94	National Science Foundation	80	CG-IO	GOVT	160	220				
167	National Science Foundation	80	CG-MSA	GOVT	160	220				
171	Interagency Committee for Meteorological Services	117	CG-MSA	GOVT	160	220			520	
172	Interagency Committee for World Weather Program	117	CG-MSA	GOVT	160	220			520	
161	Federal Committee for Meteorological Services and Supporting Research (FCMSSR)	117	CG-MSA	GOVT	160	220			520	
268	Interagency Committee on Oceanography	125	CG-RA	GOVT	160	230			510	
26	State University Marine Research Organizations	26	CG-AN	PRIV	160				540	
95	Smithsonian Institution	81	CG-IO	PRIV	160					
97	Academic and Scientific Communities	83	CG-IO	PRIV	160	200	320	400	500	
148	Academic Community	83	CG-MO	PRIV	160	200	320	400	500	
158	Academic Community	83	CG-MP	PRIV	160	200	320	400	500	
179	Academic and Scientific Communities	83	CG-MSA	PRIV	160	200	320	400	500	
173	National Academy of Sciences	122	CG-MSA	PRIV	160					
265	National Academy of Sciences	122	CG-RA	PRIV	160					
176	American Oceanographic Association	125	CG-MSA	PRIV	160	220			510	
263	National Association of Marine Surveyors	179	CG-RBS	COML	161	210	330	430	543	
87	Defense Mapping Agency	75	CG-IO	GOVT	161	210		430	543	
164	Defense Mapping Agency	75	CG-MSA	GOVT	161	210		430	543	
240	Defense Mapping Agency	75	CG-RA	GOVT	161	210		430	543	
89	U.S. Geological Survey	76	CG-IO	GOVT	161	210		430	543	
165	U.S. Geological Survey	76	CG-MSA	GOVT	161	210		430	543	

170 Recreation (Boating-Related)

301	National Marine Distributors Association	191	CG-RBS	COML	170				540	
34	Federal, State and Local Agencies	91	CG-EA	GOVT	170				510	
108	State/Local governments	91	CG-IO	GOVT	170				510	
147	State/Local Governments (Civil emergency, law enforcement agencies)	91	CG-MO	GOVT	170				510	
157	State/Local Governments (Civil Emergency Agencies, Law Enforcement Agencies)	91	CG-MP	GOVT	170				510	
214	State Governments (Legislatures, Regulatory Agencies, Boating Administrations)	91	CG-PSS	GOVT	170				510	
215	Local Governments (Port Authorities, Law Enforcement Agencies, Fire Departments)	91	CG-PSS	GOVT	170				510	
297	National Association of State Boating Law Administrators	91	CG-RBS	GOVT	170				540	
307	State and Local Governments	91	CG-RBS	GOVT	170				500	
323	State/local Governments	91	CG-SAR	GOVT	170				500	
538	State and Local Law Enforcement Agencies	91	CG-ELT	GOVT	170				500	
275	Department of Defense Special Services	174	CG-RBS	GOVT	170	220			540	
265	American Boat Builders and Repair Association	181	CG-RBS	MFG	170				540	
299	National Association of Engine and Boat Manufacturers	189	CG-RBS	MFG	170				540	
302	Boating Industry Association	192	CG-RBS	MFG	170				540	
222	Recreational Boaters	25	CG-PSS	PERS	170	220			540	
14	U. S. Coast Guard Auxiliary	14	CG-AN	PRIV	170	220			540	
270	U.S. Coast Guard Auxiliary	14	CG-RBS	PRIV	170	220			540	

170 Recreation (Boating-Related)

313	U.S. Coast Guard Auxiliary	14	CG-SAR	PRIV	170	220		540
15	U. S. Power Squadron	15	CG-AN	PRIV	170	220		540
259	U.S. Power Squadron	15	CG-RA	PRIV	170	220		540
273	U.S. Power Squadron	15	CG-RBS	PRIV	170	220		540
16	Cruising Club of America	16	CG-AN	PRIV	170	220		540
17	Storm and Trysail Club	17	CG-AN	PRIV	170	220		540
24	Fishermen, recreational	24	CG-AN	PRIV	170	220		540
115	Fishermen (Recreational)	24	CG-IO	PRIV	170	220		540
228	Fishermen, Recreational	24	CG-PSS	PRIV	170	220		540
316	Fishermen, Recreational	24	CG-SAR	PRIV	170	220		540
540	Fishermen, Recreational	24	CG-ELT	PRIV	170	220		540
25	Recreational boaters (marinas, yacht clubs, individuals)	25	CG-AN	PRIV	170	220		540
36	Marinas	25	CG-BA	PRIV	170	220		540
77	Recreational Boaters	25	CG-CVS	PRIV	170	220		540
305	Various recreational boaters (yacht clubs, associations, individuals)	25	CG-RBS	PRIV	170	220		540
314	Recreational Boaters	25	CG-SAR	PRIV	170	220		540
330	Recreational Boatmen	25	CG-GAC	PRIV	170	220		540
35	Private citizens	35	CG-BA	PRIV	170	220		540
332	Military and Civilian Coast Guard Personnel as Individuals	35	CG-GAP	PRIV	170	220		540
51	Boy Scouts	49	CG-CVS	PRIV	170	220		540
52	Sea Scouts	49	CG-CVS	PRIV	170	220		540
276	Boy Scouts of America	49	CG-RBS	PRIV	170	220		540
278	Girl Scouts of America	49	CG-RBS	PRIV	170	220		540
309	National Scouting Organization	49	CG-RBS	PRIV	170	220		540
310	Naval Sea Cadet Corps	49	CG-RBS	PRIV	170	220		540
135	American Boat and Yacht Council	107	CG-MEP	PRIV	170	220		540
262	American Boat and Yacht Council	107	CG-RBS	PRIV	170	220		540
271	American Water Ski Association	171	CG-RBS	PRIV	170	220		540
272	National Boating Federation	172	CG-RBS	PRIV	170	220		540
274	American Alliance for Health, Physical Ed. & Recreation	173	CG-RES	PRIV	170	220		540
280	National Safety Council	176	CG-RBS	PRIV	170			540
296	National Safety Council	176	CG-RBS	PRIV	170			540
334	National Safety Council	176	CG-GAS	PRIV	170			540
281	YMCA	177	CG-RBS	PRIV	170			540
335	American Red Cross	178	CG-GAS	PRIV	170			540
284	American Power Boat Association	180	CG-RBS	PRIV	170	220		540
291	Allied Boating Association of Canada	183	CG-RBS	PRIV	170			540
298	Boating Safety Advisory Council	188	CG-RES	PRIV	170	220		540
300	Boat Owners Association of the United States	190	CG-RBS	PRIV	170			540
303	National Safe Boating Committee, Inc.	193	CG-RBS	PRIV	170			540
304	North American Yacht Racing Union	194	CG-RBS	PRIV	170			540
308	National Water Safety Congress	195	CG-RBS	PRIV	170			540
319	General Aviation	199	CG-SAR	PRIV	170	220		540
320	Civil Air Patrol	200	CG-SAR	PRIV	170	220		540

180 Ecology Preservation, Development and Management

1	U. S. Forest Service	1	CG-AN	GOVT	180			543
8	U.S. Fish and Wildlife Service	8	CG-AN	GOVT	180			
121	Environmental Protection Agency	96	CG-MEP	GOVT	180			500
196	Environmental Protection Agency	96	CG-PSS	GOVT	180			500
255	Environmental Protection Agency	96	CG-RA	GOVT	180			500

180 Ecology Preservation, Development and Management

386	Environmental Protection Agency	96	M-PORTS	GOVT	180				500	
387	Environmental Protection Agency	96	M-EN&EV	GOVT	180				500	
170	Interagency Committee for Marine Environmental Protection	119	CG-MSA	GOVT	180	220		400	510	
182	Interagency Ocean Disposal Program Coordinating Committee (IODPCC)	129	CG-MSA	GOVT	180				510	
195	U.S. Customs Service	135	CG-PSS	GOVT	180		311	400	560	
536	International Whaling Commission	249	CG-ELT	INTL	180	210			560	
537	North Pacific Fur Seal Commission	250	CG-ELT	INTL	180	210			560	
128	Sierra Club	101	CG-MEP	PRIV	180	200	300	400	510	
129	Friends of the Earth	102	CG-MEP	PRIV	180	200	300	400	510	
130	Environmental Defense Fund	103	CG-MEP	PRIV	180	200	300	400	510	
131	National Wildlife Federation	104	CG-MEP	PRIV	180				510	
140	Conservationists	110	CG-MEP	PRIV	180	200	300	400	510	
269	Wild Goose Association	170	CG-RA	PRIV	180				510	

SET 200

This set of programs/clients is sorted

according to Ship Operations as follows:

210 Ship Movement/Pouting/Navigation

- 211 Harbor
- 212 Coastal (Including Great Lakes)
- 213 High Seas

220 Weather Reporting and Dissemination

- 221 Ice Reporting and Dissemination

230 Ship Communication

- 231 Harbor
- 232 Coastal (Including Great Lakes)
- 233 High Seas

240 Ship Fueling and Revictualling

250 Cargo Allocation.

260 Ships Manpower

- 261 Licensing of Officers
- 262 Certificating of Seamen
- 263 Training

270 Ship Operating Costs

SHIP OPERATIONS GENERAL (200)

263	American Merchant Marine Institute	165	CG-RA	COML	100	200	320	400	500	
462	Marine Exchange of San Francisco Bay	221	M-SHIPG	COML	100	200	300	400	500	
463	Marine Exchange of San Francisco Bay	221	M-PORTS	COML	100	200	300	400	500	
466	Maritime Association of the Port of New York	221	M-SHIPG	COML	100	200	300	400	500	
467	Maritime Association of the Port of New York	221	M-PORTS	COML	100	200	300	400	500	
468	Maritime Association of the Port of New York	221	M-EN&EV	COML	100	200	300	400	500	
469	Maritime Association of the Port of New York	221	M-CHAND	COML	100	200	300	400	500	
472	Mobile Steamship Association	221	M-SHIPG	COML	100	200	300	400	500	
473	Mobile Steamship Association	221	M-PORTS	COML	100	200	300	400	500	
474	Mobile Steamship Association	221	M-EN&EV	COML	100	200	300	400	500	
475	Mobile Steamship Association	221	M-CHAND	COML	100	200	300	400	500	
476	New Orleans Steamship Association	221	M-SHIPG	COML	100	200	300	400	500	
477	New Orleans Steamship Association	221	M-PORTS	COML	100	200	300	400	500	
478	New Orleans Steamship Association	221	M-EN&EV	COML	100	200	300	400	500	
479	New Orleans Steamship Association	221	M-CHAND	COML	100	200	300	400	500	
480	New York Shipping Association, Inc.	221	M-Shipg	COML	100	200	300	400	500	
481	New York Shipping Association, Inc.	221	M-PORTS	COML	100	200	300	400	500	
482	New York Shipping Association, Inc.	221	M-EN&EV	COML	100	200	300	400	500	
483	New York Shipping Association, Inc.	221	M-CHAND	COML	100	200	300	400	500	
484	New York Towboat and Harbor Carriers Association	221	M-SHIPG	COML	100	200	300	400	500	
485	New York Towboat and Harbor Carriers Association	221	M-PORTS	COML	100	200	300	400	500	
494	Philadelphia Marine Trade Association	221	M-SHIPG	COML	100	200	300	400	500	
495	Philadelphia Marine Trade Association	221	M-PORTS	COML	100	200	300	400	500	
496	Philadelphia Marine Trade Association	221	M-EN&EV	COML	100	200	300	400	500	
497	Philadelphia Marine Trade Association	221	M-CHAND	COML	100	200	300	400	500	
503	Steamship Trade Association of Baltimore, Inc.	221	M-SHIPG	COML	100	200	300	400	500	
504	Steamship Trade Association of Baltimore, Inc.	221	M-PORTS	COML	100	200	300	400	500	
505	Steamship Trade Association of Baltimore, Inc.	221	M-EN&EV	COML	100	200	300	400	500	
506	Steamship Trade Association of Baltimore, Inc.	221	M-CHAND	COML	100	200	300	400	500	
486	Pacific Maritime Association	235	M-SHIPG	COML	100	200	300	400	500	
487	Pacific Maritime Association	235	M-PORTS	COML	100	200	300	400	500	
488	Pacific Maritime Association	235	M-EN&EV	COML	100	200	300	400	500	
489	Pacific Maritime Association	235	M-CHAND	COML	100	200	300	400	500	
490	Pacific Merchant Shippers Association	236	M-SHIPG	COML	100	200	300	400	500	
491	Pacific Merchant Shippers Association	236	M-PORTS	COML	100	200	300	400	500	
492	Pacific Merchant Shippers Association	236	M-EN&EV	COML	100	200	300	400	500	
493	Pacific Merchant Shippers Association	236	M-CHAND	COML	100	200	300	400	500	
46	Maritime Administration	45	CG-CVS	GOVT	100	200	300	400	500	
117	Maritime Administration	45	CG-MEP	GOVT	100	200	300	400	500	
185	Maritime Administration	45	CG-PSS	GOVT	100	200	300	400	500	
230	Maritime Administration	45	CG-RA	GOVT	100	200	300	400	500	
92	U.S. Coast Guard	79	CG-IO	GOVT	100	200	300	400	500	
341	U. S. Coast Guard	79	M-SBLDG	GOVT	100	200	300	400	500	
342	U. S. Coast Guard	79	M-SHIPG	GOVT	100	200	300	400	500	
343	U. S. Coast Guard	79	M-SHCON	GOVT	100	200	300	400	500	
344	U. S. Coast Guard	79	M-MSCI	GOVT	100	200	300	400	500	
345	U. S. Coast Guard	79	M-NAV&C	GOVT	100	200	300	400	500	
346	U. S. Coast Guard	79	M-PORTS	GOVT	100	200	300	400	500	
347	U.S. Coast Guard	79	M-NPROP	GOVT	100	200	300	400	500	

348	U. S. Coast Guard	79	M-ADSYS	GOVT	100	200	300	400	500
349	U. S. Coast Guard	79	M-CHAND	GOVT	100	200	300	400	500
223	Public Vessels	147	CG-PSS	GOVT	100	200	300		540
442	Boston Shipping Authority	221	M-SHIPG	GOVT	100	200	300	400	510
443	Boston Shipping Authority	221	M-PORTS	GOVT	100	200	300	400	500
444	Boston Shipping Authority	221	M-EN&EV	GOVT	100	200	300	400	500
445	Boston Shipping Authority	221	M-CHAND	GOVT	100	200	300	400	500
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS	INTL	100	200	300	400	500
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS	INTL	100	200	300	400	500
376	Intergovernmental Maritime Consultative Organization	57	M-SBLDG	INTL	100	200	300	400	500
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG	INTL	100	200	300	400	500
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C	INTL	100	200	300	400	500
381	Intergovernmental Maritime Consultative Organization	57	M-NPROP	INTL	100	200	300	400	500
382	Intergovernmental Maritime Consultative Organization	57	M-EN&EV	INTL	100	200	300	400	500
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG	INTL	100	200	300	400	500
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG	INTL	100	200	300	400	500
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS	INTL	100	200	300	400	500
470	International Maritime Satellite Preparatory Committee	230	M-SHIPG	INTL	100	200			540
471	International Maritime Satellite Preparatory Committee	230	M-NAV&C	INTL	100	200			540
150	Electronics and ordnance equipment manufacturers	115	CG-MO	MFG	100	200	320	400	500
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP	MFG	100	200	320	400	500
267	Electronic Industry Association	115	CG-RA	MFG	100	200	320	400	500
264	Institute of Electrical and Electronic Engineers	166	CG-RA	MFG	100	200	320	400	500
266	American Radio Relay League	47	CG-RA	PRIV	100	200	320	400	500
260	American Museum of Natural History	164	CG-RA	PRIV	100	200	320	400	500
10	American Institute of Merchant Shipping	10	CG-AN	COML	120	200	310	400	500
60	American Institute of Merchant Shipping	10	CG-CVS	COML	120	200	310	400	500
126	American Institute of Merchant Shipping	10	CG-MEP	COML	120	200	310	400	500
204	American Institute of Merchant Shipping	10	CG-PSS	COML	120	200	310	400	500
257	American Institute of Merchant Shipping	10	CG-RA	COML	120	200	310	400	500
402	American Institute of Merchant Shipping	10	M-SHIPG	COML	120	200	310	400	500
403	American Institute of Merchant Shipping	10	M-MARKA	COML	120	200	310	400	500
12	Lake Carriers Association	12	CG-AN	COML	120	200	330	400	540
104	Lake Carriers Association	12	CG-IO	COML	120	200	330	400	540
202	(Great) Lake Carriers Association	12	CG-PSS	COML	120	200	330	400	540
459	Lake Carriers Association	12	M-SHIPG	COML	120	200	330	400	540
460	Lake Carriers Association	12	M-PORTS	COML	120	200	330	400	540
461	Lake Carriers Association	12	M-CHAND	COML	120	200	330	400	540
18	Commercial Vessel Operators, U. S. and foreign	18	CG-AN	COML	120	200	300	400	500
32	Commercial Water Transportation Firms	18	CG-BA	COML	120	200	300	400	540
33	Shippers	18	CG-BA	COML	120	200	300	400	540
64	Maritime Commerce (Owners, Operators, Shippers, Carriers, Agents)	18	CG-CVS	COML	120	200	300	400	500
138	Merchant Shipping Industry	18	CG-MEP	COML	120	200	300	400	500
216	Commercial Cargo Vessel & Dry Cargo Barge Industry	18	CG-PSS	COML	120	200	300	400	500
317	Maritime Industry	18	CG-SAR	COML	120	200	300	400	500
324	Merchant Vessels (U.S.)	18	CG-GAC	COML	120	200	300	400	500
404	U. S. Flag shipowners, operators and/or agents	18	M-SHIPG	COML	120	200	300	400	500
405	U. S. Flag shipowners, operators and/or agents	18	M-SHCON	COML	120	200	300	400	500
406	U. S. Flag shipowners, operators and/or agents	18	M-NAV&C	COML	120	200	300	400	500

407	U. S. Flag shipowners, operators and/or agents	18	M-PORTS	COML	120	200	300	400	500
408	U. S. Flag shipowners, operators and/or agents	18	M-MARKA	COML	120	200	300	400	500
409	U. S. Flag shipowners, operators and/or agents	18	M-CAORF	COML	120	200	300	400	500
446	Council of American Flag Ship Operators	18	M-SHIPG	COML	120	200	300	400	500
447	Council of North Atlantic Shipping Association	18	M-SHIPG	COML	120	200	300	400	500
59	American Bureau of Shipping	56	CG-CVS	COML	120	200	300	400	540
400	American Bureau of Shipping	56	M-SHIPG	COML	120	200	300	400	540
401	American Bureau of Shipping	56	M-MARKA	COML	120	200	300	400	540
66	Foreign Commercial Vessels	59	CG-CVS	COML	120	200	300	420	540
321	Foreign Merchant Vessels	59	CG-SAR	COML	120	200	300	420	540
325	Merchant Vessels (foreign)	59	CG-GAC	COML	120	200	300	420	540
105	Dominion Marine Association (Canada)	88	CG-IO	COML	120	200	330	400	500
218	Terminal Operators (Port Authorities, Private Owners, Stevedoring Companies)	145	CG-PSS	COML	120	200	300	400	500
327	Harbor and River Tugboats	202	CG-GAC	COML	120	200	340	430	540
388	National Maritime Council	210	M-SBLDG	COML	120	200	300	400	500
389	National Maritime Council	210	M-SHIPG	COML	120	200	300	400	500
390	National Maritime Council	210	M-SHCON	COML	120	200	300	400	540
391	National Maritime Council	210	M-PORTS	COML	120	200	300	400	540
392	National Maritime Council	210	M-MARKA	COML	120	200	300	400	540
393	National Maritime Council	210	M-CHAND	COML	120	200	300	400	540
448	Federation of American Controlled Shipping	224	M-SHIPG	COML	120	200	310	400	500
449	Federation of American Controlled Shipping	224	M-PORTS	COML	120	200	310	400	500
450	Federation of American Controlled Shipping	224	M-CHAND	COML	120	200	310	400	500
509	Transportation Institute	241	M-SHIPG	COML	120	200	300	400	500
510	Transportation Institute	241	M-SHCON	COML	120	200	300	400	500
511	Transportation Institute	241	M-MSCI	COML	120	200	300	400	500
512	Transportation Institute	241	M-NAV&C	COML	120	200	300	400	500
513	Transportation Institute	241	M-EN&DV	COML	120	200	300	400	500
514	Transportation Institute	241	M-ADSYS	COML	120	200	300	400	500
515	Transportation Institute	241	M-CAORF	COML	120	200	300	400	500
27	State Marine Organizations	27	CG-AN	GOVT	120	200	330	400	540
527	U.S. Attorney's Office	243	CG-ELT	GOVT	120	200			560
106	International Association of Great Lakes Ports	89	CG-IO	INTL	120	200	330	400	500
133	International Association of Passenger Liners	106	CG-MEP	INTL	120	200	300	400	540
221	Mariners (Commercial Operators)	18	CG-PSS	PERS	120	200	300	400	500
429	Council of American Master Mariners, Inc.	18	M-SHIPG	PERS	120	200	300	400	500
430	Council of American Master Mariners, Inc.	18	M-NAV&C	PERS	120	200	300	400	500
431	Council of American Master Mariners, Inc.	18	M-PORTS	PERS	120	200	300	400	500
55	Seafarers International Union	53	CG-CVS	PERS	120	200	340		540
56	Masters, Mates and Pilots Association	54	CG-CVS	PERS	120	200	340	400	540
102	Masters, Mates and Pilots Association	54	CG-IO	PERS	120	200	340	400	540
201	Masters, Mates and Pilots Association	54	CG-PSS	PERS	120	200	340	400	540
220	Pilot Associations and Masters	54	CG-PSS	PERS	120	200	340	400	540
58	Lake Carriers Pilotage Association	55	CG-CVS	PERS	120	200	340		540
96	Arctic Institute of North America	82	CG-IO	PRIV	120	200	360	400	500
178	Arctic Institute of North America	82	CG-MSA	PRIV	120	200	360	400	500
5	U.S. Navy	5	CG-AN	GOVT	150	200	320		540
85	U.S. Navy	5	CG-IO	GOVT	150	200	320		540
118	U.S. Navy	5	CG-MEP	GOVT	150	200	320		540

SHIP OPERATIONS GENERAL (200)

152	U.S. Navy	5	CG-MP	GOVT	150	200	320		540
187	U.S. Navy	5	CG-PSS	GOVT	150	200	320		540
237	U.S. Navy	5	CG-RA	GOVT	150	200	320		540
311	U.S. Navy	5	CG-SAR	GOVT	150	200	320		540
337	U.S. Navy	5	CG-GAS	GOVT	150	200	320		540
353	U.S. Navy	5	M-SBLDG	GOVT	150	200	320		540
354	U.S. Navy	5	M-SHIPG	GOVT	150	200	320		540
355	U.S. Navy	5	M-MSCI	GOVT	150	200	320		540
356	U.S. Navy	5	M-EN&DV	GOVT	150	200	320		540
357	U.S. Navy	5	M-ADSYS	GOVT	150	200	320		540
358	U.S. Navy	5	M-CHAND	GOVT	150	200	320		540
6	Military Sealift Command	6	CG-AN	GOVT	150	200	330	420	540
238	Military Sealift Command	6	CG-RA	GOVT	150	200	330	420	540
543	Military Sealift Command	6	M-SHIPG	GOVT	150	200	330	420	540
544	Military Sealift Command	6	M-SHCON	GOVT	150	200	330	420	540
545	Military Sealift Command	6	M-CHAND	GOVT	150	200	330	420	540
383	North Atlantic Treaty Organization	209	M-SHIPG	INTL	150	200	300	400	500
384	North Atlantic Treaty Organization	209	M-PORTS	INTL	150	200	300	400	500
385	North Atlantic Treaty Organization	209	M-CHAND	INTL	150	200	300	400	500
162	U.S. Navy	5	CG-MSA	GOVT	160	200	320		540
97	Academic and Scientific Communities	83	CG-IO	PRIV	160	200	320	400	500
149	Academic Community	83	CG-MO	PRIV	160	200	320	400	500
156	Academic Community	83	CG-MP	PRIV	160	200	320	400	500
179	Academic and Scientific Communities	83	CG-MSA	PRIV	160	200	320	400	500
128	Sierra Club	101	CG-MEP	PRIV	180	200	300	400	510
129	Friends of the Earth	102	CG-MEP	PRIV	180	200	300	400	510
130	Environmental Defense Fund	103	CG-MEP	PRIV	180	200	300	400	510
140	Conservationists	110	CG-MEP	PRIV	180	200	300	400	510
186	Committee on International Ocean Affairs (CIOA)	127	CG-MSA	INTL	100	210	340	400	500
184	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	127	CG-MSA	INTL	100	210	340	400	500
183	Ocean Affairs Board (OAB)	127	CG-MSA	PRIV	100	210	340	400	500
19	Commercial Offshore Exploration Firms	19	CG-AN	CONL	110	210	340		
78	Commercial Diving Industry (Underwater Vessel Owners and Operators)	69	CG-CVS	CONL	110	210	354	400	540
68	Offshore Petroleum and Mineral Industry	61	CG-CVS	MFG	110	210	340	410	510

210 Ship Movement/Routing/Navigation

23	Fishermen, commercial	23	CG-AN	CONL	114	210		421	540
114	Fishermen (Commercial)	23	CG-IO	CONL	114	210		421	540
227	Fishermen, Commercial	23	CG-PSS	CONL	114	210		421	540
315	Fishermen, Commercial	23	CG-SAR	CONL	114	210		421	540
326	Fishing Vessels (U.S. and Foreign)	23	CG-GAC	CONL	114	210		421	540
539	Fishermen, Commercial	23	CG-ELT	CONL	114	210		421	540
533	Inter-American Tuna Commission	246	CG-ELT	INTL	114	210			560
534	Internation Commission for the Conservation of Atlantic Tuna	247	CG-ELT	INTL	114	210			560
535	International North Pacific Fisheries Commission	248	CG-ELT	INTL	114	210			560
541	International Pacific Halibut Commission	251	CG-ELT	INTL	114	210		421	540
542	Sockeye Salmon Commission	252	CG-ELT	INTL	114	210		421	540
22	Insurance Industry	22	CG-AN	CONL	120	210	340	400	540
63	Lloyds of London	22	CG-CVS	CONL	120	210	340	400	540
71	Insurance and Hull Underwriters	22	CG-CVS	CONL	120	210	340	400	540
134	American Institute of Marine Underwriters	22	CG-MEP	CONL	120	210	340	400	540

141	Insurance Industry		22	CG-NEP	COML	120	210	340	400	540
226	Insurance Industry		22	CG-PSS	COML	120	210	340	400	540
306	The Insurance Industry	210 Ship Movement/Routing/Navigation	22	CG-RBS	COML	120	210	340	400	540
42	Towing Industry Advisory Committee		41	CG-BA	COML	120	210	330	430	540
43	American Waterways Operators, Inc.		42	CG-BA	COML	120	210	330	400	540
438	American Waterways Operators, Inc.		42	M-SHIPG	COML	120	210	330	400	540
439	American Waterways Operators, Inc.		42	M-NAV&C	COML	120	210	330	400	540
440	American Waterways Operators, Inc.		42	M-PORTS	COML	120	210	330	400	540
441	American Waterways Operators, Inc.		42	M-CHAND	COML	120	210	330	400	540
83	International Safety and Security Organizations		74	CG-CVS	INTL	120	210	340	430	540
286	American Institute of Marine Underwriters		22	CG-RBS	MFG	120	210	340	400	540
50	Underwriter's Laboratory		48	CG-CVS	MFG	120	210	300	421	540
80	Naval Architects and Marine Engineers		48	CG-CVS	MFG	120	210	300	421	540
288	Society of Naval Architects and Marine Engineers		48	CG-RBS	MFG	120	210	300	421	540
289	Underwriter's Laboratory		48	CG-RBS	MFG	120	210	300	421	540
519	Society of Naval Architects and Marine Engineers		48	M-SBLDG	MFG	120	210	300	421	540
520	Society of Naval Architects and Marine Engineers		48	M-SHCON	MFG	120	210	300	421	540
521	Society of Naval Architects and Marine Engineers		48	M-MACHY	MFG	120	210	300	421	540
522	Society of Naval Architects and Marine Engineers		48	M-NPROP	MFG	120	210	300	421	540
523	Society of Naval Architects and Marine Engineers		48	M-ALSYS	MFG	120	210	300	421	540
524	Society of Naval Architects and Marine Engineers		48	M-CHAND	MFG	120	210	300	421	540
20	Pilot Associations		20	CG-AN	PERS	120	210	340		540
57	American Pilots Association		20	CG-CVS	PERS	120	210	340		540
200	National Pilot Association		20	CG-PSS	PERS	120	210	340		540
206	American Pilots Association		20	CG-PSS	PERS	120	210	340		540
262	American Pilots Association		20	CG-RA	PERS	120	210	340		540
516	American Pilots Association		20	M-SHIPG	PERS	120	210	340		540
517	American Pilots Association		20	M-SHCON	PERS	120	210	340		540
518	American Pilots Association		20	M-PORTS	PERS	120	210	340		540
61	American Waterways Operators, Inc.		42	CG-CVS	PERS	120	210	330	400	540
127	American Waterways Operators, Inc.		42	CG-NEP	PERS	120	210	330	400	540
212	American Waterways Operators, Inc.		42	CG-PSS	PERS	120	210	330	400	540
13	Institute of Navigation		13	CG-AN	PRIV	120	210			543
261	Institute of Navigation		13	CG-RA	PRIV	120	210			543
45	The Waterways Journal		44	CG-BA	PRIV	120	210	330	400	540
75	Passengers on Waterborne Vessels		67	CG-CVS	PRIV	120	210	330	430	540
116	Transportation (Commuters)		67	CG-IO	PRIV	120	210	330	430	540
139	Barge Industry		109	CG-NEP	COML	130	210	360	400	500
217	Tank Vessel and Tank Barge Industry		109	CG-PSS	MFG	130	210	360	400	500
234	Joint Chiefs of Staff		152	CG-RA	GOVT	150	210		400	
283	National Association of Marine Surveyors		179	CG-RBS	COML	161	210	330	430	543
87	Defense Mapping Agency		75	CG-IO	GOVT	161	210		430	543
164	Defense Mapping Agency		75	CG-MSA	GOVT	161	210		430	543
240	Defense Mapping Agency		75	CG-RA	GOVT	161	210		430	543
69	U.S. Geological Survey		76	CG-IO	GOVT	161	210		430	543
165	U.S. Geological Survey		76	CG-MSA	GOVT	161	210		430	543
536	International Whaling Commission		249	CG-ELT	INTL	180	210			560
537	North Pacific Fur Seal Commission		250	CG-ELT	INTL	180	210			560
39	National and Local Association of Port Authorities	211 Harbor	21	CG-BA	COML	100	211	330		540

210 **Ship Movement/Routing/Navigation**

211 **Harbor**

212 **Coastal (Including Great Lakes)**

213 **High Seas**

220 **Weather Reporting and Dissemination**

205	American Association of Port Authorities	21	CG-PSS	COML	100	211	330		540
435	American Association of Port Authorities	21	M-SHIPG	COML	100	211	330		540
436	American Association of Port Authorities	21	M-PORTS	COML	100	211	330		540
437	American Association of Port Authorities	21	M-CHAND	COML	100	211	330		540
21	Port Authorities	21	CG-AN	GOVT	100	211	330		540
65	State/Local Port Authorities	21	CG-CVS	GOVT	100	211	330		540
40	Industrial Development Commissions	39	CG-BA	MFG	100	211	330		540
331	State Port Authorities	21	CG-GAC	PRIV	100	211	330		540
99	U.S. Army Corps of Engineers	85	CG-IO	GOVT	150	211	330	430	543
120	Corps of Engineers	85	CG-MEP	GOVT	150	211	330	430	543
189	Corps of Engineers	85	CG-PSS	GOVT	150	211	330	430	543
277	Corps of Engineers	85	CG-RBS	GOVT	150	211	330	430	543
41	National Water Resources Council	40	CG-BA	GOVT	120	212	330	410	540
91	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
100	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
193	St. Lawrence Seaway Development Corporation	78	CG-PSS	GOVT	120	212	330	410	543
246	St. Lawrence Seaway Development Corporation	78	CG-RA	GOVT	120	212	330	410	543
103	St. Lawrence Seaway Authority (Canada)	87	CG-IO	GOVT	120	212	330	410	543
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA	GOVT	100	220	300	400	500
2	National Oceanic and Atmospheric Administration	2	CG-AN	GOVT	110	220	332		543
88	National Oceanic and Atmospheric Administration	2	CG-IO	GOVT	110	220	332		543
161	National Oceanic and Atmospheric Administration	2	CG-MSA	GOVT	110	220	332		543
186	National Oceanic and Atmospheric Administration	2	CG-PSS	GOVT	110	220	332		543
279	National Oceanic and Atmospheric Administration	2	CG-RBS	GOVT	110	220	332		543
350	National Oceanic and Atmospheric Administration	2	M-SBLDG	GOVT	110	220	332		543
351	National Oceanic and Atmospheric Administration	2	M-MSCI	GOVT	110	220	332		543
352	National Oceanic and Atmospheric Administration	2	M-EN&EV	GOVT	110	220	332		543
526	Drug Enforcement Administration	2	CG-ELT	GOVT	110	220	300		543
9	National Aeronautics and Space Administration	9	CG-AN	GOVT	110	220			510
93	National Aeronautics and Space Administration	9	CG-IO	GOVT	110	220			510
250	National Aeronautics and Space Administration	9	CG-RA	GOVT	110	220			510
546	National Aeronautics and Space Administration	9	M-NAV&C	GOVT	110	220			510
525	National Oceanic and Atmospheric Administration	242	CG-ELT	GOVT	110	220	300		543
318	Commercial Aviation	198	CG-SAR	COML	120	220			540
322	Foreign Aircraft	198	CG-SAR	COML	120	220			540
329	Commercial Aircraft	198	CG-GAC	COML	120	220			540
3	U.S. Air Force	3	CG-AN	GOVT	150	220			
86	U.S. Air Force	3	CG-IO	GOVT	150	220			
163	U.S. Air Force	3	CG-MSA	GOVT	150	220			
235	U.S. Air Force	3	CG-RA	GOVT	150	220			
312	U.S. Air Force	3	CG-SAR	GOVT	150	220			
338	U.S. Air Force	3	CG-GAS	GOVT	150	220			
94	National Science Foundation	80	CG-IO	GOVT	160	220			
167	National Science Foundation	80	CG-MSA	GOVT	160	220			
171	Interagency Committee for Meteorological Services	117	CG-MSA	GOVT	160	220			520
172	Interagency Committee for World Weather Program	117	CG-MSA	GOVT	160	220			520
161	Federal Committee for Meteorological Services and Supporting Research (FCMSSR)	117	CG-MSA	GOVT	160	220			520
176	American Oceanographic Association	125	CG-MSA	PRIV	160	220			510
275	Department of Defense Special Services	174	CG-RBS	GOVT	170	220			540

220 Weather Reporting and Dissemination

221 Ice Reporting and Dissemination

222	Recreational Boaters	25	CG-PSS	PERS	170	220		540
14	U. S. Coast Guard Auxiliary	14	CG-AN	PRIV	170	220		540
270	U.S. Coast Guard Auxiliary	14	CG-RBS	PRIV	170	220		540
313	U.S. Coast Guard Auxiliary	14	CG-SAR	PRIV	170	220		540
15	U. S. Power Squadron	15	CG-AN	PRIV	170	220		540
259	U.S. Power Squadron	15	CG-RA	PRIV	170	220		540
273	U.S. Power Squadron	15	CG-RBS	PRIV	170	220		540
16	Cruising Club of America	16	CG-AN	PRIV	170	220		540
17	Storm and Trysail Club	17	CG-AN	PRIV	170	220		540
24	Fishermen, recreational	24	CG-AN	PRIV	170	220		540
115	Fishermen (Recreational)	24	CG-IO	PRIV	170	220		540
228	Fishermen, Recreational	24	CG-PSS	PRIV	170	220		540
316	Fishermen, Recreational	24	CG-SAR	PRIV	170	220		540
540	Fishermen, Recreational	24	CG-ELT	PRIV	170	220		540
25	Recreational boaters (marinas, yacht clubs, individuals)	25	CG-AN	PRIV	170	220		540
36	Marinas	25	CG-BA	PRIV	170	220		540
77	Recreational Boaters	25	CG-CVS	PRIV	170	220		540
305	Various recreational boaters (yacht clubs, associations, individuals)	25	CG-RBS	PRIV	170	220		540
314	Recreational Boaters	25	CG-SAR	PRIV	170	220		540
330	Recreational Boatmen	25	CG-GAC	PRIV	170	220		540
35	Private citizens	35	CG-BA	PRIV	170	220		540
332	Military and Civilian Coast Guard Personnel as Individuals	35	CG-GAP	PRIV	170	220		540
51	Boy Scouts	49	CG-CVS	PRIV	170	220		540
52	Sea Scouts	49	CG-CVS	PRIV	170	220		540
276	Boy Scouts of America	49	CG-RBS	PRIV	170	220		540
278	Girl Scouts of America	49	CG-RBS	PRIV	170	220		540
309	National Scouting Organization	49	CG-RBS	PRIV	170	220		540
310	Naval Sea Cadet Corps	49	CG-RBS	PRIV	170	220		540
135	American Boat and Yacht Council	107	CG-MDP	PRIV	170	220		540
262	American Boat and Yacht Council	107	CG-RBS	PRIV	170	220		540
271	American Water Ski Association	171	CG-RBS	PRIV	170	220		540
272	National Boating Federation	172	CG-RBS	PRIV	170	220		540
274	American Alliance for Health, Physical Ed. & Recreation	173	CG-RBS	PRIV	170	220		540
284	American Power Boat Association	180	CG-RBS	PRIV	170	220		540
298	Boating Safety Advisory Council	188	CG-RBS	PRIV	170	220		540
319	General Aviation	199	CG-SAR	PRIV	170	220		540
320	Civil Air Patrol	200	CG-SAR	PRIV	170	220		540
170	Interagency Committee for Marine Environmental Protection	119	CG-MSA	GOVT	180	220	400	510
101	Great Lakes Basin Commission	86	CG-IO	COML		221		
98	Upper Great Lakes Regional Commission	84	CG-IO	GOVT		221		

230 Ship Communication

256	Radio Technical Commission for Marine Services	47	CG-RA	COML		230		
49	Federal Communications Commission	47	CG-CVS	GOVT		230		
197	Federal Communications Commission	47	CG-PSS	GOVT		230		
252	Federal Communications Commission	47	CG-RA	GOVT		230		
254	Office of Telecommunications Policy	47	CG-RA	GOVT		230		
256	Interdepartmental Radio Advisory Committee	47	CG-RA	GOVT		230		
203	American Radio Association	136	CG-PSS	COML	100	230		
199	Radio Technical Commission for Marine Services	136	CG-PSS	PRIV	100	230		
144	Department of Transportation	112	CG-MO	GOVT	120	230	410	540

154	Department of Transportation	230 Ship Communication	112	CG-MP	GOVT	120	230		410	540	
266	Interagency Committee on Oceanography		125	CG-RA	GOVT	160	230			510	
219	Oil Transfer Facility Industry	231 Harbor	146	CG-PSS	COML	100	240	300	400	500	
251	Department of Energy	232 Coastal (Including Great Lakes)	159	CG-RA	GOVT	110	240	323	400	540	
360	Department of Energy	233 High Seas	159	M-PORTS	GOVT	110	240	323	400	540	
361	Department of Energy		159	M-NPROP	GOVT	110	240	323	400	540	
362	Department of Energy		159	M-EN&EV	GOVT	110	240	323	400	540	
207	International Longshoremens Association		138	CG-PSS	INTL	120	240	300	440	540	
206	International Longshoremen and Warehouse Union		138	CG-PSS	INTL	120	240	300	440	540	
415	American Longshore Unions		138	M-PORTS	PERS	120	240	300	440	540	
416	American Longshore Unions	240 Ship Fueling and Revictualling	138	M-CHAND	PERS	120	240	300	440	540	
11	American Transport Association		11	CG-AN	COML	120	250	300	400	500	
124	Federal Maritime Commission		99	CG-MEP	GOVT	120	250		410	510	
196	Federal Maritime Commission	250 Cargo Allocation	99	CG-PSS	GOVT	120	250		410	510	
363	Federal Maritime Commission		99	M-SHIPG	GOVT	120	250		410	510	
47	Department of Defense		206	CG-CVS	GOVT	150	250		400	540	
190	U.S. Public Health Service	260 Ships Manpower	132	CG-PSS	GOVT		260		440		
192	Immigration and Naturalization Service		134	CG-PSS	GOVT		260		440	561	
528	Immigration and Naturalization Service		134	CG-ELT	GOVT		260		440	561	
340	Department of Labor		205	CG-GAS	GOVT		260		440	547	
76	Maritime Training Institutions		68	CG-CVS	PERS		260		440	547	
454	Labor-Management Maritime Committee		226	M-SBLDG	PERS	100	260	310	440	547	
455	Labor-Management Maritime Committee		226	M-SHIPG	PERS	100	260	310	440	547	
456	Labor-Management Maritime Committee		226	M-SHCON	PERS	100	260	310	440	547	
457	Labor-Management Maritime Committee		226	M-PORTS	PERS	100	260	310	440	547	
458	Labor-Management Maritime Committee		226	M-CHAND	PERS	100	260	310	440	547	
253	Nuclear Regulatory Commission		160	CG-RA	GOVT	112	260	323	420	530	
376	Nuclear Regulatory Commission		160	M-PORTS	GOVT	112	260	323	420	530	
377	Nuclear Regulatory Commission		160	M-NPROP	GOVT	112	260	323	420	530	
232	U.S. Merchant Marine Academy		150	CG-RA	GOVT	120	260		440	540	
233	Bureau of Census		151	CG-RA	GOVT	120	260	310	440		
364	Economic Development Administration		206	M-PORTS	GOVT	120	260		400		
53	International Labor Organization		51	CG-CVS	PERS	120	260		440	547	
54	National Maritime Union		52	CG-CVS	PERS	120	260		440	547	
69	Maritime Labor Organizations		52	CG-CVS	PERS	120	260		440	547	
422	Labor Organizations		52	M-SBLDG	PERS	120	260		440	547	
423	Labor Organizations		52	M-SHIPG	PERS	120	260		440	547	
424	Labor Organizations		52	M-SHCON	PERS	120	260		440	547	
425	Labor Organizations		52	M-PORTS	PERS	120	260		440	547	
426	Labor Organizations		52	M-MACHY	PERS	120	260		440	547	
427	Labor Organizations		52	M-NPROP	PERS	120	260		440	547	
428	Labor Organizations		52	M-CHAND	PERS	120	260		440	547	
211	Seamens Union of the Pacific		53	CG-PSS	PERS	120	260		440	547	
410	American Seafaring Unions		53	M-SHIPG	PERS	120	260		440	547	
411	American Seafaring Unions		53	M-SHCON	PERS	120	260		440	547	
412	American Seafaring Unions		53	M-ADSYS	PERS	120	260		440	547	
413	American Seafaring Unions		53	M-CAORF	PERS	120	260		440	547	
414	American Seafaring Unions		53	M-CHAND	PERS	120	260		440	547	
419	American Independent Tanker Unions		53	M-SBLDG	PERS	120	260		440	547	

420	American Independent Tanker Unions	260 Ships Manpower		53	M-PORTS	PERS	120	260		440	547
421	American Independent Tanker Unions			53	M-MACHY	PERS	120	260		440	547
432	United Seamen's Service, Inc.		261 Licensing of Officers	53	M-SHIPG	PERS	120	260		440	547
433	United Seamen's Service, Inc.		262 Certificating of Seamen	53	M-PORTS	PERS	120	260		440	547
434	United Seamen's Service, Inc.		263 Training	53	M-CHAND	PERS	120	260		440	547
67	Merchant Seamen			60	CG-CVS	PERS	120	260		440	547
464	Marine Towing and Transportation Employers Association			228	M-SHIPG	PERS	120	260	310	440	500
465	Marine Towing and Transportation Employers Association			228	M-PORTS	PERS	120	260	310	440	500
507	Tanker Service Committee, Inc.			240	M-SHIPG	COML	131	260	300	400	500
506	Tanker Service Committee, Inc.			240	M-PORTS	COML	131	260	300	400	500
112	Petroleum Industry			95	CG-IO	MFG	100	270	300	400	500
125	American Petroleum Institute	270 Ship Operating Costs		95	CG-MEP	MFG	100	270	300	400	500
137	Petroleum Industry			95	CG-MEP	MFG	100	270	300	400	500
224	Petroleum Industry			95	CG-PSS	MFG	100	270	300	400	500
81	Brokers and Mortgagees (Lending and Holding Institutions)			72	CG-CVS	COML	120	270	310		540
74	Chemical Industry			66	CG-CVS	MFG	130	270		400	540
113	Chemical Industry			66	CG-IO	MFG	130	270		400	540
225	Chemical Industry			66	CG-PSS	MFG	130	270		400	540
109	Coal Industry			92	CG-IO	MFG	130	270	330	400	540
110	Steel Industry			93	CG-IO	MFG	130	270	330	400	540
111	Stone and Cement Industry			94	CG-IO	MFG	130	270	330	400	540

SET 300

This set of programs/clients is sorted according to Ship Characteristics as follows:

310 Ship Documentation

- 311 Registry and Ownership
- 312 Certification
- 313 Admeasurement

320 Ship Construction and Repair

- 321 Construction Standards
- 322 Shipbuilding Practices (Including Research)
- 323 Main and Auxiliary Equipment (Including Research)

330 Ship Size

- 331 Tonnage
- 332 Draft
- 333 Beam
- 334 Length
- 335 Height

340 Ship Maneuverability

350 Basic Ship Designs

- 351 Conventional
- 352 Catamaran
- 353 Swath
- 354 Submersible
- 355 Surface Skimmer

360 Cargo Carrier Configuration

- 361 Hull-Borne
- 362 Towed
- 363 Lighter Aboard
- 364 Roll-On Roll-Off

SHIP CHARACTERISTICS GENERAL (300)

369	American Institute of Industrial Engineers	208	M-SBLDG	MFG	100		300	400	500	
370	American Institute of Industrial Engineers	208	M-MACHY	MFG	100		300	400	500	
371	American Institute of Industrial Engineers	208	M-NPROP	MFG	100		300	400	500	
394	American Society of Naval Engineers	211	M-SBLDG	MFG	100		300	400	500	
395	American Society of Naval Engineers	211	M-SHCON	MFG	100		300	400	500	
396	American Society of Naval Engineers	211	M-MACHY	MFG	100		300	400	500	
397	American Society of Naval Engineers	211	M-NPROP	MFG	100		300	400	500	
398	American Society of Naval Engineers	211	M-ADSYS	MFG	100		300	400	500	
399	American Society of Naval Engineers	211	M-CHAND	MFG	100		300	400	500	
174	National Academy of Engineering	124	CG-MSA	PRIV	100		300	400	500	
175	Marine Technology Society	124	CG-MSA	PRIV	100		300	400	500	
72	Classification and Certification	64	CG-CVS	GOVT	120		300			
462	Marine Exchange of San Francisco Bay	221	M-SHIPG	COML	100	200	300	400	500	
463	Marine Exchange of San Francisco Bay	221	M-PORTS	COML	100	200	300	400	500	
466	Maritime Association of the Port of New York	221	M-SHIPG	COML	100	200	300	400	500	
467	Maritime Association of the Port of New York	221	M-PORTS	COML	100	200	300	400	500	
468	Maritime Association of the Port of New York	221	M-EN&EV	COML	100	200	300	400	500	
469	Maritime Association of the Port of New York	221	M-CHAND	COML	100	200	300	400	500	
472	Mobile Steamship Association	221	M-SHIPG	COML	100	200	300	400	500	
473	Mobile Steamship Association	221	M-PORTS	COML	100	200	300	400	500	
474	Mobile Steamship Association	221	M-EN&EV	COML	100	200	300	400	500	
475	Mobile Steamship Association	221	M-CHAND	COML	100	200	300	400	500	
476	New Orleans Steamship Association	221	M-SHIPG	COML	100	200	300	400	500	
477	New Orleans Steamship Association	221	M-PORTS	COML	100	200	300	400	500	
478	New Orleans Steamship Association	221	M-EN&EV	COML	100	200	300	400	500	
479	New Orleans Steamship Association	221	M-CHAND	COML	100	200	300	400	500	
480	New York Shipping Association, Inc.	221	M-Shipg	COML	100	200	300	400	500	
481	New York Shipping Association, Inc.	221	M-PORTS	COML	100	200	300	400	500	
482	New York Shipping Association, Inc.	221	M-EN&EV	COML	100	200	300	400	500	
483	New York Shipping Association, Inc.	221	M-CHAND	COML	100	200	300	400	500	
484	New York Towboat and Harbor Carriers Association	221	M-SHIPG	COML	100	200	300	400	500	
485	New York Towboat and Harbor Carriers Association	221	M-PORTS	COML	100	200	300	400	500	
494	Philadelphia Marine Trade Association	221	M-SHIPG	COML	100	200	300	400	500	
495	Philadelphia Marine Trade Association	221	M-PORTS	COML	100	200	300	400	500	
496	Philadelphia Marine Trade Association	221	M-EN&EV	COML	100	200	300	400	500	
497	Philadelphia Marine Trade Association	221	M-CHAND	COML	100	200	300	400	500	
503	Steamship Trade Association of Baltimore, Inc.	221	M-SHIPG	COML	100	200	300	400	500	
504	Steamship Trade Association of Baltimore, Inc.	221	M-PORTS	COML	100	200	300	400	500	
505	Steamship Trade Association of Baltimore, Inc.	221	M-EN&EV	COML	100	200	300	400	500	
506	Steamship Trade Association of Baltimore, Inc.	221	M-CHAND	COML	100	200	300	400	500	
486	Pacific Maritime Association	235	M-SHIPG	COML	100	200	300	400	500	
487	Pacific Maritime Association	235	M-PORTS	COML	100	200	300	400	500	
488	Pacific Maritime Association	235	M-EN&EV	COML	100	200	300	400	500	
489	Pacific Maritime Association	235	M-CHAND	COML	100	200	300	400	500	
490	Pacific Merchant Shippers Association	236	M-SHIPG	COML	100	200	300	400	500	
491	Pacific Merchant Shippers Association	236	M-PORTS	COML	100	200	300	400	500	
492	Pacific Merchant Shippers Association	236	M-EN&EV	COML	100	200	300	400	500	
493	Pacific Merchant Shippers Association	236	M-CHAND	COML	100	200	300	400	500	
46	Maritime Administration	45	CG-CVS	GOVT	100	200	300	400	500	

117	Maritime Administration	45	CG-MEP	GOVT	100	200	300	400	500	
185	Maritime Administration	45	CG-PSS	GOVT	100	200	300	400	500	
230	Maritime Administration	45	CG-RA	GOVT	100	200	300	400	500	
92	U.S. Coast Guard	79	CG-IO	GOVT	100	200	300	400	500	
341	U. S. Coast Guard	79	M-SBLDG	GOVT	100	200	300	400	500	
342	U. S. Coast Guard	79	M-SHIPG	GOVT	100	200	300	400	500	
343	U. S. Coast Guard	79	M-SHCON	GOVT	100	200	300	400	500	
344	U. S. Coast Guard	79	M-MSCI	GOVT	100	200	300	400	500	
345	U. S. Coast Guard	79	M-NAV&C	GOVT	100	200	300	400	500	
346	U. S. Coast Guard	79	M-PORTS	GOVT	100	200	300	400	500	
347	U.S. Coast Guard	79	M-NPROP	GOVT	100	200	300	400	500	
348	U. S. Coast Guard	79	M-ADSYS	GOVT	100	200	300	400	500	
349	U. S. Coast Guard	79	M-CHAND	GOVT	100	200	300	400	500	
223	Public Vessels	147	CG-PSS	GOVT	100	200	300		540	
442	Boston Shipping Authority	221	M-SHIPG	GOVT	100	200	300	400	510	
443	Boston Shipping Authority	221	M-PORTS	GOVT	100	200	300	400	500	
444	Boston Shipping Authority	221	M-EN&EV	GOVT	100	200	300	400	500	
445	Boston Shipping Authority	221	M-CHAND	GOVT	100	200	300	400	500	
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS	INTL	100	200	300	400	500	
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS	INTL	100	200	300	400	500	
378	Intergovernmental Maritime Consultative Organization	57	M-SBLDG	INTL	100	200	300	400	500	
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG	INTL	100	200	300	400	500	
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C	INTL	100	200	300	400	500	
381	Intergovernmental Maritime Consultative Organization	57	M-NPROP	INTL	100	200	300	400	500	
382	Intergovernmental Maritime Consultative Organization	57	M-EN&EV	INTL	100	200	300	400	500	
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG	INTL	100	200	300	400	500	
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG	INTL	100	200	300	400	500	
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS	INTL	100	200	300	400	500	
18	Commercial Vessel Operators, U. S. and foreign	18	CG-AN	COML	120	200	300	400	500	
32	Commercial Water Transportation Firms	18	CG-BA	COML	120	200	300	400	540	
33	Shippers	18	CG-BA	COML	120	200	300	400	540	
64	Maritime Commerce (Owners, Operators, Shippers, Carriers, Agents)	18	CG-CVS	COML	120	200	300	400	500	
136	Merchant Shipping Industry	18	CG-MEP	COML	120	200	300	400	500	
216	Commercial Cargo Vessel & Dry Cargo Barge Industry	18	CG-PSS	COML	120	200	300	400	500	
317	Maritime Industry	18	CG-SAR	COML	120	200	300	400	500	
324	Merchant Vessels (U.S.)	18	CG-GAC	COML	120	200	300	400	500	
404	U. S. Flag shipowners, operators and/or agents	18	M-SHIPG	COML	120	200	300	400	500	
405	U. S. Flag shipowners, operators and/or agents	18	M-SHCON	COML	120	200	300	400	500	
406	U. S. Flag shipowners, operators and/or agents	18	M-NAV&C	COML	120	200	300	400	500	
407	U. S. Flag shipowners, operators and/or agents	18	M-PORTS	COML	120	200	300	400	500	
408	U. S. Flag shipowners, operators and/or agents	18	M-MARKA	COML	120	200	300	400	500	
409	U. S. Flag shipowners, operators and/or agents	18	M-CAORF	COML	120	200	300	400	500	
446	Council of American Flag Ship Operators	18	M-SHIPG	COML	120	200	300	400	500	
447	Council of North Atlantic Shipping Association	18	M-SHIPG	COML	120	200	300	400	500	
59	American Bureau of Shipping	56	CG-CVS	COML	120	200	300	400	540	
400	American Bureau of Shipping	56	M-SHIPG	COML	120	200	300	400	540	
401	American Bureau of Shipping	56	M-MARKA	COML	120	200	300	400	540	
66	Foreign Commercial Vessels	59	CG-CVS	COML	120	200	300	420	540	
321	Foreign Merchant Vessels	59	CG-SAR	COML	120	200	300	420	540	

SHIP CHARACTERISTICS GENERAL (300)

325	Merchant Vessels (foreign)	59	CG-GAC	COML	120	200	300	420	540
218	Terminal Operators (Port Authorities, Private Owners, Stevedoring Companies)	145	CG-PSS	COML	120	200	300	400	500
388	National Maritime Council	210	M-SBLDG	COML	120	200	300	400	500
389	National Maritime Council	210	M-SHIPG	COML	120	200	300	400	500
390	National Maritime Council	210	M-SHCON	COML	120	200	300	400	540
391	National Maritime Council	210	M-PORTS	COML	120	200	300	400	540
392	National Maritime Council	210	M-MARKA	COML	120	200	300	400	540
393	National Maritime Council	210	M-CHAND	COML	120	200	300	400	540
509	Transportation Institute	241	M-SHIPG	COML	120	200	300	400	500
510	Transportation Institute	241	M-SHCON	COML	120	200	300	400	500
511	Transportation Institute	241	M-MSCI	COML	120	200	300	400	500
512	Transportation Institute	241	M-NAV&C	COML	120	200	300	400	500
513	Transportation Institute	241	M-EN&EV	COML	120	200	300	400	500
514	Transportation Institute	241	M-ADSYS	COML	120	200	300	400	500
515	Transportation Institute	241	M-CAORF	COML	120	200	300	400	500
133	International Association of Passenger Liners	106	CG-MEP	INTL	120	200	300	400	540
221	Mariners (Commercial Operators)	16	CG-PSS	PERS	120	200	300	400	500
429	Council of American Master Mariners, Inc.	18	M-SHIPG	PERS	120	200	300	400	500
430	Council of American Master Mariners, Inc.	18	M-NAV&C	PERS	120	200	300	400	500
431	Council of American Master Mariners, Inc.	18	M-PORTS	PERS	120	200	300	400	500
383	North Atlantic Treaty Organization	209	M-SHIPG	INTL	150	200	300	400	500
384	North Atlantic Treaty Organization	209	M-PORTS	INTL	150	200	300	400	500
385	North Atlantic Treaty Organization	209	M-CHAND	INTL	150	200	300	400	500
128	Sierra Club	101	CG-MEP	PRIV	180	200	300	400	510
129	Friends of the Earth	102	CG-MEP	PRIV	180	200	300	400	510
130	Environmental Defense Fund	103	CG-MEP	PRIV	180	200	300	400	510
140	Conservationists	110	CG-MEP	PRIV	180	200	300	400	510
50	Underwriter's Laboratory	48	CG-CVS	MFG	120	210	300	421	540
80	Naval Architects and Marine Engineers	48	CG-CVS	MFG	120	210	300	421	540
288	Society of Naval Architects and Marine Engineers	48	CG-RBS	MFG	120	210	300	421	540
289	Underwriter's Laboratory	48	CG-RBS	MFG	120	210	300	421	540
519	Society of Naval Architects and Marine Engineers	48	M-SBLDG	MFG	120	210	300	421	540
520	Society of Naval Architects and Marine Engineers	48	M-SHCON	MFG	120	210	300	421	540
521	Society of Naval Architects and Marine Engineers	48	M-MACHY	MFG	120	210	300	421	540
522	Society of Naval Architects and Marine Engineers	48	M-NPROP	MFG	120	210	300	421	540
523	Society of Naval Architects and Marine Engineers	48	M-ADSYS	MFG	120	210	300	421	540
524	Society of Naval Architects and Marine Engineers	48	M-CHAND	MFG	120	210	300	421	540
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA	GOVT	100	220	300	400	500
526	Drug Enforcement Administration	2	CG-ELT	GOVT	110	220	300		543
525	National Oceanic and Atmospheric Administration	242	CG-ELT	GOVT	110	220	300		543
219	Oil Transfer Facility Industry	146	CG-PSS	COML	100	240	300	400	500
207	International Longshoremens Association	138	CG-PSS	INTL	120	240	300	440	540
208	International Longshoremen and Warehouse Union	138	CG-PSS	INTL	120	240	300	440	540
415	American Longshore Unions	138	M-PORTS	PERS	120	240	300	440	540
416	American Longshore Unions	138	M-CHAND	PERS	120	240	300	440	540
11	American Transport Association	11	CG-AN	COML	120	250	300	400	500
507	Tanker Service Committee, Inc.	240	M-SHIPG	COML	131	260	300	400	500
508	Tanker Service Committee, Inc.	240	M-PORTS	COML	131	260	300	400	500
112	Petroleum Industry	95	CG-IO	MFG	100	270	300	400	500

125	American Petroleum Institute	95	CG-MEP	MFG	100	270	300	400	500
137	Petroleum Industry	95	CG-MEP	MFG	100	270	300	400	500
224	Petroleum Industry	95	CG-PSS	MFG	100	270	300	400	500

SHIP CHARACTERISTICS GENERAL (300)

310 Ship Documentation

311 Registry and Ownership
312 Certification
313 Admeasurement

10	American Institute of Merchant Shipping	10	CG-AN	COML	120	200	310	400	500
60	American Institute of Merchant Shipping	10	CG-CVS	COML	120	200	310	400	500
126	American Institute of Merchant Shipping	10	CG-MEP	COML	120	200	310	400	500
204	American Institute of Merchant Shipping	10	CG-PSS	COML	120	200	310	400	500
257	American Institute of Merchant Shipping	10	CG-RA	COML	120	200	310	400	500
402	American Institute of Merchant Shipping	10	M-SHIPG	COML	120	200	310	400	500
403	American Institute of Merchant Shipping	10	M-MARKA	COML	120	200	310	400	500
448	Federation of American Controlled Shipping	224	M-SHIPG	COML	120	200	310	400	500
449	Federation of American Controlled Shipping	224	M-PORTS	COML	120	200	310	400	500
450	Federation of American Controlled Shipping	224	M-CHAND	COML	120	200	310	400	500
454	Labor-Management Maritime Committee	226	M-SBLDG	PERS	100	260	310	440	547
455	Labor-Management Maritime Committee	226	M-SHIPG	PERS	100	260	310	440	547
456	Labor-Management Maritime Committee	226	M-SHCON	PERS	100	260	310	440	547
457	Labor-Management Maritime Committee	226	M-PORTS	PERS	100	260	310	440	547
458	Labor-Management Maritime Committee	226	M-CHAND	PERS	100	260	310	440	547
233	Bureau of Census	151	CG-RA	GOVT	120	260	310	440	
464	Marine Towing and Transportation Employers Association	228	M-SHIPG	PERS	120	260	310	440	500
465	Marine Towing and Transportation Employers Association	228	M-PORTS	PERS	120	260	310	440	500
81	Brokers and Mortgagees (Lending and Holding Institutions)	72	CG-CVS	COML	120	270	310		540
531	U.S. Customs Service	135	CG-ELT	GOVT	120		311	400	560
195	U.S. Customs Service	135	CG-PSS	GOVT	180		311	400	560

320 Ship Construction and Repair

231	National Bureau of Standards	149	CG-RA	GOVT			320		
372	National Bureau of Standards	149	M-SBLDG	GOVT			320		
373	National Bureau of Standards	149	M-MACHY	GOVT			320		
374	National Bureau of Standards	149	M-NPROP	GOVT			320		
375	National Bureau of Standards	149	M-CHAND	GOVT			320		
417	American Shipyard Unions	214	M-SBLDG	PERS	100		320		547
418	American Shipyard Unions	214	M-MACHY	PERS	100		320		547
294	International Standards Organization	70	CG-RBS	INTL	120		320	420	540
70	Ship and Boat Yards	63	CG-CVS	MFG	120		320	421	510
149	Shipbuilders	63	CG-MO	MFG	120		320	421	500
159	Shipbuilders	63	CG-MP	MFG	120		320	421	510
498	Shipbuilders Council of America	63	M-SBLDG	MFG	120		320	421	500
499	Shipbuilders Council of America	63	M-MACHY	MFG	120		320	421	500
500	Shipbuilders Council of America	63	M-NPROP	MFG	120		320	421	500
501	Shipbuilders Council of America	63	M-ADSYS	MFG	120		320	421	500
502	Shipbuilders Council of America	63	M-CHAND	MFG	120		320	421	500
73	Manufacturers and Venders of Marine Equipment	65	CG-CVS	MFG	120		320	420	
293	Various Marine Manufacturers, Dealers and Distributors	65	CG-RBS	MFG	120		320	420	
79	Standardization and Technical Societies	70	CG-CVS	MFG	120		320	420	540
287	American National Standards Institute	70	CG-RBS	MFG	120		320	420	540
292	Canadian Standards Association Testing Laboratories	70	CG-RBS	MFG	120		320	420	540
295	Society of Automotive Engineers	70	CG-RBS	MFG	120		320	420	540
365	American Society of Testing Materials	70	M-SBLDG	MFG	120		320	420	540
366	American Society of Testing Materials	70	M-MACHY	MFG	120		320	420	540
368	American Society of Testing Materials	70	M-CHAND	MFG	120		320	420	540

320 Ship Construction and Repair

321 Construction Standards

322 Shipbuilding Practices (Including Research)

323 Main and Auxiliary Equipment (Including Research)

367	American Society of Testing Materials	207	M-NPROP	MFG	120		320	420	540
263	American Merchant Marine Institute	165	CG-RA	COML	100	200	320	400	500
150	Electronics and ordnance equipment manufacturers	115	CG-MO	MFG	100	200	320	400	500
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP	MFG	100	200	320	400	500
267	Electronic Industry Association	115	CG-RA	MFG	100	200	320	400	500
264	Institute of Electrical and Electronic Engineers	166	CG-RA	MFG	100	200	320	400	500
266	American Radio Relay League	47	CG-RA	PRIV	100	200	320	400	500
260	American Museum of Natural History	164	CG-RA	PRIV	100	200	320	400	500
5	U.S. Navy	5	CG-AN	GOVT	150	200	320		540
85	U.S. Navy	5	CG-IO	GOVT	150	200	320		540
118	U.S. Navy	5	CG-MEP	GOVT	150	200	320		540
152	U.S. Navy	5	CG-MP	GOVT	150	200	320		540
187	U.S. Navy	5	CG-PSS	GOVT	150	200	320		540
237	U.S. Navy	5	CG-RA	GOVT	150	200	320		540
311	U.S. Navy	5	CG-SAR	GOVT	150	200	320		540
337	U.S. Navy	5	CG-GAS	GOVT	150	200	320		540
353	U.S. Navy	5	M-SBLDG	GOVT	150	200	320		540
354	U.S. Navy	5	M-SHIPG	GOVT	150	200	320		540
355	U.S. Navy	5	M-MSCI	GOVT	150	200	320		540
356	U.S. Navy	5	M-EN&EV	GOVT	150	200	320		540
357	U.S. Navy	5	M-ADSYS	GOVT	150	200	320		540
358	U.S. Navy	5	M-CHAND	GOVT	150	200	320		540
162	U.S. Navy	5	CG-MSA	GOVT	160	200	320		540
97	Academic and Scientific Communities	83	CG-IO	PRIV	160	200	320	400	500
146	Academic Community	83	CG-MO	PRIV	160	200	320	400	500
158	Academic Community	83	CG-MP	PRIV	160	200	320	400	500
179	Academic and Scientific Communities	83	CG-MSA	PRIV	160	200	320	400	500
251	Department of Energy	159	CG-RA	GOVT	110	240	323	400	540
360	Department of Energy	159	M-PORTS	GOVT	110	240	323	400	540
361	Department of Energy	159	M-NPROP	GOVT	110	240	323	400	540
362	Department of Energy	159	M-EN&EV	GOVT	110	240	323	400	540
253	Nuclear Regulatory Commission	160	CG-RA	GOVT	112	260	323	420	530
376	Nuclear Regulatory Commission	160	M-PORTS	GOVT	112	260	323	420	530
377	Nuclear Regulatory Commission	160	M-NPROP	GOVT	112	260	323	420	530

330 Ship Size

44	Tennessee Valley Authority	43	CG-BA	GOVT			330		540
107	Various Chambers of Commerce	90	CG-IO	COML	120		330	400	500
12	Lake Carriers Association	12	CG-AN	COML	120	200	330	400	540
104	Lake Carriers Association	12	CG-IO	COML	120	200	330	400	540
202	(Great) Lake Carriers Association	12	CG-PSS	COML	120	200	330	400	540
459	Lake Carriers Association	12	M-SHIPG	COML	120	200	330	400	540
460	Lake Carriers Association	12	M-PORTS	COML	120	200	330	400	540
461	Lake Carriers Association	12	M-CHAND	COML	120	200	330	400	540
105	Dominion Marine Association (Canada)	88	CG-IO	COML	120	200	330	400	500
27	State Marine Organizations	27	CG-AN	GOVT	120	200	330	400	540
106	International Association of Great Lakes Ports	89	CG-IO	INTL	120	200	330	400	500
6	Military Sealift Command	6	CG-AN	GOVT	150	200	330	420	540
238	Military Sealift Command	6	CG-RA	GOVT	150	200	330	420	540
543	Military Sealift Command	6	M-SHIPG	GOVT	150	200	330	420	540
544	Military Sealift Command	6	M-SHCON	GOVT	150	200	330	420	540

330 **Ship Size**

331 **Tonnage**
332 **Draft**
333 **Beam**
334 **Length**
335 **Height**

545	**Military Sealift Command**	6	M-CHAND	GOVT	150	200	330	420	540
42	**Towing Industry Advisory Committee**	41	CG-BA	COML	120	210	330	430	540
43	American Waterways Operators, Inc.	42	CG-BA	COML	120	210	330	400	540
438	American Waterways Operators, Inc.	42	M-SHIPG	COML	120	210	330	400	540
439	American Waterways Operators, Inc.	42	M-NAV&C	COML	120	210	330	400	540
440	American Waterways Operators, Inc.	42	M-PORTS	COML	120	210	330	400	540
441	American Waterways Operators, Inc.	42	M-CHAND	COML	120	210	330	400	540
61	American Waterways Operators, Inc.	42	CG-CVS	PERS	120	210	330	400	540
127	American Waterways Operators, Inc.	42	CG-MEP	PERS	120	210	330	400	540
212	American Waterways Operators, Inc.	42	CG-PSS	PERS	120	210	330	400	540
45	The Waterways Journal	44	CG-BA	PRIV	120	210	330	400	540
75	Passengers on Waterborne Vessels	67	CG-CVS	PRIV	120	210	330	430	540
116	Transportation (Commuters)	67	CG-IO	PRIV	120	210	330	430	540
263	National Association of Marine Surveyors	179	CG-RBS	COML	161	210	330	430	543
39	National and Local Association of Port Authorities	21	CG-BA	COML	100	211	330		540
205	American Association of Port Authorities	21	CG-PSS	COML	100	211	330		540
435	American Association of Port Authorities	21	M-SHIPG	COML	100	211	330		540
436	American Association of Port Authorities	21	M-PORTS	COML	100	211	330		540
437	American Association of Port Authorities	21	M-CHAND	COML	100	211	330		540
21	Port Authorities	21	CG-AN	GOVT	100	211	330		540
65	State/Local Port Authorities	21	CG-CVS	GOVT	100	211	330		540
40	Industrial Development Commissions	39	CG-BA	MFG	100	211	330		540
331	State Port Authorities	21	CG-GAC	PRIV	100	211	330		540
99	U.S. Army Corps of Engineers	85	CG-IO	GOVT	150	211	330	430	543
120	Corps of Engineers	85	CG-MEP	GOVT	150	211	330	430	543
189	Corps of Engineers	85	CG-PSS	GOVT	150	211	330	430	543
277	Corps of Engineers	85	CG-RBS	GOVT	150	211	330	430	543
41	National Water Resources Council	40	CG-BA	GOVT	120	212	330	410	540
91	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
100	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
193	St. Lawrence Seaway Development Corporation	78	CG-PSS	GOVT	120	212	330	410	543
246	St. Lawrence Seaway Development Corporation	78	CG-RA	GOVT	120	212	330	410	543
103	St. Lawrence Seaway Authority (Canada)	87	CG-IO	GOVT	120	212	330	410	543
109	Coal Industry	92	CG-IO	MFG	130	270	330	400	540
110	Steel Industry	93	CG-IO	MFG	130	270	330	400	540
111	Stone and Cement Industry	94	CG-IO	MFG	130	270	330	400	540
2	National Oceanic and Atmospheric Administration	2	CG-AN	GOVT	110	220	332		543
66	National Oceanic and Atmospheric Administration	2	CG-IO	GOVT	110	220	332		543
161	National Oceanic and Atmospheric Administration	2	CG-MSA	GOVT	110	220	332		543
186	National Oceanic and Atmospheric Administration	2	CG-PSS	GOVT	110	220	332		543
279	National Oceanic and Atmospheric Administration	2	CG-RBS	GOVT	110	220	332		543
350	National Oceanic and Atmospheric Administration	2	M-SBLDG	GOVT	110	220	332		543
351	National Oceanic and Atmospheric Administration	2	M-MSCI	GOVT	110	220	332		543
352	National Oceanic and Atmospheric Administration	2	M-EN&EV	GOVT	110	220	332		543
26	State Highway Departments	26	CG-BA	GOVT	120		335	410	543
30	Public Bridge Authorities and Commissions	30	CG-BA	GOVT	120		335	410	543
37	Association of State Highway Officials (ASHO)	36	CG-EA	PRIV	120		335	410	543

340 **Ship Maneuverability**

327	Harbor and River Tugboats	202	CG-GAC	COML	120	200	340	430	540
55	Seafarers International Union	53	CG-CVS	PERS	120	200	340		540

56	Masters, Mates and Pilots Association	54	CG-CVS	PERS	120	200	340	400	540
102	Masters, Mates and Pilots Association	54	CG-IO	PERS	120	200	340	400	540
201	Masters, Mates and Pilots Association	54	CG-PSS	PERS	120	200	340	400	540
220	Pilot Associations and Masters	54	CG-PSS	PERS	120	200	340	400	540
58	Lake Carriers Pilotage Association	55	CG-CVS	PERS	120	200	340		540
180	Committee on International Ocean Affairs (CIOA)	127	CG-MSA	INTL	100	210	340	400	500
184	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	127	CG-MSA	INTL	100	210	340	400	500
183	Ocean Affairs Board (OAB)	127	CG-MSA	PRIV	100	210	340	400	500
19	Commercial Offshore Exploration Firms	19	CG-AN	COML	110	210	340		
68	Offshore Petroleum and Mineral Industry	61	CG-CVS	MFG	110	210	340	410	510
22	Insurance Industry	22	CG-AN	COML	120	210	340	400	540
63	Lloyds of London	22	CG-CVS	COML	120	210	340	400	540
71	Insurance and Hull Underwriters	22	CG-CVS	COML	120	210	340	400	540
134	American Institute of Marine Underwriters	22	CG-MEP	COML	120	210	340	400	540
141	Insurance Industry	22	CG-MEP	COML	120	210	340	400	540
226	Insurance Industry	22	CG-PSS	COML	120	210	340	400	540
306	The Insurance Industry	22	CG-RBS	COML	120	210	340	400	540
83	International Safety and Security Organizations	74	CG-CVS	INTL	120	210	340	430	540
286	American Institute of Marine Underwriters	22	CG-RBS	MFG	120	210	340	400	540
20	Pilot Associations	20	CG-AN	PERS	120	210	340		540
57	American Pilots Association	20	CG-CVS	PERS	120	210	340		540
200	National Pilot Association	20	CG-PSS	PERS	120	210	340		540
206	American Pilots Association	20	CG-PSS	PERS	120	210	340		540
262	American Pilots Association	20	CG-RA	PERS	120	210	340		540
516	American Pilots Association	20	M-SHIPG	PERS	120	210	340		540
517	American Pilots Association	20	M-SHCON	PERS	120	210	340		540
518	American Pilots Association	20	M-PORTS	PERS	120	210	340		540
78	Commercial Diving Industry (Underwater Vessel Owners and Operators)	69	CG-CVS	COML	110	210	354	400	540
31	Railroad Companies	31	CG-BA	COML	120		360	400	540
38	American Association of Railroads (AAR)	37	CG-BA	COML	120		360	400	540
96	Arctic Institute of North America	82	CG-IO	PRIV	120	200	360	400	500
178	Arctic Institute of North America	82	CG-MSA	PRIV	120	200	360	400	500
139	Barge Industry	109	CG-MEP	COML	130	210	360	400	500
217	Tank Vessel and Tank Barge Industry	109	CG-PSS	MFG	130	210	360	400	500

340 Ship Maneuverability

354 Submersible

360 Cargo Carrier Configuration

361 Hull-Borne
362 Towed
363 Lighter Aboard
364 Roll-On Roll-Off

SET 400

This set of programs/clients is sorted according to the Land-Sea Interface as follows:

410 Inter-Modal Cargo Movement

420 Cargo Handling

- 421 Ship Operations
- 422 Terminal Operations

430 Port/Terminal

- 431 Cargo Throughput Capacity
- 432 Cargo Storage Capacity

440 Port/Terminal Manpower

- 441 Licensing/Certification
- 442 Training

90	Bureau of Land Management	77	CG-IO	GOVT	110			400	510
29	City and County Governments	29	CG-BA	GOVT	120			400	540
194	Materials Transportation Bureau	143	CG-PSS	GOVT	120			400	530
234	Joint Chiefs of Staff	152	CG-RA	GOVT	150	210		400	
170	Interagency Committee for Marine Environmental Protection	119	CG-MSA	GOVT	160	220		400	510
47	Department of Defense	206	CG-CVS	GOVT	150	250		400	540
364	Economic Development Administration	206	M-PORTS	GOVT	120	260		400	
74	Chemical Industry	66	CG-CVS	MFG	130	270		400	540
113	Chemical Industry	66	CG-IO	MFG	130	270		400	540
225	Chemical Industry	66	CG-PSS	MFG	130	270		400	540
369	American Institute of Industrial Engineers	206	M-SBLDG	MFG	100		300	400	500
370	American Institute of Industrial Engineers	208	M-MACHY	MFG	100		300	400	500
371	American Institute of Industrial Engineers	208	M-NPROP	MFG	100		300	400	500
394	American Society of Naval Engineers	211	M-SBLDG	MFG	100		300	400	500
395	American Society of Naval Engineers	211	M-SHCON	MFG	100		300	400	500
396	American Society of Naval Engineers	211	M-MACHY	MFG	100		300	400	500
397	American Society of Naval Engineers	211	M-NPROP	MFG	100		300	400	500
398	American Society of Naval Engineers	211	M-ALSYS	MFG	100		300	400	500
399	American Society of Naval Engineers	211	M-CHAND	MFG	100		300	400	500
174	National Academy of Engineering	124	CG-MSA	PRIV	100		300	400	500
175	Marine Technology Society	124	CG-MSA	PRIV	100		300	400	500
462	Marine Exchange of San Francisco Bay	221	M-SHIPG	COML	100	200	300	400	500
463	Marine Exchange of San Francisco Bay	221	M-PORTS	COML	100	200	300	400	500
466	Maritime Association of the Port of New York	221	M-SHIPG	COML	100	200	300	400	500
467	Maritime Association of the Port of New York	221	M-PORTS	COML	100	200	300	400	500
468	Maritime Association of the Port of New York	221	M-EN&LV	COML	100	200	300	400	500
469	Maritime Association of the Port of New York	221	M-CHAND	COML	100	200	300	400	500
472	Mobile Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
473	Mobile Steamship Association	221	M-PORTS	COML	100	200	300	400	500
474	Mobile Steamship Association	221	M-EN&LV	COML	100	200	300	400	500
475	Mobile Steamship Association	221	M-CHAND	COML	100	200	300	400	500
476	New Orleans Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
477	New Orleans Steamship Association	221	M-PORTS	COML	100	200	300	400	500
478	New Orleans Steamship Association	221	M-EN&EV	COML	100	200	300	400	500
479	New Orleans Steamship Association	221	M-CHAND	COML	100	200	300	400	500
480	New York Shipping Association, Inc.	221	M-Shipg	COML	100	200	300	400	500
481	New York Shipping Association, Inc.	221	M-PORTS	COML	100	200	300	400	500
482	New York Shipping Association, Inc.	221	M-EN&EV	COML	100	200	300	400	500
483	New York Shipping Association, Inc.	221	M-CHAND	COML	100	200	300	400	500
484	New York Towboat and Harbor Carriers Association	221	M-SHIPG	COML	100	200	300	400	500
485	New York Towboat and Harbor Carriers Association	221	M-PORTS	COML	100	200	300	400	500
494	Philadelphia Marine Trade Association	221	M-SHIPG	COML	100	200	300	400	500
495	Philadelphia Marine Trade Association	221	M-PORTS	COML	100	200	300	400	500
496	Philadelphia Marine Trade Association	221	M-EN&EV	COML	100	200	300	400	500
497	Philadelphia Marine Trade Association	221	M-CHAND	COML	100	200	300	400	500
503	Steamship Trade Association of Baltimore, Inc.	221	M-SHIPG	COML	100	200	300	400	500
504	Steamship Trade Association of Baltimore, Inc.	221	M-PORTS	COML	100	200	300	400	500
505	Steamship Trade Association of Baltimore, Inc.	221	M-EN&EV	COML	100	200	300	400	500
506	Steamship Trade Association of Baltimore, Inc.	221	M-CHAND	COML	100	200	300	400	500

486	Pacific Maritime Association	235	M-SHIPG	COML	100	200	300	400	500
487	Pacific Maritime Association	235	M-PORTS	COML	100	200	300	400	500
488	Pacific Maritime Association	235	M-EN&LV	COML	100	200	300	400	500
489	Pacific Maritime Association	235	M-CHAND	COML	100	200	300	400	500
490	Pacific Merchant Shippers Association	236	M-SHIPG	COML	100	200	300	400	500
491	Pacific Merchant Shippers Association	236	M-PORTS	COML	100	200	300	400	500
492	Pacific Merchant Shippers Association	236	M-EN&EV	COML	100	200	300	400	500
493	Pacific Merchant Shippers Association	236	M-CHAND	COML	100	200	300	400	500
46	Maritime Administration	45	CG-CVS	GOVT	100	200	300	400	500
117	Maritime Administration	45	CG-MEP	GOVT	100	200	300	400	500
185	Maritime Administration	45	CG-PSS	GOVT	100	200	300	400	500
230	Maritime Administration	45	CG-RA	GOVT	100	200	300	400	500
92	U.S. Coast Guard	79	CG-IO	GOVT	100	200	300	400	500
341	U. S. Coast Guard	79	M-SBLDG	GOVT	100	200	300	400	500
342	U. S. Coast Guard	79	M-SHIPG	GOVT	100	200	300	400	500
343	U. S. Coast Guard	79	M-SHCON	GOVT	100	200	300	400	500
344	U. S. Coast Guard	79	M-MSCI	GOVT	100	200	300	400	500
345	U. S. Coast Guard	79	M-NAV&C	GOVT	100	200	300	400	500
346	U. S. Coast Guard	79	M-PORTS	GOVT	100	200	300	400	500
347	U.S. Coast Guard	79	M-NPROP	GOVT	100	200	300	400	500
348	U. S. Coast Guard	79	M-ADSYS	GOVT	100	200	300	400	500
349	U. S. Coast Guard	79	M-CHAND	GOVT	100	200	300	400	500
442	Boston Shipping Authority	221	M-SHIPG	GOVT	100	200	300	400	510
443	Boston Shipping Authority	221	M-PORTS	GOVT	100	200	300	400	500
444	Boston Shipping Authority	221	M-EN&EV	GOVT	100	200	300	400	500
445	Boston Shipping Authority	221	M-CHAND	GOVT	100	200	300	400	500
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS	INTL	100	200	300	400	500
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS	INTL	100	200	300	400	500
378	Intergovernmental Maritime Consultative Organization	57	M-SBLDG	INTL	100	200	300	400	500
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG	INTL	100	200	300	400	500
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C	INTL	100	200	300	400	500
381	Intergovernmental Maritime Consultative Organization	57	M-NPROP	INTL	100	200	300	400	500
382	Intergovernmental Maritime Consultative Organization	57	M-EN&LV	INTL	100	200	300	400	500
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG	INTL	100	200	300	400	500
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG	INTL	100	200	300	400	500
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS	INTL	100	200	300	400	500
18	Commercial Vessel Operators, U. S. and foreign	18	CG-AN	COML	120	200	300	400	500
32	Commercial Water Transportation Firms	18	CG-BA	COML	120	200	300	400	540
33	Shippers	18	CG-BA	COML	120	200	300	400	540
64	Maritime Commerce (Owners, Operators, Shippers, Carriers, Agents)	18	CG-CVS	COML	120	200	300	400	500
138	Merchant Shipping Industry	18	CG-MEP	COML	120	200	300	400	500
216	Commercial Cargo Vessel & Dry Cargo Barge Industry	18	CG-PSS	COML	120	200	300	400	500
317	Maritime Industry	18	CG-SAR	COML	120	200	300	400	500
324	Merchant Vessels (U.S.)	18	CG-GAC	COML	120	200	300	400	500
404	U. S. Flag shipowners, operators and/or agents	18	M-SHIPG	COML	120	200	300	400	500
405	U. S. Flag shipowners, operators and/or agents	18	M-SHCON	COML	120	200	300	400	500
406	U. S. Flag shipowners, operators and/or agents	18	M-NAV&C	COML	120	200	300	400	500
407	U. S. Flag shipowners, operators and/or agents	18	M-PORTS	COML	120	200	300	400	500
408	U. S. Flag shipowners, operators and/or agents	18	M-MARKA	COML	120	200	300	400	500

449	Federation of American Controlled Shipping	224	M-PORTS	COML	120	200	310	400	500
450	Federation of American Controlled Shipping	224	M-CHAND	COML	120	200	310	400	500
531	U.S. Customs Service	135	CG-ELT	GOVT	120		311	400	560
195	U.S. Customs Service	135	CG-PSS	GOVT	180		311	400	560
263	American Merchant Marine Institute	165	CG-RA	COML	100	200	320	400	500
150	Electronics and ordnance equipment manufacturers	115	CG-MO	MFG	100	200	320	400	500
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP	MFG	100	200	320	400	500
267	Electronic Industry Association	115	CG-RA	MFG	100	200	320	400	500
204	Institute of Electrical and Electronic Engineers	166	CG-RA	MFG	100	200	320	400	500
266	American Radio Relay League	47	CG-RA	PRIV	100	200	320	400	500
260	American Museum of Natural History	164	CG-RA	PRIV	100	200	320	400	500
97	Academic and Scientific Communities	83	CG-IO	PRIV	160	200	320	400	500
146	Academic Community	83	CG-MO	PRIV	160	200	320	400	500
158	Academic Community	83	CG-MP	PRIV	160	200	320	400	500
179	Academic and Scientific Communities	83	CG-MSA	PRIV	160	200	320	400	500
251	Department of Energy	159	CG-RA	GOVT	110	240	323	400	540
360	Department of Energy	159	M-PORTS	GOVT	110	240	323	400	540
361	Department of Energy	159	M-NPROP	GOVT	110	240	323	400	540
362	Department of Energy	159	M-EN&EV	GOVT	110	240	323	400	540
107	Various Chambers of Commerce	90	CG-IO	COML	120		330	400	500
12	Lake Carriers Association	12	CG-AN	COML	120	200	330	400	540
104	Lake Carriers Association	12	CG-IO	COML	120	200	330	400	540
202	(Great) Lake Carriers Association	12	CG-PSS	COML	120	200	330	400	540
459	Lake Carriers Association	12	M-SHIPG	COML	120	200	330	400	540
460	Lake Carriers Association	12	M-PORTS	COML	120	200	330	400	540
461	Lake Carriers Association	12	M-CHAND	COML	120	200	330	400	540
105	Dominion Marine Association (Canada)	88	CG-IO	COML	120	200	330	400	500
27	State Marine Organizations	27	CG-AN	GOVT	120	200	330	400	540
106	International Association of Great Lakes Ports	89	CG-IO	INTL	120	200	330	400	500
43	American Waterways Operators, Inc.	42	CG-BA	COML	120	210	330	400	540
438	American Waterways Operators, Inc.	42	M-SHIPG	COML	120	210	330	400	540
439	American Waterways Operators, Inc.	42	M-NAV&C	COML	120	210	330	400	540
440	American Waterways Operators, Inc.	42	M-PORTS	COML	120	210	330	400	540
441	American Waterways Operators, Inc.	42	M-CHAND	COML	120	210	330	400	540
61	American Waterways Operators, Inc.	42	CG-CVS	PERS	120	210	330	400	540
127	American Waterways Operators, Inc.	42	CG-MEP	PERS	120	210	330	400	540
212	American Waterways Operators, Inc.	42	CG-PSS	PERS	120	210	330	400	540
45	The Waterways Journal	44	CG-BA	PRIV	120	210	330	400	540
109	Coal Industry	92	CG-IO	MFG	130	270	330	400	540
110	Steel Industry	93	CG-IO	MFG	130	270	330	400	540
111	Stone and Cement Industry	94	CG-IO	MFG	130	270	330	400	540
56	Masters, Mates and Pilots Association	54	CG-CVS	PERS	120	200	340	400	540
102	Masters, Mates and Pilots Association	54	CG-IO	PERS	120	200	340	400	540
201	Masters, Mates and Pilots Association	54	CG-PSS	PERS	120	200	340	400	540
220	Pilot Associations and Masters	54	CG-PSS	PERS	120	200	340	400	540
180	Committee on International Ocean Affairs (CIOA)	127	CG-MSA	INTL	100	210	340	400	500
184	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	127	CG-MSA	INTL	100	210	340	400	500
183	Ocean Affairs Board (OAB)	127	CG-MSA	PRIV	100	210	340	400	500
22	Insurance Industry	22	CG-AN	COML	120	210	340	400	540

409	U. S. Flag shipowners, operators and/or agents	18	M-CAORF	COML	120	200	300	400	500
446	Council of American Flag Ship Operators	18	M-SHIPG	COML	120	200	300	400	500
447	Council of North Atlantic Shipping Association	18	M-SHIPG	COML	120	200	300	400	500
59	American Bureau of Shipping	56	CG-CVS	COML	120	200	300	400	540
400	American Bureau of Shipping	56	M-SHIPG	COML	120	200	300	400	540
401	American Bureau of Shipping	56	M-MARKA	COML	120	200	300	400	540
218	Terminal Operators (Port Authorities, Private Owners, Stevedoring Companies)	145	CG-PSS	COML	120	200	300	400	500
388	National Maritime Council	210	M-SELDG	COML	120	200	300	400	500
389	National Maritime Council	210	M-SHIPG	COML	120	200	300	400	500
390	National Maritime Council	210	M-SHCON	COML	120	200	300	400	540
391	National Maritime Council	210	M-PORTS	COML	120	200	300	400	540
392	National Maritime Council	210	M-MARKA	COML	120	200	300	400	540
393	National Maritime Council	210	M-CHAND	COML	120	200	300	400	540
509	Transportation Institute	241	M-SHIPG	COML	120	200	300	400	500
510	Transportation Institute	241	M-SHCON	COML	120	200	300	400	500
511	Transportation Institute	241	M-MSCI	COML	120	200	300	400	500
512	Transportation Institute	241	M-NAV&C	COML	120	200	300	400	500
513	Transportation Institute	241	M-ENSLV	COML	120	200	300	400	500
514	Transportation Institute	241	M-ADSYS	COML	120	200	300	400	500
515	Transportation Institute	241	M-CAORF	COML	120	200	300	400	500
133	International Association of Passenger Liners	106	CG-MEP	INTL	120	200	300	400	540
221	Mariners (Commercial Operators)	18	CG-PSS	PERS	120	200	300	400	500
429	Council of American Master Mariners, Inc.	18	M-SHIPG	PERS	120	200	300	400	500
430	Council of American Master Mariners, Inc.	18	M-NAV&C	PERS	120	200	300	400	500
431	Council of American Master Mariners, Inc.	18	M-PORTS	PERS	120	200	300	400	500
383	North Atlantic Treaty Organization	209	M-SHIPG	INTL	150	200	300	400	500
384	North Atlantic Treaty Organization	209	M-PORTS	INTL	150	200	300	400	500
385	North Atlantic Treaty Organization	209	M-CHAND	INTL	150	200	300	400	500
128	Sierra Club	101	CG-MEP	PRIV	180	200	300	400	510
129	Friends of the Earth	102	CG-MEP	PRIV	180	200	300	400	510
130	Environmental Defense Fund	103	CG-MEP	PRIV	180	200	300	400	510
140	Conservationists	110	CG-MEP	PRIV	180	200	300	400	510
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA	GOVT	100	220	300	400	500
219	Oil Transfer Facility Industry	146	CG-PSS	COML	100	240	300	400	500
11	American Transport Association	11	CG-AN	COML	120	250	300	400	500
507	Tanker Service Committee, Inc.	240	M-SHIPG	COML	131	260	300	400	500
508	Tanker Service Committee, Inc.	240	M-PORTS	COML	131	260	300	400	500
112	Petroleum Industry	95	CG-IO	MFG	100	270	300	400	500
125	American Petroleum Institute	95	CG-MEP	MFG	100	270	300	400	500
137	Petroleum Industry	95	CG-MEP	MFG	100	270	300	400	500
224	Petroleum Industry	95	CG-PSS	MFG	100	270	300	400	500
10	American Institute of Merchant Shipping	10	CG-AN	COML	120	200	310	400	500
60	American Institute of Merchant Shipping	10	CG-CVS	COML	120	200	310	400	500
126	American Institute of Merchant Shipping	10	CG-MEP	COML	120	200	310	400	500
204	American Institute of Merchant Shipping	10	CG-PSS	COML	120	200	310	400	500
257	American Institute of Merchant Shipping	10	CG-RA	COML	120	200	310	400	500
402	American Institute of Merchant Shipping	10	M-SHIPG	COML	120	200	310	400	500
403	American Institute of Merchant Shipping	10	M-MARKA	COML	120	200	310	400	500
448	Federation of American Controlled Shipping	224	M-SHIPG	COML	120	200	310	400	500

LAND-SEA INTERFACE (400)

63	Lloyds of London	22	CG-CVS	COML	120	210	340	400	540	
71	Insurance and Hull Underwriters	22	CG-CVS	COML	120	210	340	400	540	
134	American Institute of Marine Underwriters	22	CG-MEP	COML	120	210	340	400	540	
141	Insurance Industry	22	CG-MEP	COML	120	210	340	400	540	
226	Insurance Industry	22	CG-PSS	COML	120	210	340	400	540	
306	The Insurance Industry	22	CG-RBS	COML	120	210	340	400	540	
266	American Institute of Marine Underwriters	22	CG-RBS	MFG	120	210	340	400	540	
76	Commercial Diving Industry (Underwater Vessel Owners and Operators)	69	CG-CVS	COML	110	210	354	400	540	
31	Railroad Companies	31	CG-BA	COML	120		360	400	540	
36	American Association of Railroads (AAR)	37	CG-BA	COML	120		360	400	540	
96	Arctic Institute of North America	82	CG-IO	PRIV	120	200	360	400	500	
176	Arctic Institute of North America	82	CG-MSA	PRIV	120	200	360	400	500	
139	Barge Industry	109	CG-MEP	COML	130	210	360	400	500	
217	Tank Vessel and Tank Barge Industry	109	CG-PSS	MFG	130	210	360	400	500	
	410 Inter-Modal Cargo Movement									
245	Federal Highway Administration	156	CG-RA	GOVT	120			410	530	
4	U.S. Army	4	CG-AN	GOVT	150			410		
64	U.S. Army	4	CG-IO	GOVT	150			410		
119	U.S. Army	4	CG-MEP	GOVT	150			410		
151	U.S. Army	4	CG-MP	GOVT	150			410		
186	U.S. Army	4	CG-PSS	GOVT	150			410		
236	U.S. Army	4	CG-RA	GOVT	150			410		
145	General Services Administration (Federal Preparedness Agency)	113	CG-MO	GOVT	150			410		
155	General Services Administration (Federal Preparedness Agency)	113	CG-MP	GOVT	150			410		
144	Department of Transportation	112	CG-MO	GOVT	120	230		410	540	
154	Department of Transportation	112	CG-MP	GOVT	120	230		410	540	
124	Federal Maritime Commission	99	CG-MEP	GOVT	120	250		410	510	
198	Federal Maritime Commission	99	CG-PSS	GOVT	120	250		410	510	
363	Federal Maritime Commission	99	M-SHIPG	GOVT	120	250		410	510	
41	National Water Resources Council	40	CG-BA	GOVT	120	212	330	410	540	
91	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543	
100	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543	
193	St. Lawrence Seaway Development Corporation	78	CG-PSS	GOVT	120	212	330	410	543	
246	St. Lawrence Seaway Development Corporation	78	CG-RA	GOVT	120	212	330	410	543	
103	St. Lawrence Seaway Authority (Canada)	67	CG-IO	GOVT	120	212	330	410	543	
26	State Highway Departments	26	CG-BA	GOVT	120		335	410	543	
30	Public Bridge Authorities and Commissions	30	CG-BA	GOVT	120		335	410	543	
37	Association of State Highway Officials (ASHO)	36	CG-BA	PRIV	120		335	410	543	
68	Offshore Petroleum and Mineral Industry	61	CG-CVS	MFG	110	210	340	410	510	
	420 Cargo Handling									
66	Foreign Commercial Vessels	59	CG-CVS	COML	120	200	300	420	540	
321	Foreign Merchant Vessels	59	CG-SAR	COML	120	200	300	420	540	
325	Merchant Vessels (foreign)	59	CG-GAC	COML	120	200	300	420	540	
294	International Standards Organization	70	CG-RBS	INTL	120		320	420	540	
73	Manufacturers and Vendors of Marine Equipment	65	CG-CVS	MFG	120		320	420		
293	Various Marine Manufacturers, Dealers and Distributors	65	CG-RBS	MFG	120		320	420		
79	Standardization and Technical Societies	70	CG-CVS	MFG	120		320	420	540	
267	American National Standards Institute	70	CG-RBS	MFG	120		320	420	540	
292	Canadian Standards Association Testing Laboratories	70	CG-RBS	MFG	120		320	420	540	
295	Society of Automotive Engineers	70	CG-RBS	MFG	120		320	420	540	
365	American Society of Testing Materials	70	M-SBLDG	MFG	120		320	420	540	

366	American Society of Testing Materials		70	M-MACHY	MFG	120		320	420	540
368	American Society of Testing Materials		70	M-CHAND	MFG	120		320	420	540
367	American Society of Testing Materials	420 Cargo Handling	207	M-NPROP	MFG	120		320	420	540
253	Nuclear Regulatory Commission		160	CG-RA	GOVT	112	260	323	420	530
376	Nuclear Regulatory Commission	421 Ship Operations	160	M-PORTS	GOVT	112	260	323	420	530
377	Nuclear Regulatory Commission	422 Terminal Operations	160	M-NPROP	GOVT	112	260	323	420	530
6	Military Sealift Command		6	CG-AN	GOVT	150	200	330	420	540
230	Military Sealift Command		6	CG-RA	GOVT	150	200	330	420	540
543	Military Sealift Command		6	M-SHIPG	GOVT	150	200	330	420	540
544	Military Sealift Command		6	M-SHCON	GOVT	150	200	330	420	540
545	Military Sealift Command		6	M-CHAND	GOVT	150	200	330	420	540
23	Fishermen, commercial		23	CG-AN	COML	114	210		421	540
114	Fishermen (Commercial)		23	CG-IO	COML	114	210		421	540
227	Fishermen, Commercial		23	CG-PSS	COML	114	210		421	540
315	Fishermen, Commercial		23	CG-SAR	COML	114	210		421	540
326	Fishing Vessels (U.S. and Foreign)		23	CG-GAC	COML	114	210		421	540
539	Fishermen, Commercial		23	CG-ELT	COML	114	210		421	540
541	International Pacific Halibut Commission		251	CG-ELT	INTL	114	210		421	540
542	Sockeye Salmon Commission		252	CG-ELT	INTL	114	210		421	540
50	Underwriter's Laboratory		48	CG-CVS	MFG	120	210	300	421	540
60	Naval Architects and Marine Engineers		48	CG-CVS	MFG	120	210	300	421	540
268	Society of Naval Architects and Marine Engineers		48	CG-RBS	MFG	120	210	300	421	540
269	Underwriter's Laboratory		48	CG-RBS	MFG	120	210	300	421	540
519	Society of Naval Architects and Marine Engineers		48	M-SBLDG	MFG	120	210	300	421	540
520	Society of Naval Architects and Marine Engineers		48	M-SHCON	MFG	120	210	300	421	540
521	Society of Naval Architects and Marine Engineers		48	M-MACHY	MFG	120	210	300	421	540
522	Society of Naval Architects and Marine Engineers		48	M-NPROP	MFG	120	210	300	421	540
523	Society of Naval Architects and Marine Engineers		48	M-ADSYS	MFG	120	210	300	421	540
524	Society of Naval Architects and Marine Engineers		48	M-CHAND	MFG	120	210	300	421	540
76	Ship and Boat Yards		63	CG-CVS	MFG	120		320	421	510
149	Shipbuilders		63	CG-MO	MFG	120		320	421	500
159	Shipbuilders		63	CG-MP	MFG	120		320	421	510
498	Shipbuilders Council of America		63	M-SBLDG	MFG	120		320	421	500
499	Shipbuilders Council of America		63	M-MACHY	MFG	120		320	421	500
500	Shipbuilders Council of America		63	M-NPROP	MFG	120		320	421	500
501	Shipbuilders Council of America		63	M-ADSYS	MFG	120		320	421	500
502	Shipbuilders Council of America		63	M-CHAND	MFG	120		320	421	500
87	Defense Mapping Agency	430 Port/Terminal	75	CG-IO	GOVT	161	210		430	543
164	Defense Mapping Agency		75	CG-MSA	GOVT	161	210		430	543
240	Defense Mapping Agency		75	CG-RA	GOVT	161	210		430	543
69	U.S. Geological Survey		76	CG-IO	GOVT	161	210		430	543
165	U.S. Geological Survey		76	CG-MSA	GOVT	161	210		430	543
42	Towing Industry Advisory Committee		41	CG-BA	COML	120	210	330	430	540
75	Passengers on Waterborne Vessels		67	CG-CVS	PRIV	120	210	330	430	540
116	Transportation (Commuters)		67	CG-IO	PRIV	120	210	330	430	540
283	National Association of Marine Surveyors		179	CG-RBS	COML	161	210	330	430	543
99	U.S. Army Corps of Engineers		85	CG-IO	GOVT	150	211	330	430	543
120	Corps of Engineers		85	CG-MEP	GOVT	150	211	330	430	543
169	Corps of Engineers		85	CG-PSS	GOVT	150	211	330	430	543

277	Corps of Engineers	85	CG-RBS	GOVT	150	211	330	430	543
327	Harbor and River Tugboats	202	CG-GAC	COML	120	200	340	430	540
63	International Safety and Security Organizations	74	CG-CVS	INTL	120	210	340	430	540
190	U.S. Public Health Service	132	CG-PSS	GOVT		260		440	
192	Immigration and Naturalization Service	134	CG-PSS	GOVT		260		440	561
526	Immigration and Naturalization Service	134	CG-ELT	GOVT		260		440	561
340	Department of Labor	205	CG-GAS	GOVT		260		440	547
76	Maritime Training Institutions	68	CG-CVS	PERS		260		440	547
232	U.S. Merchant Marine Academy	150	CG-RA	GOVT	120	260		440	540
53	International Labor Organization	51	CG-CVS	PERS	120	260		440	547
54	National Maritime Union	52	CG-CVS	PERS	120	260		440	547
69	Maritime Labor Organizations	52	CG-CVS	PERS	120	260		440	547
422	Labor Organizations	52	M-SBLDG	PERS	120	260		440	547
423	Labor Organizations	52	M-SHIPG	PERS	120	260		440	547
424	Labor Organizations	52	M-SHCON	PERS	120	260		440	547
425	Labor Organizations	52	M-PORTS	PERS	120	260		440	547
426	Labor Organizations	52	M-MACHY	PERS	120	260		440	547
427	Labor Organizations	52	M-NPROF	PERS	120	260		440	547
428	Labor Organizations	52	M-CHAND	PERS	120	260		440	547
211	Seamens Union of the Pacific	53	CG-PSS	PERS	120	260		440	547
410	American Seafaring Unions	53	M-SHIPG	PERS	120	260		440	547
411	American Seafaring Unions	53	M-SHCON	PERS	120	260		440	547
412	American Seafaring Unions	53	M-ADSYS	PERS	120	260		440	547
413	American Seafaring Unions	53	M-CAORF	PERS	120	260		440	547
414	American Seafaring Unions	53	M-CHAND	PERS	120	260		440	547
419	American Independent Tanker Unions	53	M-SBLDG	PERS	120	260		440	547
420	American Independent Tanker Unions	53	M-PORTS	PERS	120	260		440	547
421	American Independent Tanker Unions	53	M-MACHY	PERS	120	260		440	547
432	United Seamen's Service, Inc.	53	M-SHIPG	PERS	120	260		440	547
433	United Seamen's Service, Inc.	53	M-PORTS	PERS	120	260		440	547
434	United Seamen's Service, Inc.	53	M-CHAND	PERS	120	260		440	547
67	Merchant Seamen	60	CG-CVS	PERS	120	260		440	547
207	International Longshoremens Association	138	CG-PSS	INTL	120	240	300	440	540
208	International Longshoremen and Warehouse Union	138	CG-PSS	INTL	120	240	300	440	540
415	American Longshore Unions	138	M-PORTS	PERS	120	240	300	440	540
416	American Longshore Unions	138	M-CHAND	PERS	120	240	300	440	540
454	Labor-Management Maritime Committee	226	M-SBLDG	PERS	100	260	310	440	547
455	Labor-Management Maritime Committee	226	M-SHIPG	PERS	100	260	310	440	547
456	Labor-Management Maritime Committee	226	M-SHCON	PERS	100	260	310	440	547
457	Labor-Management Maritime Committee	226	M-PORTS	PERS	100	260	310	440	547
458	Labor-Management Maritime Committee	226	M-CHAND	PERS	100	260	310	440	547
233	Bureau of Census	151	CG-RA	GOVT	120	260	310	440	
464	Marine Towing and Transportation Employers Association	228	M-SHIPG	PERS	120	260	310	440	500
465	Marine Towing and Transportation Employers Association	228	M-PORTS	PERS	120	260	310	440	500

430 Port/Terminal

431 Cargo Throughput Capacity

432 Cargo Storage Capacity

440 Port/Terminal Manpower

SET 500

This set of programs/clients is sorted according to Environmental, Safety, Legal Constraints as follows:

510 Water Pollution Control

- 511 Deballasting/Tank Cleaning and Stripping
- 512 Port/Terminal Waste Transfer, Storage, Disposal
- 513 Oil Spill Prevention and Abatement
- 514 Ocean Dumping

520 Air Pollution Control

530 Hazardous Material Handling

540 Safety

- 541 Intra-Ship (Ship Operating Standards)
- 542 Inter-Ship
- 543 Land-Ship
- 544 Shipborne Cargo
- 545 Cargo Transfer
- 546 Terminal Storage
- 547 Personnel

560 Maritime Law Enforcement

- 561 Customs and Smuggling
- 562 Admiralty Law
- 565 Piracy, Barratry, Hijacking

570 Protection of Offshore Assets

ENVIRONMENTAL, SAFETY, LEGAL CONSTRAINTS GENERAL (500)

177	Sea Use Foundation	126	CG-MSA	PRIV	100				500
307	State and Local Governments	91	CG-KBS	GOVT	170				500
323	State/local Governments	91	CG-SAR	GOVT	170				500
536	State and Local Law Enforcement Agencies	91	CG-ELT	GOVT	170				500
121	Environmental Protection Agency	96	CG-MEP	GOVT	180				500
196	Environmental Protection Agency	96	CG-PSS	GOVT	180				500
255	Environmental Protection Agency	96	CG-RA	GOVT	180				500
386	Environmental Protection Agency	96	M-PORTS	GOVT	180				500
387	Environmental Protection Agency	96	M-EN&EV	GOVT	180				500
369	American Institute of Industrial Engineers	208	M-SBLDG	MFG	100		300	400	500
370	American Institute of Industrial Engineers	208	M-MACHY	MFG	100		300	400	500
371	American Institute of Industrial Engineers	208	M-NPROP	MFG	100		300	400	500
394	American Society of Naval Engineers	211	M-SBLDG	MFG	100		300	400	500
395	American Society of Naval Engineers	211	M-SHCON	MFG	100		300	400	500
396	American Society of Naval Engineers	211	M-MACHY	MFG	100		300	400	500
397	American Society of Naval Engineers	211	M-NPROP	MFG	100		300	400	500
398	American Society of Naval Engineers	211	M-ADSYS	MFG	100		300	400	500
399	American Society of Naval Engineers	211	M-CHAND	MFG	100		300	400	500
174	National Academy of Engineering	124	CG-MSA	PRIV	100		300	400	500
175	Marine Technology Society	124	CG-MSA	PRIV	100		300	400	500
462	Marine Exchange of San Francisco Bay	221	M-SHIPG	COML	100	200	300	400	500
463	Marine Exchange of San Francisco Bay	221	M-PORTS	COML	100	200	300	400	500
466	Maritime Association of the Port of New York	221	M-SHIPG	COML	100	200	300	400	500
467	Maritime Association of the Port of New York	221	M-PORTS	COML	100	200	300	400	500
468	Maritime Association of the Port of New York	221	M-EN&EV	COML	100	200	300	400	500
469	Maritime Association of the Port of New York	221	M-CHAND	COML	100	200	300	400	500
472	Mobile Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
473	Mobile Steamship Association	221	M-PORTS	COML	100	200	300	400	500
474	Mobile Steamship Association	221	M-EN&EV	COML	100	200	300	400	500
475	Mobile Steamship Association	221	M-CHAND	COML	100	200	300	400	500
476	New Orleans Steamship Association	221	M-SHIPG	COML	100	200	300	400	500
477	New Orleans Steamship Association	221	M-PORTS	COML	100	200	300	400	500
478	New Orleans Steamship Association	221	M-EN&EV	COML	100	200	300	400	500
479	New Orleans Steamship Association	221	M-CHAND	COML	100	200	300	400	500
480	New York Shipping Association, Inc.	221	M-Shipg	COML	100	200	300	400	500
481	New York Snipping Association, Inc.	221	M-PORTS	COML	100	200	300	400	500
482	New York Shipping Association, Inc.	221	M-EN&EV	COML	100	200	300	400	500
483	New York Shipping Association, Inc.	221	M-CHAND	COML	100	200	300	400	500
484	New York Towboat and Harbor Carriers Association	221	M-SHIPG	COML	100	200	300	400	500
485	New York Towboat and Harbor Carriers Association	221	M-PORTS	COML	100	200	300	400	500
494	Philadelphia Marine Trade Association	221	M-SHIPG	COML	100	200	300	400	500
495	Philadelphia Marine Trade Association	221	M-PORTS	COML	100	200	300	400	500
496	Philadelphia Marine Trade Association	221	M-EN&EV	COML	100	200	300	400	500
497	Philadelphia Marine Trade Association	221	M-CHAND	COML	100	200	300	400	500
503	Steamship Trade Association of Baltimore, Inc.	221	M-SHIPG	COML	100	200	300	400	500
504	Steamship Trade Association of Baltimore, Inc.	221	M-PORTS	COML	100	200	300	400	500
505	Steamship Trade Association of Baltimore, Inc.	221	M-EN&EV	COML	100	200	300	400	500
506	Steamship Trade Association of Baltimore, Inc.	221	M-CHAND	COML	100	200	300	400	500
486	Pacific Maritime Association	235	M-SHIPG	COML	100	200	300	400	500

487	Pacific Maritime Association	235	M-PORTS	COML	100	200	300	400	500
488	Pacific Maritime Association	235	M-EN&EV	COML	100	200	300	400	500
489	Pacific Maritime Association	235	M-CHAND	COML	100	200	300	400	500
490	Pacific Merchant Shippers Association	236	M-SHIPG	COML	100	200	300	400	500
491	Pacific Merchant Shippers Association	236	M-PORTS	COML	100	200	300	400	500
492	Pacific Merchant Shippers Association	236	M-EN&EV	COML	100	200	300	400	500
493	Pacific Merchant Shippers Association	236	M-CHAND	COML	100	200	300	400	500
46	Maritime Administration	45	CG-CVS	GOVT	100	200	300	400	500
117	Maritime Administration	45	CG-MEP	GOVT	100	200	300	400	500
165	Maritime Administration	45	CG-PSS	GOVT	100	200	300	400	500
230	Maritime Administration	45	CG-RA	GOVT	100	200	300	400	500
92	U.S. Coast Guard	79	CG-IO	GOVT	100	200	300	400	500
341	U. S. Coast Guard	79	M-SBLDG	GOVT	100	200	300	400	500
342	U. S. Coast Guard	79	M-SHIPG	GOVT	100	200	300	400	500
343	U. S. Coast Guard	79	M-SHCON	GOVT	100	200	300	400	500
344	U. S. Coast Guard	79	M-MSCI	GOVT	100	200	300	400	500
345	U. S. Coast Guard	79	M-NAV&C	GOVT	100	200	300	400	500
346	U. S. Coast Guard	79	M-PORTS	GOVT	100	200	300	400	500
347	U.S. Coast Guard	79	M-NPROP	GOVT	100	200	300	400	500
348	U. S. Coast Guard	79	M-ADSYS	GOVT	100	200	300	400	500
349	U. S. Coast Guard	79	M-CHAND	GOVT	100	200	300	400	500
443	Boston Shipping Authority	221	M-PORTS	GOVT	100	200	300	400	500
444	Boston Shipping Authority	221	M-EN&EV	GOVT	100	200	300	400	500
445	Boston Shipping Authority	221	M-CHAND	GOVT	100	200	300	400	500
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS	INTL	100	200	300	400	500
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS	INTL	100	200	300	400	500
378	Intergovernmental Maritime Consultative Organization	57	M-SBLDG	INTL	100	200	300	400	500
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG	INTL	100	200	300	400	500
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C	INTL	100	200	300	400	500
381	Intergovernmental Maritime Consultative Organization	57	M-NPROP	INTL	100	200	300	400	500
382	Intergovernmental Maritime Consultative Organization	57	M-EN&EV	INTL	100	200	300	400	500
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG	INTL	100	200	300	400	500
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG	INTL	100	200	300	400	500
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS	INTL	100	200	300	400	500
16	Commercial Vessel Operators, U. S. and foreign	18	CG-AN	COML	120	200	300	400	500
64	Maritime Commerce (Owners, Operators, Shippers, Carriers, Agents)	18	CG-CVS	COML	120	200	300	400	500
138	Merchant Shipping Industry	18	CG-MEP	COML	120	200	300	400	500
216	Commercial Cargo Vessel & Dry Cargo Barge Industry	18	CG-PSS	COML	120	200	300	400	500
317	Maritime Industry	18	CG-SAR	COML	120	200	300	400	500
324	Merchant Vessels (U.S.)	18	CG-GAC	COML	120	200	300	400	500
404	U. S. Flag shipowners, operators and/or agents	18	M-SHIPG	COML	120	200	300	400	500
405	U. S. Flag shipowners, operators and/or agents	18	M-SHCON	COML	120	200	300	400	500
406	U. S. Flag shipowners, operators and/or agents	18	M-NAV&C	COML	120	200	300	400	500
407	U. S. Flag shipowners, operators and/or agents	18	M-PORTS	COML	120	200	300	400	500
408	U. S. Flag shipowners, operators and/or agents	18	M-MARKA	COML	120	200	300	400	500
409	U. S. Flag shipowners, operators and/or agents	18	M-CAORF	COML	120	200	300	400	500
446	Council of American Flag Ship Operators	18	M-SHIPG	COML	120	200	300	400	500
447	Council of North Atlantic Shipping Association	18	M-SHIPG	COML	120	200	300	400	500
216	Terminal Operators (Port Authorities, Private Owners, Stevedoring Companies)	145	CG-PSS	COML	120	200	300	400	500

ENVIRONMENTAL, SAFETY, LEGAL CONSTRAINTS GENERAL (500)

388	National Maritime Council	210	M-SBLDG	COML	120	200	300	400	500
389	National Maritime Council	210	M-SHIPG	COML	120	200	300	400	500
509	Transportation Institute	241	M-SHIPG	COML	120	200	300	400	500
510	Transportation Institute	241	M-SHCON	COML	120	200	300	400	500
511	Transportation Institute	241	M-MSCI	COML	120	200	300	400	500
512	Transportation Institute	241	M-NAV&C	COML	120	200	300	400	500
513	Transportation Institute	241	M-EN&EV	COML	120	200	300	400	500
514	Transportation Institute	241	M-ADSYS	COML	120	200	300	400	500
515	Transportation Institute	241	M-CAORF	COML	120	200	300	400	500
221	Mariners (Commercial Operators)	18	CG-PSS	PERS	120	200	300	400	500
429	Council of American Master Mariners, Inc.	18	M-SHIPG	PERS	120	200	300	400	500
430	Council of American Master Mariners, Inc.	18	M-NAV&C	PERS	120	200	300	400	500
431	Council of American Master Mariners, Inc.	18	M-PORTS	PERS	120	200	300	400	500
363	North Atlantic Treaty Organization	209	M-SHIPG	INTL	150	200	300	400	500
364	North Atlantic Treaty Organization	209	M-PORTS	INTL	150	200	300	400	500
365	North Atlantic Treaty Organization	209	M-CHAND	INTL	150	200	300	400	500
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA	GOVT	100	220	300	400	500
219	Oil Transfer Facility Industry	146	CG-PSS	COML	100	240	300	400	500
11	American Transport Association	11	CG-AN	COML	120	250	300	400	500
507	Tanker Service Committee, Inc.	240	M-SHIPG	COML	131	260	300	400	500
508	Tanker Service Committee, Inc.	240	M-PORTS	COML	131	260	300	400	500
112	Petroleum Industry	95	CG-IO	MFG	100	270	300	400	500
125	American Petroleum Institute	95	CG-MEP	MFG	100	270	300	400	500
137	Petroleum Industry	95	CG-MEP	MFG	100	270	300	400	500
224	Petroleum Industry	95	CG-PSS	MFG	100	270	300	400	500
10	American Institute of Merchant Shipping	10	CG-AN	COML	120	200	310	400	500
60	American Institute of Merchant Shipping	10	CG-CVS	COML	120	200	310	400	500
126	American Institute of Merchant Shipping	10	CG-MEP	COML	120	200	310	400	500
204	American Institute of Merchant Shipping	10	CG-PSS	COML	120	200	310	400	500
257	American Institute of Merchant Shipping	10	CG-RA	COML	120	200	310	400	500
402	American Institute of Merchant Shipping	10	M-SHIPG	COML	120	200	310	400	500
403	American Institute of Merchant Shipping	10	M-MARKA	COML	120	200	310	400	500
448	Federation of American Controlled Shipping	224	M-SHIPG	COML	120	200	310	400	500
449	Federation of American Controlled Shipping	224	M-PORTS	COML	120	200	310	400	500
450	Federation of American Controlled Shipping	224	M-CHAND	COML	120	200	310	400	500
263	American Merchant Marine Institute	165	CG-RA	COML	100	200	320	400	500
150	Electronics and ordnance equipment manufacturers	115	CG-MO	MFG	100	200	320	400	500
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP	MFG	100	200	320	400	500
267	Electronic Industry Association	115	CG-RA	MFG	100	200	320	400	500
264	Institute of Electrical and Electronic Engineers	166	CG-RA	MFG	100	200	320	400	500
266	American Radio Relay League	47	CG-RA	PRIV	100	200	320	400	500
260	American Museum of Natural History	164	CG-RA	PRIV	100	200	320	400	500
97	Academic and Scientific Communities	83	CG-IO	PRIV	160	200	320	400	500
148	Academic Community	83	CG-MO	PRIV	160	200	320	400	500
158	Academic Community	83	CG-MP	PRIV	160	200	320	400	500
179	Academic and Scientific Communities	83	CG-MSA	PRIV	160	200	320	400	500
107	Various Chambers of Commerce	90	CG-IO	COML	120		330	400	500
105	Dominion Marine Association (Canada)	68	CG-IO	COML	120	200	330	400	500
106	International Association of Great Lakes Ports	89	CG-IO	INTL	120	200	330	400	500

ENVIRONMENTAL, SAFETY, LEGAL CONSTRAINTS GENERAL (500)

160	Committee on International Ocean Affairs (CIOA)	127	CG-MSA	INTL	100	210	340	400	500
164	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	127	CG-MSA	INTL	100	210	340	400	500
163	Ocean Affairs Board (OAB)	127	CG-MSA	PRIV	100	210	340	400	500
96	Arctic Institute of North America	82	CG-IO	PRIV	120	200	360	400	500
178	Arctic Institute of North America	82	CG-MSA	PRIV	120	200	360	400	500
139	Barge Industry	109	CG-MEP	COML	130	210	360	400	500
217	Tank Vessel and Tank Barge Industry	109	CG-PSS	MFG	130	210	360	400	500
149	Shipbuilders	63	CG-MO	MFG	120		320	421	500
498	Shipbuilders Council of America	63	M-SBLDG	MFG	120		320	421	500
499	Shipbuilders Council of America	63	M-MACHY	MFG	120		320	421	500
500	Shipbuilders Council of America	63	M-NPROP	MFG	120		320	421	500
501	Shipbuilders Council of America	63	M-ADSYS	MFG	120		320	421	500
502	Shipbuilders Council of America	63	M-CHAND	MFG	120		320	421	500
464	Marine Towing and Transportation Employers Association	228	M-SHIPG	PERS	120	260	310	440	500
465	Marine Towing and Transportation Employers Association	228	M-PORTS	PERS	120	260	310	440	500

510 Water Pollution Control

511 Deballasting/Tank Cleaning and Stripping
512 Port/Terminal Waste Transfer, Storage, Disposal
513 Oil Spill Prevention and Abatement
514 Ocean Dumping

34	Federal, State and Local Agencies	91	CG-BA	GOVT	170				510
108	State/Local governments	91	CG-IO	GOVT	170				510
147	State/Local Governments (Civil emergency, law enforcement agencies)	91	CG-MO	GOVT	170				510
157	State/Local Governments (Civil Emergency Agencies, Law Enforcement Agencies)	91	CG-MP	GOVT	170				510
214	State Governments (Legislatures, Regulatory Agencies, Boating Administrations)	91	CG-PSS	GOVT	170				510
215	Local Governments (Port Authorities, Law Enforcement Agencies, Fire Departments)	91	CG-PSS	GOVT	170				510
162	Interagency Ocean Disposal Program Coordinating Committee (IODPCC)	129	CG-MSA	GOVT	180				510
131	National Wildlife Federation	104	CG-MEP	PRIV	180				510
269	Wild Goose Association	170	CG-RA	PRIV	180				510
9	National Aeronautics and Space Administration	9	CG-AN	GOVT	110	220			510
93	National Aeronautics and Space Administration	9	CG-IO	GOVT	110	220			510
250	National Aeronautics and Space Administration	9	CG-RA	GOVT	110	220			510
546	National Aeronautics and Space Administration	9	M-NAV&C	GOVT	110	220			510
176	American Oceanographic Association	125	CG-MSA	PRIV	160	220			510
266	Interagency Committee on Oceanography	125	CG-RA	GOVT	160	230			510
90	Bureau of Land Management	77	CG-IO	GOVT	110			400	510
170	Interagency Committee for Marine Environmental Protection	119	CG-MSA	GOVT	160	220		400	510
442	Boston Shipping Authority	221	M-SHIPG	GOVT	100	200	300	400	510
128	Sierra Club	101	CG-MEP	PRIV	180	200	300	400	510
129	Friends of the Earth	102	CG-MEP	PRIV	180	200	300	400	510
130	Environmental Defense Fund	103	CG-MEP	PRIV	180	200	300	400	510
140	Conservationists	110	CG-MEP	PRIV	180	200	300	400	510
124	Federal Maritime Commission	99	CG-MEP	GOVT	120	250		410	510
198	Federal Maritime Commission	99	CG-PSS	GOVT	120	250		410	510
363	Federal Maritime Commission	99	M-SHIPG	GOVT	120	250		410	510
66	Offshore Petroleum and Mineral Industry	61	CG-CVS	MFG	110	210	340	410	510
70	Ship and Boat Yards	63	CG-CVS	MFG	120		320	421	510
159	Shipbuilders	63	CG-MP	MFG	120		320	421	510

520 Air Pollution Control

171	Interagency Committee for Meteorological Services	117	CG-MSA	GOVT	160	220			520
172	Interagency Committee for World Weather Program	117	CG-MSA	GOVT	160	220			520
161	Federal Committee for Meteorological Services and Supporting Research (FCMSSR)	117	CG-MSA	GOVT	160	220			520

530 Hazardous Material Handling

194	Materials Transportation Bureau	143	CG-PSS	GOVT	120			400	530
245	Federal Highway Administration	156	CG-RA	GOVT	120			410	530
253	Nuclear Regulatory Commission	160	CG-RA	GOVT	112	260	323	420	530

376	Nuclear Regulatory Commission	530 Hazardous Material Handling	160	M-PORTS	GOVT	112	260	323	420	530
377	Nuclear Regulatory Commission		160	M-NPROP	GOVT	112	260	323	420	530
290	International Council of Marine Industry Association		182	CG-RBS	INTL	100				540
210	National Transportation Safety Board		141	CG-PSS	GOVT	120				540
26	State University Marine Research Organizations		26	CG-AN	PRIV	160				540
301	National Marine Distributors Association		191	CG-RBS	COML	170				540
297	National Association of State Boating Law Administrators		91	CG-RBS	GOVT	170				540
265	American Boat Builders and Repair Association		181	CG-RBS	MFG	170				540
299	National Association of Engine and Boat Manufacturers		189	CG-RBS	MFG	170				540
302	Boating Industry Association		192	CG-RBS	MFG	170				540
280	National Safety Council		176	CG-RBS	PRIV	170				540
296	National Safety Council		176	CG-RBS	PRIV	170				540
334	National Safety Council		176	CG-GAS	PRIV	170				540
261	YMCA		177	CG-RBS	PRIV	170				540
335	American Red Cross		178	CG-GAS	PRIV	170				540
291	Allied Boating Association of Canada		183	CG-RBS	PRIV	170				540
300	Boat Owners Association of the United States		190	CG-RBS	PRIV	170				540
303	National Safe Boating Committee, Inc.		193	CG-RBS	PRIV	170				540
304	North American Yacht Racing Union		194	CG-RBS	PRIV	170				540
308	National Water Safety Congress		195	CG-RBS	PRIV	170				540
470	International Maritime Satellite Preparatory Committee		230	M-SHIPG	INTL	100	200			540
471	International Maritime Satellite Preparatory Committee		230	M-NAV&C	INTL	100	200			540
318	Commercial Aviation		198	CG-SAR	COML	120	220			540
322	Foreign Aircraft		198	CG-SAR	COML	120	220			540
329	Commercial Aircraft		198	CG-GAC	COML	120	220			540
275	Department of Defense Special Services		174	CG-RBS	GOVT	170	220			540
222	Recreational Boaters		25	CG-PSS	PERS	170	220			540
14	U. S. Coast Guard Auxiliary		14	CG-AN	PRIV	170	220			540
270	U.S. Coast Guard Auxiliary		14	CG-RBS	PRIV	170	220			540
313	U.S. Coast Guard Auxiliary		14	CG-SAR	PRIV	170	220			540
15	U. S. Power Squadron		15	CG-AN	PRIV	170	220			540
259	U.S. Power Squadron		15	CG-RA	PRIV	170	220			540
273	U.S. Power Squadron		15	CG-RBS	PRIV	170	220			540
16	Cruising Club of America		16	CG-AN	PRIV	170	220			540
17	Storm and Trysail Club		17	CG-AN	PRIV	170	220			540
24	Fishermen, recreational		24	CG-AN	PRIV	170	220			540
115	Fishermen (Recreational)		24	CG-IO	PRIV	170	220			540
226	Fishermen, Recreational		24	CG-PSS	PRIV	170	220			540
316	Fishermen, Recreational		24	CG-SAR	PRIV	170	220			540
540	Fishermen, Recreational		24	CG-ELT	PRIV	170	220			540
25	Recreational boaters (marinas, yacht clubs, individuals)		25	CG-AN	PRIV	170	220			540
36	Marinas		25	CG-BA	PRIV	170	220			540
77	Recreational Boaters		25	CG-CVS	PRIV	170	220			540
305	Various recreational boaters (yacht clubs, associations, individuals)		25	CG-RBS	PRIV	170	220			540
314	Recreational Boaters		25	CG-SAR	PRIV	170	220			540
330	Recreational Boatmen		25	CG-GAC	PRIV	170	220			540
35	Private citizens		35	CG-BA	PRIV	170	220			540
332	Military and Civilian Coast Guard Personnel as Individuals		35	CG-GAP	PRIV	170	220			540
51	Boy Scouts		49	CG-CVS	PRIV	170	220			540

52	**Sea Scouts**	49	CG-CVS	PRIV	170	220			540
276	**Boy Scouts of America**	49	CG-RBS	PRIV	170	220			540
278	Girl Scouts of America	49	CG-RBS	PRIV	170	220			540
309	National Scouting Organization	49	CG-RBS	PRIV	170	220			540
310	Naval Sea Cadet Corps	49	CG-RBS	PRIV	170	220			540
135	American Boat and Yacht Council	107	CG-MEP	PRIV	170	220			540
262	American Boat and Yacht Council	107	CG-RBS	PRIV	170	220			540
271	American Water Ski Association	171	CG-RBS	PRIV	170	220			540
272	National Boating Federation	172	CG-RBS	PRIV	170	220			540
274	American Alliance for Health, Physical Ed. & Recreation	173	CG-RBS	PRIV	170	220			540
284	American Power Boat Association	180	CG-RBS	PRIV	170	220			540
298	Boating Safety Advisory Council	188	CG-RBS	PRIV	170	220			540
319	General Aviation	199	CG-SAR	PRIV	170	220			540
320	Civil Air Patrol	200	CG-SAR	PRIV	170	220			540
223	Public Vessels	147	CG-PSS	GOVT	100	200	300		540
81	Brokers and Mortgagees (Lending and Holding Institutions)	72	CG-CVS	COML	120	270	310		540
5	U.S. Navy	5	CG-AN	GOVT	150	200	320		540
65	U.S. Navy	5	CG-IO	GOVT	150	200	320		540
118	U.S. Navy	5	CG-MEP	GOVT	150	200	320		540
152	U.S. Navy	5	CG-MP	GOVT	150	200	320		540
167	U.S. Navy	5	CG-PSS	GOVT	150	200	320		540
237	U.S. Navy	5	CG-RA	GOVT	150	200	320		540
311	U.S. Navy	5	CG-SAR	GOVT	150	200	320		540
337	U.S. Navy	5	CG-GAS	GOVT	150	200	320		540
353	U.S. Navy	5	M-SBLDG	GOVT	150	200	320		540
354	U.S. Navy	5	M-SHIPG	GOVT	150	200	320		540
355	U.S. Navy	5	M-MSCI	GOVT	150	200	320		540
356	U.S. Navy	5	M-EN&EV	GOVT	150	200	320		540
357	U.S. Navy	5	M-ADSYS	GOVT	150	200	320		540
358	U.S. Navy	5	M-CHAND	GOVT	150	200	320		540
162	U.S. Navy	5	CG-MSA	GOVT	160	200	320		540
44	Tennessee Valley Authority	43	CG-BA	GOVT			330		540
39	National and Local Association of Port Authorities	21	CG-BA	COML	100	211	330		540
205	American Association of Port Authorities	21	CG-PSS	COML	100	211	330		540
435	American Association of Port Authorities	21	M-SHIPG	COML	100	211	330		540
436	American Association of Port Authorities	21	M-PORTS	COML	100	211	330		540
437	American Association of Port Authorities	21	M-CHAND	COML	100	211	330		540
21	Port Authorities	21	CG-AN	GOVT	100	211	330		540
65	State/Local Port Authorities	21	CG-CVS	GOVT	100	211	330		540
40	Industrial Development Commissions	39	CG-BA	MFG	100	211	330		540
331	State Port Authorities	21	CG-GAC	PRIV	100	211	330		540
55	Seafarers International Union	53	CG-CVS	PERS	120	200	340		540
58	Lake Carriers Pilotage Association	55	CG-CVS	PERS	120	200	340		540
20	Pilot Associations	20	CG-AN	PERS	120	210	340		540
57	American Pilots Association	20	CG-CVS	PERS	120	210	340		540
200	National Pilot Association	20	CG-PSS	PERS	120	210	340		540
206	American Pilots Association	20	CG-PSS	PERS	120	210	340		540
262	American Pilots Association	20	CG-RA	PERS	120	210	340		540
516	American Pilots Association	20	M-SHIPG	PERS	120	210	340		540

540 Safety

517	American Pilots Association	20	M-SHCON	PERS	120	210	340		540
516	American Pilots Association	20	M-PORTS	PERS	120	210	340		540
29	City and County Governments	29	CG-BA	GOVT	120			400	540
47	Department of Defense	206	CG-CVS	GOVT	150	250		400	540
74	Chemical Industry	66	CG-CVS	MFG	130	270		400	540
113	Chemical Industry	66	CG-IO	MFG	130	270		400	540
225	Chemical Industry	66	CG-PSS	MFG	130	270		400	540
32	Commercial Water Transportation Firms	18	CG-BA	COML	120	200	300	400	540
33	Shippers	18	CG-BA	COML	120	200	300	400	540
59	American Bureau of Shipping	56	CG-CVS	COML	120	200	300	400	540
400	American Bureau of Shipping	56	M-SHIPG	COML	120	200	300	400	540
401	American Bureau of Shipping	56	M-MARKA	COML	120	200	300	400	540
390	National Maritime Council	210	M-SHCON	COML	120	200	300	400	540
391	National Maritime Council	210	M-PORTS	COML	120	200	300	400	540
392	National Maritime Council	210	M-MARKA	COML	120	200	300	400	540
393	National Maritime Council	210	M-CHAND	COML	120	200	300	400	540
133	International Association of Passenger Liners	106	CG-MEP	INTL	120	200	300	400	540
251	Department of Energy	159	CG-RA	GOVT	110	240	323	400	540
360	Department of Energy	159	M-PORTS	GOVT	110	240	323	400	540
361	Department of Energy	159	M-NPROP	GOVT	110	240	323	400	540
362	Department of Energy	159	M-EN&EV	GOVT	110	240	323	400	540
12	Lake Carriers Association	12	CG-AN	COML	120	200	330	400	540
104	Lake Carriers Association	12	CG-IO	COML	120	200	330	400	540
202	(Great) Lake Carriers Association	12	CG-PSS	COML	120	200	330	400	540
459	Lake Carriers Association	12	M-SHIPG	COML	120	200	330	400	540
460	Lake Carriers Association	12	M-PORTS	COML	120	200	330	400	540
461	Lake Carriers Association	12	M-CHAND	COML	120	200	330	400	540
27	State Marine Organizations	27	CG-AN	GOVT	120	200	330	400	540
43	American Waterways Operators, Inc.	42	CG-BA	COML	120	210	330	400	540
436	American Waterways Operators, Inc.	42	M-SHIPG	COML	120	210	330	400	540
439	American Waterways Operators, Inc.	42	M-NAV&C	COML	120	210	330	400	540
440	American Waterways Operators, Inc.	42	M-PORTS	COML	120	210	330	400	540
441	American Waterways Operators, Inc.	42	M-CHAND	COML	120	210	330	400	540
61	American Waterways Operators, Inc.	42	CG-CVS	PERS	120	210	330	400	540
127	American Waterways Operators, Inc.	42	CG-MEP	PERS	120	210	330	400	540
212	American Waterways Operators, Inc.	42	CG-PSS	PERS	120	210	330	400	540
45	The Waterways Journal	44	CG-BA	PRIV	120	210	330	400	540
109	Coal Industry	92	CG-IO	MFG	130	270	330	400	540
110	Steel Industry	93	CG-IO	MFG	130	270	330	400	540
111	Stone and Cement Industry	94	CG-IO	MFG	130	270	330	400	540
56	Masters, Mates and Pilots Association	54	CG-CVS	PERS	120	200	340	400	540
102	Masters, Mates and Pilots Association	54	CG-IO	PERS	120	200	340	400	540
201	Masters, Mates and Pilots Association	54	CG-PSS	PERS	120	200	340	400	540
220	Pilot Associations and Masters	54	CG-PSS	PERS	120	200	340	400	540
22	Insurance Industry	22	CG-AN	COML	120	210	340	400	540
63	Lloyds of London	22	CG-CVS	COML	120	210	340	400	540
71	Insurance and Hull Underwriters	22	CG-CVS	COML	120	210	340	400	540
134	American Institute of Marine Underwriters	22	CG-MEP	COML	120	210	340	400	540
141	Insurance Industry	22	CG-MEP	COML	120	210	340	400	540

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226	Insurance Industry	22	CG-PSS	COML	120	210	340	400	540
306	The Insurance Industry	22	CG-RBS	COML	120	210	340	400	540
266	American Institute of Marine Underwriters	22	CG-RBS	MFG	120	210	340	400	540
76	Commercial Diving Industry (Underwater Vessel Owners and Operators)	69	CG-CVS	COML	110	210	354	400	540
31	Railroad Companies	31	CG-BA	COML	120		360	400	540
36	American Association of Railroads (AAR)	37	CG-BA	COML	120		360	400	540
144	Department of Transportation	112	CG-MO	GOVT	120	230		410	540
154	Department of Transportation	112	CG-MP	GOVT	120	230		410	540
41	National Water Resources Council	40	CG-BA	GOVT	120	212	330	410	540
66	Foreign Commercial Vessels	59	CG-CVS	COML	120	200	300	420	540
321	Foreign Merchant Vessels	59	CG-SAR	COML	120	200	300	420	540
325	Merchant Vessels (foreign)	59	CG-GAC	COML	120	200	300	420	540
294	International Standards Organization	70	CG-RBS	INTL	120		320	420	540
79	Standardization and Technical Societies	70	CG-CVS	MFG	120		320	420	540
287	American National Standards Institute	70	CG-RBS	MFG	120		320	420	540
292	Canadian Standards Association Testing Laboratories	70	CG-RBS	MFG	120		320	420	540
295	Society of Automotive Engineers	70	CG-RBS	MFG	120		320	420	540
365	American Society of Testing Materials	70	M-SBLDG	MFG	120		320	420	540
366	American Society of Testing Materials	70	M-MACHY	MFG	120		320	420	540
366	American Society of Testing Materials	70	M-CHAND	MFG	120		320	420	540
367	American Society of Testing Materials	207	M-NPROP	MFG	120		320	420	540
6	Military Sealift Command	6	CG-AN	GOVT	150	200	330	420	540
238	Military Sealift Command	6	CG-RA	GOVT	150	200	330	420	540
543	Military Sealift Command	6	M-SHIPG	GOVT	150	200	330	420	540
544	Military Sealift Command	6	M-SHCON	GOVT	150	200	330	420	540
545	Military Sealift Command	6	M-CHAND	GOVT	150	200	330	420	540
23	Fishermen, commercial	23	CG-AN	COML	114	210		421	540
114	Fishermen (Commercial)	23	CG-IO	COML	114	210		421	540
227	Fishermen, Commercial	23	CG-PSS	COML	114	210		421	540
315	Fishermen, Commercial	23	CG-SAR	COML	114	210		421	540
326	Fishing Vessels (U.S. and Foreign)	23	CG-GAC	COML	114	210		421	540
539	Fishermen, Commercial	23	CG-ELT	COML	114	210		421	540
541	International Pacific Halibut Commission	251	CG-ELT	INTL	114	210		421	540
542	Sockeye Salmon Commission	252	CG-ELT	INTL	114	210		421	540
50	Underwriter's Laboratory	46	CG-CVS	MFG	120	210	300	421	540
80	Naval Architects and Marine Engineers	46	CG-CVS	MFG	120	210	300	421	540
266	Society of Naval Architects and Marine Engineers	46	CG-RBS	MFG	120	210	300	421	540
269	Underwriter's Laboratory	46	CG-RBS	MFG	120	210	300	421	540
519	Society of Naval Architects and Marine Engineers	48	M-SBLDG	MFG	120	210	300	421	540
520	Society of Naval Architects and Marine Engineers	46	M-SHCON	MFG	120	210	300	421	540
521	Society of Naval Architects and Marine Engineers	48	M-MACHY	MFG	120	210	300	421	540
522	Society of Naval Architects and Marine Engineers	46	M-NPROP	MFG	120	210	300	421	540
523	Society of Naval Architects and Marine Engineers	48	M-ADSYS	MFG	120	210	300	421	540
524	Society of Naval Architects and Marine Engineers	46	M-CHAND	MFG	120	210	300	421	540
42	Towing Industry Advisory Committee	41	CG-BA	COML	120	210	330	430	540
75	Passengers on Waterborne Vessels	67	CG-CVS	PRIV	120	210	330	430	540
116	Transportation (Commuters)	67	CG-IO	PRIV	120	210	330	430	540
327	Harbor and River Tugboats	202	CG-GAC	COML	120	200	340	430	540
83	International Safety and Security Organizations	74	CG-CVS	INTL	120	210	340	430	540

1	U. S. Forest Service	1	CG-AN	GOVT	180				543
13	Institute of Navigation	13	CG-AN	PRIV	120	210			543
261	Institute of Navigation	13	CG-RA	PRIV	120	210			543
526	Drug Enforcement Administration	2	CG-ELT	GOVT	110	220	300		543
525	National Oceanic and Atmospheric Administration	242	CG-ELT	GOVT	110	220	300		543
2	National Oceanic and Atmospheric Administration	2	CG-AN	GOVT	110	220	332		543
88	National Oceanic and Atmospheric Administration	2	CG-IO	GOVT	110	220	332		543
161	National Oceanic and Atmospheric Administration	2	CG-MSA	GOVT	110	220	332		543
186	National Oceanic and Atmospheric Administration	2	CG-PSS	GOVT	110	220	332		543
279	National Oceanic and Atmospheric Administration	2	CG-RBS	GOVT	110	220	332		543
350	National Oceanic and Atmospheric Administration	2	M-SBLDG	GOVT	110	220	332		543
351	National Oceanic and Atmospheric Administration	2	M-MSCI	GOVT	110	220	332		543
352	National Oceanic and Atmospheric Administration	2	M-EN&EV	GOVT	110	220	332		543
91	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
100	St. Lawrence Seaway Development Corporation	78	CG-IO	GOVT	120	212	330	410	543
193	St. Lawrence Seaway Development Corporation	78	CG-PSS	GOVT	120	212	330	410	543
246	St. Lawrence Seaway Development Corporation	78	CG-RA	GOVT	120	212	330	410	543
103	St. Lawrence Seaway Authority (Canada)	87	CG-IO	GOVT	120	212	330	410	543
28	State Highway Departments	28	CG-BA	GOVT	120		335	410	543
30	Public Bridge Authorities and Commissions	30	CG-BA	GOVT	120		335	410	543
37	Association of State Highway Officials (ASHO)	36	CG-BA	PRIV	120		335	410	543
87	Defense Mapping Agency	75	CG-IO	GOVT	161	210		430	543
164	Defense Mapping Agency	75	CG-MSA	GOVT	161	210		430	543
240	Defense Mapping Agency	75	CG-RA	GOVT	161	210		430	543
89	U.S. Geological Survey	76	CG-IO	GOVT	161	210		430	543
165	U.S. Geological Survey	76	CG-MSA	GOVT	161	210		430	543
283	National Association of Marine Surveyors	179	CG-RBS	COML	161	210	330	430	543
99	U.S. Army Corps of Engineers	85	CG-IO	GOVT	150	211	330	430	543
120	Corps of Engineers	85	CG-MEP	GOVT	150	211	330	430	543
189	Corps of Engineers	85	CG-PSS	GOVT	150	211	330	430	543
277	Corps of Engineers	85	CG-RBS	GOVT	150	211	330	430	543
48	Occupational Safety and Health Administration	46	CG-CVS	GOVT					547
333	Occupational Safety and Health Administration	46	CG-GAS	GOVT					547
417	American Shipyard Unions	214	M-SBLDG	PERS	100		320		547
418	American Shipyard Unions	214	M-MACHY	PERS	100		320		547
340	Department of Labor	205	CG-GAS	GOVT		260		440	547
76	Maritime Training Institutions	68	CG-CVS	PERS		260		440	547
53	International Labor Organization	51	CG-CVS	PERS	120	260		440	547
54	National Maritime Union	52	CG-CVS	PERS	120	260		440	547
69	Maritime Labor Organizations	52	CG-CVS	PERS	120	260		440	547
422	Labor Organizations	52	M-SBLDG	PERS	120	260		440	547
423	Labor Organizations	52	M-SHIPG	PERS	120	260		440	547
424	Labor Organizations	52	M-SHCON	PERS	120	260		440	547
425	Labor Organizations	52	M-PORTS	PERS	120	260		440	547
426	Labor Organizations	52	M-MACHY	PERS	120	260		440	547
427	Labor Organizations	52	M-NPROP	PERS	120	260		440	547
428	Labor Organizations	52	M-CHAND	PERS	120	260		440	547
211	Seamens Union of the Pacific	53	CG-PSS	PERS	120	260		440	547
410	American Seafaring Unions	53	M-SHIPG	PERS	120	260		440	547

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- **541 Intra-Ship (Ship Operating Standards)**
- **542 Inter-Ship**
- **543 Land-Ship**
- **544 Shipborne Cargo**
- **545 Cargo Transfer**
- **546 Terminal Storage**
- **547 Personnel**

547 Personnel

560 Maritime Law Enforcement

561 Customs and Smuggling
562 Admiralty Law
565 Piracy, Barratry, Hijacking

411	American Seafaring Unions	53	M-SHCON	PERS	120	260		440	547
412	American Seafaring Unions	53	M-ADSYS	PERS	120	260		440	547
413	American Seafaring Unions	53	M-CAORF	PERS	120	260		440	547
414	American Seafaring Unions	53	M-CHAND	PERS	120	260		440	547
419	American Independent Tanker Unions	53	M-SBLDG	PERS	120	260		440	547
420	American Independent Tanker Unions	53	M-PORTS	PERS	120	260		440	547
421	American Independent Tanker Unions	53	M-MACHY	PERS	120	260		440	547
432	United Seamen's Service, Inc.	53	M-SHIPG	PERS	120	260		440	547
433	United Seamen's Service, Inc.	53	M-PORTS	PERS	120	260		440	547
434	United Seamen's Service, Inc.	53	M-CHAND	PERS	120	260		440	547
67	Merchant Seamen	60	CG-CVS	PERS	120	260		440	547
454	Labor-Management Maritime Committee	226	M-SBLDG	PERS	100	260	310	440	547
455	Labor-Management Maritime Committee	226	M-SHIPG	PERS	100	260	310	440	547
456	Labor-Management Maritime Committee	226	M-SHCON	PERS	100	260	310	440	547
457	Labor-Management Maritime Committee	226	M-PORTS	PERS	100	260	310	440	547
458	Labor-Management Maritime Committee	226	M-CHAND	PERS	100	260	310	440	547
123	Department of Justice	98	CG-MEP	GOVT					560
191	Federal Bureau of Investigation	133	CG-PSS	GOVT					560
241	Department of Justice	154	CG-RA	GOVT					560
530	Internal Revenue Service	244	CG-ELT	GOVT	120				560
532	Bereau of Alcohol, Tobacco and Firearms	245	CG-ELT	GOVT	120				560
527	U.S. Attorney's Office	243	CG-ELT	GOVT	120	200			560
533	Inter-American Tuna Commission	246	CG-ELT	INTL	114	210			560
534	Internation Commission for the Conservation of Atlantic Tuna	247	CG-ELT	INTL	114	210			560
535	International North Pacific Fisheries Commission	248	CG-ELT	INTL	114	210			560
536	International Whaling Commission	249	CG-ELT	INTL	180	210			560
537	North Pacific Fur Seal Commission	250	CG-ELT	INTL	180	210			560
531	U.S. Customs Service	135	CG-ELT	GOVT	120		311	400	560
195	U.S. Customs Service	135	CG-PSS	GOVT	180		311	400	560
192	Immigration and Naturalization Service	134	CG-PSS	GOVT		260		440	561
528	Immigration and Naturalization Service	134	CG-ELT	GOVT		260		440	561

APPENDIX B

PARAMETER GENERATION WORKSHOP RESULTS

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Table B-1 Candidate Parameter Listing

Table B-2 Candidate Parameter Classifications

Table B-3 Tentative Parameter Selection List

Figure B-1 Distribution of Candidate Parameter Scores vs Ranks Combined Marad/CG Responses

Table B-4 Final Parameter Selection List

TABLE B-1

CANDIDATE PARAMETER LISTING

The enclosed listing represents the output of the Workshop in nearly verbatim form. These elements (nucleus parameters, trends and events) have been reviewed, categorized and sorted three times (by the "SRT" field) in order to group similar elements. Grouped elements will facilitate identification of candidate parameters, trends and events to be used in the study.

The following is a key to the headings found in this appendix.

No.	Unique Record Number
SET	Broad Area of Concern. Complete listings are given in Table 2-2 and Appendix A.
C	A preliminary sorting/aggregating code. Disregard.
SRT	Candidate parameter classification number (used to group similar items).

NO.	SET	C	SRT	TEXT
634	100	A	10	EXPANDED USE OF MARINE ENVIRONMENT
55	100	P	10	Increased underwater activity.
56	100	P	10	More underwater pipelines.
78	100	P	10	Conflicts between recreational and commercial usage.
80	100	P	10	Conflicts between extractive and shipping industries.
81	100	P	10	Conflicts between fishing and extractive or shipping industries.
96	100	P	10	Marking of minor obstructions: off-shore lobstering fixed gear, anchor buoys for exploratory oil rigs, etc.).
115	100	P	10	Density of personnel on, above, or under the ocean surface.
146	100	P	10	Management of conflicting uses of the ocean.
148	100	P	10	Conflict of shipping lanes on fishing areas.
14	100	S	10	Overall consideration - merging of CG, NOAA, MARAD, Marine Functions of EPA into one Dept. - Consolidation of effort with less cross-Dept. quarreling and duplication of expense and manpower to achieve consistent goals.
135	100	S	10	Gradual expansion of economic zone.
113	100	S	10	Configuration & location of undersea habitats.
144	100	S	10	Land reclamation.
145	100	S	10	Submarine cable and pipeline usage.
169	100	S	10	National policy.
635	100	A	20	EXPANSION INTO ICY WATERS
57	110	P	20	Exploration of resources in icy waters - Arctic, Antarctic.
252	121	P	20	Operation of surface ships in arctic environments.
61	210	P	20	Possible increase in convoys in ice-infested waters.
210	210	P	20	New icebreaking techniques, especially in confined harbors, rivers, and canals.
139	121	R	20	Feasibility of northwest passage for all vessel types.
7	121	S	20	Polar routes, especially around the Arctic, will increase as our knowledge of ice technology increases.
127	121	S	20	Polar commercial operations.
196	212	S	20	Year-round use of Great Lakes domestic waterways.
636	100	A	30	INTERNATIONAL ORGANIZATIONS AND CONCERNS
136	100	P	30	International management or control of activities by conflicting users.
151	100	P	30	International agreements through IMCO are necessary for world-wide uniformity.
153	100	P	30	Increased authority of international organizations (UN & specialized organizations) over ocean activities.
154	100	P	30	International exchange of data.

NO.	SET	C	SRT	TEXT
26	100	S	30	International LOS.
171	100	S	30	Law of the Sea results.
574	100	T	30	Phenomenon of "boat people" spreads to other parts of world; numbers head for U.S. from Caribbean, some South American countries.
637	110	A	40	ECONOMIC AND POLITICAL STIMULATION OF OFFSHORE RESOURCE DEVELOPMENT
165	110	P	40	Cost of at-sea processing vs. land processing.
175	110	P	40	U.S. development & utilization of vessels capable of marine resource exploration and extraction has to be high prioritized.
176	110	P	40	Tax break for private industry.
177	110	P	40	Share of booty for incentive industry.
178	110	P	40	At-sea processing ships would cut down labor & transportation costs shoreside.
15	110	S	40	Economic encouragement of mariculture efforts, mineral extraction/production, through tax benefits for R&D.
16	110	S	40	Economic encouragement of energy development only as consistent with environmental concerns.
17	110	T	40	Need to develop alternate means of development - e.g. mining and fuel extraction (and possibly processing) facilities located on seabed, rather than operating through rigs subject to surface storms.
638	111	A	50	ENERGY EXTRACTION AND PRODUCTION
110	111	P	50	Configuration of offshore rigs (size/shape).
112	112	P	50	Methods of transmitting energy produced in the ocean environment to shore.
126	112	P	50	Energy conversion plants: hydrogen, OTEC.
1	111	S	50	Oil and gas exploration will be constrained to the OCS primarily out to 50 to 100 miles from the shoreline.
4	111	S	50	Coal mining will be essentially under the ocean floor in tunnels, however, strip mining will be explored later.
24	111	S	50	Surveillance for energy extraction.
135	112	S	50	Alternative sources of energy used in ocean activities (ie, current, waves, wind, solar, etc.).
579	112	S	50	Devices using wave and tide energy will have to be controlled.
639	113	A	60	MINERAL EXTRACTION
164	110	P	60	Installation of special mineral processing/energy extraction equipment.
25	113	P	60	Mineral extraction/onboard gear.
102	113	P	60	Desalinization plants increase in number.
117	113	P	60	Location/size of desalinization plants.
128	113	P	60	Mining vessels.
158	113	P	60	Type of mineral extraction vessel (floating, fixed).
166	113	P	60	Location of mineral resources.
116	113	R	60	Movement of icebergs (blocks); both natural & towed.

NO.	SET	C	SRT	TEXT
172	113	R	60	Movement of polar ice for use in populated areas for potable water supply, thermal energy application.
6	111	S	60	Sand and gravel areas will be essentially the same.
2	113	S	60	Deep sea mineral mining will not really begin on a commercial production basis during the next 5-10 years, and will be found mainly at far distances (500 miles) from the shore.
27	113	S	60	Unions vs. national vs. company mineral extraction endeavors.
37	113	S	60	Mining/mineral cartels.
640	114	A	70	FISHING AND MARICULTURE
125	110	P	70	Factory ships.
155	114	P	70	Number of fishing vessels.
134	115	P	70	Fish farming.
156	115	P	70	Size of mariculture areas.
157	115	P	70	Location of mariculture areas (distance offshore, depth).
5	114	S	70	Fishing will remain essentially in the areas being used today.
93	114	S	70	International fishing laws receive more support.
3	115	S	70	Mariculture will be limited - close to the shore, probably no more than 2-3 miles from shore.
179	115	S	70	Mariculture is in trouble for lack of suitable pollution-free areas.
641	120	A	80	INTERNATIONAL TRADE
73	120	P	80	Changes in conference systems.
170	120	P	80	International shipping conferences (or perhaps mining conferences).
282	250	P	80	Effect of timely communications and cargo allocation systems on liner/tramp operations.
89	121	R	80	Potential of new canals in region of present Panama & Suez Canals.
94	121	R	80	Another Trans-american canal is built.
11	100	S	80	As development of deep sea mining and oil/gas exploitation progresses, artificial islands/sub-ports may have to be created establishing new routes.
62	120	S	80	Increase in world trade.
85	120	S	80	Increased trade with Africa, South America.
86	120	S	80	Decreased trade with Middle East.
388	120	S	80	International agreements being pressed by Third World countries to increase their tonnage.
473	120	S	80	Increased trade with China (gradually).
506	120	S	80	Strong growth in U.S. import/export trade.
586	120	S	80	There will be a relaxation of trade barriers with increased growth of multinational corporations.
9	121	S	80	Trade routes U.S./China will increase, requiring establishment of new ports in China and improvement of West Coast/Alaska ports.

NO.	SET	C	SRT	TEXT
10	121	S	80	Trade routes from Europe, Africa, S.America should approximately the same. However, trade over these routes, especially from Africa, should increase substantially.
137	121	S	80	Effect of a sea level canal from Atlantic to Pacific.
642	120	A	90	TRANSPORTATION SCHEDULING
258	120	P	90	Specialized container ships moving point to point on fixed schedule will increase.
250	121	P	90	Single route shipping (Port A to Port B and return, solely).
643	120	A	100	TRANSPORTATION AND NAVIGATION SYSTEMS
149	100	P	100	Hazards to navigation resulting from offshore structures and plants.
52	120	P	100	Increased number of vessels in supply and logistics.
114	120	P	100	Density of shipping.
142	120	P	100	Passenger transportation.
168	120	P	100	Navigation systems.
336	120	P	100	Impact of changes in ocean shipping on Great Lakes operations.
288	210	P	100	Aids to navigation (provided for users).
319	210	P	100	Problems and advantages associated with maritime surface, airborne, submarine, and land interests using long range aids to navigation systems.
324	210	P	100	Development of worldwide NAVSAT COOP through IMCO/U.N.
338	210	P	100	Increase scope of electronic navigation aids to provide maximum possible coverage throughout world.
239	211	P	100	Improved harbor navigation - adaptation of more sophisticated equipment as used in air travel.
222	212	P	100	Coastal and Great Lakes traffic will increase, especially coastal.
265	212	P	100	Zoning of coastal areas include specific ship traffic.
224	213	P	100	High seas traffic, essentially foreign, will increase.
18	110	Q	100	Transport could be effected in bulk, to surface terminals where materials would be loaded onto vessels for final processing/disposition onshore.
227	230	Q	100	Navstar/GPS will replace LORAN-C on a global basis; on a local basis, LORAN-C (with GPS capabilities) should be advanced to the next generation of LORAN.
205	121	S	100	Ports of call dependent upon waterway & bottom configuration.
613	210	S	100	If long range aids to navigation are recognized as a contributor to protection of marine environment, what nation is responsible for funding and managing the system? (See Note 500A).
644	120	A	110	TRADE, GENERAL
82	120	P	110	Strong growth in coastal trade.
214	250	P	110	Allocation becomes centralized for specific types of cargo.
8	121	Q	110	Submarine trade routes will be initiated, to be followed by submarine barge and submarine trains during the latter half of the 25-year period.
160	120	S	110	Trade patterns.
28	121	S	110	Computerized trade routes.

NO.	SET	C	SRT	TEXT
123	121	S	110	Shipping lane shifts.
143	121	S	110	Passenger routes.
645	130	A	120	TRADE GOODS
468	130	P	120	Increased export of fresh produce (citrus, lettuce, etc.).
180	131	P	120	Liquid bulk carriers need greater safeguards from accidental discharge (double bottoms, more backup systems, higher incentives to attract technically oriented personnel, etc.).
159	137	P	120	Quantities of cargo moved.
469	130	S	120	Increased export of coal.
578	131	S	120	Toward end of 25 year period there will be a decrease in petroleum shipments.
470	132	S	120	Continuing high level of exports of grains (wheat, corn, soybeans).
646	150	A	130	NATIONAL DEFENSE
120	150	P	130	National defense needs (size & type of naval vessels).
147	150	P	130	Suitability of merchant ships for MSC use.
152	150	P	130	Integration of naval defense capability with container ships.
161	150	P	130	Reliance of navy on merchant fleet in national defense.
181	150	P	130	Convoy concept is out the window in view of vulnerability in nuclear warfare.
183	150	P	130	Ocean location of fixed or mobile unconventional defense installations.
12	150	S	130	Defense underwater naval activity will increase.
20	150	S	130	Decisions must be made on defensive roles of CG and Navy -- At what point do the functional roles interface?
106	150	S	130	Switch to a sea-based missile system.
647	160	A	140	OCEANOGRAPHIC RESEARCH
38	160	P	140	Offshore research vessels (e.g. in Arctic or Antarctic).
162	160	P	140	Volume/intensity of oceanographic research.
13	160	S	140	Research underwater naval activity will increase.
19	160	S	140	Oceanographic research should be significantly emphasized to aid in development of undersea energy/mining programs.
648	170	A	150	RECREATIONAL USAGE
163	170	P	150	Volume/location of recreation boating activity offshore.
103	170	T	150	Ocean platforms for recreational uses.
104	170	T	150	Undersea parks.
184	170	T	150	Recreational submarine boating activity.
185	170	T	150	Man-made ocean resort sites.

NO.	SET	C	SRT	TEXT
649	180	A	160	ECOLOGICAL CONSIDERATIONS
75	180	P	160	Effects of areas to be avioded, marine santuaries.
22	180	S	160	More funding and support for proper execution of MEP functions.
23	180	S	160	Extraction/exploitation facilities must not be permitted to employ themselves in advance of MEP technologies. Ecological considerations cannot be ignored nor minimized.
71	180	S	160	Studies of the effects of large oil spill on ecology.
84	180	S	160	Impact of increased recreational use on ecology.
70	180	T	160	Pollution-control centers worldwide.
650	200	A	170	RULES OF THE NAUTICAL ROAD
203	210	P	170	Surface/subsurface rules-of-road interface.
206	210	P	170	Changes to navigation rules.
218	210	P	170	Rules-of-road changes to accommodate vessel maneuverability constraints.
322	210	P	170	Unification of rules of the road.
340	210	P	170	Get rid of the various rules of road systems and standardize according to international rules. Present system is confusing to the student mariner and appears unjustified by cost-effectiveness or safety considerations.
590	210	P	170	Adequacy of rules of road to serve future shipping and constraints imposed on shipping development by rules of road.
651	200	A	180	SHIP OPERATIONS, GENERAL
244	200	P	180	Helicopter/VSTOL aircraft operations.
482	200	P	180	No significant advance in ship operations except as required by advances in ship technology.
652	200	A	190	TRAFFIC CONTROL AND PILOTAGE
39	121	P	190	Need for specific shipping lanes in open waters.
90	210	P	190	Higher use of VTS in harbors and ports throughout the world.
217	210	P	190	Extended areas of required pilotage (including fairways/TSS, etc.).
279	210	P	190	Impact of vessel traffic control on speed and efficiency of cargo movement.
285	210	P	190	Recognition of international authority for positive vessel traffic regulations and control.
305	210	P	190	Traffic control systems.
307	210	P	190	Interactive (ship-shore, ship-ship) ship control systems.
308	210	P	190	Interlocking control grids.
325	210	P	190	Increased reliance/dependence on CG Vessel Traffic Systems (VTSs) with penalty provisions for non-compliance.
330	210	P	190	Extended control areas for surveillance and control of ships -- 200 miles.
331	210	P	190	Interactive transponder systems.
497	210	P	190	More VTS systems.

NO.	SET	C	SRT	TEXT
639	210	P	190	Vessel separation schemes.
620	210	P	190	Improved surveillance systems: satellites (spy quality perhaps), each ship required to carry an identification transponder.
264	211	P	190	Greater use of VTS in smaller ports - similar to airports.
337	211	P	190	Increased development and use of VTS systems in all significant ports -- reduce costs -- increase efficiency of same to permit program expansion.
269	211	Q	190	Vessels are completely computer programmed to enter port without assistance (pilot or tug).
91	210	T	190	VTS drops out of CG mission.
653	200	A	200	SHIP ROUTING
208	210	P	200	Use of environmental routing (accounting for forecast weather & currents).
209	210	P	200	Offshore ship movement control-similar to present VTSs or FAA control of aircraft.
246	210	P	200	Automated ship routing changes made possible by satellite surveillance and increased knowledge of currents and weather.
312	210	P	200	Vessel routing and warning systems (Fastnet yacht race!).
354	210	P	200	Duty cycle programs with onboard computers run ships from port-to-port/input from weather satellites.
270	210	Q	200	Weather reporting and forecasting is computerized and routes are changed accordingly.
654	200	A	210	SHIPBOARD NAVIGATION
254	138	P	210	Real time exchange of position, course, speed, etc., by automatic communications.
122	210	P	210	Average duration of merchant voyage (port to port).
201	210	P	210	Decreased reliance on floating and fixed visual navigation aids.
207	210	P	210	Changes to navigation equipment-available & required.
213	210	P	210	Greater use of space operations in navigation equipment.
236	210	P	210	More automation and use of computers.
237	210	P	210	Satellite navigation.
238	210	P	210	Continuous readout of vessel locations via satellite locating.
255	210	P	210	Automated position fixing and course correction.
277	210	P	210	Positive, accurate, round-the-clock navigational means.
335	210	P	210	"One-man" conning systems.
432	323	P	210	Amount of advanced navigation equipment installed (to develop a performance record for automation).
362	200	Q	210	Instantaneous ship information --including position.
289	210	Q	210	Navigation equipment required on user vessels or craft.
655	200	A	220	COLLISION/GROUNDING AVOIDANCE
211	210	P	220	Use of night vision devices or other capability to better detect hazards that are now missed by radar.

NO.	SET	C	SRT	TEXT
212	210	P	220	SONAR which would warn of a rising bottom ahead to warn of impending grounding.
219	210	P	220	Audio reception device to detect sound in fog.
256	210	P	220	Automated collision avoidance on the open sea.
278	210	P	220	Vessel size/speed vs numbers of collisions and groundings.
292	210	P	220	Hydrographic information dissemination.
297	210	P	220	Underkeel clearance as a factor of mean water depth, weather and tide changes, vessel static draft, vessel dynamic draft changes.
300	210	P	220	Grounding avoidance systems.
306	210	P	220	Collision avoidance systems (on-board).
656	220	A	230	WEATHER/ICE REPORTING
280	220	P	230	Effectiveness of weather/ice routing on movement of goods.
309	220	P	230	Weather and sea monitoring systems (remote).
310	220	P	230	Ocean and polar data buoys.
311	220	P	230	Automatic "weather stations" on board ship.
326	220	P	230	Development of system of communications whereby mariners could call for weather information -- regardless of their location.
225	220	S	230	Weather forecasting and ice reporting should see some improvement.
226	220	T	230	Weather forecasts - with accuracy up to 1 week should be realized within the 25-year period.
657	230	A	240	COMMUNICATIONS
98	230	P	240	Emergency communications (EPIRBs, etc.).
167	230	P	240	Communications capabilities.
197	230	P	240	Increased utilization of communications satellites.
230	230	P	240	Increased use of CB for local traffic.
281	230	P	240	Effectiveness of ship-ship communication for safe navigation.
313	230	P	240	Frequency allocations for maritime communications.
314	230	P	240	Improved use of maritime frequency spectrum.
320	230	P	240	Communications problems related to different languages.
327	230	P	240	Required bridge-to-bridge communications between passing vessels.
332	230	P	240	Data-links for fast transmission of data at low cost.
339	230	P	240	Improvement of technology as possible to minimize natural interference with radio transmissions (especially VHF). Increase net of monitor/relay systems.
271	230	Q	240	Ship communications are changed to mandatory voice-to-voice.
228	230	S	240	Communications will be highly computerized.

NO.	SET	C	SRT	TEXT
229	230	S	240	Knowledge of the ionosphere-sun spot cycle-will be advanced considerably.
658	240	A	250	SHIP FUELING AND REVICTUALLING
231	240	P	250	Increased use of nuclear and hydrogen fuel results in less need for refueling, though refueling stations will become more sophisticated.
283	240	P	250	Effect of fueling sites on ship operations (eg, delays).
272	240	R	250	National synfuels become largest source of fuel for the fleet.
659	260	A	260	SHIP PERSONNEL, HUMAN FACTORS
107	260	P	260	Size of U.S. Merchant marine (number of "sailors").
109	260	P	260	Age of "average" merchant sailor.
133	260	P	260	Crew morale during extended trips or tours.
202	260	P	260	High turnover of crew between voyages due to increased underway/away from homeport time.
204	260	P	260	Integrated tug/barge operations where crew & tug change "hulls" at voyage end.
303	260	P	260	Habitability standards.
304	260	P	260	Human factors.
660	260	A	270	TRAINING OF SHIP PERSONNEL
76	260	P	270	National & International standards for training of ship personnel (conventional merchant, fishing, and off-shore supply craft, etc.).
108	260	P	270	Skill/training/knowledge level of sailors.
194	260	P	270	Declining skill level of entry-level personnel.
301	260	P	270	Retraining of crew members (recycle radio operators to electronics maintenance.
315	260	P	270	Use of simulators for licensing and training.
316	260	P	270	Onboard educational systems using computers and communications.
74	261	P	270	Decreased need for Maritime Academies due to union schools.
174	263	P	270	Development of training needs to insure proper utilization of complex equipment.
195	263	P	270	Sharp rise in training costs for personnel (real dollars).
198	263	P	270	Use of simulators to train personnel may lower certain aspects of training cost.
328	263	P	270	Requirements for higher education to become a seaman. Training emphasis commensurate with desired results.
341	263	P	270	While state-of-the-art familiarity with technological aids is essential, emphasis must be placed equally on the "ancient arts" (eg, celestial navigation, marlinspike seamanship, etc.). (See Note 200A).
290	260	Q	270	Navigation training required for users -- international standards.
661	260	A	280	LICENSING/CERTIFICATION OF SHIP PERSONNEL
220	260	P	280	Licensing of crew for surface effect vessels (high speed) to be similar to aircraft licensing & qualifications.
240	260	P	280	More stringent rules on licensing of officers and certification of seamen on vessels entering U. S. ports, especially vessels carrying hazardous cargoes.

NO.	SET	C	SRT	TEXT
287	260	P	280	Ship operator qualifications (masters, pilots) vis-a-vis VTS, ship size.
261	260	Q	280	Changes in licensing of ship personnel.
262	260	Q	280	International licensing systems.
291	260	Q	280	Operator licensing -- international standards.
263	261	T	280	Requirements for CG officers onboard ships to be licensed.
662	260	A	290	SHIP MANNING LEVELS
233	260	P	290	U. S. ships not more sophisticated than at present.
234	260	P	290	Europe/China/Japan/Russia will take advantage of computerization and advanced ship technology so as to require less manpower.
241	260	P	290	Reduction in number of officers and seamen per ship as automation increases.
260	260	P	290	Smaller crews, reduced frequency of revictualling.
268	260	P	290	Vessel crews decrease.
317	260	P	290	Extensive use of automation.
318	260	P	290	Require very reliable back-up systems for automated equipment.
284	261	P	290	Relationship of ship automation to officer requirements (numbers, qualifications).
663	270	A	300	SHIP OPERATING COSTS
193	270	P	300	Increase/decrease in ship maintenance costs.
235	270	P	300	Ship operating costs for U. S. will increase unless shipbuilding technology and practices are advanced.
298	270	P	300	Operating costs vs ship size/speed.
299	270	P	300	Tanker vs pipeline operating (and lifecycle) costs.
192	270	R	300	Cost of conventional fuels quadruples by 2000.
191	270	S	300	Increase in personnel costs.
664	280	A	310	INTERNAL SHIP OPERATIONS
245	280	P	310	Automation of bridge/engineering & communications systems.
333	280	P	310	Interior data and communications systems for cargo monitoring, ship control, etc.
396	280	P	310	Computerized engine room and handling equipment.
471	280	P	310	Improved cargo monitoring and condition maintenance for perishables.
527	280	P	310	Computerized administrative program for master's use (This takes a lot of his time, especially at ship arrival time when he should be concerned primarily with safe maneuvering).
544	280	P	310	Computerized inventory and loading sequence systems.
616	280	P	310	Tank monitoring systems (for levels) and automatic shutoffs to prevent overflow while loading.
199	320	P	310	More reliability-improved ability for preventative maintenance via computer sensors detecting problems.

NO.	SET	C	SRT	TEXT
350	323	P	310	On-board preservation equipment -- fire suppression and flood control.
665	300	A	320	SPECIALIZATION OF SHIP TYPES
54	300	P	320	Increased specialization of vessels.
35	350	P	320	Decreased use of break-bulk vessels.
248	350	P	320	Single purpose (cargo) vessels, eg, LNG carriers.
381	350	P	320	Ships will be more specialized, with increased point-to-point movement on fixed schedules.
630	350	P	320	Sophisticated LPG/LNG ships will increase.
58	360	P	320	Specialized vessels-logistics & support, tankers.
63	360	P	320	Fewer general cargo type vessels.
64	360	P	320	More special vessels running on relatively fixed schedules.
88	360	P	320	Increase in tug-barge uses in high seas commerce (both conventional and unit tows).
370	360	P	320	Barge and towed configurations used for ocean shipping.
458	362	P	320	Perhaps more ocean going tug barges, perhaps "integrated".
356	360	Q	320	Transportation systems include ships that ride onto shore and convert to a truck.
444	360	Q	320	Hydrofoils could tow dirigible-type airborne barges.
666	300	A	330	SHIP TYPES - CONTAINER, RoRo, LASH
150	360	P	330	Container ships should replace break-bulk carriers.
352	360	P	330	Improved techniques in container and LASH cargo systems.
416	360	P	330	Effectiveness of LASH, RoRo ship types.
424	360	P	330	Trend toward non-self sustaining container ships.
46	363	P	330	More LASH type vessels.
450	363	P	330	LASH vessels should be encouraged for practicality in confined waters and ports.
488	364	P	330	More roll on - roll off ships.
553	410	P	330	Increased use of container ships.
382	364	R	330	More roll-on, roll-off to reduce port congestion, especially as more less developed nations become increasingly involved in international trade.
667	300	A	340	SUITABILITY OF MERCHANT SHIPS FOR NATIONAL DEFENSE NEEDS
419	300	P	340	Compatibility with U.S. defense mobilization needs.
425	300	P	340	Adaptability/compatibility for installation of weapons systems.
443	300	P	340	Usefulness of ship designs for supporting national defense.
668	310	A	350	REGISTRY, OWNERSHIP, AND CERTIFICATION OF SHIPS

NO.	SET	C	SRT	TEXT
361	310	P	350	International ship documentation via worldwide computers.
393	310	P	350	Increase of U.S.-owned, but under foreign registry, vessels.
411	311	P	350	Portion of U.S. trade in U.S. bottoms.
386	312	P	350	Certification will become more standardized.
412	312	P	350	Effect of varied national certification standards on efficiency of cargo movement, safety.
30	310	Q	350	Need for inspection of various bulk (liquid) cargo vessels.
452	300	S	350	Tax laws (affect registry and construction features).
48	310	S	350	Inspection and examination of vessels from "hostile" or nations of questionable veracity.
385	311	S	350	Changes in U.S. laws will increase number of U.S.-owned ships.
391	311	S	350	Change in ownership requirements for CDS, ODS.
447	311	S	350	Provisions must be taken on an international basis to discourage registration and ownership practices such as those accepted by Liberia and Panama (See Note 300A).
462	311	S	350	Encourage U.S.-homeported vessels through tax breaks and incentives.
669	320	A	360	SHIP CONSTRUCTION MATERIALS
131	320	P	360	Corrosion problems from new materials and processes.
347	320	P	360	New materials such as fiberglass.
351	320	P	360	Better coatings for preservation and anti-fouling.
355	320	P	360	Use of composites (Revlar) as a hull covering to prevent oil pollution.
433	320	P	360	Hull material.
446	320	P	360	Improved anti-fouling or de-fouling systems.
368	323	P	360	Materials technology increases steam efficiency/turbine efficiency.
670	320	A	370	HULL FEATURES
40	320	P	370	Double bottom vessels used worldwide.
59	320	P	370	Construction-reinforced for movement in icy waters.
69	320	P	370	Reinforced-hulled vessels obviate the need for CG icebreakers.
129	320	P	370	Special strength factors (for, say, ice).
138	320	P	370	Icebreaker tankers.
380	320	P	370	More ice reinforced ships to traverse Arctic waters for petroleum and mineral exploitation.
434	320	P	370	Type of hull construction.
557	320	P	370	International use of double bottoms.
671	321	A	380	CONSTRUCTION STANDARDS

NO.	SET	C	SRT	TEXT
321	320	P	380	Metrication issues.
376	320	P	380	Shipyards switch to metric standard.
379	320	P	380	Safety standards in U.S. shipyards.
441	320	P	380	Metrication of shipbuilding industry.
395	321	P	380	Construction standards should be reducing with this use of advanced construction materials and construction techniques.
463	321	O	380	World standards for shipbuilding/outfitting.
466	321	O	380	Certification for shipyards meeting worldwide ship construction standards.
672	322	A	390	CONSTRUCTION TECHNOLOGIES
334	210	P	390	Standard bridges - pre-fabued and set in place.
360	320	P	390	Computer-aided ship construction programs using PERT-type schemes.
387	320	P	390	Repair procedures will be simplified -- more modular type construction.
390	320	P	390	Strong union opposition to further automation in shipbuilding.
435	320	P	390	Year of construction.
436	320	P	390	Year of major refitting or modification.
474	320	P	390	Modular construction of ships.
475	320	P	390	Standard sterns and bridges.
345	321	P	390	Modular/compartmentized -- ejection of damaged area so not to jeopardize remaining cargo.
358	322	P	390	New technologies for building ships -- mass production, interchangeable parts (only 70 years behind other industries).
373	322	P	390	Increased automation of American shipyards.
394	322	P	390	Shipbuilding practices -- more modernization, computerized.
413	322	P	390	Effect of automated shipbuilding practices.
476	322	P	390	Ship design to facilitate automated construction processes.
673	322	A	400	SHIP CONSTRUCTION, GENERAL
357	320	P	400	Less ship construction and restricted to a few large shipyards.
374	320	P	400	Continuing/arrested decline in U.S. shipbuilding/repair.
200	320	S	400	Government subsidies decrease and shipbuilders resort to private funds and companies.
440	320	S	400	Capital availability for shipbuilding.
674	323	A	410	SHIP PROPULSION
349	320	P	410	Redundancy requirements (dual boiler, twin screw).
121	323	P	410	Conversion of merchant fleet to sail power.

NO.	SET	C	SRT	TEXT
173	323	P	410	Solar energy development for shipboard power plants.
257	323	P	410	Use of nuclear power in large vessels.
274	323	P	410	Nuclear power as prime propulsion.
329	323	P	410	Use of nuclear power for most large vessels on long routes, polar operations.
348	323	P	410	New propulsion -- basic power sources, new types of propellers, new control devices such as trusters.
366	323	P	410	Gas turbines replace diesels.
367	323	P	410	Low-speed diesels and steam ships increase.
414	323	P	410	Effect of nuclear and gas turbine plants on vessel speed, cost, DWT.
429	323	P	410	Propulsion fuel.
430	323	P	410	Fuel consumption rate.
437	323	P	410	Type of propulsion.
438	323	P	410	Type of propulsion control and redundant systems.
445	323	P	410	Machinery to use coal or coal-oil slurries.
29	323	Q	410	Wind-assisted ships on specific trade routes.
435	323	Q	410	Ship combinations of sail/engine power will increase.
410	323	Q	410	Hydrogen fuel capability should increase.
675	330	A	420	SHIP SIZE
346	330	P	420	Length, breadth, depth, draft, speed, maneuvering characteristics.
401	330	P	420	Some increase in beam, no higher, but longer than presently.
415	330	P	420	Ship draft vs tonnage -- effect on ports accessible.
431	330	P	420	Types of cargo carried and cargo capacity.
453	330	P	420	Ships will level off in size, operate at reduced speeds (unless alternate forms of cheap energy are found).
467	330	P	420	Ship size vs. vulnerability during war.
377	331	P	420	Increased use of 150,000+ DWT oil carriers.
397	331	P	420	Tonnages of ocean going vessels should increase.
398	331	P	420	Tankers 700,000 - 1,000,000 DWT.
399	331	P	420	LNG/LPG tankers: almost 1/2 larger than at present.
400	332	P	420	Shallow-draft oil tankers will increase.
454	332	P	420	Drafts will remain about the same as now for vessels using conventional ports, but beams will increase.
31	350	P	420	Technologies for increasing size/capacity of cargo vessels.

NO.	SET	C	SRT	TEXT
371	331	Q	420	1 million DWT vessel by 1985.
464	331	Q	420	Discourage VLCC/ULCC liquid bulk carriers in view of environmental catastrophies.
448	330	S	420	An absolute limit on vessel size should be imposed, so that no vessel may be built larger than those now operating (See Note 300B).
676	340	A	430	SHIP MANEUVERABILITY
344	323	P	430	Turbine-side mounted for maneuvering in emergency situations -- thrust perpendicular to normal (forward direction).
422	323	P	430	Special maneuvering devices such as bow thrusters.
439	323	P	430	Type of steering systems and redundant systems.
383	340	P	430	Ship maneuverability will increase -- more computer-assisted movement, especially in port and harbor areas.
402	340	P	430	More maneuverable.
403	340	P	430	Propulsion systems capable of stopping ships in less distance.
418	340	P	430	Relationship of maneuverability to ship size and power.
451	340	P	430	Wherever possible, design consideration should be given to bow thruster devices to enable a pivoting maneuver by small and moderate-sized vessels.
455	340	P	430	Improved maneuvering features will be added (thrusters).
456	340	P	430	Emergency stopping capability needed.
465	340	P	430	Automation vs reliability in close-in maneuvering situations.
677	350	A	440	SHIP DESIGNS, GENERAL
215	250	P	440	Use of high performance watercraft challenge jet transportation for expensive energy.
423	300	P	440	Helicopter landing facility aboard for medical evacuation, pilot, etc.
477	320	P	440	Ship design to reduce life cycle maintenance costs.
343	350	P	440	Flexible hull -- articulated for better mobility -- especially large tanker-type vessels.
359	350	P	440	Increased use in computer-aided ship design.
428	350	P	440	Ship speed.
457	350	P	440	Convertible ships capable of rapidly and cheaply converting from containerships to bulk, break-bulk or RoRo operations.
678	351	A	450	CONVENTIONAL, SINGLE DISPLACEMENT HULL DESIGNS
375	350	P	450	Container ships built to accommodate requirements of "Arapaho" concept.
378	350	P	450	Resurgent demand for small, break-bulk carriers in coastal trades.
404	351	P	450	Conventional ships, using oil fuel, should decline.
679	352	A	460	TWIN HULL DESIGNS
417	350	P	460	Feasibility (cost, payload) of twin-hulled ships.
409	353	Q	460	SWATH-type should increase steadily, substantially during the latter half of the period.

NO.	SET	C	SRT	TEXT
680	354	A	470	SUBMERSIBLE DESIGNS
186	354	P	470	Cargo submarines for arctic tankers.
187	354	P	470	Cargo submarines for navy resupply at sea or defense logistics in general.
188	354	P	470	Submarines for work boats for offshore operations.
189	354	P	470	Submarine feeder systems from deep ocean mines to surface.
384	354	P	470	Use of submersibles will increase, in construction of platforms at sea and underwater mining.
101	350	Q	470	Semi-submerged or submarine cargo carriers.
119	350	Q	470	Underwater transportation of petroleum/chemicals in flexible (rubber) vessels.
67	354	Q	470	Use of underwater/submarine merchant vessels.
406	354	Q	470	Submarine freighters, tankers and barges.
681	355	A	480	SURFACE SKIMMER DESIGNS
140	350	P	480	Fast surface-effect vessels for defense, SAR, logistics support.
141	350	P	480	Surface effect icebreaker with dash capability.
182	350	P	480	High speed vessels w/modified ASW capability could proceed independently.
369	350	P	480	High performance vessels used for high-speed port-to-port shipments.
275	355	P	480	Use of hovercraft for certain cargoes on short runs.
353	355	P	480	More use of hydrofoils.
408	355	P	480	Hydrofoils, especially on coastal traffic.
426	355	P	480	Hydrofoils.
427	355	P	480	Surface effect ships.
449	355	P	480	Surface skimmers should be encouraged for transport between off-shore operating sites and shore facilities, where cost-effective for general coastal use.
407	355	Q	480	Ocean-going ACV as well as hydrofoils will increase.
682	410	A	490	INTERMODAL CARGO MOVEMENT
273	120	P	490	Break bulk cargo becomes part of total transportation system.
543	138	P	490	Automatic identification of containers (magnetic and visual coding).
34	410	P	490	Ship/pipeline slurry systems.
49	410	P	490	Location of lightering zones.
132	410	P	490	Transportation to shore from moored vessels or vessels remaining at sea.
223	410	P	490	Barge traffic on the inland rivers will also increase coincidental with the decline of rail capabilities.
232	410	P	490	Cargo heavily containerized.

NO.	SET	C	SRT	TEXT
478	410	P	490	Inter-modal cargo: ship-truck increase, ship/helo/air increase.
481	410	P	490	Ship to shore pipelines will increase.
496	410	P	490	Lightering offshore to barges for ICW and inland river shipment.
502	410	P	490	Use of pipelines within port area to transfer bulk cargoes.
514	410	P	490	Increased use of slurry-type pipelines to ship a variety of items (coal, grains, powders, fuels, etc.).
529	410	P	490	Movement of cargo from offshore terminals to land via pipeline, lighter.
541	410	P	490	Container monitoring systems (source to consignee).
549	410	P	490	Connection of terminals with slurry pipelines.
47	420	P	490	Less loading, unloading, reloading of cargo from destinations.
249	420	P	490	Lightering offshore.
33	430	P	490	Transportation systems incorporating lightering vessels.
551	430	P	490	Worldwide port capability to handle inter-model cargo.
517	410	S	490	Railroads and rail service increase due to the increase in shipping from and to U.S. ports.
683	420	A	500	CARGO HANDLING, GENERAL
32	420	P	500	Offshore/loading/unloading interface problem.
111	420	P	500	Method of transferring resources (chemical/ores) from fixed rigs to shore.
251	420	P	500	Transfer of offshore mined/drilled resources directly to ships.
493	420	P	500	Improved controls for equipment for handling hazardous materials.
512	420	P	500	Specialized cargo handling due to advances in cargo handling equipment.
515	420	P	500	Techniques to slurry cargo in ports increase, as do illegal cargoes.
523	420	P	500	Integration of terminal and ship's cargo transfer control to achieve safe shutdown in event of emergency.
528	420	P	500	Automated transfer of bulk/ore/slurry cargoes.
684	420	A	510	TRADE GOODS PACKAGING
242	410	P	510	Pre-packaged cargo containers for bulk and liquid cargoes.
542	410	P	510	Large intermodal containers (rail-ship-barge).
45	420	P	510	Continued increase in goods packaged in containers.
510	420	P	510	Containerization of liquids for on-loading/off-loading, avoiding use of on-shore pipeline systems.
511	420	P	510	Flotation capability for modularized cargo so that off-loading/on-loading can occur in deeper water (reduce need for deepwater ports).
520	421	P	510	Automated shipboard technologies for break-bulk cargo-- maybe standardized containers.
505	420	Q	510	Lack of standardization of container sizes complicates intermodal transfers, wastes cargo storage space.

NO.	SET	C	SRT	TEXT
685	421	A	520	CARGO HANDLING, SHIP
463	420	P	520	Standardization of liquid cargo transfer fittings (bow or amidships) for special use such as deepwater ports, etc.
522	420	P	520	Special cargo transfer fittings such as bow or amidships manifold for deepwater port.
487	421	P	520	Use of portable (on-board) cranes for unloading containers in smaller ports.
545	421	P	520	Strap-on cranes to convert container ships to military logistics ships.
461	430	P	520	SPM mooring fittings for deepwater ports.
521	430	P	520	Special mooring arrangements such as fittings for deepwater port SPM.
686	422	A	530	CARGO HANDLING, TERMINAL
494	420	P	530	Development of simpler RoRo and container handling facilities for use in minor ports.
546	420	P	530	Helicopter off-loading systems.
547	422	P	530	Heavy lift cranes in more ports.
552	422	P	530	Certification system for dockside cranes (through IMCO).
554	422	P	530	Trend toward increased dependence dockside for containership loading/discharging.
276	420	Q	530	Potential use of hybrid airships for more rapid loading and unloading, especially in ports having primitive loading and unloading facilities.
534	430	S	530	Smaller ports unable to afford cranes for container-handling.
687	430	A	540	*PORT FACILITIES, GENERAL*
539	403	P	540	Federal vs state or local authority over ports.
43	410	P	540	Changes in methods of storage for goods to use in transportation systems.
363	430	P	540	Specific ports to handle specific sizes and types of ships.
479	430	P	540	Terminals: size and cargo handling capability should increase.
537	430	P	540	Conflicts over port jurisdictions.
513	430	P	540	Specialized cargo handling equipment increases the likelihood for specialized ports.
530	430	P	540	Effect of harbor characteristics (depth, area) on ship characteristics and vice versa.
536	430	P	540	International standardization, to fullest possible extent, of port facilities (cranes, container reception and stowage facilities) to provide maximum efficiency and turn-around time, minimum problems in loading/offload.
628	430	P	540	Adequacy of AN to serve future shipping.
483	431	P	540	Cargo throughput capacity should be more computerized, increased use of robots.
489	431	P	540	Cargo throughput will be improved - more specialized.
484	432	P	540	Cargo storage capacity: no significant increase, except in oil/gas tankage.
540	432	P	540	High-rise container terminals.
499	430	S	540	More development of Southeastern U.S. ports.

NO.	SET	C	SRT	TEXT
688	430	A	550	SHIP TURN-AROUND TIME
342	270	P	550	Restrictions should not be applied to prohibit or restrict turn-around carriage of cargo, provided that safety standards are not infringed by such activities.
498	420	P	550	More efficiency directed toward lowering turn-around time.
519	420	P	550	Turn-around time in ports decreases.
247	430	P	550	Rapid turn-around in port.
531	430	P	550	Ship in-port turnaround time.
490	431	P	550	Much improvement of cargo movement inside the port area resulting in less in-port time for vessels.
689	430	A	560	HARBOR/CHANNEL IMPROVEMENT
259	430	P	560	Increased use of small harbors with fewer navigational aids.
392	430	P	560	Increased draft requirements of larger carriers creates demand for deeper harbors.
591	430	P	560	Improved channels -- increased width, removal of rocks or small islands (eg, Shooter's Island in New York) -- increased turn radii and more width at turns.
592	430	P	560	Look-around systems for turns that have visual and radar obstruction.
364	430	Q	560	Deeper draft ships come to U.S. ports due to dredging advances.
501	430	R	560	No U.S. ice-locked ports.
190	430	S	560	Increasing reliance on user fees to finance harbor/channel improvements.
216	430	S	560	Better techniques to dredge harbor, and increase tonnage (for supertankers).
495	430	S	560	More limits on both new and maintenance dredging in U.S. ports.
500	430	S	560	Dredging increases may lead to private industry taking part in it -- private corporations dredging channels for their own ships.
690	430	A	570	HARBOR/CHANNEL/TERMINAL TRAFFIC
77	100	P	570	Increased conjestion at ports & harbors.
221	430	P	570	Harbor traffic will increase and become more congested, especially with recreational boats.
365	430	P	570	Kort nozzles used in port/lightering ship operations.
691	430	A	580	PORT/TERMINAL SHIP SERVICES
420	430	P	580	Self-contained line handling equipment vs. dockside requirements.
421	430	P	580	Special tug requirements.
532	430	P	580	Effect of automatic mooring systems at offshore terminals.
692	430	A	590	DEEPWATER PORTS
44	430	P	590	More offshore ports - allow expanded use of large carriers.
250	430	P	590	Use of Deepwater Ports for chemicals and dry bulk cargoes.
286	430	P	590	Dependence on deepwater ports for large vessels.

NO.	SET	C	SRT	TEXT
459	430	P	590	Deepwater ports where commercial vessels could tow submersible barges and increase carrying capability.
472	430	P	590	Increased use of offshore terminals for liquids and slurries.
480	430	P	590	Artificial island terminals will be required to handle oil and gas, and mineral slurries.
524	430	P	590	Recreation and other services for crews for quick turnaround ships including VLCCs at deepwater ports.
525	430	P	590	Ability for foreign ships to exchange crew members at deepwater ports.
372	430	R	590	2 deepwater ports serve east coast of U.S.: U.S. can accept submarine tankers.
509	430	S	590	Growing demand for deepwater ports as transfer points for hazardous cargo.
693	440	A	600	PORT/TERMINAL PERSONNEL, GENERAL
533	440	P	600	Availability of longshore personnel (quantity, competence).
550	440	P	600	Reduction of featherbedding by dock crews by upgrading of personnel, increased income security, reduced numbers.
556	440	P	600	Problems caused by language barriers.
486	440	S	600	Longshoremen's wages rise steadily in real dollars.
503	440	S	600	Growth in frequency, duration of longshoremen's strikes.
694	440	A	610	PORT/TERMINAL PERSONNEL, TRAINING, AND QUALIFICATION
485	440	P	610	Port terminal manpower: advanced technologies will require that warehousemen and longshoreman be better trained, licensed and certified.
535	440	P	610	Increased consideration given to safety training for port personnel, particularly in regard to petroleum, hazardous materials, and liquefied gases.
538	441	P	610	Special licensing and standards required for port construction such as deepwater port license, COE, EPA, state and local permits.
491	442	P	610	Increased training of shore personnel to operate more specialized handling equipment.
537	442	P	610	Training/education background for personnel should be centralized and computerized.
555	442	P	610	Standard training levels for longshoremen (through IMCO).
492	440	Q	610	More stringent licensing and training of personnel handling hazardous cargoes.
695	500	A	620	ENVIRONMENTAL CONSIDERATIONS, GENERAL
323	500	P	620	Operating rules to protect the marine and air environment.
53	510	P	620	More possibilities of pollution.
100	510	P	620	Ocean incineration.
568	510	P	620	Coastal zoning designates areas of minimum pollution and environmental damage.
600	510	P	620	Effect of foreign and international pollution laws on ship design and operation.
601	510	P	620	Pollution liability as a constraint on ship size or routing.
612	510	P	620	Oil spill liability.
72	510	Q	620	Large chemical spills occur.

NO.	SET	C	SRT	TEXT
558	510	O	620	All forms of overboard discharges are illegal
594	510	S	620	Develop technologies to cope with sub-surface pollution problems such as that posed by the Campeche incident.
565	510	T	620	Chemical spills occur.
696	511	A	630	WATER POLLUTION CONTROL, SHIPBOARD
41	510	P	630	Specific bilging requirements.
124	510	P	630	Waste disposal or conversion ships.
267	510	P	630	On-board pollution fighting equipment.
332	510	P	630	Garbage and waste recycling systems.
617	510	P	630	Continued use of load-on-top, segregated ballast, double bottoms.
389	511	P	630	Effects of crude washing, clean ballast systems.
587	511	P	630	Certification of personnel qualified to clean/strip tanks.
618	511	P	630	Reduced oil pollution from tank cleaning; the oil is getting more valuable.
625	511	P	630	Port/pierside tank cleaning operations developing, reducing ocean deballasting.
563	510	O	630	Lube-oil burnoff systems incorporated within the vessels.
593	510	O	630	Ban on "flushing" in open waters (international agreement required) and territorial seas, emphasis should be focused on separation, recycling systems to maximum use of refined products/minerals, minimize harmful effect.
697	512	A	640	WATER POLLUTION CONTROL, PORT/TERMINAL
534	510	P	640	Environmental monitoring during cargo transfer, such as detection of oil pollution during transfer at deepwater ports and conventional ports.
548	510	P	640	Environmental control systems for bulk terminals.
582	512	P	640	More disposable facilities for waste in port areas.
615	512	P	640	Port recycling facilities for slops, oily ballast.
626	512	P	640	Port/terminal waste transfer, storage, disposal to waste conversion plants for municipal heating systems.
698	513	A	650	OIL SPILL PREVENTION AND ABATEMENT
42	513	P	650	Need to carry oil pollution control devices onboard ships.
559	513	P	650	Merchant vessels are required to carry pollution abatement devices.
561	513	P	650	Continued increased oil pollution due to spillage in lightering and mode-changing evolutions.
627	513	O	650	Oil spill prevention and abatement improvement with advanced technology.
621	513	T	650	Near-elimination of dumping of unprocessed pollutants.
699	514	A	660	OCEAN DUMPING
99	514	P	660	Ocean dumping (including hazardous wastes).
118	514	P	660	Location/quantity of ocean dumping of trash/toxic chemicals.

NO.	SET	C	SRT	TEXT
583	514	S	660	More stringent enforcement of ocean dumping.
588	514	S	660	Prohibit ocean dumping.
92	530	S	660	Radioactive dumping in the ocean - citizen concern.
562	514	T	660	Radioactive ocean dumping begins.
730	520	A	670	AIR POLLUTION CONTROL
602	520	P	670	Effect of air pollution standards on steam (especially coal-fired) ships.
624	520	P	670	Danger from hazardous vapors with helicopter operations from VLCCs at deepwater ports.
564	520	Q	670	Air pollution requirements for ships follow those for autos.
622	520	Q	670	Vapor recycling on tankers.
628	520	Q	670	Ship energy management systems to reduce air pollution.
577	520	S	670	Concerns/restraints on use of incinerator ships.
563	520	T	670	Materials technology decreases air pollution.
570	520	T	670	Acid rain kills thousands of lakes located within several hundred miles of industrial centers.
731	530	A	680	HAZARDOUS CARGO HANDLING
79	530	P	680	Increased shipping of hazardous cargo, ie, oil, chemicals, radio active.
516	530	P	680	Accidents at dangerous cargo loading ports increase -- requiring more inspectors and safety engineering.
581	530	P	680	More use of special containers to handle hazardous cargoes.
584	530	P	680	Separate areas or even designated ports away from congested areas to handle hazardous cargoes.
589	530	P	680	Stringent packaging specifications for hazardous material, and dedicated/worldwide vessel stowage compatibility (IMCO).
595	530	P	680	Maintain penalty provisions to discourage carelessness by personnel in oil and hazardous substance transfer operations.
604	530	P	680	Safety of moving hazardous materials via ship vis-a-vis other modes.
605	530	P	680	Special procedures (routing, escort, sea lane clearance) imposed and the movement of hazardous materials.
606	530	P	680	Quantities and types of hazardous materials moved by ship.
629	530	P	680	LPG ships need better regulation and technology.
566	530	Q	680	Single national (and eventually international) control point for monitoring the movement of dangerous cargo (and enlarged to include the monitoring of oil shipments).
596	530	S	680	What are CG/EPA roles in hazardous material responses? CG appears from many accounts to be the agency to handle, despite lack of familiarity and adequate funding. Definition and money is needed.
732	540	A	690	SAFETY CONSIDERATIONS, GENERAL
65	540	P	690	Better safety equipment & more safety standards.
66	540	P	690	Decrease in rate of accidents.
130	540	P	690	Safety problems.

NO.	SET	C	SRT	TEXT
266	540	P	690	Safety requirements increase.
293	540	P	690	Distress alerting.
294	540	P	690	Distress locating.
526	540	P	690	Cargo security (theft, fire, etc.) during transfer phase.
603	540	P	690	Constraints on ports open to nuclear-powered ships.
95	542	P	690	Navigation lights that indicate relative manueverability (such as current deep draft vessel lights for use in restricted waters).
597	542	P	690	Communications in coastal/restricted waters should be required to avert collision casualties and reduce confusion -- this can be linked with expansion of VTS systems.
295	540	S	690	SAR coordination.
296	540	S	690	Casualty data collection, analysis, and international dissemination.
703	540	A	700	SAFETY CONSIDERATIONS, PERSONNEL-RELATED
576	541	P	700	Minimum crew requirements for firefighting and storm damage control.
607	541	P	700	Ability for emergency action as a limiting constraint on crew reduction.
97	547	P	700	Life preserving equipment.
567	547	P	700	Medical evacuations decrease due to advances in emergency medicines and medical technology.
619	547	P	700	Higher environmental standards for crew conditions (asbestos, dust, fumes, noise, heat) - OSHA is coming.
704	560	A	710	MARITIME LAW ENFORCEMENT
610	560	P	710	Special jurisdiction issues (civil and criminal) foreign crew members in port and at deepwater ports.
508	561	P	710	Customs problems presented by demand for increased speed of intermodal container transfers.
573	561	P	710	Growth in number of smugglers plying U.S. coastal waters.
572	565	P	710	Trade-offs in ideal crew size: minimum number need to run highly automated ships vs minimum number needed to defend against pirates in some foreign ports and at sea.
571	565	Q	710	Seamen's training includes anti-terrorist tactics.
623	510	S	710	Fisheries and mining patrols.
580	560	S	710	Much law enforcement work will be done by remote sensors.
598	560	S	710	Piracy should be punishable by death; hijacking should be dealt with extremely severely, though political matters may be a big problem in obtaining international accord.
614	560	S	710	How do we police and prosecute foreign vessels causing deliberate or careless oil pollution off our coasts?
518	561	S	710	Smuggling will increase as faster ships are developed.
585	561	S	710	More smuggling of drugs, illegal immigrants.
36	565	S	710	Need to defend mining vessels onboard/and passive defense offshore - pirates.
243	565	S	710	Laws for piracy and hijacking should be more strict and enforced.
735	570	A	720	PROTECTION OF OFFSHORE ASSETS

NO.	SCT	C	SRT	TEXT
60	570	P	720	Potential pollution to be avoided.
575	510	S	720	In era of energy shortages, off-shore drilling rigs become vulnerable to sabotage, require increased protection.
599	510	S	720	Protection of offshore assets should be regarded as equivalent to defense of homeland or national vessels, and administered appropriately.
21	570	S	720	CG must demand more funding and support for its (presumably) increased role in offshore protection.
50	570	S	720	Security of U.S. "fixed" assets on O.C.S.
51	570	S	720	Terrorist activity on/under oceans.
83	570	S	720	Vulnerability of harbors to terrorist activity.
87	570	S	720	Vulnerability of offshore facilities to terrorist activity (including mineral extraction platforms and deep water port facilities).
442	570	S	720	Need for secure ship/platform/land communications.
611	570	S	720	Federal vs owner responsibility for protection of offshore assets.
631	570	S	720	Development of SONAR/acoustic arrays around platform/mining areas.
632	570	S	720	Development of LASER detection systems.
633	570	S	720	Need for faster police/combat ships.
68	570	T	720	Terrorist attacks increase in larger ship Deep Water Ports.
569	570	T	720	Coast Guard becomes the lead agency for protection of offshore assets (includes underwater activity, inspection techniques, high speed vehicles, monitoring systems and advanced weapons).

NOTES FOR CANDIDATE PARAMETER LISTING

NOTE 200A (Item # 341/263). While state-of-the-art familiarity with technological aids is essential, emphasis must be placed equally on the "Ancient Arts" (i.e., Celestial Nav, Marlin-Spike, etc.). The Coast Guard's effectiveness is reduced when emphasis on these functions is minimized; certainly, the Merchant Marine is as vitally affected or more so. Training need not be arduous (or brutal) -- It must be thorough. Underway training must be emphasized and encouraged, for Maritime and CG officers; it would be beneficial for enlised personnel and seamen/eng. personnel as well.

NOTE 300A (Item # 447/311). Provisions must be taken on an international basis to discourage registration and ownership practices such as those accepted by Liberia and Panama, e.g. laws banning importation/exportation on those vessels which do not meet an adequate, internationally-agreed standard for adequacy of personnel training and competence, material condition, and accessibility of owner to legal action and restitution.

NOTE 300B (Item # 448/330). An absolute limit on vessel size should be imposed, so that no vessel may be built larger than those now operating, this impacts upon accessibility of port facilities as much as navigational safety. Indeed, encouragement should be given to reducing vessel size, increasing the number of ships, and revitalizing the human role in the Maritime industry.

NOTE 500A (Item # 613/210). If long range aids to navigation are recognized as a contributor to protection of marine environment, what nation is responsible for funding and managing the system? Nearest nation, nation receiving cargo, nation(s) of ship registry, or some systematic sharing of costs such as funding of International Ice Patrol.

TABLE B-2

CANDIDATE PARAMETER CLASSIFICATIONS

10	EXPANDED USE OF MARINE ENVIRONMENT
20	EXPANSION INTO ICY WATERS
30	INTERNATIONAL ORGANIZATIONS AND CONCERNS
40	ECONOMIC AND POLITICAL STIMULATION OF OFFSHORE RESOURCE DEVELOPMENT
50	ENERGY EXTRACTION AND PRODUCTION
60	MINERAL EXTRACTION
70	FISHING AND MARICULTURE
80	INTERNATIONAL TRADE
90	TRANSPORTATION SCHEDULING
100	TRANSPORTATION AND NAVIGATION SYSTEMS
110	TRADE, GENERAL
120	TRADE GOODS
130	NATIONAL DEFENSE
140	OCEANOGRAPHIC RESEARCH
150	RECREATIONAL USAGE
160	ECOLOGICAL CONSIDERATIONS
170	RULES OF THE NAUTICAL ROAD
180	SHIP OPERATIONS, GENERAL
190	TRAFFIC CONTROL AND PILOTAGE
200	SHIP ROUTING
210	SHIPBOARD NAVIGATION
220	COLLISION/GROUNDING AVOIDANCE
230	WEATHER/ICE REPORTING
240	COMMUNICATIONS
250	SHIP FUELING AND REVICTUALLING
260	SHIP PERSONNEL, HUMAN FACTORS
270	TRAINING OF SHIP PERSONNEL
280	LICENSING/CERTIFICATION OF SHIP PERSONNEL

290|SHIP MANNING LEVELS

300|SHIP OPERATING COSTS

310|INTERNAL SHIP OPERATIONS

320|SPECIALIZATION OF SHIP TYPES

330|SHIP TYPES - CONTAINER, RoRo, LASH

340|SUITABILITY OF MERCHANT SHIPS FOR NATIONAL DEFENSE NEEDS

350|REGISTRY, OWNERSHIP, AND CERTIFICATION OF SHIPS

360|SHIP CONSTRUCTION MATERIALS

370|HULL FEATURES

380|CONSTRUCTION STANDARDS

390|CONSTRUCTION TECHNOLOGIES

400|SHIP CONSTRUCTION, GENERAL

410|SHIP PROPULSION

420|SHIP SIZE

430|SHIP MANEUVERABILITY

440|SHIP DESIGNS, GENERAL

450|CONVENTIONAL, SINGLE DISPLACEMENT HULL DESIGNS

460|TWIN HULL DESIGNS

470|SUBMERSIBLE DESIGNS

480|SURFACE SKIMMER DESIGNS

490|INTERMODAL CARGO MOVEMENT

500|CARGO HANDLING, GENERAL

510|TRADE GOODS PACKAGING

520|CARGO HANDLING, SHIP

530|CARGO HANDLING, TERMINAL

540|PORT FACILITIES, GENERAL

550|SHIP TURN-AROUND TIME

560|HARBOR/CHANNEL IMPROVEMENT

570|HARBOR/CHANNEL/TERMINAL TRAFFIC

580|PORT/TERMINAL SHIP SERVICES

590|DEEPWATER PORTS

600|PORT/TERMINAL PERSONNEL, GENERAL

610|PORT/TERMINAL PERSONNEL, TRAINING AND QUALIFICATION

620|ENVIRONMENTAL CONSIDERATIONS, GENERAL

630|WATER POLLUTION CONTROL, SHIPBOARD

640|WATER POLLUTION CONTROL, PORT/TERMINAL

650|OIL SPILL PREVENTION AND ABATEMENT

660|OCEAN DUMPING

670|AIR POLLUTION CONTROL

680|HAZARDOUS CARGO HANDLING

690|SAFETY CONSIDERATIONS, GENERAL

700|SAFETY CONSIDERATIONS, PERSONNEL-RELATED

710|MARITIME LAW ENFORCEMENT

720|PROTECTION OF OFFSHORE ASSETS

TABLE B-3

TENTATIVE PARAMETER SELECTION LIST

SCHEME

- Include the 7 parameters highest ranked by MarAd
- Include the 7 parameters highest ranked by Coast Guard

RESULT

Parameter	MarAd Rank	CG Rank	Combined Rank
190	10	4	5
210	18	6	13
220	4	1	3
240	9	5	8
300	2	17	1
350A	1	13	4
390A	3	3	2
400	6	24	9
410B	5	21	6
430	23	7	15
550	7	32	10
570	28	2	7

- -

Total number of parameters: 12 (2 are held in common)

	MarAd	CG	Combined
Percent of total weight	47.6	47.9	53.1

FIGURE B-1

DISTRIBUTION OF CANDIDATE PARAMETER SCORES VS RANKS

COMBINED MARAD/CG RESPONSES

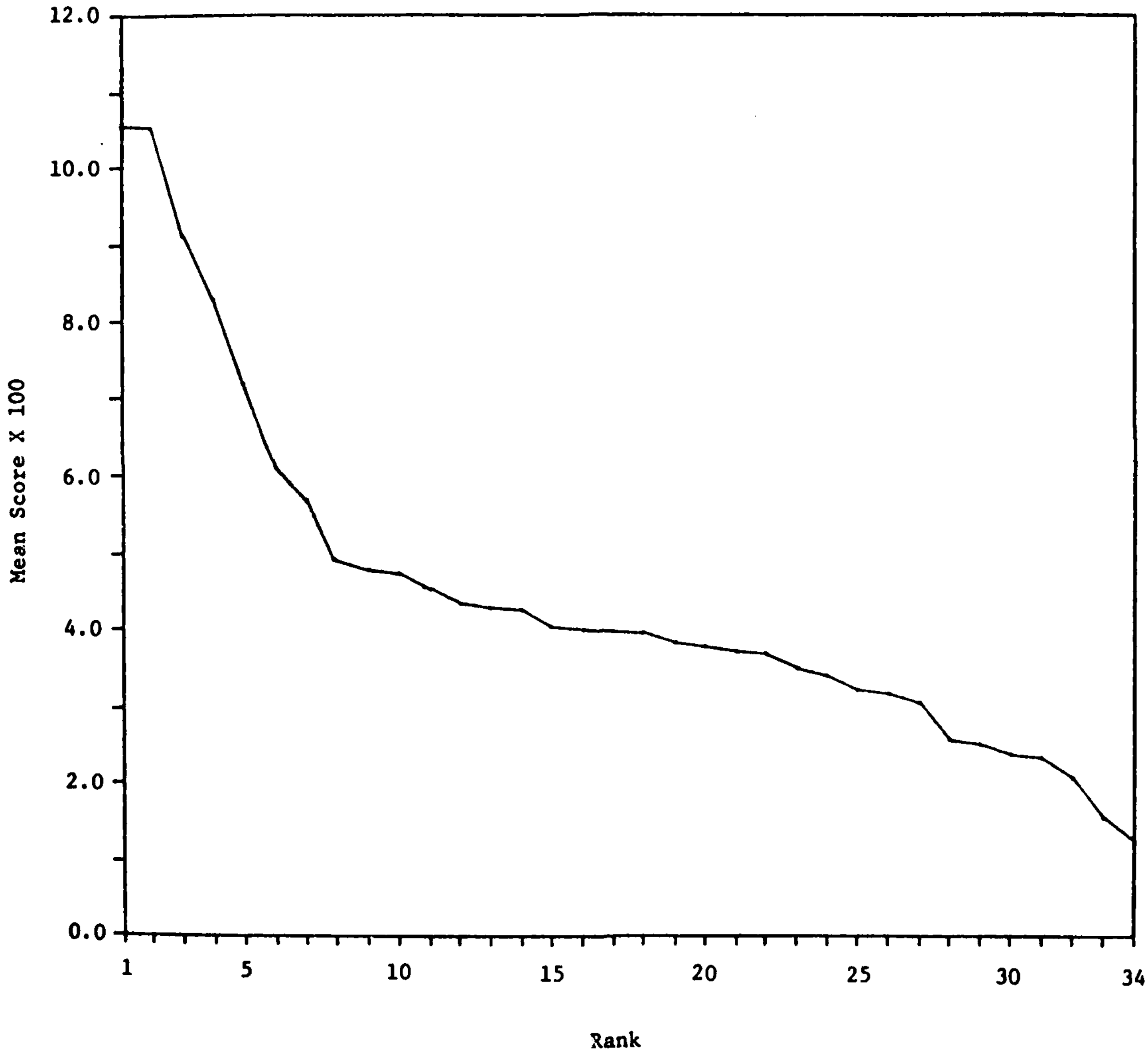

TABLE B-4

FINAL PARAMETER SELECTION LIST

SCHEME

- Include the 8 parameters highest ranked by MarAd
- Include the 8 parameters highest ranked by Coast Guard
- Delete parameters 240 and 390A

RESULT

Parameter	MarAd Rank	CG Rank	Combined Rank
190	10	4	5
210	18	6	13
220	4	1	3
280	29	8	22
300	2	17	1
350A	1	13	4
400	6	24	9
410B	5	21	6
420	8	11	14
430	23	7	15
550	7	32	10
570	28	2	7

Total number of parameters: 12

	MarAd	CG	Combined
Percent of total weight	48.5	49.2	53.6

APPENDIX C

PARAMETER EVALUATION QUESTIONNAIRE

FUTURE MERCHANT FLEET STUDY FOR MARAD AND COAST GUARD

Parameter Evaluation

Forecasting International, Ltd. is engaged in a study of future merchant fleets jointly sponsored by the Coast Guard and the Maritime Administration. The broad general setting for this study is based on a prior FI Study for MarAd which addressed the implications of three possible future scenarios for the maritime industry as a whole, and MarAd R&D programs in particular.

The focus of the present study is on the nature of merchant fleets which might evolve under the broad scenarios produced in the first study. In other words, the area of concern has narrowed; it has also expanded to include both MarAd and Coast Guard interests. These interests derive from each agency's programs and from the organizations and entities (clientele) with which these programs interact.

A joint MarAd/CG/FI workshop was held in August to generate lists of parameters to describe or measure changes which will affect the Coast Guard and MarAd over the next 25 years. A parameter was defined as follows:

> A parameter is a merchant fleet-related trend of concern to Coast Guard programs, MarAd R&D programs, and/or Coast Guard and MarAd clientele.

The 12 workshop participants produced a list of 634 items. These items included parameters as well as general considerations (such as inflation or shipping subsidy policies) which are more appropriate for incorporation in the political, societal, technological, economic and environmental domains of the broad scenarios mentioned above.

The workshop items have been categorized and sorted several times in order to find distinct groupings of merchant fleet-related trends. The attached list of candidate parameters has evolved from these groupings. While the purpose of the workshop was simply to generate items, the present task is to evaluate and more clearly define the parameters in terms of usable trends.

The objectives of the present effort are, specifically:

- To assess the relative importance of each candidate parameter to assure that the study focuses on matters of relevance to Coast Guard and MarAd programs.
- To elicit comments and suggestions, particularly with respect to the measures of effectiveness contemplated and sources of available data.

The following materials are provided to assist in the assessment:

<u>Appendix</u>

1 A brief description of each parameter together with 1 or more proposed measures of effectiveness, notes concerning data sources and availability, and room for comments/suggestions.

2 A list of principal data sources available (these are referenced by number in Appendix 1).

3 A scoring sheet for parameter importance estimation.

We are asking you to evaluate each parameter, according to your perception of its future importance to Coast Guard and/or MarAd programs and clientele. The evaluation method is termed "magnitude estimation." The essence of magnitude estimation is to assign an arbitrary importance value (number) to some parameter (call it a standard) and then to express the importance of each of the other parameters as a fraction or multiple of the standard. Many people find that ranking the elements is helpful initially.

Ranking is relatively simple, but it does not address differences in importance, and it does not readily permit assessing a group response (or a Coast Guard vs. MarAd response). In other words, ranking is a limited tool, but useful as a first step. Magnitude estimation produces a ratio scale which, like most of the measures used in physics, is susceptible to general arithmetic and statistical operations; differences between estimates have meaning, and group and intra-group responses are easily dealt with. For these reasons, magnitude estimation is particularly appropriate for present purposes.

To summarize the evaluation procedure:

1. Review Appendix 1. Become familiar with the meaning of the parameters.

2. Put the parameters in rank order based on your perceptions of their future importance to your programs (i.e., MarAd participants consider the importance of the parameters to MarAd programs; Coast Guard participants consider Coast Guard programs). Record your assessments on scoring sheet (Appendix 3) with rank #1 indicating highest importance. Ranking should assist you in making magnitude estimates.

3. Estimate the importance of each parameter. Choose any parameter in your ranked list as a standard reference point--any one you like--and assign it any value you choose. Every other parameter should then be evaluated in relation to this standard value. Ask yourself "If my standard Parameter X has an importance value of 100, what importance value should Parameter Y have?" For example, if another parameter seems 10 times as important, assign it a value of 1000 on the Scoring Sheet. If a particular parameter seems half as important as the standard, write in a value of 50. In other words, express your estimates in terms of multiples or fractions of your standard value. You may use any whole or fractional numbers that are greater than 0, no matter how large or small they are, just so long as they represent to you how important the parameter is when compared to your chosen standard. You may also assign the same value to more than one parameter.

Record your name and your estimates on the Scoring Sheet and indicate your affiliation (MarAd or Coast Guard). Although much more time can be spent, an hour should be enough time to complete this undertaking.

In addition to the ranks and magnitude estimates of the candidate parameters, your comments and suggestions regarding the selection are also sought. We recognize that the list is neither exhaustive nor mutually exclusive. Furthermore, the meaures of effectiveness are tentative: are there better ones? are historical data available? Your knowleage and insights will be greatly appreciated and will coontribute to a more meaningful study.

Please return your score sheets and any comments or suggestions by Wednesday, 17 October 1979 as follows:

Coast Guard: Lt. T. Marhevko (G-DSA-3), Room 5405
Telephone: 426-1050

MarAd: Dr. J. Lisnyk, Room 4625
Telephone: 377-2671

It is intended to establish a final list of parameters based on the results of this evaluation (which will be provided to you). To assure that the final results are relevant and useful, we plan to continue our joint participation efforts at key points in the study when your expertise is needed, and in a manner which does not intrude on your time to an unwarranted extent.

APPENDIX 1

DESCRIPTION OF CANDIDATE PARAMETERS

Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
190 Traffic Control and Pilotage	Number of Collisions/ Groundings per Ton-Mile, VTS-controlled vs. Uncontrolled (Measures Safety)	Coast Guard Data Available?	
	Number of Ton-Miles Moved Per Time Period, VTS-controlled vs. Uncontrolled (Measures Efficiency)	Coast Guard Data Available?	
210 Shipboard Navigation (Voyage Duration, Port-to-Port)	Vessel Speed Over Ground vs. Nominal Vessel Speed, for Selected Ship Types and Sizes, for Selected Routes or a Composite Average of Selected Routes	9	
220 Collision/Grounding Avoidance	Number of Collisions/Groundings per 1000 Vessels Per Time, for Selected Ship Types/Sizes/Speeds, or a Composite Average Vessel	9	
	Number of Collisions/Groundings per Ton-Mile per Time, Overall or as a Function of Selected Traffic Density Areas and/or Areas of Difficult Hydrography	9	
240 Communications	Effectiveness of Ship-Ship Communications in Preventing Collisions		
	Shipping Efficiency as a Function of Ship-Shore Communications for Ship Routing, Scheduling, and Cargo Allocation		

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DESCRIPTION OF CANDIDATE PARAMETERS (Continued)

	Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
270	Training of Ship Personnel (Training Costs)	Total Cost of Training Ship Personnel Per Time		
		Per Capita Cost of Training Ship Personnel Per Time		
280	Licensing/Certification of Ship Personnel	Number of Licenses/Certificates Issued Per Time		
		CG Workload as a Function of Licensing/Certification of Ship Personnel Per Time, Measured in Man Hours or Dollars Per Unit Time		
290	Ship Manning Levels	Crew Size Per Time for Selected Ship Types/Sizes or a Composite Average	9	
300	Ship Operating Costs	Ship Operating Cost as a Function of Personnel, Fuel, Insurance, Maintenance Costs Per Time for Selected Ship Types/Sizes Measured in Dollars/Voyage Day or Dollars/Year	9 13	
320	Specialization of Ship Types	Number (or Percentage of Total Fleet) of Ships Per Time by Selected Ship Types (Including Seagoing Barges)		
350 A	Registry, Ownership and Certification of Ships (U.S. Fleet)	Number (or Percentage of World Fleet) of US-Flag Ships by Selected Ship Type Per Time	9	

DESCRIPTION OF CANDIDATE PARAMETERS (Continued)

Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
600 A Port/Terminal Personnel, General (Number of Port Workers)	Number of Longshoremen Per Time		
600 B Port/Terminal Personnel, General (Productivity)	Man Hours Lost Per Time Because of Longshoremen's Strikes		
	Cargo Throughput (Tons or Dollars) Lost Per Time Because of Longshoremen's Strikes	12	
	Average Longshoremen's Wages Per Time	9	
610 A Port/Terminal Personnel: Training and Qualification (Training)	Total (or Per Capita) Cost of Training Port/Terminal Personnel Per Time		
610 B Port/Terminal Personnel: Training and Qualification (Licensing/Certification)	Number of Licenses/Certificates Issued Per Time		
	CG Workload as a Function of Licensing/Certification of Port Personnel Per Time, Measured in Man Hours or Dollars Per Unit Time		

DESCRIPTION OF CANDIDATE PARAMETERS (Continued)

Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
520 Cargo Handling, Ship	Number (or Percentage of Total Containership Fleet) of Non-Self-Sustaining Containerships Per Time		
	DWT (or Percentage of Total Containership Fleet DWP) of Non-Self-Sustaining Containerships Per Time		
530 Cargo Handling, Terminal	Number of Standard Containers (or Cargo Tonnage) Handled by US and Foreign Ports Per Time		
540 Port Facilities, General	US Cargo Throughput (Seaborne Imports and Exports) Per 1000 Longshoremen Per Time		
550 Ship Turn-Around Time	Average Turn-Around Time Per Time for Selected Ship Types/Sizes Measured in Days/Voyage or Days Per Year		
560 Harbor/Channel Improvement	Weight or Volume of Dredging in US Ports Per Time		
570 Harbor/Channel/Terminal Traffic (Traffic Density)	Numbers of Vessels Per Harbor Area Per Time		
	Number of Collisions Per Harbor Area Per Time		

DESCRIPTION OF CANDIDATE PARAMETERS (Continued)

	Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
410 B	Ship Propulsion (Fuel Consumption)	Specific Fuel Consumption Per Time for Selected Powerplants	9	
410 C	Ship Propulsion (Horsepower)	Frequent Maximum Horsepower Achieved by Selected Power Plants Per Time	9	
		Specific Volume Required by Selected Power Plants Per Time		
420	Ship Size	Average (or Maximum) Ship Size (DWT, Length, Draft) Per Time of Selected Ship Types	9	
430	Ship Maneuverability	Average Stopping Distance Per Unit Length Per Time of Selected Ship Types	9	
440	Ship Designs, General	Frequent Maximum Ship Speed Per Time for Selected Ship Types	9	
490 A	Intermodal Cargo Movement (Containerization)	Quantity or Percentage of Total Non-Bulk Cargo Moved Via Containers Per Time	9	
490 B	Intermodal Cargo Movement (Lightering Activity)	Quantity or Percentage of Total Cargo Lightered Per Time in the Course of Origin to Destination Shipments, Measured in Ton-Miles Per Unit Time		
490 C	Intermodal Cargo Movement (Pipelines)	Quantity or Percentage of Total Cargo Moved via Intra-Port or Ship to Shore Pipeline Per Time Measured in Ton-Miles Per Unit Time		

DESCRIPTION OF CANDIDATE PARAMETERS (Continued)

	Candidate Parameter	Possible Measures of Effectiveness (MOE)	Availability of MOE Data	Comments/Suggestions
		Aggregate DWT (or Percentage of World Fleet) of US-Flag Ships by Selected Ship Type Per Time		
350 B	Registry, Ownership and Certification of Ships (Flags of Convenience (FOC))	Number (or Percentage of World Fleet) of US FOC Ships by Selected Ship Type Per Time		
		Aggregate DWT (or Percentage of World Fleet) of US FOC Ships by Selected Ship Types Per Time		
370	Hull Features	Number of Tankers (or Percentage of Tanker Fleet) Built With Double Bottoms Per Time		
390 A	Construction Technologies (Shipbuilding Productivity)	Man Hours Per Light Ship Ton Per Time	9	
390 B	Construction Technologies (Age of US Fleet)	Average Age of US Fleet Per Time		
400	Ship Construction, General	Ship Delivery Capacity in Tons Per Time Possibly by Ship Size Classes	9	
410 A	Ship Propulsion (Type of Plant)	Number (or Percentage of Total) of Ships Propelled by Selected Power Plants Per Time	9	

APPENDIX 2

PRINCIPAL SOURCES

1. Three Alternative Future Scenarios for the Maritime Environment, Forecasting International, Ltd., 1976.

2. The U.S. Merchant Marine and The International Conference System, Harbridge House, Inc.

3. Merchant Fleet Forecast of Vessels in U.S.-Foreign Trade, Temple, Barker and Sloane, Inc., 1978.

4. A Long-Term Forecast of U.S. Waterborne Foreign Trade 1976-2000, Maritime Administration, 1977.

5. A Technology Assessment of Offshore Industry and Its Impact on the Maritime Industry 1976-2000, BDM Corporation, 1977.

6. Expansion of the Soviet Merchant Marine into the U.S. Maritime Trades, Maritime Administration, 1977.

7. Establishing a 200-Mile Fisheries Zone, Office of Technology Assesment, 1977.

8. A Study of the Future Requirements for Ships That Will Be Engaged in the U.S. World Trade for Both the Short and Long Term, Temple, Barker and Sloane, Inc., 1976.

9. U.S. Ocean Shipping Technology Forecast and Assessment, United Aircraft Research Laboratories, 1974.

10. Technological Forecast of Marine Transportation Systems 1970 to 2000, Moore, C. G. and Pomrehn, H. P., 1969.

11. Container Vessel Capacity in the U.S. Oceanborne Trade, Foreign and Domestic, 1976 and Forecast, Maritime Administration, 1979.

12. U.S. Bureau of the Census, Statistical Abstract of the U.S., various years through 1978.

13. Energy Use in the Marine Transportation Industry, Booz, Allen & Hamilton, 1977.

APPENDIX 3

PARAMETER IMPORTANCE ESTIMATE SCORING SHEET

Participant ______________________

MarAd_____
C.G._____

Estimated Importance of Future Changes in the Parameter to MarAd R&D Programs and Coast Guard Programs and Their Clientele

	Candidate Parameter	Rank	Magnitude Estimate
190	Traffic Control and Pilotage	_____	_____
210	Shipboard Navigation (Voyage Duration, Port-to-Port)	_____	_____
220	Collision/Grounding Avoidance	_____	_____
240	Communications	_____	_____
270	Training of Ship Personnel (Training Costs)	_____	_____
280	Licensing/Certification of Ship Personnel	_____	_____
290	Ship Manning Levels	_____	_____
300	Ship Operating Costs	_____	_____
320	Specialization of Ship Types	_____	_____
350 A	Registry, Ownership and Certification of Ships (U.S. Fleet)	_____	_____
350 B	Registry, Ownership and Certification of Ships (Flags of Convenience (FOC))	_____	_____
370	Hull Features	_____	_____
390 A	Construction Technologies (Shipbuilding Productivity)	_____	_____
390 B	Construction Technologies (Age of US Fleet)	_____	_____
400	Ship Construction, General	_____	_____
410 A	Ship Propulsion (Type of Plant)	_____	_____

APPENDIX 3

PARAMETER IMPORTANCE ESTIMATE SCORING SHEET (Continued)

Participant ______________________

MarAd_____
C.G._____

Estimated Importance of Future Changes in the Parameter to MarAd R&D Programs and Coast Guard Programs and Their Clientele

	Candidate Parameter	Rank	Magnitude Estimate
410 B	Ship Propulsion (Fuel Consumption)	____	____
410 C	Ship Propulsion (Horsepower)	____	____
420	Ship Size	____	____
430	Ship Maneuverability	____	____
440	Ship Designs, General	____	____
490 A	Intermodal Cargo Movement (Containerization)	____	____
490 B	Intermodal Cargo Movement (Lightering Activity)	____	____
490 C	Intermodal Cargo Movement (Pipelines)	____	____
520	Cargo Handling, Ship	____	____
530	Cargo Handling, Terminal	____	____
540	Port Facilities, General	____	____
550	Ship Turn-Around Time	____	____
560	Harbor/Channel Improvement	____	____
570	Harbor/Channel/Terminal Traffic (Traffic Density)	____	____
600 A	Port/Terminal Personnel, General (Number of Port Workers)	____	____
600 B	Port/Terminal Personnel, General (Productivity)	____	____
610 A	Port/Terminal Personnel: Training and Qualification (Training)	____	____
610 B	Port/Terminal Personnel: Training and Qualification (Licensing/Certification)	__	____

APPENDIX D

PARAMETER EVALUATION RESULTS: MARITIME ADMINISTRATION RESPONDENTS

Ranks and scores were assigned by the respondent, following instructions contained in the parameter evaluation questionnaire, Appendix C.

The "Normalized Score" column shows the assigned scores, transformed so that all scores sum to 1.00000.

RESPONDENT #1

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

	CHRISTENSEN MARITIME ADMINISTRATION	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	34	1.00	0.00063
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	20	38.00	0.02394
3	220: COLLISION/GROUNDING AVOIDANCE	33	3.00	0.00189
4	240: COMMUNICATIONS	8	80.00	0.05041
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	21	35.00	0.02205
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	16	47.00	0.02962
7	290: SHIP MANNING LEVELS	9	75.00	0.04726
8	300: SHIP OPERATING COSTS	2	90.00	0.05671
9	320: SPECIALIZATION OF SHIP TYPES	3	87.00	0.05482
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	10	70.00	0.04411
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	19	40.00	0.02520
12	370: HULL FEATURES	32	5.00	0.00315
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	1	100.00	0.06301
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	11	67.00	0.04222
15	400: SHIP CONSTRUCTION, GENERAL	15	50.00	0.03151
16	410A: SHIP PROPULSION (TYPE OF PLANT)	12	65.00	0.04096
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	4	85.00	0.05356
18	410C: SHIP PROPULSION (HORSEPOWER)	17	45.00	0.02836
19	420: SHIP SIZE	5	84.00	0.05293
20	430: SHIP MANEUVERABILITY	28	15.00	0.00945
21	440: SHIP DESIGNS, GENERAL	13	60.00	0.03781
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	7	82.00	0.05167
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	25	25.00	0.01575
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	27	18.00	0.01134
25	520: CARGO HANDLING, SHIP	26	20.00	0.01260
26	530: CARGO HANDLING, TERMINAL	18	42.00	0.02647
27	540: PORT FACILITIES, GENERAL	14	55.00	0.03466
28	550: SHIP TURN-AROUND TIME	6	83.00	0.05230
29	560: HARBOR/CHANNEL IMPROVEMENT	31	7.00	0.00441
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	22	32.00	0.02016
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	24	28.00	0.01764
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	23	30.00	0.01890
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	29	13.00	0.00819
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	30	10.00	0.00630

RESPONDENT #2

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

	BLACK MARITIME ADMINISTRATION	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE		0.00	0.00000
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)		0.00	0.00000
3	220: COLLISION/GROUNDING AVOIDANCE		0.00	0.00000
4	240: COMMUNICATIONS	14	70.00	0.03865
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	21	40.00	0.02209
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL		0.00	0.00000
7	290: SHIP MANNING LEVELS	15	65.00	0.03589
8	300: SHIP OPERATING COSTS	1	100.00	0.05522
9	320: SPECIALIZATION OF SHIP TYPES	8	85.00	0.04694
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	9	85.00	0.04694
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	10	85.00	0.04694
12	370: HULL FEATURES		0.00	0.00000
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	12	70.00	0.03865
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	11	70.00	0.03865
15	400: SHIP CONSTRUCTION, GENERAL	2	99.00	0.05467
16	410A: SHIP PROPULSION (TYPE OF PLANT)	13	70.00	0.03865
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	7	90.00	0.04970
18	410C: SHIP PROPULSION (HORSEPOWER)	18	60.00	0.03313
19	420: SHIP SIZE	26	30.00	0.01657
20	430: SHIP MANEUVERABILITY		0.00	0.00000
21	440: SHIP DESIGNS, GENERAL	17	65.00	0.03589
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	3	95.00	0.05246
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	20	45.00	0.02485
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	19	50.00	0.02761
25	520: CARGO HANDLING, SHIP	4	94.00	0.05191
26	530: CARGO HANDLING, TERMINAL	5	94.00	0.05191
27	540: PORT FACILITIES, GENERAL	25	20.00	0.01104
28	550: SHIP TURN-AROUND TIME	6	94.00	0.05191
29	560: HARBOR/CHANNEL IMPROVEMENT	16	65.00	0.03589
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)		0.00	0.00000
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	10	85.00	0.04694
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	9	85.00	0.04694
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)		0.00	0.00000
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)		0.00	0.00000

RESPONDENT #3

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

	GROSS MARITIME ADMINISTRATION	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	13	80.00	0.03671
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	26	48.00	0.02203
3	220: COLLISION/GROUNDING AVOIDANCE	25	48.00	0.02203
4	240: COMMUNICATIONS	12	85.00	0.03901
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	29	36.00	0.01652
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	27	41.00	0.01882
7	290: SHIP MANNING LEVELS	28	38.00	0.01744
8	300: SHIP OPERATING COSTS	2	99.00	0.04543
9	320: SPECIALIZATION OF SHIP TYPES	17	67.00	0.03075
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	19	61.00	0.02799
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	31	34.00	0.01560
12	370: HULL FEATURES	33	14.00	0.00642
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	1	100.00	0.04589
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	16	68.00	0.03121
15	400: SHIP CONSTRUCTION, GENERAL	10	85.00	0.03901
16	410A: SHIP PROPULSION (TYPE OF PLANT)	3	95.00	0.04360
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	11	85.00	0.03901
18	410C: SHIP PROPULSION (HORSEPOWER)	20	58.00	0.02662
19	420: SHIP SIZE	21	57.00	0.02616
20	430: SHIP MANEUVERABILITY	15	78.00	0.03580
21	440: SHIP DESIGNS, GENERAL	22	55.00	0.02524
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	23	50.00	0.02295
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	24	48.00	0.02203
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	18	65.00	0.02983
25	520: CARGO HANDLING, SHIP	4	90.00	0.04130
26	530: CARGO HANDLING, TERMINAL	4	90.00	0.04130
27	540: PORT FACILITIES, GENERAL	4	90.00	0.04130
28	550: SHIP TURN-AROUND TIME	4	90.00	0.04130
29	560: HARBOR/CHANNEL IMPROVEMENT	4	90.00	0.04130
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	14	78.00	0.03580
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	25.00	0.01147
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	4	90.00	0.04130
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	29	36.00	0.01652
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	34	5.00	0.00229

RESPONDENT #4

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

	LISNYK MARITIME ADMINISTRATION	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	32	30.00	0.01307
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	17	60.00	0.02614
3	220: COLLISION/GROUNDING AVOIDANCE	9	100.00	0.04357
4	240: COMMUNICATIONS	9	100.00	0.04357
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	30	40.00	0.01743
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	39	10.00	0.00436
7	290: SHIP MANNING LEVELS	9	100.00	0.04357
8	300: SHIP OPERATING COSTS	4	200.00	0.08715
9	320: SPECIALIZATION OF SHIP TYPES	22	50.00	0.02179
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	1	300.00	0.13072
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	22	50.00	0.02179
12	370: HULL FEATURES	38	15.00	0.00654
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	4	200.00	0.08715
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	17	60.00	0.02614
15	400: SHIP CONSTRUCTION, GENERAL	22	50.00	0.02179
16	410A: SHIP PROPULSION (TYPE OF PLANT)	9	100.00	0.04357
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	9	100.00	0.04357
18	410C: SHIP PROPULSION (HORSEPOWER)	33	20.00	0.00871
19	420: SHIP SIZE	9	100.00	0.04357
20	430: SHIP MANEUVERABILITY	22	50.00	0.02179
21	440: SHIP DESIGNS, GENERAL	39	10.00	0.00436
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	17	60.00	0.02614
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	33	20.00	0.00871
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	33	20.00	0.00871
25	520: CARGO HANDLING, SHIP	33	20.00	0.00871
26	530: CARGO HANDLING, TERMINAL	17	60.00	0.02614
27	540: PORT FACILITIES, GENERAL	22	50.00	0.02179
28	550: SHIP TURN-AROUND TIME	22	50.00	0.02179
29	560: HARBOR/CHANNEL IMPROVEMENT	17	60.00	0.02614
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	30	40.00	0.01743
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	15	80.00	0.03486
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	17	60.00	0.02614
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	33	20.00	0.00871
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	39	10.00	0.00436

RESPONDENT #5

PARAMETER IMPORTANCE ESTIMATES

MARITIME ADMINISTRATION RESPONSES

	RINEHART MARITIME ADMINISTRATION	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	27	20.00	0.01444
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	4	80.00	0.05776
3	220: COLLISION/GROUNDING AVOIDANCE	10	60.00	0.04332
4	240: COMMUNICATIONS	17	35.00	0.02527
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	8	60.00	0.04332
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	28	20.00	0.01444
7	290: SHIP MANNING LEVELS	14	40.00	0.02888
8	300: SHIP OPERATING COSTS	5	80.00	0.05776
9	320: SPECIALIZATION OF SHIP TYPES	20	30.00	0.02166
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	1	100.00	0.07220
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	19	30.00	0.02166
12	370: HULL FEATURES	24	20.00	0.01444
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	7	70.00	0.05054
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	15	40.00	0.02888
15	400: SHIP CONSTRUCTION, GENERAL	2	100.00	0.07220
16	410A: SHIP PROPULSION (TYPE OF PLANT)	21	25.00	0.01805
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	6	70.00	0.05054
18	410C: SHIP PROPULSION (HORSEPOWER)	22	25.00	0.01805
19	420: SHIP SIZE	3	80.00	0.05776
20	430: SHIP MANEUVERABILITY	13	50.00	0.03610
21	440: SHIP DESIGNS, GENERAL	23	25.00	0.01805
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	16	35.00	0.02527
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	25	20.00	0.01444
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	34	5.00	0.00361
25	520: CARGO HANDLING, SHIP	18	30.00	0.02166
26	530: CARGO HANDLING, TERMINAL	26	20.00	0.01444
27	540: PORT FACILITIES, GENERAL	11	50.00	0.03610
28	550: SHIP TURN-AROUND TIME	9	60.00	0.04332
29	560: HARBOR/CHANNEL IMPROVEMENT	12	50.00	0.03610
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	33	10.00	0.00722
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	30	10.00	0.00722
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	29	15.00	0.01083
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	31	10.00	0.00722
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	32	10.00	0.00722

APPENDIX E

PARAMETER EVALUATION RESULTS: COAST GUARD RESPONDENTS

Ranks and scores were assigned by the respondent, following instructions contained in the parameter evaluation questionnaire, Appendix C.

The "Normalized Score" column shows the assigned scores, transformed so that all scores sum to 1.00000.

RESPONDENT #1

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	BANNAN COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	8	70.00	0.07243
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	10	60.00	0.06208
3	220: COLLISION/GROUNDING AVOIDANCE	3	85.00	0.08795
4	240: COMMUNICATIONS	10	60.00	0.06208
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	1	100.00	0.10347
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	2	90.00	0.09312
7	290: SHIP MANNING LEVELS	5	80.00	0.08277
8	300: SHIP OPERATING COSTS	32	1.00	0.00103
9	320: SPECIALIZATION OF SHIP TYPES	22	3.00	0.00310
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	4	80.00	0.08277
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	25	1.00	0.00103
12	370: HULL FEATURES	19	5.00	0.00517
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	6	75.00	0.07760
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	23	3.00	0.00310
15	400: SHIP CONSTRUCTION, GENERAL	18	5.00	0.00517
16	410A: SHIP PROPULSION (TYPE OF PLANT)	24	1.00	0.00103
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	27	1.00	0.00103
18	410C: SHIP PROPULSION (HORSEPOWER)	21	5.00	0.00517
19	420: SHIP SIZE	13	20.00	0.02069
20	430: SHIP MANEUVERABILITY	12	25.00	0.02587
21	440: SHIP DESIGNS, GENERAL	12	25.00	0.02587
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	28	1.00	0.00103
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	15	15.00	0.01552
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	16	15.00	0.01552
25	520: CARGO HANDLING, SHIP	20	5.00	0.00517
26	530: CARGO HANDLING, TERMINAL	29	1.00	0.00103
27	540: PORT FACILITIES, GENERAL	17	5.00	0.00517
28	550: SHIP TURN-AROUND TIME	30	1.00	0.00103
29	560: HARBOR/CHANNEL IMPROVEMENT	11	50.00	0.05173
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	9	70.00	0.07243
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	17	5.00	0.00517
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	34	0.50	0.00052
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	23	2.00	0.00207
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	33	1.00	0.00103

RESPONDENT #2

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	DITTO COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	4	450.00	0.07965
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	10	350.00	0.06195
3	220: COLLISION/GROUNDING AVOIDANCE	5	400.00	0.07080
4	240: COMMUNICATIONS	6	375.00	0.06637
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	1	500.00	0.08850
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	2	500.00	0.08850
7	290: SHIP MANNING LEVELS	3	475.00	0.08407
8	300: SHIP OPERATING COSTS	33	10.00	0.00177
9	320: SPECIALIZATION OF SHIP TYPES	20	40.00	0.00708
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	14	150.00	0.02655
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	15	100.00	0.01770
12	370: HULL FEATURES	11	300.00	0.05310
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	7	350.00	0.06195
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	8	350.00	0.06195
15	400: SHIP CONSTRUCTION, GENERAL	9	350.00	0.06195
16	410A: SHIP PROPULSION (TYPE OF PLANT)	21	40.00	0.00708
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	18	50.00	0.00885
18	410C: SHIP PROPULSION (HORSEPOWER)	22	30.00	0.00531
19	420: SHIP SIZE	12	250.00	0.04425
20	430: SHIP MANEUVERABILITY	19	45.00	0.00796
21	440: SHIP DESIGNS, GENERAL	13	200.00	0.03540
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	23	30.00	0.00531
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	24	30.00	0.00531
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	30	20.00	0.00354
25	520: CARGO HANDLING, SHIP	27	25.00	0.00442
26	530: CARGO HANDLING, TERMINAL	26	25.00	0.00442
27	540: PORT FACILITIES, GENERAL	25	25.00	0.00442
28	550: SHIP TURN-AROUND TIME	31	20.00	0.00354
29	560: HARBOR/CHANNEL IMPROVEMENT	17	50.00	0.00885
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	16	50.00	0.00885
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	15.00	0.00265
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	34	5.00	0.00088
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	28	20.00	0.00354
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	29	20.00	0.00354

RESPONDENT #3

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

FELDMAN COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1 190: TRAFFIC CONTROL AND PILOTAGE	3	9.00	0.04663
2 210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	6	8.00	0.04145
3 220: COLLISION/GROUNDING AVOIDANCE	2	9.00	0.04663
4 240: COMMUNICATIONS	1	9.00	0.04663
5 270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	21	3.00	0.01554
6 280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	8	8.00	0.04145
7 290: SHIP MANNING LEVELS	10	8.00	0.04145
8 300: SHIP OPERATING COSTS	34	2.00	0.01036
9 320: SPECIALIZATION OF SHIP TYPES	7	7.00	0.03627
10 350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	31	1.00	0.00518
11 350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	30	1.00	0.00518
12 370: HULL FEATURES	9	9.00	0.04663
13 390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	20	6.00	0.03109
14 390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	19	5.00	0.02591
15 400: SHIP CONSTRUCTION, GENERAL	11	7.00	0.03627
16 410A: SHIP PROPULSION (TYPE OF PLANT)	13	7.00	0.03627
17 410B: SHIP PROPULSION (FUEL CONSUMPTION)	23	7.00	0.03627
18 410C: SHIP PROPULSION (HORSEPOWER)	14	6.00	0.03109
19 420: SHIP SIZE	15	5.00	0.02591
20 430: SHIP MANEUVERABILITY	5	9.00	0.04663
21 440: SHIP DESIGNS, GENERAL	12	6.00	0.03109
22 490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	22	7.00	0.03627
23 490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	16	7.00	0.03627
24 490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	17	7.00	0.03627
25 520: CARGO HANDLING, SHIP	18	7.00	0.03627
26 530: CARGO HANDLING, TERMINAL	24	6.00	0.03109
27 540: PORT FACILITIES, GENERAL	25	3.00	0.01554
28 550: SHIP TURN-AROUND TIME	26	4.00	0.02073
29 560: HARBOR/CHANNEL IMPROVEMENT	29	5.00	0.02591
30 570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	4	8.00	0.04145
31 600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	33	1.00	0.00518
32 600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	32	1.00	0.00518
33 610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	28	2.00	0.01036
34 610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	27	3.00	0.01554

RESPONDENT #4

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	H COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	19	350.00	0.02108
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	7	850.00	0.05120
3	220: COLLISION/GROUNDING AVOIDANCE	9	850.00	0.05120
4	240: COMMUNICATIONS	8	850.00	0.05120
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	26	300.00	0.01807
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	23	305.00	0.01837
7	290: SHIP MANNING LEVELS	29	105.00	0.00633
8	300: SHIP OPERATING COSTS	1	1000.00	0.06024
9	320: SPECIALIZATION OF SHIP TYPES	10	800.00	0.04819
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	33	10.00	0.00060
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	34	10.00	0.00060
12	370: HULL FEATURES	30	100.00	0.00602
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	21	350.00	0.02108
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	22	350.00	0.02108
15	400: SHIP CONSTRUCTION, GENERAL	28	150.00	0.00904
16	410A: SHIP PROPULSION (TYPE OF PLANT)	2	910.00	0.05482
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	3	905.00	0.05452
18	410C: SHIP PROPULSION (HORSEPOWER)	4	900.00	0.05422
19	420: SHIP SIZE	5	850.00	0.05120
20	430: SHIP MANEUVERABILITY	6	845.00	0.05090
21	440: SHIP DESIGNS, GENERAL	11	800.00	0.04819
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	16	410.00	0.02470
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	17	405.00	0.02440
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	18	400.00	0.02410
25	520: CARGO HANDLING, SHIP	12	750.00	0.04518
26	530: CARGO HANDLING, TERMINAL	13	745.00	0.04488
27	540: PORT FACILITIES, GENERAL	14	600.00	0.03614
28	550: SHIP TURN-AROUND TIME	15	500.00	0.03012
29	560: HARBOR/CHANNEL IMPROVEMENT	27	150.00	0.00904
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	20	350.00	0.02108
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	24	300.00	0.01807
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	25	300.00	0.01807
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	31	50.00	0.00301
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	32	50.00	0.00301

RESPONDENT #5

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	MARGESON COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	5	1000.00	0.04126
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	3	1000.00	0.04126
3	220: COLLISION/GROUNDING AVOIDANCE	1	9999.99	0.41264
4	240: COMMUNICATIONS	7	100.00	0.00413
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	12	50.00	0.00206
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	4	1000.00	0.04126
7	290: SHIP MANNING LEVELS	10	100.00	0.00413
8	300: SHIP OPERATING COSTS	31	1.00	0.00004
9	320: SPECIALIZATION OF SHIP TYPES	17	10.00	0.00041
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	21	10.00	0.00041
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	20	10.00	0.00041
12	370: HULL FEATURES	16	10.00	0.00041
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	32	1.00	0.00004
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	26	5.00	0.00021
15	400: SHIP CONSTRUCTION, GENERAL	15	10.00	0.00041
16	410A: SHIP PROPULSION (TYPE OF PLANT)	18	10.00	0.00041
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	28	5.00	0.00021
18	410C: SHIP PROPULSION (HORSEPOWER)	19	10.00	0.00041
19	420: SHIP SIZE	9	100.00	0.00413
20	430: SHIP MANEUVERABILITY	6	500.00	0.02063
21	440: SHIP DESIGNS, GENERAL	8	100.00	0.00413
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	27	5.00	0.00021
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	22	10.00	0.00041
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	23	5.00	0.00021
25	520: CARGO HANDLING, SHIP	25	5.00	0.00021
26	530: CARGO HANDLING, TERMINAL	24	5.00	0.00021
27	540: PORT FACILITIES, GENERAL	13	50.00	0.00206
28	550: SHIP TURN-AROUND TIME	14	10.00	0.00041
29	560: HARBOR/CHANNEL IMPROVEMENT	11	100.00	0.00413
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	2	9999.99	0.41264
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	34	1.00	0.00004
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	33	1.00	0.00004
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	29	5.00	0.00021
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	30	5.00	0.00021

RESPONDENT #6

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	MARHEVKO COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	3	440.00	0.05337
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	7	345.00	0.04184
3	220: COLLISION/GROUNDING AVOIDANCE	2	450.00	0.05458
4	240: COMMUNICATIONS	4	430.00	0.05215
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	9	310.00	0.03760
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	13	295.00	0.03578
7	290: SHIP MANNING LEVELS	20	220.00	0.02668
8	300: SHIP OPERATING COSTS	29	120.00	0.01455
9	320: SPECIALIZATION OF SHIP TYPES	23	185.00	0.02244
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	17	230.00	0.02790
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	21	200.00	0.02426
12	370: HULL FEATURES	27	145.00	0.01759
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	16	250.00	0.03032
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	26	150.00	0.01819
15	400: SHIP CONSTRUCTION, GENERAL	5	390.00	0.04730
16	410A: SHIP PROPULSION (TYPE OF PLANT)	24	160.00	0.01941
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	28	140.00	0.01698
18	410C: SHIP PROPULSION (HORSEPOWER)	33	50.00	0.00606
19	420: SHIP SIZE	14	280.00	0.03396
20	430: SHIP MANEUVERABILITY	30	120.00	0.01455
21	440: SHIP DESIGNS, GENERAL	8	330.00	0.04002
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	34	50.00	0.00606
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	15	270.00	0.03275
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	31	80.00	0.00970
25	520: CARGO HANDLING, SHIP	6	350.00	0.04245
26	530: CARGO HANDLING, TERMINAL	19	220.00	0.02668
27	540: PORT FACILITIES, GENERAL	10	310.00	0.03760
28	550: SHIP TURN-AROUND TIME	22	190.00	0.02304
29	560: HARBOR/CHANNEL IMPROVEMENT	25	160.00	0.01941
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	1	500.00	0.06064
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	50.00	0.00606
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	18	225.00	0.02729
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	12	300.00	0.03639
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	11	300.00	0.03639

RESPONDENT #7

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	NOLL COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	4	900.00	0.06560
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	12	580.00	0.04227
3	220: COLLISION/GROUNDING AVOIDANCE	1	1000.00	0.07289
4	240: COMMUNICATIONS	23	90.00	0.00656
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	14	500.00	0.03644
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	3	950.00	0.06924
7	290: SHIP MANNING LEVELS	9	730.00	0.05321
8	300: SHIP OPERATING COSTS	27	50.00	0.00364
9	320: SPECIALIZATION OF SHIP TYPES	16	350.00	0.02551
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	6	850.00	0.06195
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	6	850.00	0.06195
12	370: HULL FEATURES	17	310.00	0.02259
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	24	70.00	0.00510
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	18	280.00	0.02041
15	400: SHIP CONSTRUCTION, GENERAL	24	70.00	0.00510
16	410A: SHIP PROPULSION (TYPE OF PLANT)	27	50.00	0.00364
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	27	50.00	0.00364
18	410C: SHIP PROPULSION (HORSEPOWER)	27	50.00	0.00364
19	420: SHIP SIZE	8	750.00	0.05466
20	430: SHIP MANEUVERABILITY	2	980.00	0.07143
21	440: SHIP DESIGNS, GENERAL	11	650.00	0.04738
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	13	570.00	0.04155
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	21	150.00	0.01093
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	14	500.00	0.03644
25	520: CARGO HANDLING, SHIP	19	270.00	0.01968
26	530: CARGO HANDLING, TERMINAL	19	270.00	0.01968
27	540: PORT FACILITIES, GENERAL	31	20.00	0.00146
28	550: SHIP TURN-AROUND TIME	32	10.00	0.00073
29	560: HARBOR/CHANNEL IMPROVEMENT	9	730.00	0.05321
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	4	900.00	0.06560
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	10.00	0.00073
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	32	10.00	0.00073
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	24	70.00	0.00510
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	22	100.00	0.00729

RESPONDENT #8

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	RIEMER COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	2	10.00	0.06369
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	3	8.00	0.05096
3	220: COLLISION/GROUNDING AVOIDANCE	1	10.00	0.06369
4	240: COMMUNICATIONS	4	8.00	0.05096
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	26	3.00	0.01911
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	6	7.00	0.04459
7	290: SHIP MANNING LEVELS	12	6.00	0.03822
8	300: SHIP OPERATING COSTS	31	1.00	0.00637
9	320: SPECIALIZATION OF SHIP TYPES	28	2.00	0.01274
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	27	2.00	0.01274
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	25	3.00	0.01911
12	370: HULL FEATURES	7	7.00	0.04459
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	21	4.00	0.02548
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	20	4.00	0.02548
15	400: SHIP CONSTRUCTION, GENERAL	13	5.00	0.03185
16	410A: SHIP PROPULSION (TYPE OF PLANT)	22	4.00	0.02548
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	19	4.00	0.02548
18	410C: SHIP PROPULSION (HORSEPOWER)	14	5.00	0.03185
19	420: SHIP SIZE	15	5.00	0.03185
20	430: SHIP MANEUVERABILITY	8	6.00	0.03822
21	440: SHIP DESIGNS, GENERAL	9	6.00	0.03822
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	29	2.00	0.01274
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	30	2.00	0.01274
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	18	5.00	0.03185
25	520: CARGO HANDLING, SHIP	23	3.00	0.01911
26	530: CARGO HANDLING, TERMINAL	24	3.00	0.01911
27	540: PORT FACILITIES, GENERAL	17	5.00	0.03185
28	550: SHIP TURN-AROUND TIME	34	1.00	0.00637
29	560: HARBOR/CHANNEL IMPROVEMENT	16	5.00	0.03185
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	5	7.00	0.04459
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	1.00	0.00637
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	33	1.00	0.00637
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	10	6.00	0.03822
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	11	6.00	0.03822

RESPONDENT #9

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

VERPLANCK COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1 190: TRAFFIC CONTROL AND PILOTAGE	1	100.00	0.09785
2 210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	25	5.00	0.00489
3 220: COLLISION/GROUNDING AVOIDANCE	2	95.00	0.09295
4 240: COMMUNICATIONS	3	85.00	0.08317
5 270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	20	8.00	0.00783
6 280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	19	9.00	0.00881
7 290: SHIP MANNING LEVELS	18	9.00	0.00881
8 300: SHIP OPERATING COSTS	16	20.00	0.01957
9 320: SPECIALIZATION OF SHIP TYPES	13	40.00	0.03914
10 350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	14	30.00	0.02935
11 350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	15	30.00	0.02935
12 370: HULL FEATURES	24	5.00	0.00489
13 390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	21	6.00	0.00587
14 390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	22	6.00	0.00587
15 400: SHIP CONSTRUCTION, GENERAL	23	6.00	0.00587
16 410A: SHIP PROPULSION (TYPE OF PLANT)	28	4.00	0.00391
17 410B: SHIP PROPULSION (FUEL CONSUMPTION)	27	4.00	0.00391
18 410C: SHIP PROPULSION (HORSEPOWER)	29	4.00	0.00391
19 420: SHIP SIZE	8	55.00	0.05382
20 430: SHIP MANEUVERABILITY	5	75.00	0.07339
21 440: SHIP DESIGNS, GENERAL	9	50.00	0.04892
22 490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	10	50.00	0.04892
23 490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	7	60.00	0.05871
24 490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	34	1.00	0.00098
25 520: CARGO HANDLING, SHIP	11	50.00	0.04892
26 530: CARGO HANDLING, TERMINAL	12	50.00	0.04892
27 540: PORT FACILITIES, GENERAL	6	60.00	0.05871
28 550: SHIP TURN-AROUND TIME	17	10.00	0.00978
29 560: HARBOR/CHANNEL IMPROVEMENT	26	5.00	0.00489
30 570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	4	80.00	0.07828
31 600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	33	2.00	0.00196
32 600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	31	3.00	0.00294
33 610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	32	2.00	0.00196
34 610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	30	3.00	0.00294

RESPONDENT #10

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	WALDEN COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	6	50.00	0.07112
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	7	40.00	0.05690
3	220: COLLISION/GROUNDING AVOIDANCE	2	100.00	0.14225
4	240: COMMUNICATIONS	8	40.00	0.05690
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	25	1.00	0.00142
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	13	10.00	0.01422
7	290: SHIP MANNING LEVELS	12	10.00	0.01422
8	300: SHIP OPERATING COSTS		0.00	0.00000
9	320: SPECIALIZATION OF SHIP TYPES	21	5.00	0.00711
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	26	1.00	0.00142
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	30	1.00	0.00142
12	370: HULL FEATURES	9	20.00	0.02845
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	23	1.00	0.00142
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	20	5.00	0.00711
15	400: SHIP CONSTRUCTION, GENERAL	24	1.00	0.00142
16	410A: SHIP PROPULSION (TYPE OF PLANT)	10	10.00	0.01422
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)		0.00	0.00000
18	410C: SHIP PROPULSION (HORSEPOWER)	11	10.00	0.01422
19	420: SHIP SIZE	5	70.00	0.09957
20	430: SHIP MANEUVERABILITY	1	100.00	0.14225
21	440: SHIP DESIGNS, GENERAL	15	10.00	0.01422
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	27	1.00	0.00142
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	22	5.00	0.00711
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)		0.00	0.00000
25	520: CARGO HANDLING, SHIP	18	10.00	0.01422
26	530: CARGO HANDLING, TERMINAL	19	10.00	0.01422
27	540: PORT FACILITIES, GENERAL	14	10.00	0.01422
28	550: SHIP TURN-AROUND TIME		0.00	0.00000
29	560: HARBOR/CHANNEL IMPROVEMENT	4	80.00	0.11380
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	3	80.00	0.11380
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	28	1.00	0.00142
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	29	1.00	0.00142
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	17	10.00	0.01422
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	16	10.00	0.01422

RESPONDENT #11

PARAMETER IMPORTANCE ESTIMATES

COAST GUARD RESPONSES

	WISNESKEY COAST GUARD	RANK	SCORE	NORMALIZED SCORE
1	190: TRAFFIC CONTROL AND PILOTAGE	4	19.00	0.05846
2	210: SHIPBOARD NAVIGATION (VOYAGE DURATION, PORT-TO-PORT)	5	18.00	0.05538
3	220: COLLISION/GROUNDING AVOIDANCE	6	10.00	0.03077
4	240: COMMUNICATIONS	3	20.00	0.06154
5	270: TRAINING OF SHIP PERSONNEL (TRAINING COSTS)	29	5.00	0.01538
6	280: LICENSING/CERTIFICATION OF SHIP PERSONNEL	1	20.00	0.06154
7	290: SHIP MANNING LEVELS	2	20.00	0.06154
8	300: SHIP OPERATING COSTS	27	5.00	0.01538
9	320: SPECIALIZATION OF SHIP TYPES	13	10.00	0.03077
10	350A: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (U.S. FLEET)	34	1.00	0.00308
11	350B: REGISTRY, OWNERSHIP AND CERTIFICATION OF SHIPS (FLAGS OF CONVENIENCE (FOC))	28	5.00	0.01538
12	370: HULL FEATURES	12	10.00	0.03077
13	390A: CONSTRUCTION TECHNOLOGIES (SHIPBUILDING PRODUCTIVITY)	33	2.00	0.00615
14	390B: CONSTRUCTION TECHNOLOGIES (AGE OF U.S. FLEET)	20	8.00	0.02462
15	400: SHIP CONSTRUCTION, GENERAL	24	7.00	0.02154
16	410A: SHIP PROPULSION (TYPE OF PLANT)	25	6.00	0.01846
17	410B: SHIP PROPULSION (FUEL CONSUMPTION)	19	8.00	0.02462
18	410C: SHIP PROPULSION (HORSEPOWER)	18	8.00	0.02462
19	420: SHIP SIZE	10	10.00	0.03077
20	430: SHIP MANEUVERABILITY	7	15.00	0.04615
21	440: SHIP DESIGNS, GENERAL	11	10.00	0.03077
22	490A: INTERMODAL CARGO MOVEMENT (CONTAINERIZATION)	26	5.00	0.01538
23	490B: INTERMODAL CARGO MOVEMENT (LIGHTERING ACTIVITY)	17	8.00	0.02462
24	490C: INTERMODAL CARGO MOVEMENT (PIPELINES)	23	7.00	0.02154
25	520: CARGO HANDLING, SHIP	21	8.00	0.02462
26	530: CARGO HANDLING, TERMINAL	22	8.00	0.02462
27	540: PORT FACILITIES, GENERAL	14	10.00	0.03077
28	550: SHIP TURN-AROUND TIME	16	8.00	0.02462
29	560: HARBOR/CHANNEL IMPROVEMENT	8	15.00	0.04615
30	570: HARBOR/CHANNEL/TERMINAL TRAFFIC (TRAFFIC DENSITY)	9	17.00	0.05231
31	600A: PORT/TERMINAL PERSONNEL, GENERAL (NUMBER OF PORT WORKERS)	32	1.00	0.00308
32	600B: PORT/TERMINAL PERSONNEL, GENERAL (PRODUCTIVITY)	31	1.00	0.00308
33	610A: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (TRAINING)	30	10.00	0.03077
34	610B: PORT/TERMINAL PERSONNEL: TRAINING AND QUALIFICATION (LICENSING/CERTIFICATION)	15	10.00	0.03077

APPENDIX F

PROJECTIONS FOR PARAMETER 420

Average DWT of ships of all types of 1000 GRT or more in the world fleet.

Parameter 420 (Table 4-5) is a measure of the size of the world merchant fleet. The average DWT (fleet DWT (Table F-1)/number of ships (Table F-2) has been rising exponentially over the last 40 years. Under Scenario R average DWT is postulated to show slow growth as a result of modest increases in U.S. foreign trade; toward the end of the period both U.S. foreign trade and average DWT are projected to rise. Trade is depressed in Scenario H, particularly oil trade. This should result in a reduction in the number of the largest ships in the fleet (tankers), hence a marked reduction in average DWT. The projection for Scenario E is simply a straight line which results in a doubling of the 1977 average DWT by 2005 in an expanding trade situation.

TABLE F-1

DEADWEIGHT TONNAGE OF THE WORLD MERCHANT FLEET
(INCLUDES SHIPS OF ALL TYPES OF 1000 GRT OR MORE)

(Millions of long tons)

HISTORICAL DATA

1939	80.6	1966	232.2
1946	99.2	1967	250.4
1951	110.7	1968	273.2
1953	119.4	1969	297.5
1955	130.0	1970	327.0
1956	136.9	1971	361.7
1957	147.3	1972	399.6
1958	158.1	1973	446.4
1959	166.0	1974	503.4
1960	171.9	1975	556.6
1961	177.3	1976	606.5
1962	185.8		

PROJECTED DATA

LN(Y) = 4.094 + 0.05760*(YEAR - 1940)
BACKCAST: 1939 - 1976 R SQUARED: 0.94

95% CONFIDENCE LIMITS (N = 23)

	LOW	MID	HIGH		LOW	MID	HIGH
1950	79.3	106.6	143.4	1980	445.2	600.1	809.0
1955	105.7	142.2	191.3	1985	593.6	800.4	1079.3
1960	140.9	189.6	255.3	1990	791.4	1067.6	1440.1
1965	187.8	252.9	340.6	1995	1055.2	1423.9	1921.4
1970	250.4	337.4	454.4	2000	1406.8	1899.1	2563.6
1975	333.9	450.0	606.3	2005	1875.7	2532.9	3420.3

Data as of 31 December except 1939 (1 September) and 1946 (30 June). Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

DEADWEIGHT TONNAGE OF THE WORLD MERCHANT FLEET
(INCLUDES SHIPS OF ALL TYPES OF 1000 GRT OR MORE)

(Millions of long tons)

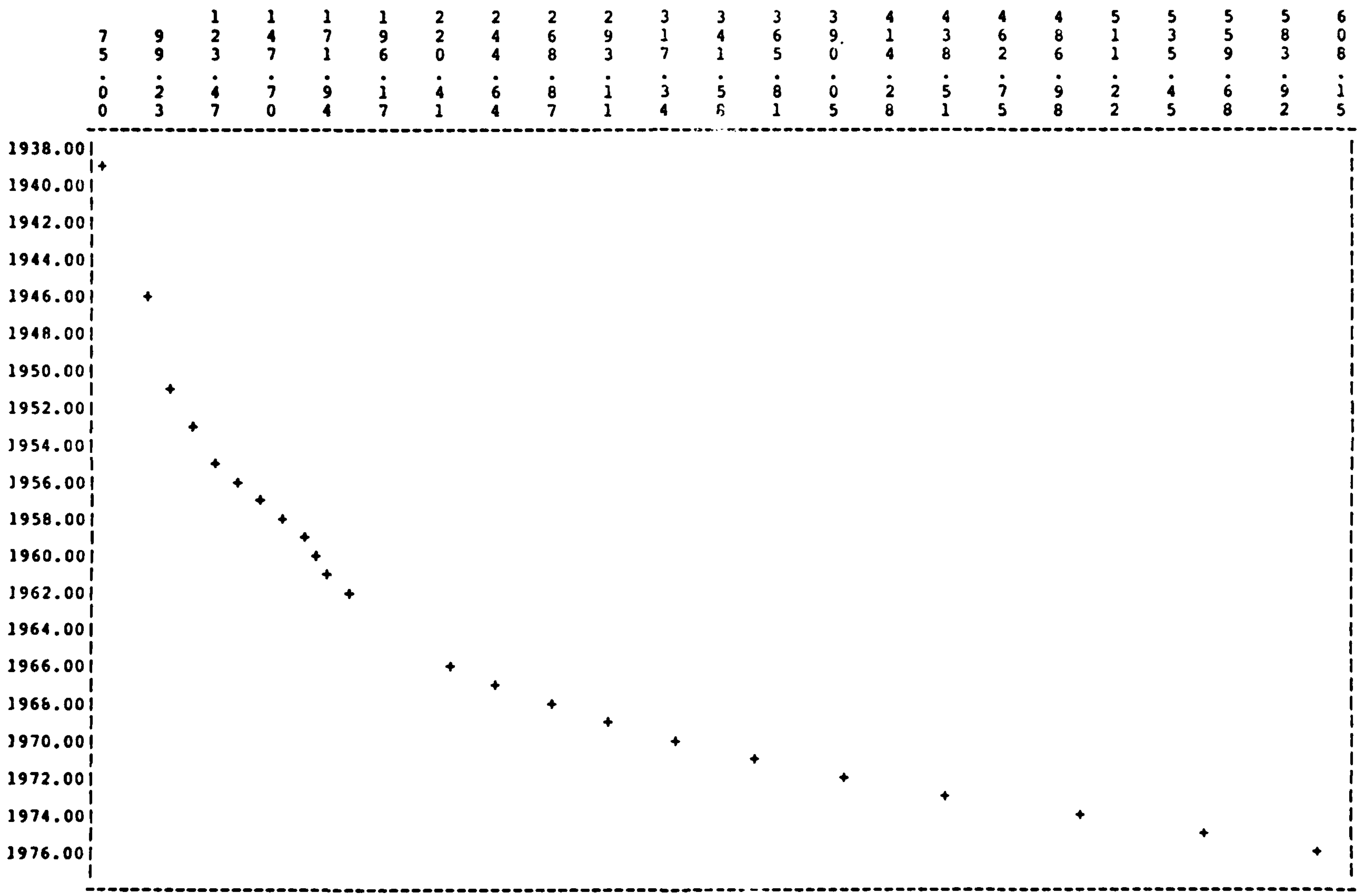


TABLE F-2

WORLD MERCHANT FLEET
(SHIPS OF 1000 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1939	12798	1966	18423
1946	12445	1967	18800
1951	13646	1968	19361
1953	14370	1969	19570
1955	15148	1970	19980
1956	15615	1971	20544
1957	16293	1972	21009
1958	16966	1973	21600
1959	17185	1974	22449
1960	17317	1975	22872
1961	17426	1976	23586
1962	17861	1977	24096

PROJECTED DATA

Y = 9905.6 + 357.43*(YEAR - 1940)
BACKCAST: 1946 - 1977 R SQUARED: 0.97

50% CONFIDENCE LIMITS (N = 23)

	LOW	MID	HIGH		LOW	MID	HIGH
1950	13123	13479	13836	1980	23843	24202	24562
1955	14910	15267	15623	1985	25630	25990	26349
1960	16697	17054	17411	1990	27416	27777	28137
1965	18483	18841	19199	1995	29203	29564	29925
1970	20270	20628	20986	2000	30990	31351	31712
1975	22057	22415	22774	2005	32776	33138	33500

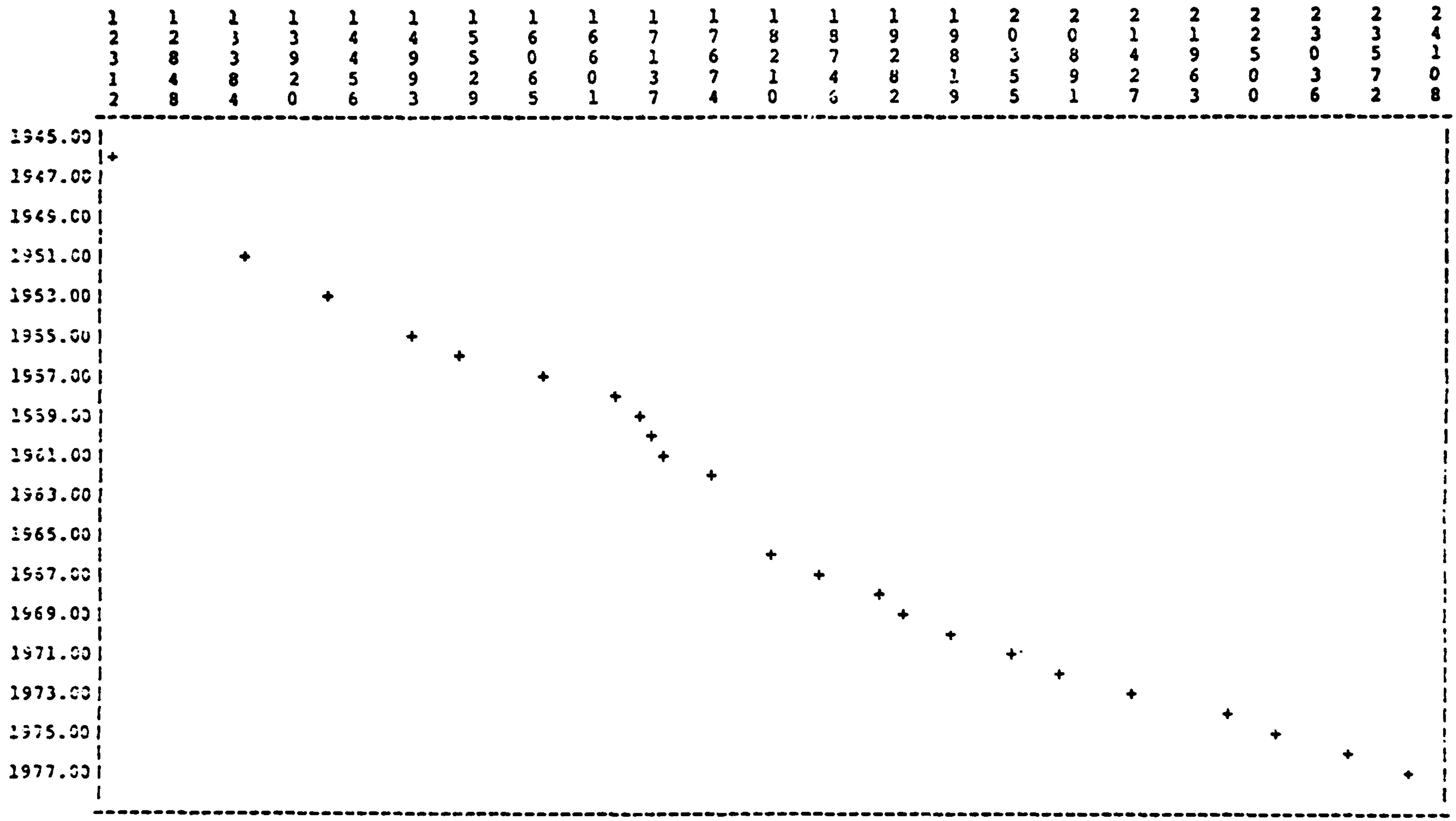
Data as of 31 December except 1939 (1 September) and 1946 (30 June). Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

WORLD MERCHANT FLEET
(SHIPS OF 1000 GRT OR MORE)

(Number of ships)



APPENDIX G
PROJECTIONS FOR PARAMETER 430

Average stopping distance for tankers of 6000 DWT or more.

The variables involved in the calculations (Tables G-1 through G-3) are the weight of a vessel and its type of power plant. Historical and projected relationships developed by Blackman (Reference A-4) have been employed. These include the DWT/displacement and stopping distance per ship length ratios (for motor and turbine power plants). Projections for average DWT (Table G-4) are based on a 6% annual increase (regression extrapolation) for Scenario E and a 2% rate for scenarios R and H, which imply more modest demands for additional large tankers. Similarly, average length is predicated on annual growth rates of 13 and 4 feet (Table G-7). Since motor-driven ships can deliver much more backing power than those with steam or gas turbines the average stopping distance has been weighted by the percentage of motor-driven tankers. These percentages are extrapolations of historical data for tankers of 100 GRT or more (Table G-6). These percentages (which are not scenario-dependent) are used for all three scenarios.

To summarize, the stopping distance is calculated for historical data, for 1980, and at subsequent five-year intervals for each scenario, using appropriate values of average DWT and length, for both motor and turbine-powered ships. An average, weighted by the percentages of motor or turbine-powered ships, is plotted in Figure 4-2.

TABLE G-1

AVERAGE STOPPING DISTANCE FOR TANKERS (PROJECTIONS)

		A	B	C=A/B	D	E	F	G	H=DE+FG	I	J=HI
YEAR AND SCENARIO		AVG DWT (000)	DWT/ DISPL	DISPL (000)	DIESEL STOP RATE (FT/FT)	PERCENT DIESEL (%)	STEAM STOP RATE (FT/FT)	PERCENT STEAM (%)	MEAN STOP RATE (FT/FT)	AVG LENGTH (FT)	MEAN STOP DIST (FT)
1980	All	98	0.860	114	10.9	77	14.7	23	11.8	775	9125
1985	R	108	0.860	126	11.0	83	14.8	17	11.6	795	9259
	H	108	0.860	126	11.0	83	14.8	17	11.6	795	9259
	E	127	0.860	148	11.2	83	15.0	17	11.8	842	9974
1990	R	118	0.860	137	11.1	86	14.9	14	11.6	815	9480
	H	118	0.860	137	11.1	86	14.9	14	11.6	815	9480
	E	156	0.860	181	11.6	86	15.3	14	12.1	908	11003
1995	R	130	0.860	151	11.3	90	15.1	10	11.7	835	9753
	H	130	0.860	151	11.3	90	15.1	10	11.7	835	9753
	E	185	0.860	215	11.7	90	15.4	10	12.1	974	11756
2000	R	143	0.860	166	11.5	94	15.2	6	11.7	855	10022
	H	143	0.860	166	11.5	94	15.2	6	11.7	855	10022
	E	214	0.860	249	12.0	94	15.6	6	12.2	1040	12705
2005	R	158	0.860	184	11.6	98	15.3	2	11.7	875	10215
	H	158	0.860	184	11.6	98	15.3	2	11.7	875	10215
	E	243	0.860	283	12.1	98	15.7	2	12.2	1107	13474

KEY TO COLUMN HEADINGS

A - Average DWT of Tankers of 6000 DWT or more (Table G-2, Figure G-2).
B - Deadweight/Displacement ratio for tankers (Figure G-3, Figure G-4).
C - Average Tanker Displacement.
D - Stopping Rate (stopping distance in feet per foot of waterline length) for diesel powered ships (Figure G-5).
E - Percentage of Diesel Powered Tankers of 100 GRT or more in the world fleet (Table G-2, Figure G-7).
F - Stopping Rate (stopping distance in feet per foot of waterline length) for steam-driven ships (Figure G-6).
G - Percentage of Steam-Driven Tankers of 100 GRT or more in the world fleet (Table G-2).
H - Mean Stopping Rate for all ships in the world fleet.
I - Average Length of Tankers of 6000 DWT or more in the world fleet (Table G-2, Figure G-8).
J - Mean Stopping Distance for Tankers of 6000 DWT or more in the world fleet.

TABLE G-2

TANKER STOPPING DISTANCE PROJECTIONS

1. Average DWT of Tankers 6000 DWT or More

Scenario E - 6% Annual Increase (Regression Extrapolation, Figure G-2)

Scenarios R & H - 2% Annual Increase

Average DWT (kLT)

	R	H	E
1980	98	98	98
1985	108	108	127
1990	118	118	156
1995	130	130	185
2000	143	143	214
2005	158	158	243

2. DWT/Displacement Ratio: Constant at 0.860

3. Average Tanker Length:

Scenario E - 13 Ft Annual Increase (Regression Extrapolation, Figure G-7)

Scenarios R & H - 4 Ft Annual Increase

Average Length (Ft)

	R	H	E
1980	775	775	775
1985	795	795	842
1990	815	815	908
1995	835	835	974
2000	855	855	1040
2005	875	875	1107

4. Power Plant Distribution (All Scenarios - Regression Extrapolation, Figure G-8)

Power Plant (% of Fleet)

	Diesel	Steam
1980	77	23
1985	83	17
1990	86	14
1995	90	10
2000	94	6
2005	98	2

TABLE G-3

AVERAGE STOPPING DISTANCE FOR TANKERS (HISTORICAL)

	A	B	C=A/B	D	E	F=DE	G	H
YEAR	AVG DWT (000)	(FIG G-4) DWT/ DISPL	DISPL (000)	(FIG G-5, G-6) STOP DIST (FT/FT)	(FIG G-6, G-8) AVG LENGTH	STOP DIST (FT)	(FIG G-7) POWER PLANT (%)	AVG STOP DI (FT)
Diesel								
1972	50.28	0.840	59.86	9.80	671	6576	73.1	
1973	55.26	0.837	66.02	9.95	683	6796	73.4	
1974	60.74	0.841	72.22	10.10	694	7009	73.2	
1975	67.97	0.845	80.44	10.27	709	7281	73.7	
1976	76.44	0.847	90.25	10.45	724	7566	74.5	
1977	84.78	0.850	99.74	10.60	738	7823	76.1	
1978	89.64	0.853	105.09	10.62	748	7944	77.9	
Steam								
1972	50.28	0.840	59.86	13.70	671	9193	26.9	
1973	55.26	0.837	66.02	13.82	683	9439	26.6	
1974	60.74	0.841	72.22	13.95	694	9681	26.8	
1975	67.97	0.845	80.44	14.14	709	10025	26.3	
1976	76.44	0.847	90.25	14.30	724	10353	25.7	
1977	84.78	0.850	99.74	14.46	738	10671	23.9	
1978	89.64	0.853	105.09	14.54	748	10876	22.1	
Combined								
1972								7280
1973								7499
1974								7725
1975								8003
1976								8277
1977								8504
1978								8592

Combined = Diesel + Steam

$$H = \frac{FG}{100} + \frac{FG}{100}$$

TABLE G-4

AVERAGE DWT OF TANKERS OF 6000 DWT OR MORE IN THE WORLD TANKER FLEET
(TOTAL DWT/TOTAL NUMBER OF SHIPS)

(Thousands of long tons)

HISTORICAL DATA

1968	33.98	1974	60.74
1969	35.72	1975	67.97
1970	41.03	1976	76.44
1971	45.92	1977	84.78
1972	50.28	1978	89.64
1973	55.26		

PROJECTED DATA

Y = 41.02 + 5.776*(YEAR - 1970)
BACKCAST: 1968 - 1978 R SQUARED: 0.98

95% CONFIDENCE LIMITS (N = 11)

	LOW	MID	HIGH
1970	34.85	41.01	47.18
1975	63.58	69.89	76.20
1980	92.32	98.77	105.22
1985	121.06	127.65	134.24
1990	149.81	156.53	163.25
1995	178.56	185.41	192.26
2000	207.31	214.29	221.27
2005	236.06	243.17	250.27

Data as of 1 January. Bulk/oil and ore/oil carriers are not included.

SOURCE

The Tanker Register. London: H. Clarkson & Co., Ltd., annual.

AVERAGE DWT OF TANKERS OF 6000 DWT OR MORE IN THE WORLD TANKER FLEET
(TOTAL DWT/TOTAL NUMBER OF SHIPS)

(Thousands of long tons)

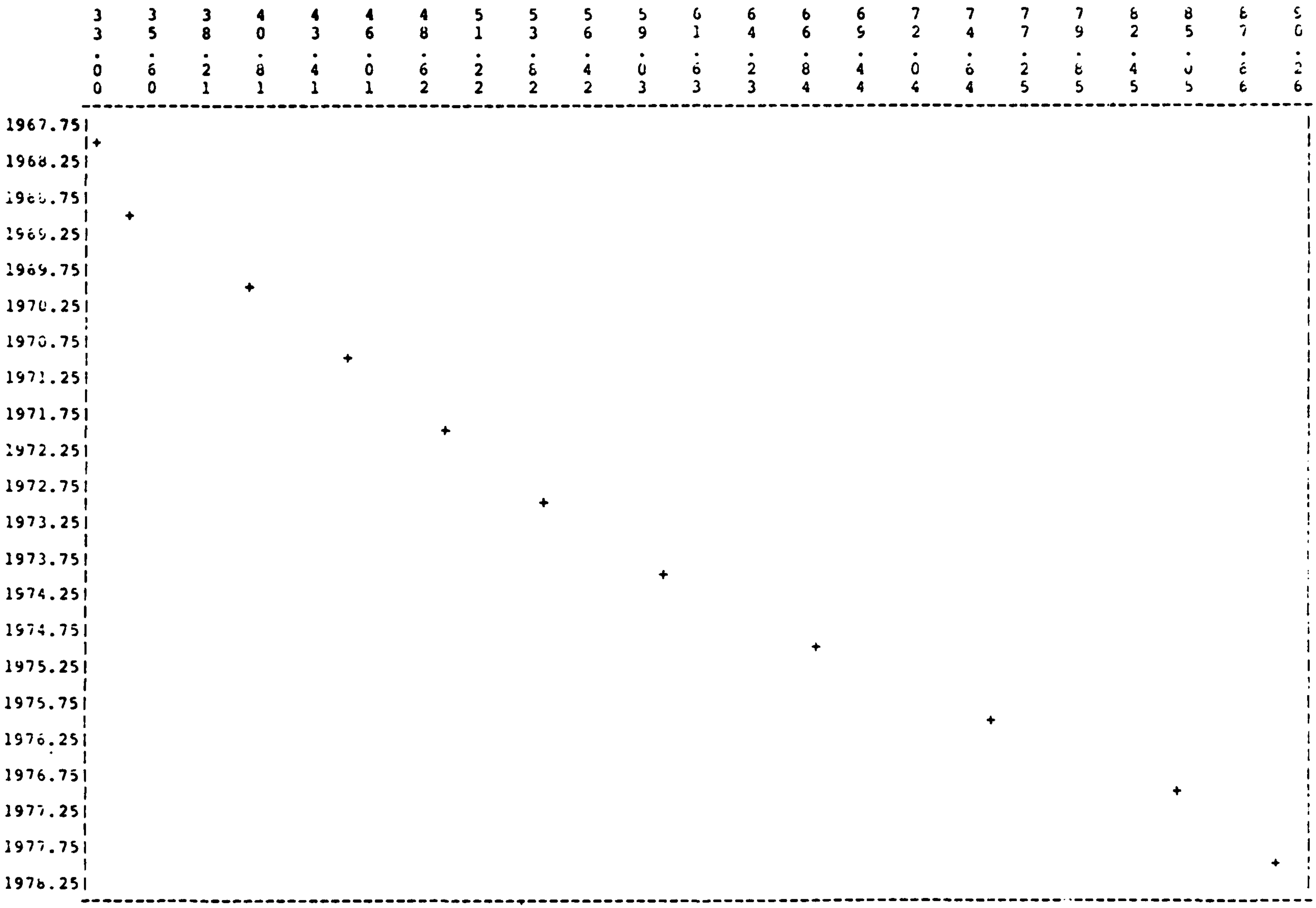


TABLE C-5

DEADWEIGHT/DISPLACEMENT RATIO
FOR TANKERS ON ORDER

(Ratio)

HISTORICAL DATA

1948	0.769	1961	0.798
1949	0.766	1962	0.804
1950	0.767	1963	0.808
1951	0.769	1964	0.808
1952	0.771	1965	0.808
1953	0.773	1966	0.812
1954	0.779	1967	0.820
1955	0.782	1968	0.828
1956	0.782	1969	0.832
1957	0.782	1970	0.833
1958	0.782	1971	0.836
1959	0.786	1972	0.840
1960	0.790		

PROJECTED DATA

Y = 0.763 + 0.00323*(YEAR - 1950)
BACKCAST: 1948 - 1972 R SQUARED: 0.96

95% CONFIDENCE LIMITS (N = 25)

	LOW	MID	HIGH		LOW	MID	HIGH
1950	0.755	0.765	0.775	1980	0.852	0.862	0.872
1955	0.771	0.781	0.791	1985	0.868	0.878	0.888
1960	0.787	0.797	0.807	1990	0.884	0.894	0.904
1965	0.803	0.813	0.823	1995	0.900	0.910	0.920
1970	0.819	0.829	0.839	2000	0.916	0.926	0.936
1975	0.836	0.845	0.855	2005	0.932	0.942	0.952

Mean values are tabulated.

SOURCE

Blackman, A. W. U.S. Ocean Shipping Technology Forecast and Assessment. Vol. III: State of Maritime Technology. Report prepared for the Maritime Administration. East Hartford, Conn.: United Aircraft Research Laboratories, July 1974.

DEADWEIGHT/DISPLACEMENT RATIO
FOR TANKERS ON ORDER

(Ratio)

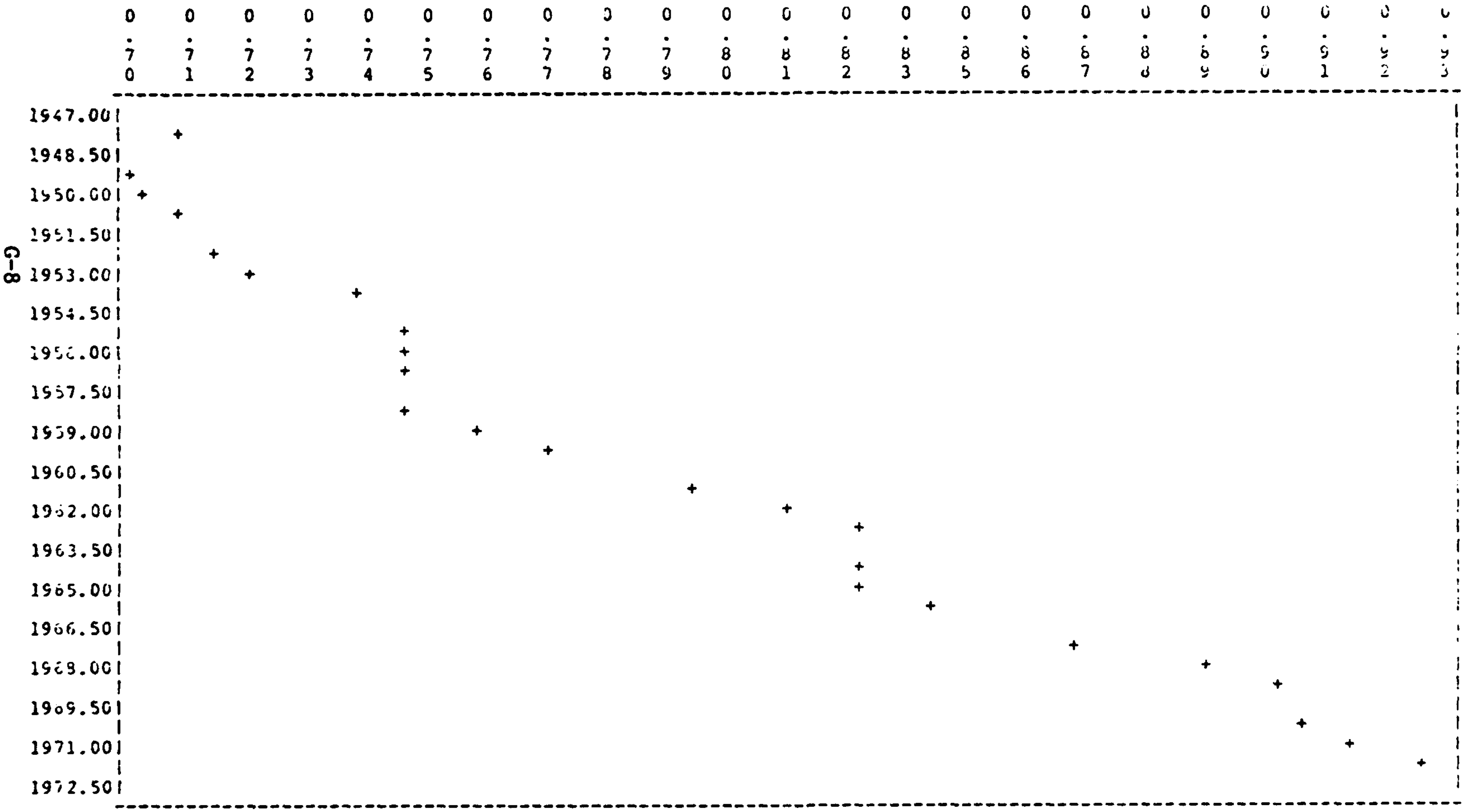
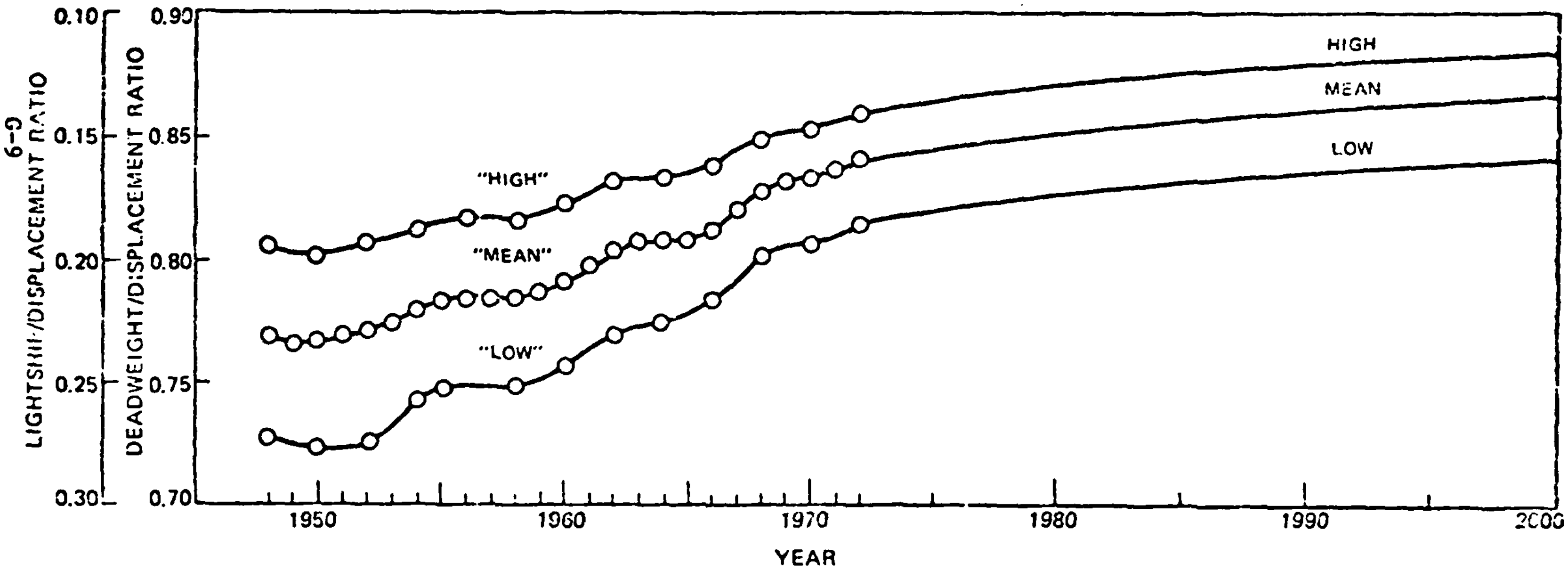


FIGURE G-1

DEADWEIGHT/DISPLACEMENT FOR TANKERS

(FOR SHIPS ON ORDER)

ALSO: LIGHTSHIP/DISPLACEMENT

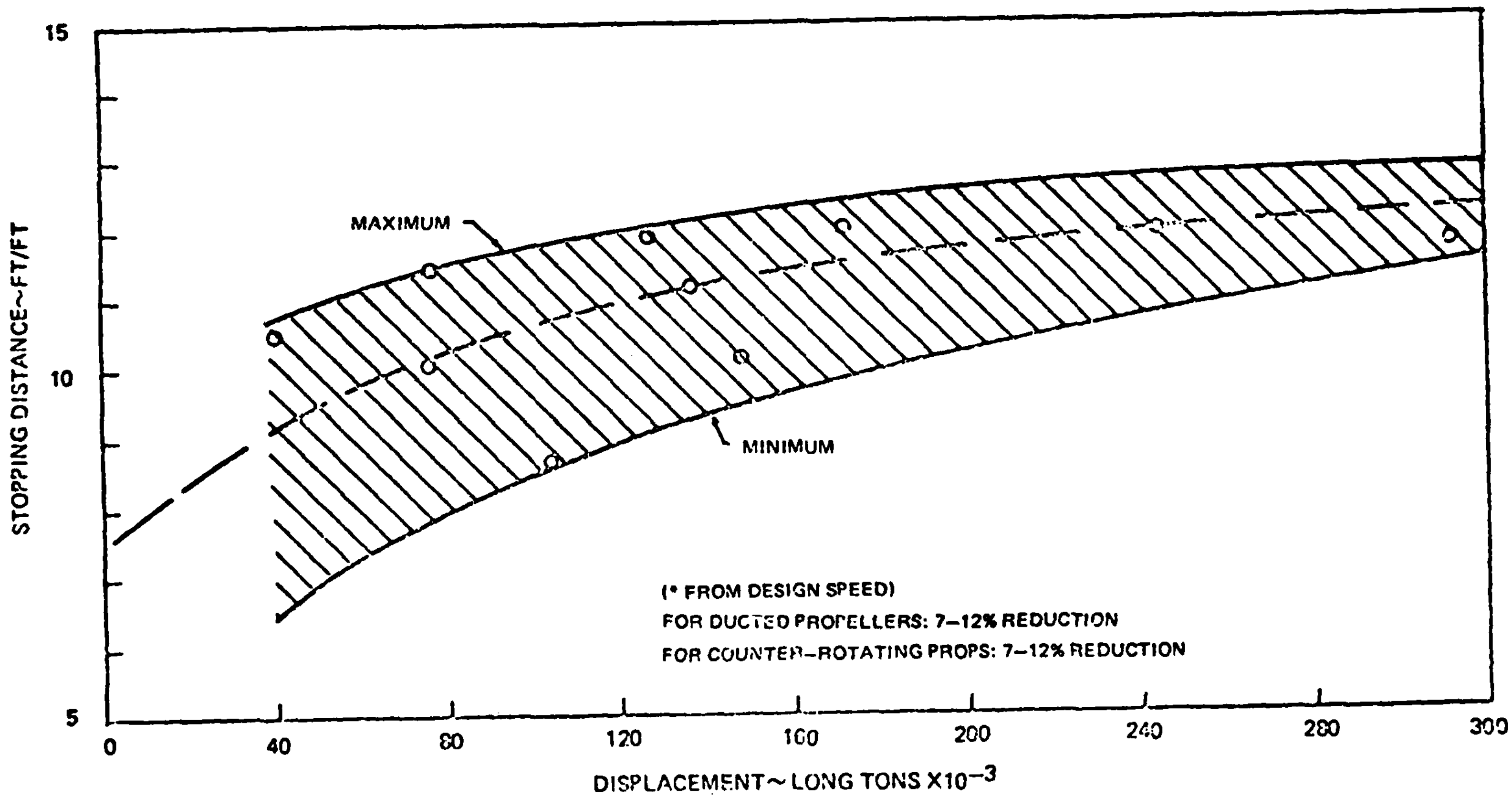


SOURCE

Blackman, A. W. U.S. Ocean Shipping Technology Forecast and Assessment. Vol. III: State of Maritime Technology. Report prepared for the Maritime Administration. East Hartford, Conn.: United Aircraft Research Laboratories, July 1974.

FIGURE G-2

STOPPING DISTANCE* PER SHIP LENGTH FOR DIESEL—POWERED SHIPS

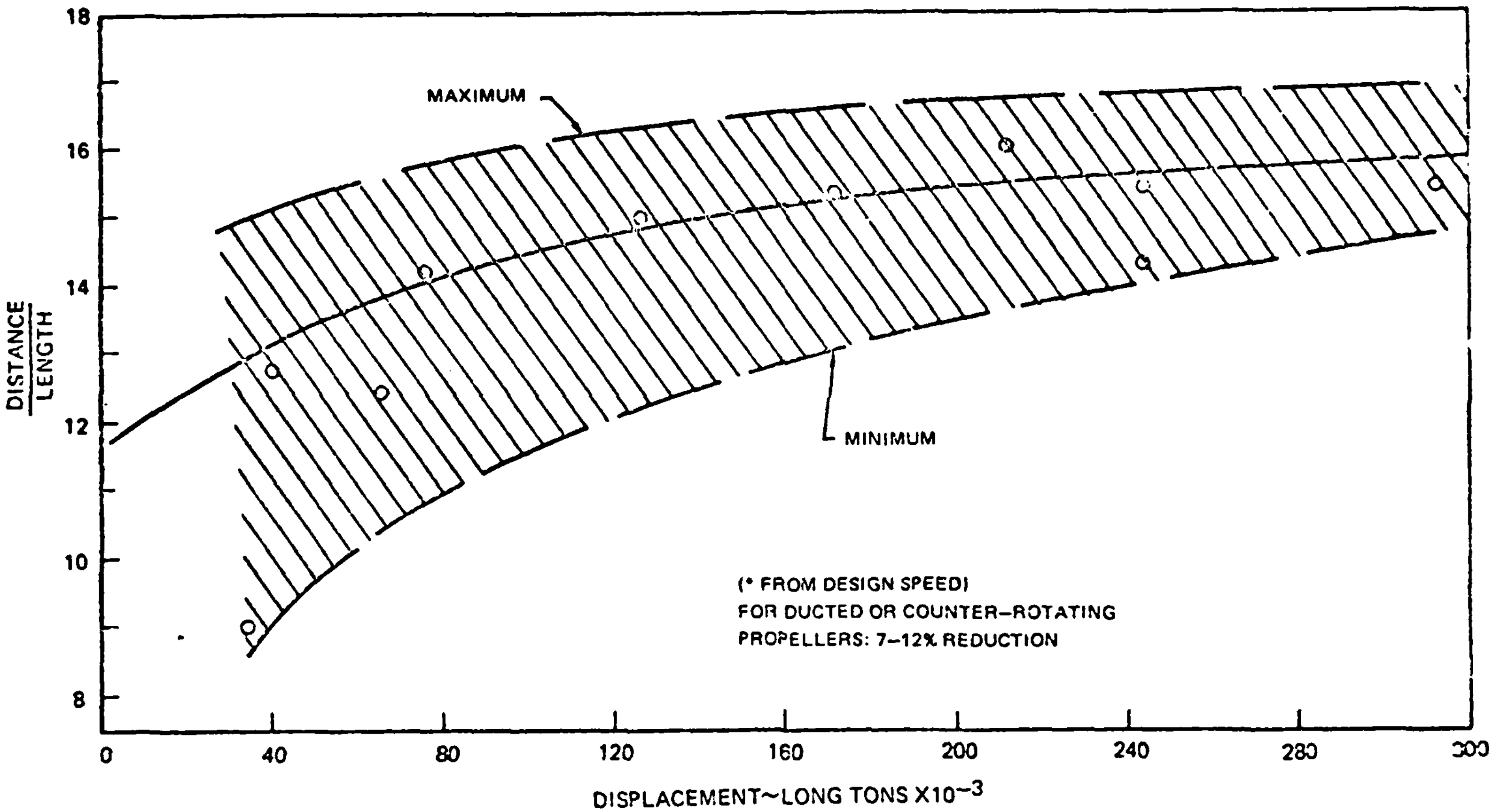


SOURCE

Blackman, A. W. U.S. Ocean Shipping Technology Forecast and Assessment. Vol. III: State of Maritime Technology. Report prepared for the Maritime Administration. East Hartford, Conn.: United Aircraft Research Laboratories, July 1974.

FIGURE G-3

STOPPING DISTANCE FOR STEAM-POWERED VESSELS



SOURCE

Blackman, A. W. U.S. Ocean Shipping Technology Forecast and Assessment. Vol. III: State of Maritime Technology. Report prepared for the Maritime Administration. East Hartford, Conn.: United Aircraft Research Laboratories, July 1974.

TABLE G-6

NUMBER OF MOTOR-DRIVEN TANKERS OF 100 GRT OR MORE AS A FRACTION OF THE WORLD TANKER FLEET

(Percent)

HISTORICAL DATA

1954	59.8	1967	70.1
1955	61.3	1968	71.0
1956	61.4	1969	72.0
1957	60.9	1970	72.6
1958	60.8	1971	72.9
1959	60.9	1972	73.1
1960	61.3	1973	73.4
1961	63.0	1974	73.2
1962	65.0	1975	73.7
1963	65.9	1976	74.5
1964	67.3	1977	76.1
1965	68.4	1978	77.9
1966	69.4		

PROJECTED DATA

Y = 63.7 + 0.762*(YEAR - 1960)

BACKCAST: 1954 - 1978 R SQUARED: 0.96

90% CONFIDENCE LIMITS (N = 25)

	LOW	MID	HIGH		LOW	MID	HIGH
1950	54.0	56.0	58.1	1980	76.9	78.9	81.0
1955	57.8	59.9	61.9	1985	80.7	82.7	84.8
1960	61.6	63.7	65.7	1990	84.5	86.5	88.6
1965	65.4	67.5	69.5	1995	88.3	90.3	92.4
1970	69.2	71.3	73.3	2000	92.1	94.2	96.2
1975	73.1	75.1	77.1	2005	95.9	98.0	100.0

Data as of 1 July. Sailing vessels and non-propelled craft are not included. Records of ships registered in the Peoples Republic of China are not complete.

SOURCE

Lloyd's Register of Shipping. Statistical Tables. London: Lloyd's Register of Shipping, annual.

NUMBER OF MOTOR-DRIVEN TANKERS OF 100 GRT OR MORE AS A FRACTION OF THE WORLD FLEET

(Percent)

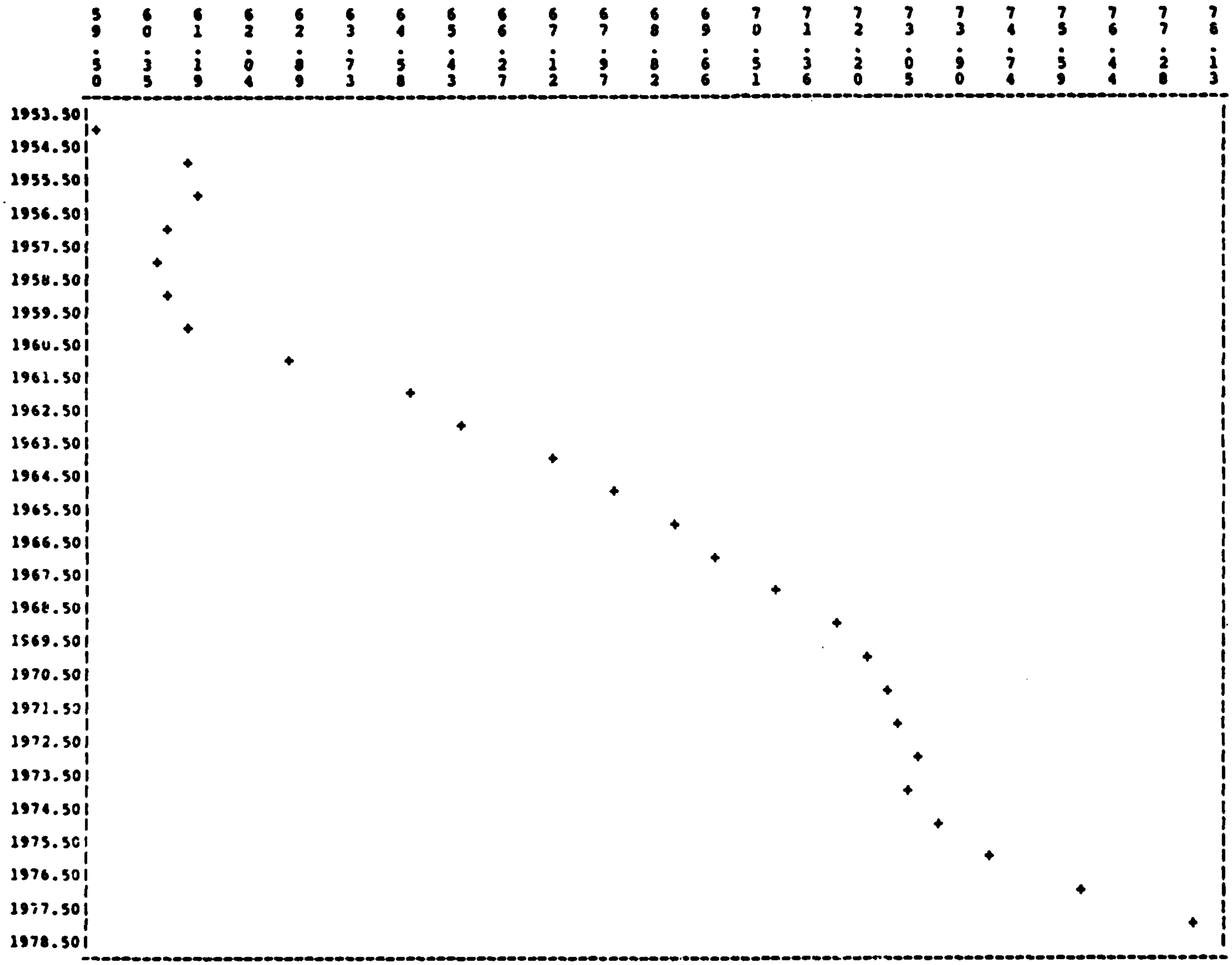


TABLE G-7

AVERAGE LENGTH OF TANKERS OF 6000 DWT OR MORE IN THE WORLD FLEET

(Feet)

HISTORICAL DATA

1972	671	1976	724
1973	683	1977	738
1974	694	1978	748
1975	709		

PROJECTED DATA

Y = 643 + 13.2*(YEAR - 1970)
BACKCAST: 1972 - 1978 R SQUARED: 1.00

95% CONFIDENCE LIMITS (N = 7)

	LOW	MID	HIGH
1970	639	643	647
1975	705	709	713
1980	771	775	780
1985	837	842	847
1990	902	908	913
1995	968	974	980
2000	1034	1040	1046
2005	1100	1107	1113

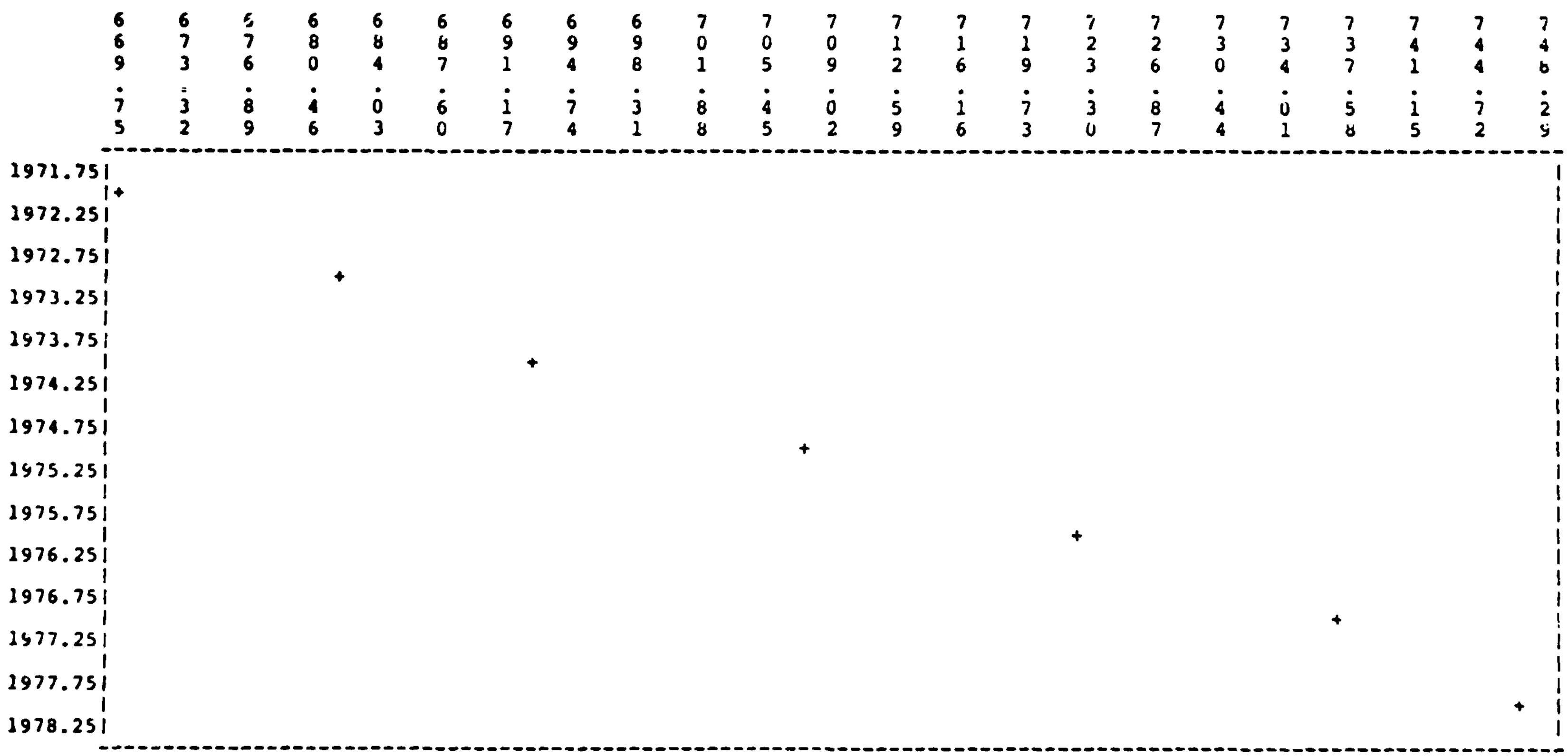
Data as of 1 January. Bulk/oil and ore/oil carriers are not included.

SOURCE

The Tanker Register. London: H. Clarkson & Co., Ltd., annual.

AVERAGE LENGTH OF TANKERS OF 6000 DWT OR MORE IN THE WORLD FLEET

(Feet)



APPENDIX H

Parameter 400: Index of U.S. Shipbuilding Capability.

An estimate of shipbuilding capability is given for major U.S. shipyards. (A major shipyard is defined as one having at least one building position with the capability to accommodate a minimum ship size of 475 feet length overall and a beam of 68 feet). Shipyard capabilities are catalogued according to the sizes and types of ships which could be constructed concurrently, e.g., a single shipway (inclined way, side-launching platform or building basin) might be able to accommodate one large tanker or three small general cargo ships. For simplicity, the index deals only with three such categories: a 610-foot container ship, a 600-foot dry bulk carrier, and a 920-foot tanker. Figures for historical data are indexed (1974 = 100) within each of these categories. A composite index is generated by weighting each category by its percentage of the total number of ships delivered in the 1970-1978 period, assuming that the three categories are representative of freighters, bulk carriers, and tankers, respectively. (See Table H-1).

The projected index for 1980 is an extrapolation of historical data. Later index projections are calculated on the basis of ship deliveries to be expected under the prevailing scenario conditions and influences. (See Table 4-7).

Maximum index values are produced under Scenario E. To test the feasibility of doubling the composite index in peacetime by 2005, maximum capability increases in each category, experienced over the 1973-1979 period, have been investigated. Depending on the mix of categories of ships built in the 1980-2005 period, the maximum composite index would fall in the 248-385 range, thereby demonstrating the feasibility of the Scenario E estimate. (See Table H-2).

TABLE H-1

SHIPYARD CAPABILITY INDEX

(Historical Data)

	General Cargo			Bulker			Tanker			Composite
	N(610')[a]	Index	Weight[b]	N(600')[a]	Index	Weight[b]	N(920')[a]	Index	Weight[b]	Index[c]
1973	75	93.8	35.5	48	88.9	11.8	13	118.2	52.7	106.1
1974	80	100.0	35.5	54	100.0	11.8	11	100.0	52.7	100.0
1975	73	91.2	35.5	49	90.7	11.8	11	100.0	52.7	95.8
1976	74	92.5	35.5	52	96.3	11.8	11	100.0	52.7	96.9
1977	75	93.8	35.5	58	107.4	11.8	12	109.1	52.7	103.5
1978	74	92.5	35.5	57	105.6	11.8	12	109.1	52.7	102.8
1979	68	85.0	35.5	52	96.3	11.8	10	90.9	52.7	89.4

Notes: [a]US shipyard capability to produce the numer of ships of the category indicated (Reference B-19)

[b]Number of Privately Owned Ships Built in US Yards 1970-78

	Number	% Total
General Cargo	60	35.5
Bulkers	20	11.8
Tankers	89	52.7
Total	169	100.0

[c]Composite Index = Index (GC) x Weight (GC) + Index (B) + Index (T) x Weight (T)

TABLE H-2

FEASIBILITY OF SCENARIO E SHIPBUILDING PROJECTIONS

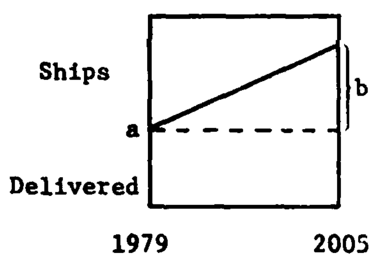
A: SCENARIO E SHIPBUILDING PROJECTION, 1977-2005

	Freighters	Bulkers	Tankers	Total
1977-1979	5	6	19	30
1980-1984	35	5	40	80
1985-1989	35	14	40	89
1990-1994	35	13	35	83
1995-1999	35	17	20	72
2000-2004	35	0	20	55
Total	180	55	174	409

B: SHIPYARD CAPACITY

Maximum Observed Annual Increase in Number of Ships Delivered, 1970-1978

Freighters	5/yr or 130 in 26 years
Bulkers	6/yr or 156 in 26 years
Tankers	1/yr or 26 in 26 years



	a	b	Area Under Curve (Shipway-Years)
Freighters	68	130	68x26+½(130x26) = 3458
Bulkers	52	156	52x26+½(156x26) = 3380
Tankers	10	26	10x26+½(26x26) = 598
Total			7436

C: SCENARIO E FEASIBILITY TEST

Ship Type	A Number Built (No.)	B Building Time (Yr)	C=AB Shipway-years Required	D Shipway-years Available	E=C/D Ratio (%)
Freighters	180	3	540	3458	16
Bulkers	55	3	165	3380	5
Tankers	174	3	522	598	87
Total	409		1227	7436	16

APPENDIX I

PROJECTIONS FOR PARAMETER 350A

Deadweight tonnage of the US privately-owned merchant fleet (ships of 1000 GRT or more).

This parameter measures the projected size of the US merchant fleet. Although fleet DWT is the fundamental measure, the numbers of ships and their average DWT by ship type are also developed.

Projections of fleet size (numbers of ships and DWT) for 1980 are extrapolations of historical data tempered slightly by judgment. Projections for other years are predicated on the following premises which are derived from the scenarios:

<u>Scenario R</u>:

- Fleet DWT remains at the 1980 level until 1990 when it rises gradually to 120% of the 1977 level.
- DWT of the average ship rises very slowly over the period (30.6 kLT in 1977 to 34.5 kLT in 2005).
- Freighter DWT rises faster than the fleet average rate; tanker DWT rises more slowly.
- The proportion of ships by type is held constant over the period, in terms of numbers of ships.

<u>Scenario H</u>:

- No new ships are delivered to the fleet.
- The oldest ships are gradually retired so that all ships built before 1955 are scrapped by 2005. See Table I-1.

<u>Scenario E</u>:

- Fleet DWT increases to 150% of the 1977 level.

- Bulk carrier DWT increases nearly 7 times.
- Average DWT for tankers and bulk carriers approximmately doubles by 2005.
- Average freighter DWT increases very slowly.

Historical data and the projections resulting from the above premises are given in the accompanying figures and tables. These data are summarized in Table 5-1, basic report.

TABLE I-1. SCENARIO H PROJECTIONS

A. 1977 Profile of Oldest Ships in the US Fleet

Category	Year Built	Freighters		Bulkers		Tankers		Total	
		No.	kLT	No.	kLT	No.	kLT	No.	kLT
A.	Pre-1945	13	236	0	0	29	825	42	1,061
B.	1945-1949	30	462	9	215	28	705	67	1,382
C.	1950-1954	35	514	5	105	42	1,095	82	1,714

B. Ship Retirements Under Scenario H

(Change)	Year	Freighters		Bulkers		Tankers		Total	
		No.	kLT	No.	kLT	No.	kLT	No.	kLT
	1980	260	4,420	16	580	280	14,000	556	19,000
(-½A)		-18	-257	-2	-50	-21	-500	-41	-807
	1985	242	4,163	14	530	259	13,500	515	18,193
(-½(A+B))		-32	-488	-7	-165	-35	-945	-74	-1,598
	1990	210	3,675	7	365	224	12,555	441	16,595
(-½B)		-15	-231	-5	-105	-14	-355	-34	-691
	1995	195	3,444	2	260	210	12,200	407	15,904
(-½C)		-6	-118	-	-	-14	-410	-20	-528
	2000	189	3,326	2	260	196	11,790	387	15,376
(-½C)		-7	-118	-	-	-15	-415	-22	-533
	2005	182	3,208	2	260	181	11,395	365	14,843

TABLE I-2

U.S. PRIVATELY-OWNED MERCHANT FLEET
(SHIPS OF 1000 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1956	1059	1968	967
1957	1012	1969	931
1958	1007	1970	793
1959	1023	1971	711
1960	1008	1972	651
1961	973	1973	596
1962	985	1974	583
1965	948	1975	580
1966	965	1976	577
1967	974	1977	571

PROJECTED DATA

	SCENARIO R	SCENARIO H	SCENARIO E
1980	556	556	556
1985	556	515	505
1990	556	441	472
1995	565	407	445
2000	580	387	432
2005	600	365	398

Data as of 31 December. Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-3

NUMBER OF FREIGHTERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET (INCLUDES SHIPS OF 1000 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1956	640	1968	615
1957	609	1969	588
1958	591	1970	475
1959	600	1971	402
1960	576	1972	361
1961	545	1973	320
1962	557	1974	313
1965	585	1975	305
1966	606	1976	299
1967	617	1977	285

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	260	260	260
1985	260	242	238
1990	260	210	217
1995	265	195	200
2000	272	189	195
2005	280	182	175

Data as of 31 December. Includes break-bulk vessels both refrigerated and unrefrigerated, containerships, partial containerships, roll-on/roll-off vessels, and barge carriers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-4

NUMBER OF BULK CARRIERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET (INCLUDES SHIPS OF 1000 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1956	40	1968	50
1957	39	1969	46
1958	41	1970	37
1959	41	1971	33
1960	57	1972	32
1961	66	1973	26
1962	70	1974	19
1965	60	1975	19
1966	57	1976	18
1967	53	1977	18

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	16	16	16
1985	16	14	15
1990	16	7	28
1995	16	2	40
2000	16	2	56
2005	17	2	52

Data as of 31 December. Includes all vessels designed to carry dry bulk cargo, as well as ore/bulk/oil carriers and other combination bulk/oil and ore/oil carriers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways, and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-5

NUMBER OF TANKERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET
(INCLUDES SHIPS OF 1000 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1956	341	1968	277
1957	327	1969	273
1958	333	1970	262
1959	343	1971	258
1960	338	1972	246
1961	327	1973	241
1962	314	1974	245
1965	276	1975	250
1966	275	1976	254
1967	278	1977	262

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	280	280	280
1985	280	259	252
1990	280	224	227
1995	284	210	205
2000	292	196	181
2005	303	181	171

Data as of 31 December. Includes crude petroleum and petroleum products tankers, chemical tankers, LNG and LPG tankers, wine tankers, molasses tankers and whaling tankers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways, and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-6

AVERAGE DWT OF FREIGHTERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET (INCLUDES SHIPS OF 1000 GRT OR MORE)

(Thousands of long tons)

HISTORICAL DATA

1956	10.6	1968	11.7
1957	10.6	1969	12.1
1958	10.7	1970	12.9
1959	10.9	1971	13.3
1960	10.7	1972	14.0
1961	10.8	1973	15.1
1962	11.1	1974	15.9
1965	11.4	1975	16.3
1966	11.5	1976	16.5
1967	11.4	1977	16.8

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	17.0	17.0	17.0
1985	17.0	17.2	17.8
1990	17.0	17.5	18.5
1995	17.0	17.7	19.2
2000	17.3	17.6	20.0
2005	17.8	17.6	20.8

Data as of 31 December. Includes break-bulk vessels both refrigerated and unrefrigerated, containerships, partial containerships, roll-on/roll-off vessels, and barge carriers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways and Special Types such as Channel Ships, Icebreakers, Cable Ships, etc., and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-7

AVERAGE DWT OF BULK CARRIERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET (INCLUDES SHIPS OF 1000 GRT OR MORE)

(Thousands of long tons)

HISTORICAL DATA

1956	14.1	1968	19.6
1957	14.0	1969	20.0
1958	14.1	1970	20.4
1959	12.0	1971	21.6
1960	14.1	1972	21.9
1961	14.7	1973	23.7
1962	15.9	1974	28.1
1965	18.3	1975	28.6
1966	18.3	1976	29.4
1967	18.8	1977	29.4

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	36.2	36.2	36.2
1985	36.2	37.8	44.5
1990	36.2	52.1	52.8
1995	37.5	130.0	61.2
2000	38.8	130.0	69.6
2005	38.2	130.0	77.8

Data as of 31 December. Includes all vessels designed to carry dry bulk cargo, as well as ore/bulk/oil carriers and other combination bulk/oil and ore/oil carriers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways, and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

TABLE I-8

AVERAGE DWT OF TANKERS COMPRISING THE PRIVATELY-OWNED U.S. MERCHANT FLEET (INCLUDES SHIPS OF 1000 GRT OR MORE)

(Thousands of long tons)

HISTORICAL DATA

1956	17.1	1968	25.1
1957	17.7	1969	26.5
1958	18.5	1970	28.1
1959	19.3	1971	29.7
1960	20.0	1972	31.6
1961	21.1	1973	34.1
1962	21.9	1974	36.2
1965	24.2	1975	37.9
1966	24.5	1976	41.4
1967	24.6	1977	45.7

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	50.0	50.0	50.0
1985	50.0	52.1	62.5
1990	50.0	56.0	75.0
1995	50.0	58.1	87.5
2000	50.3	60.2	100.0
2005	49.7	63.0	112.5

Data as of 31 December. Includes crude petroleum and petroleum products tankers, chemical tankers, LNG and LPG tankers, wine tankers, molasses tankers and whaling tankers. Excludes ships operating exclusively on the Great Lakes and Inland Waterways, and merchant ships owned by any military force.

SOURCE

U.S. Department of Commerce. Maritime Administration. Merchant Fleets of the World. Washington, D.C.: Government Printing Office, annual.

APPENDIX J

PROJECTIONS FOR PARAMETER 220

Number of US casualties (collisions, rammings, groundings) per thousand ship operating days per year.

This parameter measures the casualty rate for US ships. Casualty rates are shown as the annual number of collisions, rammings and groundings suffered by US ships divided by the number of operating days available to the fleet. Calculation of historical data (Table 4-9 and J-2, and Tables J-2 and J-3) is straightforward; projections, however, are more complex.

As might be expected, the number of casualties varies rather widely from year to year. It appears to be dependent upon the volume of US foreign trade, the quantity carried in US ships, the number of ships and the fleet DWT (sources and calculations are given in Table J-4). Since ships smaller than 1000 GRT have historically made up 70-90% of the total fleet, casualty projections are sensitive to their number. The prediction equations used are only fairly accurate (R^2 = 0.9). For this reason, casualty rates have been "predicted" for historical data (and plotted as a broken line in Figure 4-5) so that a comparison with actual data can be made. The essence of the graph, however, is the general shape the projections assume under the influence of the three scenarios.

TABLE J-1

CASUALTIES (COLLISIONS, RAMMINGS, AND GROUNDINGS) SUFFERED BY U.S. COMMERCIAL VESSELS

(Number of casualties)

HISTORICAL DATA

1959	1580	1969	2362
1960	1623	1970	2235
1961	1689	1971	2427
1962	1690	1972	2396
1963	1295	1973	2733
1964	1761	1974	2919
1965	1912	1975	3092
1966	1799	1976	3262
1967	1889	1977	3529
1968	2096	1978	3928

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	4128	4128	4128
1985	3900	4468	4585
1990	3698	4924	4705
1995	3470	5310	4582
2000	3283	5586	3944
2005	2996	5929	3170

Based on U.S. commercial vessel casualties investigated by Coast Guard Marine Inspectors where physical damage to property exceeded $1500. Casualties to barges and commercial and recreational motorboats are not included. Before 1976 casualties are for year ending 30 June; after 1976, for year ending 30 September. 1976 comprises 15 months; 4/5 of the casualties in this period are used. Projections are based on estimates of the portion of U.S. foreign trade carried in U.S. ships and fleet DWT.

SOURCE

U.S. Department of Transportation. U.S. Coast Guard. "Statistics of Casualties." Proceedings of the Marine Safety Council. Washington, D.C.: Government Printing Office, bi-monthly.

CASUALTIES (COLLISIONS, RAMMINGS, AND GROUNDINGS) SUFFERED BY U.S. COMMERCIAL VESSELS

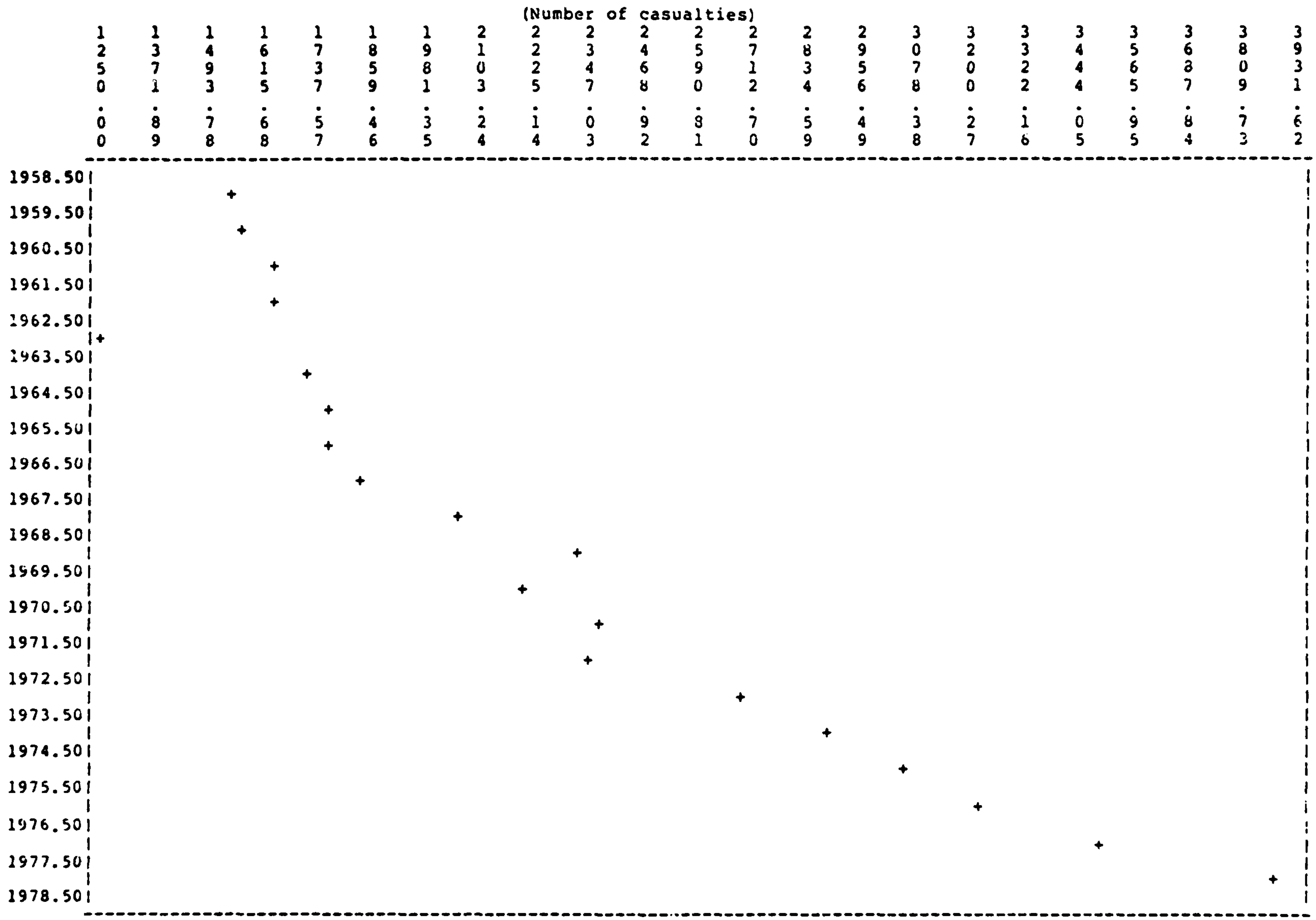


TABLE J-2

TOTAL ANNUAL SHIP OPERATING DAYS (U.S. MERCHANT FLEET)

(Operating days (000))

HISTORICAL DATA

1959	1414	1969	1073
1960	1376	1970	1023
1961	1334	1971	1141
1962	1271	1972	1265
1963	1256	1973	1394
1964	1199	1974	1402
1965	1165	1975	1499
1966	1136	1976	1593
1967	1126	1977	1635
1968	1102	1978	1637

PROJECTED DATA

SCENARIO

	R	H	E		R	H	E
1980	1835	1835	1835	1995	1735	2017	2267
1985	1800	1899	2020	2000	1716	2041	2331
1990	1770	1970	2152	2005	1662	2081	2402

Vessel population as of 1 July. All U.S. ships of 100 GRT or more are included except sailing vessels and non-propelled craft. Annual ship operating days (reflecting time lost due to overhaul, inspection, repairs, etc.) are based on 337 days per ship annually in the period 1955-59. This figure is increased by 2 days annually each succeeding 5-year period; after 1974 it is held at 345 days. Projections reflect further operating day estimates and estimated fleet size.

SOURCE 1

Lloyd's Register of Shipping. Statistical Tables. London: Lloyd's Register of Shipping, annual.

SOURCE 2

Temple, Barker & Sloane, Inc. Merchant Fleet Forecast of Vessels in U.S.-Foreign Trade. Vol. II Final Report. Report prepared for the Maritime Administration. Wellesley Hills, Mass.: Temple, Barker & Sloane, Inc., January 2, 1978.

TABLE J-3

U.S. MERCHANT FLEET
(INCLUDES SHIPS OF ALL TYPES OF 100 GRT OR MORE)

(Number of ships)

HISTORICAL DATA

1954	4755	1967	3303
1955	4537	1968	3232
1956	4432	1969	3146
1957	4374	1970	2983
1958	4301	1971	3327
1959	4195	1972	3687
1960	4059	1973	4053
1961	3935	1974	4086
1962	3749	1975	4346
1963	3706	1976	4616
1964	3537	1977	4740
1965	3416	1978	4746
1966	3332		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	5289	5289	5289
1985	5159	5471	5788
1990	5043	5709	6132
1995	4915	5899	6422
2000	4834	6022	6566
2005	4682	6194	6765

Data as of 1 July. Sailing vessels and non-propelled craft are not included. Projections are based on estimates of U.S. foreign trade and the number and DWT of ships of 1000 GRT or more.

SOURCE

Lloyd's Register of Shipping. Statistical Tables. London: Lloyd's Register of Shipping, annual.

TABLE J-4

CASUALTY RATE PROJECTIONS

		A	B	C[a]	D	E=C+D	F	C[b]	H	I=EH	J=C/I
YEAR	SCENARIO	US FOREIGN TRADE		US SHIPS				US	OPERATING DAYS		
		Total (mST)	In US Ships (kLT)	100-1000 GRT (No.)	1000 + GRT (No.)	Total (No.)	DWT (mLT)	Casualties (No.)	Per Ship (No.)	Total (k)	Casualty Rate Projection
	REF:	Fig. 3-9	Fig. 3-10		Tab. I-2	Tab. J-2	Fig. I-1	Fig. J-2		Tab. J-1	Fig. J-1
1965		444	29700	2247	948	3195	14.65	2228	341	1090	2.04
1966		471	28200	2209	965	3174	14.96	2223	341	1082	2.05
1967		466	22000	2234	974	3208	15.12	2287	341	1094	2.09
1968		508	27200	2237	967	3204	15.35	2250	341	1093	2.06
1969		521	21400	2391	931	3322	15.45	2374	341	1133	2.09
1970		581	27500	2585	793	3378	14.41	2372	343	1158	2.05
1971		566	26800	2878	711	3589	13.89	2536	343	1231	2.06
1972		630	25900	3026	651	3677	13.64	2612	343	1261	2.07
1973		767	43100	3187	596	3783	13.72	2567	343	1298	1.98
1974		764	44300	3523	583	4106	14.45	2825	343	1408	2.01
1975		749	34100	3751	580	4331	15.03	3119	345	1494	2.09
1976		856	36700	3923	577	4500	16.02	3260	345	1552	2.10
1977		935	37600	4233	571	4804	17.32	3570	345	1657	2.15
1980	ALL	970	39000	4733	556	5289	19.00	4178	347	1835	2.25
1985	R	1090	44800	4603	556	5159	19.00	3900	349	1800	2.17
1990	R	1210	50800	4487	556	5043	19.00	3698	351	1770	2.09
1995	R	1380	59100	4350	565	4915	19.30	3470	353	1735	2.00
2000	R	1590	69600	4254	580	4834	20.00	3283	355	1716	1.91
2005	R	1900	84800	4082	600	4682	20.70	2996	355	1662	1.80
1985	H	870	31100	4956	515	5471	18.19	4468	347	1898	2.35
1990	H	780	23000	5268	441	5709	16.60	4924	345	1970	2.50
1995	H	710	17100	5492	407	5899	15.90	5310	342	2017	2.63
2000	H	650	12800	5635	387	6022	15.38	5586	339	2042	2.74
2005	H	580	10400	5029	365	6194	14.04	5929	336	2081	2.85
1985	E	1200	55700	5283	505	5788	20.70	4585	349	2020	2.27
1990	E	1550	83000	5660	472	6132	22.50	4705	351	2152	2.19
1995	E	1960	122500	5977	445	6422	24.20	4582	353	2267	2.02
2000	E	2520	189000	6134	432	6566	25.90	3944	355	2331	1.74
2005	E	3220	284600	6367	398	6765	26.90	3170	355	2402	1.44

NOTES:

a: $C = 23848 - 9211.4 \log D - 2563.4 \log A + 10813 \log F$. ($R^2 = 0.91$)

b: $\frac{\log G}{1000} = -0.04128 - 0.00127\ (B/1000) + 0.13360\ (E/1000)$. ($R^2 = 0.88$)

APPENDIX K

PROJECTIONS FOR PARAMETER 550

Index of annual port time per round trip.

The algorithm for average annual port time per round trip developed by Temple, Barker and Sloane[1] (TBS) has been employed with minor modifications. The algorithm, which divides port time into two terms (cargo handling time and additional port time), is outlined in Figure K-1. It has been exercised for each ship sub-type (listed in Table K-1); for each term an average, weighted by ship sub-type population, has been developed for each ship type. These data have been indexed, using ship type population as the weighting factor; a composite index, weighting cargo handling and additional port time equally, is shown in Table 4-10.

Average DWT by TBS ship type (termed "ship sub-type" in this study) is calculable for the years 1971-1976.[2] Projections depend on scenario conditions and have been predicated on projected ship types (freighter, bulker, tanker) given in Table 5-1, basic report. Projections for the number of ships by sub-type appear in Table 5-2, basic report. Average DWT by ship sub-type has been developed within the constraints imposed by the number of ships and total DWT for the type, and by selecting a reasonable average DWT trend for each ship sub-type. The elements of the algorithm (Figure K-1) are discussed in the following paragraphs.

Ship carrying capacity is a complex variable because freighters are volume-limited, whereas bulkers and tankers are weight-limited. TBS values for the various factors

FIGURE K-1

AVERAGE ANNUAL PORT TIME PER ROUND TRIP ALGORITHM

$$\text{Average Annual Port Time Per Round Trip} = \text{Cargo Handling Time} + \text{Additional Port Time}$$

$$T = \frac{\text{Average Ship Capacity}}{\text{Average Cargo Handling Rate}} + \left(\begin{array}{l}\text{Delay by Trade}\\ \text{Route Group}\end{array}\right) \times \left(\begin{array}{l}\text{Portion of U S Trade}\\ \text{Carried by Route Group}\end{array}\right)$$

$$T = 4\left(\frac{\frac{VS \cdot CDF \cdot DC \cdot LF}{BS}}{f(DWT)}\right) + f(RG) \cdot f(RW)$$

WHERE:

T = Average Annual Port Time per Round Trip for each Ship Sub-Type

VS = Vessel Size (DWT or Bale Cubic)

CDF = Cargo Deadweight Factor

DC = Deck Cargo Factor

LF = Round Trip Load Factor

BS = Broken Stowage Factor

f(DWT) = Cargo Handling Rate for each Ship Sub-Type

f(RG) = Delay by Trade Route Group for each Ship Sub-Type

f(RW) = Portion of Trade carried on each Trade Route Group by each Ship Sub-Type

Source: Reference A-19, Chapter VIII

TABLE K-1

CLASSIFICATION OF SHIP TYPES AND SUB-TYPES

FREIGHTER

GENERAL CARGO (GC)

- Freighter
- Freighter/Nuclear
- Freighter/Refrig.
- Combo. Pass. & Cargo
- Combo/Refrig.
- Combo/Nuclear

PARTIAL CONTAINER (PC)

- Pallet Carrier
- Partial Container
- Bulk Containership

FULL CONTAINER (FC)

- Containership
- Container/Car Carrier
- Container/Rail Carrier
- Container/ Ro-Ro
- Roll-on/Roll-off
- Car Carrier

BARGE CARRIER (BC)

- Barge Carrier
- Container/Barge Carrier

BULK CARRIER

DRY BULK (DB)

- Bauxite Carrier
- Bulk Carrier
- Cement Carrier
- Colliers
- Limestone Carrier
- Nickel Carrier
- Ore Carrier
- Pallet Carrier
- Phosphate Carrier

BULK CARRIER, continued

DRY BULK (DB) continued

- Salt Carrier
- Sand Carrier
- Urea Carrier
- Woodchip Carrier
- Timber Carrier
- Cattle Carrier
- Bulk/Car Carrier
- Bulk/Timber Carrier

COMBINATION CARRIER (CC)

- Bulk/Oil
- Ore/Bulk/Oil
- Ore/Oil Carrier

TANKER

LIQUIFIED GAS (LG)

- LPG Tanker
- LNG Tanker

LIQUID BULK(LB)

- Asphalt Tanker
- Asphalt/Bitumen
- Bitumen
- Chemical Tanker
- Molasses Tanker
- Nuclear Tanker
- Phosphorus Tanker
- Solvents Tanker
- Sulphur Tanker
- Tanker
- Whaling Tanker
- Wine Tanker

Source: After Reference A-19, Exhibit V-I.

(shown in Table K-2) were used in calculating historical capacities for all ship sub-types and for projections for bulkers and tankers. Projected capacities for freighters were obtained by regression analysis of historical data.

Cargo handling rates are given for each ship sub-type in Figure K-2. In order to obtain a formula in units of long tons per hour, some simplifications were necessary with respect to the full container (FC) and barge carrier (BC) sub-types. Measurement tons (of 40 cubic feet) were first obtained. Total volume (import and export) of containerizable (high and low value) trade by commodity group for 1975,[3] was calculated both in long tons and, using measurement ton conversion factors by commodity group,[4] in measurement tons. By this weighted averaging procedure a representative conversion factor of 1 LT = 2.11 MT resulted, thereby permitting an average cargo handling rate in tons per hour to be used for container ships and barge carriers.

Table K-3 contains cargo handling rate growth factors for all ship sub-types under the three scenarios. TBS projections[5] for 1980-2000 have been used. The 1980 values have been applied for all scenarios; values for 1985-2000 have been used without modification for Scenario E, since the TBS and Scenario E assumptions are similar. Values for 2005 have been extrapolated. Scenario H is a no-growth case; 1980 values have been used for the entire 25 year period. Values for Scenario R show half the Scenario E growth.

The cargo handling rates developed by TBS are averages of loading rates and discharging rates. Therefore, in this simple round trip model there are four cargo handlng evolutions per round trip. This completes the description of this first term of the port time algorithm, cargo handling time.

The second term, additional port time, deals with all other delays which can keep an operational ship in port,

TABLE K-2

SHIP CARRYING CAPACITY FACTORS

A. HISTORICAL

	SHIP SUB-TYPE							
CARGO DEADWEIGHT FACTOR(CDF):	GC	PC	FC	BC	DB	CC	LG	LB
Below 40 k DWT	1.00	1.00	1.00	1.00	0.90	0.90	0.91	0.90
40-70 k DWT	1.00	1.00	1.00	1.00	0.92	0.92	0.93	0.92
70-120 k DWT	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95
Over 120 k DWT	1.00	1.00	1.00	1.00	0.97	0.97	0.97	0.97
DECK CARGO FACTOR(DC):	1.08	1.30	1.00	1.00	1.00	1.00	1.00	1.00
BROKEN STOWAGE FACTOR(BS):	1.40	1.45	1.20	1.20	1.00	1.00	1.08	1.00
LOAD FACTOR(LF):								
Heavy Leg	0.80	0.80	0.80	0.80	1.00	1.00	1.00	1.00
Light Leg	0.60	0.60	0.60	0.60	0	0	0	0
Round Trip	1.40	1.40	1.40	1.40	1.00	1.00	1.00	1.00

B. PROJECTIONS (Based on Regression Analysis of Historical Data)

		R^2
GC:	Capacity = -8.25 + 1.31 *(DWT)	0.92
PC:	Capacity = -5.82 + 1.26 *(DWT)	0.58
FC:	Capacity = -48.8 + 4.01 *(DWT)	0.88
BC:	Capacity = 0.280 + 0.594 *(DWT)	0.99
DB:	Capacity = (CDF)*(DWT)	-
CC:	Capacity = (CDF)*(DWT)	-
LG:	Capacity = (CDF)*(DWT)/(BS)	-
LB:	Capacity = (CDF)*(DWT)	-

Broken Stowage Factor (BS) Projection for Liquified Gas Carriers (LG)

1980	1.06
1985	1.04
1990	1.03
1995	1.03
2000	1.02
2005	1.02

Sources: Reference A-19, Chapter VIII and Reference B-17.

FIGURE K-2

CARGO HANDLING RATES
IN TONS PER HOUR (TPH)
OR CUBIC FEET PER HOUR (CFPH)
1975

SHIP TYPE/SUB-TYPE	
FREIGHTERS	
General Cargo (GC)	TPH = 109 + 1.0 (kDWT)
Partial Container (PC)	TPH = 218 + 2.0 (kDWT)
Full Container (FC)	CFPH = 18,000 + 2000 (kDWT)
	TPH = 213 + 23.7 (kDWT)
Barge Carrier (BC)	CFPH = 59,025
	TPH = 699
BULK CARRIERS	
Dry Bulk (DB)	TPH = 575 + 16.3 (kDWT)
Combination Carrier (CC)	TPH = 473 + 26.7 (kDWT)
TANKERS	
Liquefied Gas Carrier (LG)	TPH = 423 + 55.3 (kDWT)
Liquid Bulk (LB)	TPH = 370 + 37 (kDWT)

Source: Reference A-19, Chapter VIII

TABLE K-3

CARGO HANDLING RATE GROWTH FACTOR*

SCENARIO AND YEAR	FREIGHTERS GC, PC, FC, BC	BULKERS DB	BULKERS CC	TANKERS LG, LB
All 1980	1.15	1.05	1.03	1.01
R 1985	1.20	1.08	1.05	1.02
1990	1.30	1.10	1.06	1.03
1995	1.40	1.13	1.08	1.04
2000	1.50	1.16	1.10	1.05
2005	1.60	1.19	1.12	1.05
H All Years	1.15	1.05	1.03	1.01
E 1985	1.30	1.10	1.06	1.02
1990	1.45	1.15	1.09	1.03
1995	1.60	1.20	1.12	1.04
2000	1.75	1.25	1.15	1.05
2005	1.80	1.27	1.16	1.05

* The 1975 Cargo Handling Rate should be multiplied by the growth rate factor from this table to obtain the Cargo Handling Rate for the given projected year.

Source (For Scenario E data, except 2005); Reference A-19, Chapter VIII such as waiting for terminal berthing space. Since round trips are being considered, delays in both US and foreign ports must be taken into account. The TBS studies[6] examined delays experienced on the 60-odd trade routes and arranged the routes in five ranks or groups. Group I, with the shortest delays, contains routes to industrialized nations; Group V, containing routes to nations with less efficient port facilities, shows the greatest delays. Delays also vary by the trade route distance (shorter routes, shorter delays). Further, ships with dedicated terminals, such as LNG carriers, experience relatively short delays. Table K-4 shows additional port time by ship sub-type and trade route group for 1975 with scenario projections for 1980-2005. TBS values (through 2000) have been used without modification for Scenario R. Projections reflect the following conditions:

	Scenario		
Condition	R	H	E
US Deepwater Ports	Few, late in period	None	Some
Trading Partners	No change	No change	More African, Persian Gulf Trade
Effect of Terrorism	Minimal	Some	Considerable
Overall Delay	Decrease	Increase	Moderate Increase

Table K-5 displays the portion of US foreign trade carried by trade route group in 1975 and projections for the three scenarios. These percentages have been used to develop a weighted value of additional port time for each ship sub-type. This completes the data requirements for exercising the algorithm given in Figure K-1, enabling a composite, average of relatives index of average annual port time per round trip to be generated, as outlined earlier in this appendix. Partial calculations are given in Table K-6 by way of illustration.

TABLE K-4

ADDITIONAL PORT TIME FOR ALL SHIP SUB-TYPES
IN DAYS PER ROUND TRIP VOYAGE
1975-2000

Trade Route Group	Year	General Cargo			Partial Container			Full Container			Barge Carrier			Dry Bulk			Liquefied Gas			Liquid Bulk		
Scenario		R	H	E	R	H	E	R	H	E	R	H	E	R	H	E	R	H	E	R	H	E
I	1975	8	8	8	8	8	8	5	5	5	5	5	5	2	2	2	1	1	1	1	1	1
	1980	8	8	8	8	8	8	5	5	5	5	5	5	2	2	2	1	1	1	1	1	1
Europe	1985	7	7	7	7	7	7	4	4	4	4	4	4	2	2	2	1	1	1	1	1	1
	1990	7	7	7	7	7	7	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1
Canada	1995	6	6	6	6	6	6	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1
	2000	6	6	6	6	6	6	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1
	2005	6	6	6	6	6	6	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1
II	1975	14	14	14	14	14	14	12	12	12	12	12	12	3	3	3	1	1	1	1	1	1
Caribbean	1980	14	14	14	14	14	14	12	12	12	12	12	12	3	3	3	1	1	1	1	1	1
	1985	12	13	13	12	13	13	10	11	11	10	11	11	3	3	3	1	1	1	1	1	1
West Coast	1990	10	12	12	10	12	12	8	10	9	8	10	9	2	3	3	1	1	1	1	1	1
of	1995	9	11	11	9	11	11	6	9	8	6	9	8	2	3	3	1	1	1	1	1	1
South America	2000	8	10	10	8	10	10	5	8	8	5	8	8	2	3	3	1	1	1	1	1	1
	2005	8	10	10	8	10	10	5	8	8	5	8	8	2	3	3	1	1	1	1	1	1
III	1975	32	32	32	32	32	32	15	15	15	15	15	15	4	4	4	1	1	1	1	1	1
	1980	29	29	29	28	28	28	14	14	14	14	14	14	4	4	4	1	1	1	1	1	1
Mediterranean	1985	26	28	27	24	27	25	12	13	13	12	13	13	3	3	4	1	1	1	1	1	1
East Coast	1990	23	26	25	20	25	23	10	12	11	10	12	11	3	3	4	1	1	1	1	1	1
of	1995	20	24	22	16	23	20	9	11	10	9	11	10	2	3	3	1	1	1	1	1	1
South America	2000	17	22	19	12	20	18	8	10	9	8	10	9	2	3	3	1	1	1	1	1	1
	2005	17	22	19	12	20	18	8	10	9	8	10	9	2	3	3	1	1	1	1	1	1
IV	1975	46	46	46	46	46	46	21	21	21	21	21	21	4	4	4	1	1	1	2	2	2
	1980	42	42	42	41	41	41	19	19	19	19	19	19	4	4	4	1	1	1	2	2	2
	1985	36	39	36	34	38	34	17	18	17	17	18	17	3	3	3	1	1	1	1	1	1
Oceania	1990	30	34	30	27	35	27	14	17	14	14	17	14	3	3	3	1	1	1	1	1	1
	1995	24	30	24	20	32	20	11	16	11	11	16	11	2	3	2	1	1	1	1	1	1
	2000	17	26	17	12	28	12	8	15	8	8	15	8	2	3	2	1	1	1	1	1	1
	2005	17	26	17	12	28	12	8	15	8	8	15	8	2	3	2	1	1	1	1	1	1
V	1975	62	62	62	62	62	62	23	23	23	23	23	23	30	30	30	1	1	1	2	2	2
	1980	50	50	50	50	50	50	20	20	20	18	18	18	20	20	20	1	1	1	1	1	1
Africa	1985	40	45	45	38	45	44	18	19	19	14	16	16	15	18	18	1	1	1	1	1	1
South Asia	1990	35	40	40	30	40	38	16	18	18	12	15	14	12	16	15	1	1	1	1	1	1
Southeast Asia	1995	30	37	35	25	37	34	14	17	17	10	14	12	9	14	12	1	1	1	1	1	1
Near East	2000	25	35	30	20	35	30	12	16	16	8	12	10	6	12	10	1	1	1	1	1	1
	2005	25	35	30	20	35	30	12	16	16	8	12	10	6	12	10	1	1	1	1	1	1

Note: For Combination Carriers (CC), use the DB + LB average

Sources: Reference A-20, Exhibits VII-1[illegible] VII-13 (Scenario R [illegible] 2005)

TABLE K-5

PORTION OF US FOREIGN TRADE CARRIED BY TRADE ROUTE GROUP

TRADE ROUTE GROUP	SCENARIO	US FOREIGN TRADE (PERCENT) 1975	1980	1985	1990	1995	2000	2005
I - Europe	Historical	19						
Canada	R		18	18	18	18	18	18
	H		18	18	18	18	18	18
	E		18	18	17	17	17	16
II - Caribbean	Historical	30						
West Coast	R		28	28	28	28	28	28
of	H		28	28	28	28	28	28
South America	E		28	27	27	26	26	25
III - Mediterranean	Historical	29						
East Coast	R		30	30	30	30	30	30
of	H		30	30	30	30	30	30
South America	E		30	29	29	28	27	27
IV - Oceania	Historical	5						
	R		4	4	4	4	4	4
	H		4	4	4	4	4	4
	E		4	4	3	3	2	2
V - Africa	Historical	17						
South Asia	R		20	20	20	20	20	20
Southeast Asia	H		20	20	20	20	20	20
Near East	E		20	22	24	26	28	30

Source: Reference B-13, v1, Table 2-7(1975 Data); Reference A-20, Exhibit VII-13.

Table K-6

Index of Port Time Per Round Trip

Partial Calculations

A	B	C=B/B.	D	E=D/D.	F	G=1/2F(C+E)	H
Ship Type	Cargo Handling Time		Additional Port Time		Fleet	Composite Index	
	Hours	Index	Hours	Index	Population	By Type	Total
1974 (Base Year)							
Freighter	207.8[a]	100.0	513.9[b]	100.00	0.54	54.0	
Bulk Carrier	89.1[a]	100.0	177.0[b]	100.00	0.03	3.0	
Tanker	75.9[a]	100.0	29.2[b]	100.00	0.42	42.0	100.0
1980 All Scenarios							
Freighter	189.1	91.0[c]	453.8	88.3[d]	0.47	42.2	
Bulk Carrier	96.4	108.2	149.7	84.6	0.03	2.9	
Tanker	81.8	107.8	24.9	85.3	0.50	48.3	93.4
1985 Scenario R							
Freighter	139.9	67.3	380.8	74.1	0.47	33.2	
Bulk Carrier	112.7	126.5	120.4	68.0	0.03	2.9	
Tanker	79.9	105.3	24.0	82.2	0.50	46.8	82.9
1990 Scenario R							
Freighter	115.6	55.6	312.3	60.8	0.47	27.3	
Bulk Carrier	91.8	103.0	96.1	54.3	0.03	2.4	
Tanker	78.7	103.7	24.0	82.2	0.50	46.4	76.1
1995 Scenario R							
Freighter	94.3	45.4	251.6	49.0	0.47	22.2	
Bulk Carrier	91.2	102.4	75.4	42.6	0.03	2.2	
Tanker	77.9	102.6	24.0	82.2	0.50	46.2	70.6
2000 Scenario R							
Freighter	77.2	37.2	204.3	39.8	0.47	18.1	
Bulk Carrier	90.8	101.9	61.9	35.0	0.03	2.1	
Tanker	77.2	101.7	24.0	82.2	0.50	46.0	66.2
2005 Scenario R							
Freighter	73.4	35.3	187.6	36.5	0.47	16.9	
Bulk Carrier	88.7	99.6	61.9	35.0	0.03	2.0	
Tanker	77.1	101.6	24.0	82.2	0.50	45.9	64.8

Notes: a - Base year values (B.) c - (189.1/207.8)x100 = 91.0
b - Base year values (D.) d - (453.8/513.9)x100 = 88.3

FOOTNOTES TO APPENDIX K

1. References A-19 and A-20.
2. Reference B-17.
3. Reference B-13.
4. Reference A-20, Chapter V.
5. Reference A-19, Chapter VIII.
6. Reference A-19, Chapter VIII, and Reference A-20, Chapter VII.

APPENDIX L

PROJECTIONS FOR PARAMETER 210

Ratio of speed of advance to design speed for US privately-owned merchant ships of 1000 GRT or more.

This parameter is designed to guage the efficiency of port-to-port voyages. Experienced transit time over specified routes compared to minimum possible transit time would provide such a guage, as would the speed of advance (SOA) (route distance divided by experienced transit time) compared to design speed. The latter measure has been adopted, but instead of taking a direct approach (e.g., by tracking a sample of ships over selected or random routes for a period of time), a simpler macro analysis has been employed.

Table 4-11 has been developed using the algorithm described in Figure L-1. Fundamentally, the algorithm calculates the number of round trips the fleet must make in order to transport the total annual US foreign trade carried in US ships; the number of trips times the effective distance over which US foreign trade moves divided by the fleet underway time yields the SOA, which is then compared to the fleet average design speed. The algorithm is described in more detail in the following paragraphs.

For historical data, effective trade route distances for each year were calculated using round trip distances by trade route and ship type (Table L-1) in conjunction with trade volume by service (liner, tanker, non-liner) for each trade route.[1] Trade route distances and trade volume data for liners were ascribed to freighters; bulk carrier and

FIGURE L-1

ALGORITHM FOR SPEED OF ADVANCE (SOA)

$$\text{SPEED OF ADVANCE} = \frac{\text{Effective Distance}}{\text{Underway Time}}$$

$$= \frac{\dfrac{\text{Cargo Ton-Miles}}{\text{Cargo Tonnage}}}{\text{365-Non-Operational Time - In-Port Time}}$$

$$\text{SOA} = \frac{A}{\dfrac{C}{\frac{V}{E}} - H}$$

WHERE:

A = Effective Trade Route Distance per Round Trip

C = Number of Operating Days per Year

V = Annual US Foreign Trade (Imports and Exports) Carried in US Ships, by Ship Type

E = Fleet Cargo Carrying Capacity per Round Trip by Ship Type

H = Annual Port Time per Round Trip

FIGURE L-2

EFFECTIVE TRADE ROUTE DISTANCES

$$A_j = \frac{\sum_i V_{ij} D_{ij}}{\sum_i V_{ij}} \qquad \text{For } j = 1,2$$

WHERE:

A_j = Effective Trade Route Distance for Ship Type j; j=1 implies Freighters, j=2 implies Bulkers and Tankers

V_{ij} = Volume of US Foreign Trade Carried by Ship Type j on Trade Route i (See Table L-1)

D_{ij} = Round Trip Distance for Ship Type j on Trade Route i

EFFECTIVE DISTANCES (kNM)

YEAR	FREIGHTER DISTANCE (A_1)	BULKER-TANKER DISTANCES (A_2)
1971	16.85	10.48
1972	16.66	15.47
1973	16.07	10.32
1974	15.73	13.64
1975	15.72	11.43
1976	16.01	10.54
MEAN	16.17	11.98
STANDARD DEVIATION	0.48	2.11

tanker trade route distances and trade volume data for non-liner and tanker services were ascribed to bulk carriers and tankers as a single ship type. The results of these calculations are given in Figure L-2. Since significant changes in US trading partners are not implied in Scenarios R and H, the mean distances shown have been used for developing projections under these scenarios.

Scenario E, however, implies more trade in raw materials with Africa, South Asia, Southeast Asia, and the Middle East. While the historical average distance for freighters has been used in the projections, bulker-tanker distances have been adjusted to reflect the shifting pattern; bulker-tanker effective distance increases gradually to 12.95 kNM by 2005.

Total US foreign trade data and the fraction carried in US ships are given in Figures 3-14 and 3-15, basic report. Since the SOA algorithm requires data for both freighters and bulkers/tankers, projected trade data have been apportioned to the two ship types. Historically, 42% of US trade has been carried by freighters;[2] 58% by bulkers and tankers. This apportionment has been retained for Scenario R and H projections. Scenario E, however, envisages a marked increased in energy and raw materials trade; the trade portion carried by bulkers and tankers has therefore been gradually increased to 86% by 2005.

Fleet cargo-carrying capacities have been derived from the algorithm discussed in Appendix K by aggregating average capacities by ship sub-type. Fleet cargo-carrying capacities per round trip are given in Table L-2 for freighters, bulk carriers, and tankers. In exercising the SOA algorithm, bulk carrier and tanker capacities have been combined.

Annual operating days and port time data are given in Table L-3. Port time data development has been discussed in Appendix K. Bulk carrier and tanker (B&T) figures represent averages of the two types, weighted by their populations.

TABLE L-1

TRADE ROUTE ROUND TRIP DISTANCES

TRADE ROUTE	BULK AND TANKER DISTANCES	LINER AND NEOBULK DISTANCES
1	9000	13500
2	6500	9000
4	3500	5000
5-7-8-9-11	7000	8000
10	9000	12000
12	19000	27000
13 Atl.	9000	12000
13 Gulf	11500	15500
41	10000	14000
42	11500	15500
43	16500	22000
51	15000	20000
52	16000	22000
53	21000	28500
16 Atl.	19500	26500
16 Gulf	18500	25500
17 Atl.	20500	28000
17 Gulf	23000	31000
17 Pac.	14000	19000
18 Atl.	23500	29500
18 Gulf	24694	33500
19	3500	4500
20	10500	14500
21	10000	12000
22	21000	26500
23	8000	10500
24	15500	17000
25	9500	13000
26	17500	24000
65	21500	29000
27	14500	19500
28	21500	29000
29	11500	16500
31	5500	10500
71	4500	6000
72	2500	3500
77	3500	4500
78	3000	4000
85	11500	15500
86	11000	15000
87	250	250
32	7500	10500
33	9000	12000
34	11500	15500
35	8000	11000
36	11000	15000
37	13500	18000
38	15000	20500
54	13500	18500
55	8500	11500
56	26500	35500
58	15500	21000
59	26000	35000
60	23000	31000
80	10000	13500
81	1500	2000
82	4500	6000
83	11000	15000
84	15500	21000
91	23500	29500
89	3000	4000
92	19000	26000
93	19500	26500
61	300	300

Source: Reference A-19, Exhibit VIII-7.

TABLE L-2

US FLEET CARGO-CARRYING CAPACITY (kLT/ROUND TRIP)

SCENARIO - YEAR		FREIGHTERS	BULKERS	TANKERS	TOTAL
Historical	1971	3,472	641.8	6,894	11,010
	1972	3,315	631.8	6,984	10,930
	1973	4,047	559.4	7,386	11,990
	1974	4,127	497.8	7,981	12,610
	1975	4,079	497.8	8,525	13,100
	1976	4,082	484.3	9,666	14,230
All	1980	3,792	531.2	12,890	17,210
R	1985	3,682	531.2	12,860	17,070
	1990	3,698	531.2	12,880	17,110
	1995	3,617	547.2	13,100	17,260
	2000	3,454	567.2	13,480	17,500
	2005	3,690	595.0	13,840	18,120
H	1985	3,650	486.0	12,400	16,540
	1990	3,112	339.2	11,550	15,000
	1995	2,936	252.2	11,210	14,400
	2000	2,800	252.2	10,820	13,870
	2005	2,573	252.2	10,480	13,300
E	1985	3,705	612.2	14,520	18,840
	1990	3,957	1341	16,150	21,440
	1995	3,843	2266	16,980	23,090
	2000	3,972	3605	17,230	24,810
	2005	3,839	3818	18,260	25,910

TABLE L-3

VESSEL TIME ALLOCATION

Total Annual Time = Operational Time + Non-Operational Time

365 Days = Port Time + Underway Time + Non-Operational Time

$$= \left(\frac{\text{Port Time}}{\text{Round Trip}} + \frac{\text{Underway Time}}{\text{Round Trip}}\right) \cdot \text{No. Round Trips/Year} + \text{Non-Operational Time}$$

A. OPERATIONAL TIME (Days Per Year)

Year	Historical	Scenario R	Scenario H	Scenario E
1970	343			
1975	345			
1980		347	347	347
1985		349	347	349
1990		351	345	351
1995		353	342	353
2000		355	339	355
2005		355	336	355

SOURCE: Reference A-19, Exhibit VIII-9, for 1975 and Scenario R (1980-2000).

B. ANNUAL PORT TIME PER ROUND TRIP (Hours)

	HISTORICAL		SCENARIO R		SCENARIO H		SCENARIO E	
YEAR	F	B&T	F	B&T	F	B&T	F	B&T
1971	804	121						
1972	781	122						
1973	746	120						
1974	722	117						
1975	722	117						
1976	710	120						
1980			643	114	643	114	643	114
1985			521	111	607	112	566	115
1990			428	107	508	110	495	125
1995			346	105	475	108	429	129
2000			282	104	439	108	380	137
2005			261	104	427	108	378	139

Key: F - Freighters

B&T - Bulk Carriers and Tankers

To obtain the SOA/speed ratio, the SOA for each of the two ship types has been divided by the design speeds given in Table 5-3, basic report. Speed projections have been based on scenario conditions as follows:

<u>Scenario R</u>: Moderate fleet growth, but fuel cost is a major speed inhibiting factor. Speed increase of 3%/5 years has been assumed.

<u>Scenario H</u>: Little or no new construction. Older, slower ships gradually retired. Speed increase of 1%/5 years has been assumed.

<u>Scenario E</u>: Booming growth. Fuel cost not a major speed constraint. Regression analysis of historical data for each ship type has been used.

A final fleet SOA/speed ratio has been obtained by averaging the ratios for the two ship types, using the type populations as weights. These data are shown in Table 4-11.

FOOTNOTES FOR APPENDIX L

1. Reference B-28, Appendix B.
2. Reference B-28, Appendix D.

APPENDIX M

PROJECTIONS FOR PARAMETER 410B

Index of US merchant ship daily fuel consumption.

The purpose of this parameter is to project daily fuel consumption for the nominal or average ship in the US merchant fleet under the three scenarios. The historical data and projections in Table 4-12 are based on the calculations shown in Table M-1, and which are explained below.

Historical data (specifically DWT, speed, and fuel use at sea and in port) have been obtained for 10 classes of freighters and 8 classes of tankers. (Data are also available for two classes of bulk carriers, but these ships are converted tankers of World War II vintage. They have not been used in generating the fuel consumption index; tanker data are assumed to be representative of bulk carriers). All of these ship classes are powered by steam turbines. Table M-2 displays DWT, speed, and fuel use data for each ship class. Average fuel use is predicated on the assumption that at-sea time for freighters is 60%, and for bulkers and tankers, 80%. Relationships among DWT, speed, and fuel use for freighters and tankers have been determined by multiple regression analysis.

Using the regression equations and average DWT and speed, historical and projected fuel use estimates have been developed as shown in Table M-1. Projections for average DWT are discussed in Appendix I and summarized in Table 5-1, basic report; speed projections are dealt with in Appendix L and summarized in Table 5-3, basic report. In both cases combined values for bulkers/tankers represent averages weighted by ship type populations.

For each ship type fuel use has been expressed as an index, using 1974 as the base year. A composite index has been generated by weighting each type index in proportion to the type population of the fleet.

TABLE M-1

DAILY FUEL CONSUMPTION INDEX CALCULATIONS

		A	B	C*	D	E	F	G	H#	I	J	K=DE+IJ
		FREIGHTERS					BULKERS & TANKERS					
	YEAR	AVG DWT (kLT)	AVG SPEED (KT)	FUEL USE (BBL/DA)	INDEX (1974=100)	FLEET WT (%)	AVG DWT (kLT)	AVG SPEED (KT)	FUEL USE (BBL/DA)	INDEX (1974=100)	FLEET WT (%)	COMPOSITE INDEX (1974=100)
<u>HISTORY</u>	1966	11.6	16.0	208	54.4	65	23.4	14.8	298	74.2	35	61.3
	1968	11.9	17.0	253	66.2	65	24.2	14.8	300	74.7	35	69.2
	1970	12.9	17.0	265	69.2	61	27.2	15.0	321	79.9	39	73.4
	1972	14.0	18.0	319	83.4	56	30.4	15.9	388	96.6	44	89.2
(BASE YEAR)	1974	15.9	19.0	382.8	100.0	54	35.6	15.9	401.6	100.0	46	100.0
	1975	16.2	20.0	428	111.8	53	37.2	15.9	406	101.0	47	106.7
	1976	16.5	20.0	431	112.7	52	40.6	15.9	415	103.2	48	108.2
	1977	16.8	20.0	435	113.6	50	44.6	15.9	425	105.8	50	109.7
<u>SCENARIO</u> ALL	1980	17.0	21.3	491	128.3	47	49.2	16.5	476	118.6	53	123.1
RESOURCE ALLOCATION (R)	1985	17.0	21.9	516	134.8	47	49.2	17.0	509	126.7	53	130.5
	1990	17.0	22.6	545	142.4	47	49.2	17.5	542	134.9	53	138.4
	1995	17.0	23.3	574	150.0	47	49.3	18.0	575	143.1	53	146.4
	2000	17.3	24.0	607	158.6	47	49.7	18.6	615	153.2	53	155.7
	2005	17.8	24.7	642	167.7	47	49.1	19.1	646	161.0	53	164.1
HARDSHIP (H)	1985	17.2	21.5	502	131.1	47	51.4	16.7	495	123.3	53	126.9
	1990	17.5	21.7	514	134.2	48	55.9	16.8	513	127.8	52	130.9
	1995	17.7	21.9	524	136.9	48	58.8	17.0	534	132.9	52	134.8
	2000	17.6	22.2	536	139.9	49	60.8	17.2	552	137.5	51	138.7
	2005	17.6	22.4	544	142.1	50	63.7	17.3	566	141.0	50	141.5
EXPANSIVE GROWTH (E)	1985	17.8	23.1	575	150.3	47	61.7	17.1	548	136.4	53	143.0
	1990	18.5	24.9	658	172.0	46	72.4	17.6	608	151.5	54	160.9
	1995	19.2	26.7	741	193.6	45	83.1	18.1	669	166.6	55	178.7
	2000	20.0	28.5	825	215.6	45	92.8	18.8	740	184.3	55	198.4
	2005	20.8	30.4	914	238.7	44	104.3	19.3	803	199.8	56	216.9

*$C=-591.5+11.54A+41.62B$, $R^2=0.99$

#$H=-733.5+2.591F+65.59G$, $R^2=0.97$

SOURCES (Average DWT and Speed): References B-17 and B-24.

TABLE M-2

CHARACTERISTICS OF EXISTING SHIP CLASSES: DWT, SPEED, FUEL USE

SHIP TYPE AND CLASS	DWT (kLT)	SPEED (KT)	FUEL USE (BBL/DAY) AT SEA	IN PORT	AVERAGE*
FREIGHTERS					
C3	10.6	18.0	440	65	290
C4	13.0	20.0	590	75	384
C4-S-1a	13.3	20.0	630	75	408
C6	18.0	22.0	810	80	518
C8	29.8	22.5	1065	150	699
C2-S-B1	10.7	15.5	275	55	187
VC2-S-AP2	10.8	15.5	275	55	187
VC2-S-AP3	10.8	17.0	350	60	234
C3-S-A2	12.3	16.5	350	60	234
C4-S-B5	15.6	16.5	380	65	254
BULK CARRIERS					
T2-SE-A1 STD	16.7	14.5	275	50	230
T2-SE-A1 JUMBO	22.0	14.5	275	50	230
TANKERS					
25 kDWT	25.8	17.4	500	80	416
37.5 kDWT	37.8	16.0	535	90	446
50 kDWT	50.1	16.5	600	100	500
80 kDWT	80.7	16.5	700	150	590
120 kDWT	121.0	16.4	800	165	673
250 kDWT	249.8	15.4	1075	220	904
T2-SE-A1 STD	16.7	14.5	300	70	254
T2-SE-A1 JUMBO	20.8	14.5	300	70	254

*At Sea Estimates: Freighters-60%; Bulkers and Tankers-80%.

SOURCE: Reference B-7, 1978.

APPENDIX N

PROJECTIONS FOR PARAMETER 300

Index of US merchant ship daily operating costs.

The purpose of this parameter is to show historical and projected changes in relative operating costs for the nominal or average US merchant ship. Recent operating cost data[1] in seven categories for 20 ship classes (listed in Table N-2) were used to generate the indices (Tables 4-13 and 4-14). The cost categories are:

Fuel Cost	Maintenance and Repair Cost
Wages	Insurance Cost
Subsistence Cost	Other Cost
Supply Cost	

Supply cost has been combined with Other cost in the development of the indices. In order to establish relationships and prediction equations, available data in each of the six categories have been subjected to regression analysis. The resulting prediction equations are given in Figure N-1. In four categories costs have been predicted directly (with adjustments for inflation, if necessary). Fuel cost and wages, however, have been treated differently. Fuel usage has been projected in Appendix M in barrels per day; fuel cost has been obtained by applying cost per barrel (Table N-1) to the usage projection. Wages have been estimated by projecting crew size and then applying the average daily wage rate (Table N-2).

Indices in both constant (1978) dollars and current dollars have been produced. The GNP implicit price deflator (Table N-3) has been used to adjust historical data to 1978 dollars. The inflation rates derived from the scenarios have been used for projections in current dollars. These rates are given in Table N-4 together with "real" cost change factors, which have also been derived from the scenarios.

Generation of the two indices differs only in the treatment of inflation, as noted above. Basically, costs have been projected for each cost category for each of the three ship types (freighters, bulk carriers, and tankers). These costs have been indexed using 1974=100 as the base year. A cost index for each ship type has been developed by averaging the cost category indices for each year, using the geometric mean.[2] The resulting ship type cost indices have then been combined to produce a composite index, using ship type populations as the weighting factor.

FIGURE N-1

COST CATEGORY PROJECTION EQUATIONS

FUEL USAGE

FREIGHTERS

$D = -591.5 + 11.54A + 41.62B$ $\quad R^2 = 0.99$, $N = 10$

BULKERS AND TANKERS

$D = -733.5 + 2.591A + 65.59B$ $\quad R^2 = 0.97$, $N = 8$

CREW SIZE

$E = 20.9 + 0.014A + 0.202B + 0.560C$ $\quad R^2 = 0.99$, $N = 8$

(Based on tanker data; tankers were the only modern ships for which cost data were available)

SUBSISTENCE COST

$F = 0.137 + 5.75E$ $\quad R^2 = 0.99$, $N = 20$

SUPPLY AND OTHER COST

$\log G = 0.96252 + 0.21589 \log A - 0.24642 \log C + 1.00715 \log E$ $\quad R^2 = 0.88$, $N = 20$

MAINTENANCE AND REPAIR COST

FREIGHTERS

$H = 438 + 40.5A - 6.31C$ $\quad R^2 = 0.93$, $N = 10$

BULKERS

$H = 641.5 + 1.89A$ $\quad R^2 = 0.99$, $N = 2$

TANKERS

$H = 341.8 + 0.3172A + 0.07551C$ $\quad R^2 = 0.99$, $N = 8$

INSURANCE COST

FREIGHTERS

$I = 411 + 20.7A$ $\quad R^2 = 0.94$, $N = 10$

BULKERS

$I = -30.2 + 20.2A$ $\quad R^2 = 0.99$, $N = 2$

TANKERS

$\log I = 1.73472 + 0.81350 \log A - 0.19215 \log C$ $\quad R^2 = 0.96$, $N = 8$

WHERE:

A = DWT (kLT)
B = Speed (KT)
C = Age (Years)
D = Fuel Usage (BBL/Day)
E = Crew Size (Number)
F = Subsistence Cost ($/Day)
G = Supply and Other Cost ($/Day)
H = Maintenance and Repair Cost ($/Day)
I = Insurance Cost ($/Day)

TABLE N-1

SHIPS' BUNKER FUEL PRICES
(MARINE FUEL OIL)

(Dollars per barrel)

HISTORICAL DATA

1947	3.02	1963	2.30
1948	2.55	1964	2.30
1949	2.05	1965	2.25
1950	2.15	1966	2.25
1952	2.10	1967	2.28
1953	2.25	1968	2.28
1954	2.35	1969	2.28
1955	2.65	1970	3.75
1956	3.05	1971	3.30
1957	2.95	1972	3.45
1958	2.41	1973	5.92
1959	2.37	1974	11.09
1960	2.52	1976	11.85
1961	2.52	1978	13.25
1962	2.45		

PROJECTED DATA

	SCENARIO		
	R	H	E
1980	13.25	13.25	13.25
1985	13.93	16.91	14.63
1990	14.64	21.58	16.15
1995	14.64	27.55	17.83
2000	14.64	35.15	19.69
2005	14.64	44.86	21.74

Prices at New York as of 31 December. Historical data in current dollars. Projections in constant 1978 dollars.

SOURCE

McGraw-Hill Publications Company. <u>Platt's List of World Oil Prices</u>. New York: McGraw-Hill Publications Company, annual.

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IMPACT OF THE FUTURE MERCHANT FLEET ON COAST GUARD OPERATING AN--ETC(U)
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TABLE N-2

AVERAGE WAGE RATE (Current Dollars)

SHIP TYPE AND CLASS	CREW (M)	WAGES 1970	1971	1974	1976	1977
FREIGHTERS						
C3	48			3830	4256	5530
C4	40			3750	4093	5360
C4-S-1a	57			4520	5020	6530
C6	40			4185	4462	5865
C8	38			3855	4090	5400
C2-S-B1	46			3625	4095	5265
VC2-S-AP2	44	2671	2873	3540	3995	5150
VC2-S-AP3	44	2671	2873	3540	3995	5150
C3-S-A2	46		3014	3655	4118	5305
C4-S-B5	46			3714	4188	5415
BULK CARRIERS						
T2-SE-A1 STD	41	2674	2706	3332	3748	4845
T2-SE-A1 JUMBO	41			3332	3748	4845
TANKERS						
25 kDWT	25			2550	2942	3875
37.5 kDWT	25			2550	2942	3875
50 kDWT	26			2702	3121	3950
80 kDWT	26			2702	3121	3950
120 kDWT	27			2772	3200	4045
250 kDWT	28			2840	3280	4140
T2-SE-A1 STD	41	2688	2988	3606	3950	5330
T2-SE-A1 JUMBO	42	2741	3048	3674	4024	5425
TOTAL	771					
MEAN CREW SIZE[a]		42.4	43.0	38.55	38.55	38.55
MEAN WAGES[b]		2689	2915	3369	3780	4907
MEAN RATE ($/MAN/DAY)		63.42	67.79	87.39	98.05	127.29

a - Arithmetic Mean
b - Geometric Mean

Source: Reference B-7

TABLE N-3

GNP PRICE DEFLATOR (AS A MEASURE OF INFLATION)

(Index (1978 = 100))

HISTORICAL DATA

1950	35.7	1965	48.8
1951	37.6	1966	50.4
1952	38.1	1967	51.9
1953	38.6	1968	54.2
1954	39.2	1969	57.0
1955	40.0	1970	60.0
1956	41.3	1971	63.1
1957	42.7	1972	65.7
1958	43.4	1973	69.5
1959	44.3	1974	76.2
1960	45.1	1975	83.5
1961	45.5	1976	87.9
1962	46.3	1977	93.1
1963	47.0	1978	100.0
1964	47.8		

Calculated from the 1972 deflator by multiplying by 0.6575.

SOURCE

U.S. Department of Commerce. Bureau of Economic Analysis. Business Statistics, 1977. Washington, D.C.: Government Printing Office, March, 1978.

TABLE N-4

SHIP OPERATING COST PROJECTION FACTORS

	A	B	C = AB	D	E = AD	F	G = AF	H	I = AH	J	K = AJ	L	M = AL
SCENARIO & COST CATEGORY	INFLATION FACTOR	1980 REAL	1980 TOTAL	1985 REAL	1985 TOTAL	1990 REAL	1990 TOTAL	1995 REAL	1995 TOTAL	2000 REAL	2000 TOTAL	2005 REAL	2005 TOTAL
SCENARIO R													
Fuel	See table below	1.000	1.000	1.051	1.673	1.105	2.467	1.105	2.929	1.105	3.478	1.105	4.131
Wages		1.000	1.135	1.000	1.592	1.000	2.233	1.000	2.652	1.000	3.149	1.000	3.740
Subsistence		1.000	1.135	1.000	1.592	1.000	2.233	1.000	2.652	1.000	3.149	1.000	3.740
Supply and Other		1.000	1.135	1.000	1.592	1.000	2.233	1.000	2.652	1.000	3.149	1.000	3.740
Maintenance & Repair		1.000	1.135	1.000	1.592	1.000	2.233	1.000	2.652	1.000	3.149	1.000	3.740
Insurance		1.000	1.135	1.000	1.592	1.000	2.233	1.000	2.652	1.000	3.149	1.000	3.740
SCENARIO H													
Fuel	See table below	1.000	1.000	1.276	2.228	1.629	4.377	2.079	8.594	2.653	16.878	3.386	33.142
Wages		1.000	1.135	1.000	1.746	1.000	2.687	1.000	4.134	1.000	6.361	1.000	9.787
Subsistence		1.000	1.135	1.000	1.746	1.000	2.687	1.000	4.134	1.000	6.361	1.000	9.787
Supply and Other		1.000	1.135	1.000	1.746	1.000	2.687	1.000	4.134	1.000	6.361	1.000	9.787
Maintenance & Repair		1.000	1.135	1.000	1.746	1.000	2.687	1.000	4.134	1.000	6.361	1.000	9.787
Insurance		1.000	1.135	1.276	2.228	1.629	4.377	2.079	8.594	2.653	16.878	3.386	33.142
SCENARIO E													
Fuel	See table below	1.000	1.000	1.104	1.599	1.219	2.254	1.346	3.176	1.486	4.474	1.641	6.306
Wages		1.000	1.135	1.000	1.448	1.000	1.849	1.000	2.360	1.000	3.011	1.000	3.844
Subsistence		1.000	1.135	1.000	1.448	1.000	1.849	1.000	2.360	1.000	3.011	1.000	3.844
Supply and Other		1.000	1.135	1.000	1.448	1.000	1.849	1.000	2.360	1.000	3.011	1.000	3.844
Maintenance & Repair		1.000	1.135	1.000	1.448	1.000	1.849	1.276	3.012	1.629	4.905	2.079	7.991
Insurance		1.000	1.135	1.469	2.128	2.159	3.992	3.172	7.486	4.661	14.034	6.848	26.326

INFLATION FACTOR (Base year 1978=1.000)

YEAR	SCENARIO R	SCENARIO H	SCENARIO E
1980	1.135	1.135	1.135
1985	1.592	1.746	1.448
1990	2.233	2.687	1.849
1995	2.652	4.134	2.360
2000	3.149	6.361	3.011
2005	3.740	9.787	3.844

FOOTNOTES FOR APPENDIX N

1. Reference B-7.

2. The geometric mean (nth root of the product of n numbers) minimizes the effect of very high or very low values in the set of numbers to be averaged. In this regard, it is superior to the arithmetic mean as a measure of central tendency.

APPENDIX O

PROJECTIONS FOR PARAMETER 280

US Merchant Marine Licenses and Documents Issued.

This parameter is intended to describe shipboard employment in terms of licensed and certificated personnel. In order to limit the estimate of licenses and documents to personnel engaged in ocean and coastwise shipping, some categories of licenses and documents have been omitted from the tabulation of original data (Reference C-6), as shown in Table O-1.

Table 4-15 tabulates the volume historical and projected licenses and documents issued. The following regression equation has been used to generate projections:

$$\log C = -2.4401 + 0.23684 \log A + 1.17224 \log B$$
$$(R^2 = 0.82,\ N = 11)$$

Where:

A = the number of US ships of 100 to 1000 GRT

B = the number of US ships of 1000+ GRT

C = the number of licenses/documents issued (in thousands)

Data for A and B reflect scenario conditions. Values for A and B appear in Tables J-3 and J-4.

TABLE O-1

CATEGORIES OF OFFICER LICENSES AND SEAMEN'S DOCUMENTS TABULATED

CATEGORY	INCLUDED IN FIGURE O-1
OFFICER LICENSES - DECK	
Master:	
Ocean	X
Coastwise	X
Great Lakes	
Bays, Sounds & Lakes	
Rivers	
Radio Officer	X
Chief Mate:	
Ocean	X
Coastwise	X
Inland Mate:	
Great Lakes	
Bays, Sounds & Lakes	
Rivers	
Second Mate:	
Ocean	X
Coastwise	X
Third Mate:	
Ocean	X
Coastwise	X
Pilots	
Great Lakes	
Bays, Sounds & Lakes	
Rivers	
Master: Uninspected Vessels	
Mate: Uninspected Vessels	
Motorboat Operators	

OFFICER LICENSES - ENGINEER (MOTOR AND STEAM)

Chief Engineer:	
Unlimited	X
Limited	X
First Assistant Engineer:	
Unlimited	X
Limited	X
Second Assistant Engineer:	
Unlimited	X
Limited	X
Third Assistant Engineer:	
Unlimited	X
Limited	X
Chief Engineer: Uninspected Vessels	
Assistant Engineer: Uninspected Vessels	

SEAMEN'S DOCUMENTS

Staff Officer	X
Continuous Discharge Book	X
Merchant Mariner's Documents	X
AB Any Waters Unlimited	X
AB Any Waters, 12 Months	X
AB Great Lakes, 18 Months	
AB Tugs and Towboats, Any Waters	
AB Bays and Sounds	
AB Seagoing Barges	
Lifeboatman	X
Electrician	X
Oiler	X
Fireman-Water Tender	X
Other QMED Ratings	X
Tankermen	X
Entry-Steward	X

APPENDIX P
PROJECTIONS FOR PARAMETER 570

Index of Marine Traffic Density for Selected US Ports

The purpose of this parameter is to guage historical traffic density and to display US traffic density trends under the influence of scenario conditions. A sample of 20 US ports has been used for development of the index. In terms of the volume of foreign trade handled, the selected ports (listed in Table 4-16 and elsewhere) include 16 of the top 20 for all services (liner, non-liner, and tanker). Collectively, 65% of US foreign trade passed through these 16 ports in 1977.[1]

Fundamentally, traffic density for each port is calculated annually as the total number of vessel trips or transits divided by the active port area. This value is indexed to the base year (1974 = 100). A composite index is then calculated by weighting each port index in proportion to the total volume of trade handled. Development of the three major variables (trade volume, number of trips, port area) is discussed in the following paragraphs.

Since each of the 20 ports handles both foreign and domestic trade (categorized as Domestic Ocean, Great Lakes, and Inland), relationships among these variables have had to be estimated in order to make projections. It has been assumed that all foreign trade passes through seaports (including Great Lakes ports) and that all Domestic Ocean trade passes through seaports. Some Great Lakes and Inland trade also passes through seaports. An algorithm for estimating the volume of trade handled by the 20-port sample is given in Figure P-1. This algorithm assumes that

FIGURE P-1

VOLUME OF TRADE HANDLED BY THE 20-PORT SAMPLE

Let B = Total volume of foreign and domestic trade handled by the 20-port sample

F = Total volume of US foreign trade

S = Total volume of foreign and domestic trade handled by seaports

T = Total volume of US waterborne trade (foreign and domestic)

a = Foreign trade as a percent of total foreign and domestic waterborne trade, a = 100F/T

b = Domestic ocean trade handled by seaports as a fraction of total domestic waterborne trade

c = Great Lakes and Inland domestic trade handled by seaports as a fraction of total domestic waterborne trade

$$\begin{matrix}\text{Total}\\\text{Seaport}\\\text{Trade}\end{matrix} = \begin{matrix}\text{Total}\\\text{Foreign}\\\text{Trade}\end{matrix} + \left(\begin{matrix}\text{Domestic}\\\text{Ocean Trade}\\\text{Fraction}\end{matrix} + \begin{matrix}\text{Other Domestic}\\\text{Seaport Trade}\\\text{Fraction}\end{matrix}\right) \times \begin{matrix}\text{Total}\\\text{Domestic}\\\text{Trade}\end{matrix}$$

$$S = F + (b + c) \times (T - F)$$

$$S = F + (b + c) \times \left(\frac{100F}{a} - F\right)$$

Let a = 49% (1977 value; 1966-1977 range: 35 to 49, increasing)

Let b = 0.26 (1977 value; 1966-1977 range: 0.24 to 0.26)

$$S = F + (0.26 + c) \times \left(\frac{100F}{49} - F\right)$$

Let $$\frac{S}{F} = \frac{F + (0.26 + c) \times \left(\frac{100F}{49} - F\right)}{F}$$

$$\frac{S}{F} = 1 + \frac{26}{49} - 0.26 + \frac{100c}{49} - c$$

$$\frac{S}{F} = 1.27 + 1.04c$$

But, for the 20-port sample in 1977, let B=S

$$\frac{B}{0.65F} = \frac{1103}{0.65x935.3} = 1.81$$

Therefore, for 1977, c = 0.52 and b + c = 0.78

Hence, $B = 0.65\left[F + 0.78\left(\frac{100F}{a} - F\right)\right]$

the 20-port sample is representative of all US seaports in respect of the volume of trade handled. Necessary coefficients have been drawn from 1977 data.[2] The accuracy of the resulting equation has been tested against historical data[3] in Table P-1. In this process the fraction of foreign trade handled by the 20-port sample has been adjusted from 0.65 to 0.66 to provide a better fit (mean error 0.2%).

The second major variable in this traffic density index is the number of vessel trips or transits of the port area. Development of a prediction equation began with linear regressions of the number of trips on the volume of trade handled for each year where data were available (1969-1977). The resulting least square estimates of the intercept and slope for each year were then subjected to separate regression analyses to obtain expressions of value versus time. These two equations (one for intercept, one for slope) were solved to obtain 1980 values for the expression

$$D = A + BC, \text{ yielding}$$

$$D = -33.51 + 1.612C$$

where D = Number of trips (thousands)

C = Total volume of trade handled (mST).

This equation has been tested against historical data as shown in Table P-1. Judging by the mean error (-5%), this equation yields results which are only approximate, but sufficiently accurate for present purposes.

The third major variable in the density index is port area. Ports vary greatly in physical configuration making consistent measurements difficult. The active area of each port was measured, although the boundaries of the active port area were frequently in doubt. This ambiguity is not considered to be fatal, however, because the index to which

TABLE P-1

PROJECTION EQUATION ERROR ANALYSES

	TOTAL TRADE HANDLED BY THE 20-PORT SAMPLE (mST)						NUMBER OF TRIPS (000)						
	A[a] Foreign Trade	B[a] Trade Fraction	C[b] Estimate	D[c] Historical	E=C-D Error	F=E/D % Error	G[c] Historical	H[d] Estimate	I=H-G Error	J % Error	K[e] Estimate	L=K-G Error	M % Error
1969	521.3	36	821.2	833.4	-12.2	-1.5	1172.5	1290.3	117.8	10.0	1309.9	137.4	11.7
1970	581.0	38	871.5	884.2	-12.7	-1.4	1747.2	1371.3	-375.8	-21.5	1391.8	-355.4	-20.3
1971	566.0	37	869.7	879.4	-9.7	-1.1	1683.9	1368.4	-315.4	-18.7	1384.1	-299.8	-17.8
1972	630.0	39	923.1	923.2	-0.1	-	1677.2	1454.5	-222.7	-13.3	1454.7	-222.5	-13.3
1973	767.4	43	1030.2	1014.9	15.3	1.5	1689.9	1627.2	-62.7	-3.7	1602.5	-87.4	-5.2
1974	764.1	43	1025.7	1023.8	1.9	0.2	1782.7	1619.9	-162.8	-9.1	1616.9	-165.8	-9.3
1975	748.7	44	984.7	980.6	4.1	0.4	1588.3	1553.8	-34.5	-2.2	1547.2	-41.1	-2.6
1976	856.0	47	1061.9	1050.3	11.6	1.1	1559.7	1678.3	118.6	7.6	1659.6	99.9	6.4
1977	935.3	49	1118.4	1102.8	15.6	1.4	1548.5	1769.4	220.8	14.3	1744.2	195.7	12.6
Sums			8706.4	8692.6			14449.9	13733.1			13710.9		
Mean Error					13.8	0.2			-716.8	-5.0		-739.0	-5.1

Notes:

a from References B-4, B-5 (Figure 3-9)

b $C = 0.66\ [A+0.78(\frac{100A}{B} - A)]$

$B = A/(\text{Total Foreign and Domestic Trade})(\%)$

c from Reference D-9

d $H = -33.51 + 1.612C$

e $K = -33.51 + 1.612D$

the variable is applied deals in relative, not absolute, values. This characteristic of an average of relatives index prevents small values (such as changes in port area) from being "lost" in comparison with large values, and it is change, rather than absolute magnitude, which is of interest in this parameter.

The traffic density index model incorporating the variables and projection equations is given in Figure P-3. Foreign trade data (F_{ik}) are given in Figure 3-9, basic report. Foreign trade as a percentage of total trade (a_k) is projected to be 40% for Scenario R and 50% for Scenarios H and E.

The distribution of total trade among the 20 ports (h_{ijk}) is scenario-dependent. Projections are given in Table P-2 together with the ranks of the ports by service in 1977. In Scenario R the distributions reflect more oil and bulk trade, and concentration of liner trade in a few ports. Smaller ports handle relatively more trade in Scenario H. The relative distribution does not change in Scenario E.

Finally, port area (E_{ijk}) projections are given in Table P-3. In Scenario R port area is held constant until after 1990 when a growth rate of 5%/5 years is estimated. There is no growth under Scenario H. A growth rate of 5%/5 years is estimated throughout the period in Scenario E.

FIGURE P-2

TRAFFIC DENSITY INDEX MODEL

$$B_{ik} = 0.66\ [F_{ik} + 0.78\ (\frac{100F_{ik}}{a_k} - F_{ik})]$$

$$D_{ijk} = \frac{H_{ijk}\ (-33.51 + 1.612\ B_{ik})}{E_{ijk}}$$

$$I_{ik} = \sum_{j=1}^{20} [D_{ijk}]_{index}\ h_{ijk} \qquad \text{for all i,k}$$

Where:

B_{ik} = Total volume (mST) of foreign and domestic trade handled by the 20-port sample for year i, scenario k

D_{ijk} = Traffic density (k trips/mi^2) for port i in year j, scenario k

$[D_{ijk}]_{index}$ = Index value of D_{ijk}, base year: 1974 = 100

E_{ijk} = Active area (mi^2) of port i in year j, scenario k

F_{ik} = Total volume (mST) of foreign trade in year i, scenario k

I_{ik} = Composite index of traffic density for year i, scenario k

a_k = Foreign trade as a percent of total foreign and domestic waterborne trade

h_{ijk} = Fraction of 20-port total trade (i.e., B_{ik}) handled by port i in year j, scenario k

$$\sum_{i=1}^{20} h_{ijk} = 1.000 \quad \text{for all j,k}$$

i = Index of ports, i=1,2,...,20

j = Index of years, j=1969-1977,1980,1985,1990,1995,2000,2005

k = Index of scenarios, k=1 implies historical data
2 implies Scenario R
3 implies Scenario H
4 implies Scenario E

TABLE P-2

FRACTION OF 20-PORT TOTAL TRADE HANDLED BY EACH PORT

	1977 Rank by Service*				Trade Fraction (Percent)											
					All Scenarios	Scenario R					Scenario H					Scenario E
	Major All	Major Liner	Major Non-Liner	Major Tanker	1980	1985	1990	1995	2000	2005	1985	1990	1995	2000	2005	All Years
Portland, ME	17			12	1.7	1.5	1.3	1.1	0.9	0.7	1.9	2.0	2.2	2.3	2.5	1.7
Boston					2.4	2.1	1.9	1.6	1.4	1.1	2.6	2.9	3.1	3.4	3.6	2.4
New York	1	1	16	1	16.8	17.8	18.9	19.9	20.9	22.0	16.0	15.2	14.5	13.7	12.9	16.8
Philadelphia	6	11	8	7	4.5	4.1	3.6	3.1	2.6	2.2	4.5	4.4	4.4	4.3	4.3	4.5
Baltimore	9	5	2		4.1	4.4	4.8	5.1	5.4	5.8	4.1	4.1	4.0	4.0	4.0	4.1
Norfolk/ Hampton Roads	7	9	1		4.0	4.3	4.7	5.0	5.4	5.7	4.0	4.0	3.9	3.9	3.9	4.0
Tampa	12		4		4.1	3.7	3.3	2.8	2.4	2.0	4.5	4.9	5.3	5.7	6.1	4.1
Mobile	16	18	9		3.3	3.6	3.8	4.1	4.3	4.6	3.3	3.3	3.3	3.3	3.3	3.3
New Orleans	4	2	3	8	14.8	15.6	16.5	17.3	18.2	19.0	14.1	13.4	12.7	12.0	11.3	14.8
Baton Rouge	5		7	5	6.3	5.6	5.0	4.3	3.7	3.0	6.2	6.2	6.1	6.1	6.0	6.3
Port Arthur	14			10	2.8	2.5	2.2	2.0	1.7	1.4	2.8	2.9	2.9	3.0	3.0	2.8
Beaumont	10			4	4.4	4.0	3.5	3.1	2.6	2.2	4.5	4.6	4.8	4.9	5.0	4.4
Texas City	19			13	3.0	2.7	2.4	2.1	1.8	1.5	3.1	3.2	3.3	3.4	3.5	3.0
Houston	3	3	6	3	9.5	10.3	11.1	11.8	12.6	13.4	9.1	8.7	8.3	7.9	7.5	9.5
Corpus Christi	8		12	6	4.3	3.9	3.4	3.0	2.5	2.1	4.3	4.2	4.2	4.1	4.1	4.3
Long Beach	11	6	14	11	3.0	2.7	2.4	2.1	1.8	1.5	3.0	3.0	3.0	3.0	3.0	3.0
Los Angeles	13	4		17	2.8	2.5	2.2	2.0	1.7	1.4	2.8	2.8	2.8	2.8	2.8	2.8
San Francisco		14			5.8	6.4	6.7	7.4	8.0	8.5	6.4	7.0	7.5	8.1	8.7	5.8
Seattle		8			1.5	1.3	1.2	1.0	0.9	0.7	1.7	1.9	2.1	2.3	2.5	1.5
Valdez					1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.4	1.6	1.8	2.0	1.0
Total					100.1	100.0	100.0	99.9	100.0	100.0	100.1	100.1	100.0	100.0	100.0	100.1

*Source: Reference B-28, Appendix G.

TABLE P-3

PORT AREA PROJECTIONS (mi^2)

	Baseline Area	All Scenarios 1980	Scenario R 1985	Scenario R 1990	Scenario R 1995	Scenario R 2000	Scenario R 2005	Scenario H All Years	Scenario E 1985	Scenario E 1990	Scenario E 1995	Scenario E 2000	Scenario E 2005
Portland, ME	7.5	7.5	7.5	7.5	7.9	8.3	8.7	7.5	7.9	8.3	8.7	9.1	9.6
Boston	47.0	47.0	47.0	47.0	49.4	51.8	54.4	47.0	49.4	51.8	54.4	57.1	60.0
New York	247.6	247.6	247.6	247.6	260.0	273.0	287.0	247.6	260.0	273.0	287.0	301.3	316.0
Philadelphia	26.0	26.0	26.0	26.0	27.3	28.7	30.0	26.0	27.3	28.7	30.0	31.5	33.0
Baltimore	2.5	2.5	2.5	2.5	2.6	2.7	2.9	2.5	2.6	2.7	2.9	3.0	3.2
Norfolk/ Hampton Roads	25.0	25.0	25.0	25.0	25.2	27.6	28.9	25.0	25.2	27.6	28.9	30.3	31.9
Tampa	230.0	230.0	230.0	230.0	241.0	254.0	266.0	230.0	241.0	254.0	266.0	279.3	293.0
Mobile	328.0	328.0	328.0	328.0	344.0	362.0	380.0	328.0	344.0	362.0	380.0	399.0	419.0
New Orleans	17.8	17.8	17.8	17.8	18.7	19.6	20.6	17.8	18.7	19.6	20.6	21.6	22.7
Baton Rouge	34.2	34.2	34.2	34.2	35.9	37.7	39.6	34.2	35.9	37.7	39.6	41.6	43.7
Port Arthur	12.0	12.0	12.0	12.0	12.6	13.2	13.9	12.0	12.6	13.2	13.9	14.6	15.3
Beaumont	26.0	26.0	26.0	26.0	27.3	28.7	30.0	26.0	27.3	28.7	30.0	31.5	33.0
Texas City	2.0	2.0	2.0	2.0	2.1	2.2	2.3	2.0	2.1	2.2	2.3	2.4	2.5
Houston	18.4	18.4	18.4	18.4	19.3	20.3	21.3	18.4	19.3	20.3	21.3	22.4	23.5
Corpus Christi	5.5	5.5	5.5	5.5	5.8	6.1	6.4	5.5	5.8	6.1	6.4	6.7	7.0
Long Beach	6.8	6.8	6.8	6.8	7.1	7.5	7.9	6.8	7.1	7.5	7.9	8.3	8.7
Los Angeles	2.8	2.8	2.8	2.8	2.9	3.1	3.2	2.8	2.9	3.1	3.2	3.4	3.5
San Francisco	450.0	450.0	450.0	450.0	472.0	496.0	520.0	450.0	472.0	496.0	520.0	546.0	573.0
Seattle	59.4	59.4	59.4	59.4	62.4	65.5	68.8	59.4	62.4	65.5	68.8	72.4	75.9
Valdez	87.5	87.5	87.5	87.5	91.9	96.5	101.3	87.5	91.9	96.5	101.3	106.4	111.7

FOOTNOTES FOR APPENDIX P

1. Reference B-28, Appendix G, Table 1.
2. Reference B-4, pp. 11, 12 and B-5, pp. 12, 13.
3. Reference D-9.

APPENDIX Q
PROJECTIONS FOR PARAMETER 190

Growth of US Vessel Traffic Management Systems

The purpose of this parameter is to illustrate the growth of US traffic management systems under conditions prevailing in the three scenarios. To do this a 20-port sample (the same sample used in the analysis of traffic density in Appendix P) has been selected to represent all US ports. The sample includes all ports in which VTSs have been implemented or proposed.

Table 4-17 displays historical and projected VTS coverage as a percent of the total area comprising the 20 ports. Supporting calculations are given in Table Q-1, where 1980 and 2005 estimates are shown. These estimates reflect slow growth until 1990 (to 42%), then more rapid growth in Scenario R. No growth is projected under Scenario H conditions. Scenario E produces steady growth over the period. Although the addition of successive VTS systems would show growth in discrete steps, a continuous linear growth has been employed in all cases as representative of the growth trends implied by the scenarios.

Although not included in the quantification of this parameter, international Traffic Separation Schemes (TSSs), and national (including US) and bilateral VTS development provide useful background information. As may be seen in Table Q-2, TSS coverage has grown steadily since 1965 while VTS coverage (Table Q-3) has exploded since 1974.

TABLE Q-1

VTS PROJECTIONS

Port	VTS Date	Port (mi^2)	Area (%)	All Scenarios 1980 (%)	Scenario R 2005 (%)	Scenario H 2005 (%)	Scenario 2005 (%)
Portland, ME		7.5	0.5				
Boston		47.0	2.9				
New York		247.6	15.1		15.1		15.1
Philadelphia		26.0	1.6				
Baltimore		2.5	0.2		0.2		0.2
Norfolk/ Hampton Rd.		25.0	1.5		1.5		1.5
Tampa		230.0	14.1				
Mobile		328.0	20.1				20.1
New Orleans	77	17.8	1.1	1.1	1.1	1.1	1.1
Baton Rouge		34.2	2.1				
Port Arthur		12.0	0.7				
Beaumont		26.0	1.6				
Texas City		2.0	0.1				
Houston	75	18.4	1.1	1.1	1.1	1.1	1.1
Corpus Christi		5.5	0.3				
Long Beach		6.8	0.4				
Los Angeles		2.8	0.2				
San Francisco	8/72	450.0	27.5	27.5	27.5	27.5	27.5
Seattle	9/72	59.4	3.6	3.6	3.6	3.6	3.6
Valdez	7/77	87.5	5.4	5.4	5.4	5.4	5.4
Total		1636.0	100.1	38.7	55.5	38.7	75.6

TABLE Q-2

WORLD TRAFFIC SEPARATION AND SHIPS' ROUTING SCHEMES

(Square miles (000))

HISTORICAL DATA

1965	1.5	1972	8.7
1968	6.5	1973	10.9
1969	7.3	1975	13.0
1970	7.4	1977	13.6
1971	8.1	1978	14.2

PROJECTED DATA

Y = 2.76 + 0.936*(YEAR - 1965)
BACKCAST: 1965 - 1978 R SQUARED: 0.95

50% CONFIDENCE LIMITS (N = 10)

	LOW	MID	HIGH
1960	0.0	0.0	0.0
1965	2.2	2.8	3.3
1970	6.9	7.4	8.0
1975	11.5	12.1	12.7
1980	16.2	16.8	17.4
1985	20.9	21.5	22.1
1990	25.5	26.2	26.8
1995	30.2	30.8	31.5
2000	34.9	35.5	36.2
2005	39.6	40.2	40.8

Includes the area comprising both traffic separation schemes and deep water routes. Nautical miles are used.

SOURCE

United Nations. Inter-Governmental Maritime Consultative Organization. Ships' Routeing. (4th Ed.), 1978.

TABLE Q-3

NATIONAL AND BILATERAL VESSEL TRAFFIC MANAGEMENT SYSTEMS OF THE WORLD

(Square miles (000))

HISTORICAL DATA

1948	0.1	1964	2.4
1949	0.1	1966	2.4
1950	0.1	1967	3.1
1952	0.2	1969	3.2
1953	1.2	1972	8.9
1957	1.2	1973	10.8
1958	1.2	1974	18.0
1959	1.3	1975	40.9
1960	1.6	1976	246.1
1962	1.7	1977	1652.8
1963	2.3		

Includes major ship canals and systems wherein some measure of guidance or control over vessel movement is exercised from shore. Coastal, harbor, estuarine, river, and lake areas traversed by seagoing vessels are included. Nautical miles are used.

SOURCE 1

Fujii, Yahei, and Yamanouchi, Hiroyuki, A Semiquantitative Analysis On Marine Traffic Management Systems (Electronic Navigation Research Institute Paper No. 20), Tokyo: Ministry of Transport (Japan), August 1978.

SOURCE 2

Reader's Digest Association, Inc. Reader's Digest 1977 Almanac and Yearbook. Pleasantville, N.Y.: Reader's Digest Association, Inc., 1977.

APPENDIX R

CLIENTELE LISTS

APPENDIX 18

Clientele identified have been arranged in groups as defined in Appendix S. The following is a key to the headings on the clientele lists.

RCD	Unique Record Number
No.	Client Identification Number
Program	See next page

APPENDIX 18

Coast Guard Programs

Short Range Aids to Navigation (CG-AN)

Bridge Administration (CG-BA)

Commercial Vessel Safety (CG-CVS)

Enforcement of Laws and Treaties (CG-ELT)

Ice Operations (CG-IO)

Marine Environmental Protection (CG-MEP)

Military Operations (CG-MO)

Military Preparedness (CG-MP)

Marine Science Activities (CG-MSA)

Port Safety and Security (CG-PSS)

Radionavigation Aids (CG-RA)

Boating Safety (CG-RBS)

Search and Rescue (CG-SAR)

Communication Services (CG-GAC)

Personnel (CG-GAP)

Hazard Control Safety (CG-GAS)

Research and Development (CG-R&D)

MARAD R&D Programs

Competitive Shipbuilding (M-SBLDG)

Competitive Shipping (M-SHIPG)

Ship Control (Automation) (M-SHCON)

Marine Science (M-MSCI)

Navigation & Communication (M-NAV&C)

Ports & Intermodal (M-PORTS)

Ships Machinery (M-MACHY)

Nuclear Propulsion (M-NPROP)

Energy & Environmental (M-EN&EV)

Advanced Ship Systems (M-ADSYS)

Market Analysis (M-MARKA)

CAORF (M-CAORF)

Cargo Handling (M-CHAND)

CLIENT GROUP: RECREATIONAL BOATING

RCD	CLIENT	NO.	PROGRAM
14	U.S. Coast Guard Auxiliary	14	CG-AN
270	U.S. Coast Guard Auxiliary	14	CG-RBS
313	U.S. Coast Guard Auxiliary	14	CG-SAR
15	U.S. Power Squadron	15	CG-AN
259	U.S. Power Squadron	15	CG-RA
273	U.S. Power Squadron	15	CG-RBS
16	Cruising Club of America	16	CG-AN
17	Storm and Trysail Club	17	CG-AN
24	Fishermen, Recreational	24	CG-AN
540	Fishermen, Recreational	24	CG-ELT
115	Fishermen, Recreational	24	CG-IO
228	Fishermen, Recreational	24	CG-PSS
316	Fishermen, Recreational	24	CG-SAR
25	Recreational boaters (marinas, yacht clubs, individuals)	25	CG-AN
35	Marinas	25	CG-BA
77	Recreational Boaters	25	CG-CVS
330	Recreational Boaters	25	CG-GAC
222	Recreational Boaters	25	CG-PSS
305	Various recreational boaters (yacht clubs, associations, individuals)	25	CG-RBS
314	Recreational Boaters	25	CG-SAR
51	Boy Scouts	49	CG-CVS
276	Boy Scouts of America	49	CG-RBS
278	Girl Scouts of America	49	CG-RBS
309	National Scouting Organization	49	CG-RBS
310	Naval Sea Cadet Corps	49	CG-RBS
52	Sea Scouts	50	CG-CVS
73	Manufacturers and Venders of Marine Equipment	65	CG-CVS
293	Various Marine Manufacturers, Dealers and Distributors	65	CG-RBS
79	Standardization and Technical Societies	70	CG-CVS
267	American National Standards Institute	70	CG-RBS
292	Canadian Standards Association Testing Laboratories	70	CG-RBS
295	Society of Automotive Engineers	70	CG-RBS
297	National Association of State Boating Law Administrators	91	CG-RBS
135	American Boat and Yacht Council	107	CG-MEP
282	American Boat and Yacht Council	107	CG-RBS
271	American Water Ski Association	171	CG-RBS
272	National Boating Federation	172	CG-RBS
274	American Alliance for Health, Physical Ed. & Recreation	173	CG-RBS
275	Department of Defense Special Services	174	CG-RBS
334	National Safety Council	176	CG-GAS
280	National Safety Council	176	CG-RBS
296	National Safety Council	176	CG-RBS
281	YMCA	177	CG-RBS
283	National Association of Marine Surveyors	179	CG-RBS
284	American Power Boat Association	180	CG-RBS
285	American Boat Builders and Repair Association	181	CG-RBS
291	Allied Boating Association of Canada	183	CG-RBS

RCD	CLIENT	NO.	PROGRAM
293	Boating Safety Advisory Council	188	CG-RBS
299	National Association of Engine and Boat Manufacturers	189	CG-RBS
300	Boat Owners Association of the United States	190	CG-RBS
301	National Marine Distributors Association	191	CG-RBS
302	Boating Industry Association	192	CG-RBS
303	National Safe Boating Committee, Inc.	193	CG-RBS
304	North American Yacht Racing Union	194	CG-RBS
308	National Water Safety Congress	195	CG-RBS

CLIENT GROUP: PORT DEVELOPMENT AND OPERATIONS

RCD	CLIENT	NO.	PROGRAM
20	Pilot Associations	20	CG-AN
57	American Pilots Association	20	CG-CVS
200	National Pilot Association	20	CG-PSS
205	American Pilots Association, Incorporation	20	CG-PSS
518	American Pilots Association	20	M-PORTS
517	American Pilots Association	20	M-SHCON
21	State/Local Ports Authorities	21	CG-AN
65	State Port Authorities	21	CG-CVS
331	State Port Authorities	21	CG-GAC
107	Various Chambers of Commerce	90	CG-IO
307	State and Local Governments	91	CG-RBS
323	State/local Governments	91	CG-SAR
205	American Association of Port Authorities	137	CG-PSS
437	American Association of Port Authorities	137	M-CHAND
436	American Association of Port Authorities	137	M-PORTS
435	American Association of Port Authorities	137	M-SHIPG
218	Terminal Operators (Port Authorities, Private Owner, Stevedoring Companies)	145	CG-PSS
327	Harbor and River Tugboats	202	CG-GAC
364	Economic Development Administration	206	M-PORTS
445	Boston Shipping Authority	221	M-CHAND
444	Boston Shipping Authority	221	M-EN&EV
443	Boston Shipping Authority	221	M-PORTS
442	Boston Shipping Authority	221	M-SHIPG
453	Marine Exchange of San Francisco Bay	227	M-PORTS
452	Marine Exchange of San Francisco Bay	227	M-SHIPG
465	Marine Towing and Transportation Employers Association	228	M-PORTS
464	Marine Towing and Transportation Employers Association	228	M-SHIPG
469	Maritime Association of the Port of New York	229	M-CHAND
468	Maritime Association of the Port of New York	229	M-EN&EV
467	Maritime Association of the Port of New York	229	M-PORTS
466	Maritime Association of the Port of New York	229	M-SHIPG
483	New York Shipping Association, Inc.	233	M-CHAND
482	New York Shipping Association, Inc.	233	M-EN&EV
481	New York Shipping Association, Inc.	233	M-PORTS
480	New York Shipping Association, Inc.	233	M-Shipg
485	New York Towboat and Harbor Carriers Association	234	M-PORTS
484	New York Towboat and Harbor Carriers Association	234	M-SHIPG
262	American Pilots Association	20	CG-RA

RCD	CLIENT	NO.	PROGRAM
48	Occupational Safety and Health Administration	46	CG-CVS

CLIENT GROUP: MARITIME PERSONNEL

53	International Labor Organization	51	CG-CVS
54	National Maritime Union	52	CG-CVS
55	Seafarers International Union	53	CG-CVS
420	American Independent Tanker Unions	53	M-PORTS
419	American Independent Tanker Unions	53	M-SBLDG
56	Masters,Mates and Pilots Association	54	CG-CVS
102	Masters,Mates and Pilots Association	54	CG-IO
201	Masters,Mates and Pilots Association	54	CG-PSS
220	Pilot Associations and Masters	54	CG-PSS
58	Lake Carriers Pilotage Association	55	CG-CVS
67	Merchant Seamen	60	CG-CVS
69	Maritime Labor Organizations	62	CG-CVS
72	Classification and Certification	64	CG-CVS
76	Maritime Training Institutions	68	CG-CVS
207	International Longshoremens Association	138	CG-PSS
416	American Longshore Unions	138	M-CHAND
415	American Longshore Unions	138	M-PORTS
208	International Longshoremen and Warehouse Union	139	CG-PSS
209	Marine Engineers Beneficial Association	140	CG-PSS
211	Seamens Union of the Pacific	142	CG-PSS
232	U.S. Merchant Marine Academy	150	CG-RA
332	Military and Civilian Coast Guard Personnel as Individuals	204	CG-GAP
340	Department of Labor	205	CG-GAS
412	American Seafaring Unions	212	M-ADSYS
413	American Seafaring Unions	212	M-CAORF
414	American Seafaring Unions	212	M-CHAND
411	American Seafaring Unions	212	M-SHCON
410	American Seafaring Unions	212	M-SHIPG
418	American Shipyard Unions	214	M-MACHY
417	American Shipyard Unions	214	M-SBLDG
421	American Independent Tanker Unions	215	M-MACHY
428	Labor Organizations	216	M-CHAND
426	Labor Organizations	216	M-MACHY
427	Labor Organizations	216	M-NPROP
425	Labor Organizations	216	M-PORTS
422	Labor Organizations	216	M-SBLDG
424	Labor Organizations	216	M-SHCON
423	Labor Organizations	216	M-SHIPG
430	Council of American Master Mariners, Inc.	218	M-NAV&C
431	Council of American Master Mariners, Inc.	218	M-PORTS
429	Council of American Master Mariners, Inc.	218	M-SHIPG
434	United Seamen's Service, Inc.	219	M-CHAND
433	United Seamen's Service, Inc.	219	M-PORTS
432	United Seamen's Service, Inc.	219	M-SHIPG
458	Labor-Management Maritime Committee	226	M-CHAND

RCD	CLIENT	NO.	PROGRAM
457	Labor-Management Maritime Committee	226	M-PORTS
454	Labor-Management Maritime Committee	226	M-SBLDG
456	Labor-Management Maritime Committee	226	M-SHCON
455	Labor-Management Maritime Committee	226	M-SHIPG
	CLIENT GROUP: WEATHER SERVICES AND NAVIGATION		
2	National Oceanic and Atmospheric Administration	2	CG-AN
89	National Oceanic and Atmospheric Administration	2	CG-AN
161	National Oceanic and Atmospheric Administration	2	CG-MSA
186	National Oceanic and Atmospheric Administration	2	CG-PSS
279	National Oceanic and Atmospheric Administration	2	CG-RBS
352	National Oceanic and Atmospheric Administration	2	M-EN&EV
351	National Oceanic and Atmospheric Administration	2	M-MSCI
350	National Oceanic and Atmospheric Administration	2	M-SBLDG
9	National Aeronautics and Space Administration	9	CG-AN
93	National Aeronautics and Space Administration	9	CG-IO
250	National Aeronautics and Space Administration	9	CG-RA
546	National Aeronautics and Space Administration	9	M-NAV&C
13	Institute of Navigation	13	CG-AN
261	Institute of Navigation	13	CG-RA
74	Chemical Industry	65	CG-CVS
113	Chemical Industry	66	CG-IO
225	Chemical Industry	66	CG-PSS
75	Passengers on Waterborne Vessels	67	CG-CVS
116	Transportation (Commuters)	67	CG-IO
78	Commercial Diving Industry (Underwater Vessel Owners and Operators	69	CG-CVS
91	St. Lawrence Seaway Development Corporation	78	CG-IO
100	St. Lawrence Seaway Development Corporation	78	CG-IO
193	St. Lawrence Seaway Development Corporation	78	CG-PSS
246	St. Lawrence Seaway Development Corporation	78	CG-RA
98	Upper Great Lakes Regional Commission	84	CG-IO
101	Great Lakes Basin Commission	86	CG-IO
103	St. Lawrence Seaway Authority (Canada)	87	CG-IO
109	Coal Industry	92	CG-IO
110	Steel Industry	93	CG-IO
111	Stone and Cement Industry	94	CG-IO
112	Petroleum Industry	95	CG-IO
137	Petroleum Industry	95	CG-MEP
224	Petroleum Industry	95	CG-PSS
171	Interagency Committee for Meteorological Services	120	CG-MSA
172	Interagency Committee for World Weather Program	121	CG-MSA
269	Wild Goose Association	170	CG-RA
525	National Oceanic and Atmospheric Administration	242	CG-ELT
	CLIENT GROUP: ENVIRONMENTAL PROTECTION, CONSERVATION AND USAGE		
1	U.S. Forest Service	1	CG-AN
7	U.S. Bureau of Mines	7	CG-AN

RCD	CLIENT	NO.	PROGRAM
9	U.S. Fish and Wildlife Service	9	CG-AN
68	Offshore Petroleum and Mineral Industry	61	CG-CVS
89	U.S. Geological Survey	76	CG-IO
165	U.S. Geological Survey	76	CG-MSA
90	Bureau of Land Management	77	CG-IO
121	Environmental Protection Agency	96	CG-MEP
195	Environmental Protection Agency	95	CG-PSS
255	Environmental Protection Agency	96	CG-RA
337	Environmental Protection Agency	96	M-EN&EV
395	Environmental Protection Agency	96	M-PORTS
122	Department of State	97	CG-MEP
242	Department of State	97	CG-RA
123	Department of Justice	98	CG-MEP
125	American Petroleum Institute	100	CG-MEP
128	Sierra Club	101	CG-MEP
129	Friends of the Earth	102	CG-MEP
130	Environmental Protection Fund	103	CG-MEP
131	National Wildlife Federation	104	CG-MEP
132	Common Cause	105	CG-MEP
136	Schuchmann Foundation Center for the Public Interest	108	CG-MEP
140	Conservationists	110	CG-MEP
170	Interagency Committee for Marine Environmental Protection	119	CG-MSA
241	Department of Justice	154	CG-RA
533	Inter-American Tuna Commission	246	CG-ELT
534	Internation Commission for the Conservation of Atlantic Tuna	247	CG-ELT
535	International North Pacific Fisheries Commission	248	CG-ELT
535	International Whaling Commission	249	CG-ELT
537	North Pacific Fur Seal Commission	250	CG-ELT
541	International Pacific Halibut Commission	251	CG-ELT
542	Sockeye Salmon Commission	252	CG-ELT

CLIENT GROUP: INSURANCE INDUSTRY

22	Insurance Industry	22	CG-AN
71	Insurance Industry	22	CG-CVS
600	Insurance and Hull Underwriters	22	CG-CVS
134	American Institute of Marine Underwriters	22	CG-MEP
141	Insurance Industry	22	CG-MEP
226	Insurance Industry	22	CG-PSS
286	American Institute of Marine Underwriters	22	CG-RBS
305	The Insurance Industry	22	CG-RBS
63	Lloyds of London	58	CG-CVS
81	Brokers and Mortgagees (Lending and Holding Innstitutions	72	CG-CVS
82	Admiralty Attorneys	73	CG-CVS

CLIENT GROUP: SHIPBUILDING AND SHIP PROPULSION

50	Underwriter's Laboratory	48	CG-CVS
289	Society of Naval Architects and Marine Engineers	48	CG-RBS

RCD	CLIENT	NO.	PROGRAM
299	Underwriter's Laboratory	48	CG-RBS
523	Society of Naval Architects and Marine Engineers	48	M-ADSYS
524	Society of Naval Architects and Marine Engineers	48	M-CHAND
521	Society of Naval Architects and Marine Engineers	48	M-MACHY
522	Society of Naval Architects and Marine Engineers	48	M-NPROP
519	Society of Naval Architects and Marine Engineers	48	M-SBLDG
520	Society of Naval Architects and Marine Engineers	48	M-SHCON
59	American Bureau of Shipping	56	CG-CVS
401	American Bureau of Shipping	56	M-MARKA
400	American Bureau of Shipping	56	M-SHIPG
70	Ship and Boat Yards	63	CG-CVS
149	Shipbuilders	63	CG-MO
159	Shipbuilders	63	CG-MP
80	Naval Architects and Marine Engineers	71	CG-CVS
231	National Bureau of Standards	149	CG-RA
375	National Bureau of Standards	149	M-CHAND
373	National Bureau of Standards	149	M-MACHY
374	National Bureau of Standards	149	M-NPROP
372	National Bureau of Standards	149	M-SBLDG
369	American Society of Testing Materials	207	M-CHAND
366	American Society of Testing Materials	207	M-MACHY
367	American Society of Testing Materials	207	M-NPROP
365	American Society of Testing Materials	207	M-SBLDG
370	American Institute of Industrial Engineers	208	M-MACHY
371	American Institute of Industrial Engineers	208	M-NPROP
369	American Institute of Industrial Engineers	208	M-SBLDG
398	American Society of Naval Engineers	211	M-ADSYS
399	American Society of Naval Engineers	211	M-CHAND
395	American Society of Naval Engineers	211	M-MACHY
397	American Society of Naval Engineers	211	M-NPROP
394	American Society of Naval Engineers	211	M-SBLDG
395	American Society of Naval Engineers	211	M-SHCON
501	Shipbuilders Council of America	238	M-ADSYS
502	Shipbuilders Council of America	238	M-CHAND
499	Shipbuilders Council of America	238	M-MACHY
500	Shipbuilders Council of America	238	M-NPROP
499	Shipbuilders Council of America	238	M-SBLDG

CLIENT GROUP: SCIENCE

19	Commercial Offshore Exploration Firms	19	CG-AN
26	State University Marine Research Organizations	26	CG-AN
27	State Marine Organizations	27	CG-AN
94	National Science Foundation	90	CG-IO
167	National Science Foundation	80	CG-MSA
95	Smithsonian Institution	81	CG-IO
95	Arctic Institute of North America	82	CG-IO
178	Arctic Institute of North America	82	CG-MSA

RCD	CLIENT	NO.	PROGRAM
97	Academic and Scientific Communities	83	CG-IO
148	Academic Community	83	CG-MO
158	Academic Community	83	CG-MP
179	Academic and Scientific Communities	83	CG-MSA
168	National Advisoryu Committee on Oceans and Atmospheré	117	CG-MSA
169	Interagency Committee for Marine Science and Engineering	118	CG-MSA
173	National Acedemy of Sciences	122	CG-MSA
265	National Academy of Sciences	122	CG-RA
174	National Acedemy of Engineering	124	CG-MSA
175	Marine Technology Society	125	CG-MSA
176	American Oceanographic Association	125	CG-MSA
177	Sea Use Foundation	126	CG-MSA
181	Federal Committee for Meteorological Services and Supporting Research (FCMSSR)	128	CG-MSA
182	Interagency Ocean Disposal Program Coordinating Committee (IODPCC)	129	CG-MSA
183	Ocean Affairs Board	130	CG-MSA
260	American Museum of Natural History	164	CG-RA
264	Institute of Electrical and Electronic Engineers	166	CG-RA
268	Interagency Committee on Oceanography	169	CG-RA

CLIENT GROUP: COMMERCIAL SHIPPING

10	American Institute of Merchant Shipping	10	CG-AN
60	American Institute of Merchant Shipping	10	CG-CVS
126	American Institute of Merchant Shipping	10	CG-MEP
204	American Institute of Merchant Shipping	10	CG-PSS
257	American Institute of Merchant Shipping	10	CG-RA
403	American Institute of Merchant Shipping	10	M-MARKA
402	American Institute of Merchant Shipping	10	M-SHIPG
11	American Transport Association	11	CG-AN
12	Lake Carriers Association	12	CG-AN
104	Lake Carriers Association	12	CG-IO
202	(Great) Lake Carriers Association	12	CG-PSS
461	Lake Carriers Association	12	M-CHAND
460	Lake Carriers Association	12	M-PORTS
459	Lake Carriers Association	12	M-SHIPG
18	Commercial Vessel Operators, U.S. and foreign	18	CG-AN
64	Maritime Commerce (Owners, Operators, Carriers, Agents)	18	CG-MEP
138	Merchant Shipping Industry	18	CG-MEP
216	Commercial Cargo Vessel & Dry Barge Industry	18	CG-PSS
221	Mariners (Commercial Operators)	18	CG-PSS
317	Maritime Industry	18	CG-SAR
409	U. S. Flag shipowners, operators and/or agents	18	M-CAORF
408	U. S. Flag shipowners, operators and/or agents	18	M-MARKA
405	U. S. Flag shipowners, operators and/or agents	18	M-NAV&C
407	U. S. Flag shipowners, operators and/or agents	18	M-PORTS
405	U. S. Flag shipowners, operators and/or agents	18	M-SHCON
404	U. S. Flag shipowners, operators and/or agents	18	M-SHIPG

RCD	CLIENT	NO.	PROGRAM
446	Council of American Flag Ship Operators	18	M-SHIPG
447	Council of North Atlantic Shipping Association	18	M-SHIPG
516	American Pilots Association	20	M-SHIPG
23	Fishermen, commercial	23	CG-AN
539	Fishermen, Commercial	23	CG-ELT
326	Fishing Vessels (U.S. and Foreign)	23	CG-GAC
114	Fishermen, (Commercial)	23	CG-IO
227	Fishermen, Commercial	23	CG-PSS
315	Fishermen, Commercial	23	CG-SAR
43	American Waterway Operators	42	CG-BA
61	American Waterway Operators, Incorporated	42	CG-CVS
601	American Waterway Operators, Incorporation	42	CG-CVS
127	American Waterway Operators, Incorporated	42	CG-MEP
614	American Waterway Operators, Incorporated	42	CG-MEP
212	American Waterway Operators, Incorporated	42	CG-PSS
441	American Waterways Operators, Inc.	42	M-CHAND
439	American Waterways Operators, Inc.	42	M-NAV&C
440	American Waterways Operators, Inc.	42	M-PORTS
438	American Waterways Operators, Inc.	42	M-SHIPG
46	Maritime Administration	45	CG-CVS
117	Maritime Administration	45	CG-MEP
185	Maritime Administration	45	CG-PSS
230	Maritime Administration	45	CG-RA
105	Dominion Marine Association (Canada)	88	CG-IO
124	Federal Maritime Commission	99	CG-MEP
198	Federal Maritime Commission	99	CG-PSS
363	Federal Maritime Commission	99	M-SHIPG
139	Barge Industry	109	CG-MEP
217	Tank Vessel and Tank Barge Industry	144	CG-PSS
223	Public Vessels	147	CG-PSS
229	House Merchant Marine and Fisheries Committee	148	CG-RA
263	American Merchant Marine Institute	165	CG-RA
324	Merchant Vessels (U.S.)	201	CG-GAC
328	U.S. Government Agencies (presently 18 agencies)	203	CG-GAC
393	National Maritime Council	210	M-CHAND
392	National Maritime Council	210	M-MARKA
391	National Maritime Council	210	M-PORTS
388	National Maritime Council	210	M-SBLDG
390	National Maritime Council	210	M-SHCON
389	National Maritime Council	210	M-SHIPG
450	Federation of American Controlled Shipping	224	M-CHAND
449	Federation of American Controlled Shipping	224	M-PORTS
448	Federation of American Controlled Shipping	224	M-SHIPG
475	Mobile Steamship Association	231	M-CHAND
474	Mobile Steamship Association	231	M-EN&EV
473	Mobile Steamship Association	231	M-PORTS
472	Mobile Steamship Association	231	M-SHIPG

RCD	CLIENT	NO.	PROGRAM
479	New Orleans Steamship Association	232	M-CHAND
478	New Orleans Steamship Association	232	M-EN&EV
477	New Orleans Steamship Association	232	M-PORTS
476	New Orleans Steamship Association	232	M-SHIPG
489	Pacific Maritime Association	235	M-CHAND
488	Pacific Maritime Association	235	M-EN&EV
487	Pacific Maritime Association	235	M-PORTS
486	Pacific Maritime Association	235	M-SHIPG
493	Pacific Merchant Shippers Association	237	M-CHAND
497	Philadelphia Marine Trade Association	237	M-CHAND
492	Pacific Merchant Shippers Association	237	M-EN&EV
496	Philadelphia Marine Trade Association	237	M-EN&EV
491	Pacific Merchant Shippers Association	237	M-PORTS
495	Philadelphia Marine Trade Association	237	M-PORTS
490	Pacific Merchant Shippers Association	237	M-SHIPG
494	Philadelphia Marine Trade Association	237	M-SHIPG
506	Steamship Trade Association of Baltimore, Inc.	239	M-CHAND
505	Steamship Trade Association of Baltimore, Inc.	239	M-EN&EV
504	Steamship Trade Association of Baltimore, Inc.	239	M-PORTS
503	Steamship Trade Association of Baltimore, Inc.	239	M-SHIPG
508	Tanker Service Committee, Inc.	240	M-PORTS
507	Tanker Service Committee, Inc.	240	M-SHIPG
514	Transportation Institute	241	M-ADSYS
515	Transportation Institute	241	M-CAORF
513	Transportation Institute	241	M-EN&EV
511	Transportation Institute	241	M-MSCI
512	Transportation Institute	241	M-NAV&C
510	Transportation Institute	241	M-SHCON
509	Transportation Institute	241	M-SHIPG
	CLIENT GROUP: MILITARY AND EMERGENCY SERVICES		
3	U.S. Air Force	3	CG-AN
338	U.S. Air Force	3	CG-GAS
85	U.S. Air Force	3	CG-IO
163	U.S. Air Force	3	CG-MSA
235	U.S. Air Force	3	CG-RA
312	U.S. Air Force	3	CG-SAR
4	U.S. Army	4	CG-AN
84	U.S. Army	4	CG-IO
119	U.S. Army	4	CG-MEP
142	U.S. Army	4	CG-MO
151	U.S. Army	4	CG-MP
188	U.S. Army	4	CG-PSS
235	U.S. Army	4	CG-RA
5	U.S. Navy	5	CG-AN
337	U.S. Navy	5	CG-GAS
85	U.S. Navy	5	CG-IO
118	U.S. Navy	5	CG-MEP

RCD	CLIENT	NO.	PROGRAM
152	U.S. Navy	5	CG-MP
162	U.S. Navy	5	CG-MSA
187	U.S. Navy	5	CG-PSS
237	U.S. Navy	5	CG-RA
311	U.S. Navy	5	CG-SAR
357	U.S. Navy	5	M-ADSYS
358	U.S. Navy	5	M-CHAND
356	U.S. Navy	5	M-EN&EV
355	U.S. Navy	5	M-MSCI
353	U.S. Navy	5	M-SBLDG
354	U.S. Navy	5	M-SHIPG
6	Military Sealift Command	6	CG-AN
238	Military Sealift Command	6	CG-RA
545	Military Sealift Command	6	M-CHAND
544	Military Sealift Command	6	M-SHCON
543	Military Sealift Command	6	M-SHIPG
92	U. S. Coast Guard	79	CG-IO
348	U. S. Coast Guard	79	M-ADSYS
349	U. S. Coast Guard	79	M-CHAND
344	U. S. Coast Guard	79	M-MSCI
345	U. S. Coast Guard	79	M-NAV&C
347	U.S. Coast Guard	79	M-NPROP
346	U. S. Coast Guard	79	M-PORTS
341	U. S. Coast Guard	79	M-SBLDG
343	U. S. Coast Guard	79	M-SHCON
342	U. S. Coast Guard	79	M-SHIPG
143	Department of Housing and Urban Development	111	CG-MO
153	Department of Housing and Urban Development	111	CG-MP
144	Department of Transportation	112	CG-MO
154	Department of Transportation	112	CG-MP
145	General Services Administration	113	CG-MO
155	General Services Administration	113	CG-MP
146	Red Cross	114	CG-MO
155	Red Cross	114	CG-MP
150	Electronics and ordnance equipment manufacturers	115	CG-MO
160	Electronics and Ordnance Equipment Manufacturers	115	CG-MP
234	Joint Chiefs of Staff	152	CG-RA
339	U.S. Marine Corps	153	CG-GAS
239	U.S. Marine Corps	153	CG-RA
335	American Red Cross	178	CG-GAS
329	Commercial Aircraft	198	CG-GAC
318	Commercial Aviation	198	CG-SAR
322	Foreign Aircraft	198	CG-SAR
319	General Aviation	199	CG-SAR
320	Civil Air Patrol	200	CG-SAR

CLIENT GROUP: SAFETY AND PORT SECURITY

526	Drug Enforcement Administration	2	CG-ELT

RCD	CLIENT	NO.	PROGRAM
157	State/Local Governments (Civil Emergency Agencies, Law Enforcement Agencies)	19	CG-MP
28	State Highway Departments	28	CG-BA
29	City and County Governments	29	CG-BA
30	Public Bridge Authorities and Commissions	30	CG-BA
31	Railroad Companies	31	CG-BA
32	Commercial Water Transportation Firms	32	CG-BA
33	Shippers	33	CG-BA
34	Federal, State and Local Agencies	34	CG-BA
35	Private citizens	35	CG-BA
37	Association of State Highway Officials	36	CG-BA
38	American Association of Railroads (AAR)	37	CG-BA
39	National and Local Association of Port Authorities	38	CG-BA
40	Industrial Development Commissions	39	CG-BA
41	National Water Resources Congresss	40	CG-BA
42	Towing Industry Advisory Committee	41	CG-BA
44	Tennessee Valley Association	43	CG-BA
45	The Waterways Journal	44	CG-BA
333	Occupational Safety and Health Administration	46	CG-GAS
55	Foreign Comnmercial Vessels	59	CG-CVS
325	Merchant Vessels (foreign)	59	CG-GAC
321	Foreign Merchant Vessels	59	CG-SAR
99	U. S. Army Corps of Engineers	85	CG-IO
120	U. S. Army Corps of Engineers	85	CG-MEP
189	Corps of Engineers	85	CG-PSS
277	Corps of Engineers	85	CG-RBS
538	State and Local Law Enforcement Agencies	91	CG-ELT
108	State/Local governments	91	CG-IO
147	State/Local Governments (Civil emergency, law enforcement agencies)	91	CG-MO
214	State/Local Governments (Legislatures, Regulatory Agencies, Boating Admins.	91	CG-PSS
529	Dept. of State (Deputy Assistant Secretary for Oceans and Fisheries Affairs)	97	CG-ELT
190	U. S. Public Health Service	132	CG-PSS
191	Federal Bureau of Investigation	133	CG-PSS
528	Immigration and Naturalization Service	134	CG-ELT
192	Immigration and Naturalization Service	134	CG-PSS
194	Materials Transportation Bureau	134	CG-PSS
531	U.S. Customs Service	135	CG-ELT
195	Bureau of Customs	135	CG-PSS
210	National Transportation Safety Board	141	CG-PSS
215	Local Governments (Port Authorities, Law Enforcement Agencies, Fire Departments)	143	CG-PSS
219	Oil Transfer Facility Industry	145	CG-PSS
613	Oil Transfer Facility Industry	146	CG-PSS
251	Department of Energy	159	CG-RA
362	Department of Energy	159	M-EN&EV
351	Department of Energy	159	M-NPROP
350	Department of Energy	159	M-PORTS
359	Department of Energy	159	M-SBLDG
253	Nuclear Regulatory Commission	160	CG-RA
377	Nuclear Regulatory Commission	160	M-NPROP

RCD	CLIENT	NO.	PROGRAM
376	Nuclear Regulatory Commission	160	M-PORTS
527	U.S. Attorney's Office	243	CG-ELT
530	Internal Revenue Service	244	CG-ELT
532	Bereau of Alcohol, Tobacco and Firearms	245	CG-ELT
	CLIENT GROUP: INTERNATIONAL BODIES		
62	Intergovernmental Maritime Consultative Organization	57	CG-CVS
213	Intergovernmental Maritime Consultative Organization	57	CG-PSS
392	Intergovernmental Maritime Consultative Organization	57	M-EN&EV
380	Intergovernmental Maritime Consultative Organization	57	M-NAV&C
391	Intergovernmental Maritime Consultative Organization	57	M-NPROP
378	Intergovernmental Maritime Consultative Organization	57	M-SBLDG
379	Intergovernmental Maritime Consultative Organization	57	M-SHIPG
83	International Safety and Security Organizations	74	CG-CVS
106	International Association of Great Lakes Ports	89	CG-IO
133	International Association of Passenger Liners	106	CG-MEP
180	Committee on International Ocean Affairs (CIOA)	127	CG-MSA
184	Panel on Intl. Programs and Intl. Cooperation in Ocean Affairs (PIPICO)	131	CG-MSA
290	International Council of Marine Industry Association	182	CG-RBS
294	International Standards Organization	185	CG-RBS
385	North Atlantic Treaty Organization	209	M-CHAND
394	North Atlantic Treaty Organization	209	M-PORTS
393	North Atlantic Treaty Organization	209	M-SHIPG
453	United Nations Committee for Trade and Development (UNCTAD)	225	M-PORTS
451	United Nations Committee for Trade and Development (UNCTAD)	225	M-SBLDG
452	United Nations Committee for Trade and Development (UNCTAD)	225	M-SHIPG
471	International Maritime Satellite Preparatory Committee	230	M-NAV&C
470	International Maritime Satellite Preparatory Committee	230	M-SHIPG
	CLIENT GROUP: MARITIME COMMUNICATIONS		
197	Federal Communications Commission	47	CG-PSS
252	Federal Communications Commission	47	CG-RA
254	Office of Telecommunications Policy	47	CG-RA
265	American Radio Relay League	47	CG-RA
97	Defense Mapping Agency	75	CG-IO
164	Defense Mapping Agency	75	CG-MSA
240	Defense Mapping Agency	75	CG-RA
165	Federal Aviation Administration	116	CG-MSA
244	Federal Aviation Administration	116	CG-RA
199	Radio Technical Commission for Marine Services	136	CG-PSS
203	American Radio Association	137	CG-PSS
233	Bureau of Census	151	CG-RA
243	Department of Agriculture	155	CG-RA
335	National Highway Traffic Safety Administration	156	CG-GAS
245	Federal Highway Administration	156	CG-RA
247	National Highway Traffic Safety Administration	156	CG-RA
249	Federal Railroad Administration	157	CG-RA

RCD	CLIENT	NO.	PROGRAM
249	Urban Mass Transportation Administration	158	CG-RA
256	Interdepartmental Radio Advisory Committee	162	CG-RA
258	Radio Technical Commission for Marine Services	163	CG-RA
267	Electronic Industry Association	168	CG-RA
49	Federal Communications Commission	47	CG-CVS

APPENDIX S

CLIENTELE GROUP DESCRIPTIONS

Scores of private and governmental organizations and associations which represent the clientele of Coast Guard and Maritime Administration programs have been identified. The listing at Appendix R is extensive but not exhaustive. In order to organize clientele interests in a manageable fashion, 13 clientele groups have been created. These clientele groups are identified below together with brief descriptions of some of their principal member organizations.

Recreational Boating

USCG Auxiliary: The Auxiliary is a nonmilitary organization of private citizens who own small boats, aircraft, or radio stations. Auxiliary members assist the Coast Guard by conducting boating education programs, patrolling marine regattas, participating in search and rescue operations, and conducting courtesy motorboat examinations.

American Boat and Yacht Council: Naval architects, marine engineers, marine underwriters, marine surveyors, manufacturers of small craft and their components, USCG and USN technical personnel and the boating public. To develop an advisory code of safety standards and recommended practices for designing, constructing, equipping and maintaining small craft, both pleasure and commercial, to 65 feet in length. Conducts research through 70 technical projects to develop advisory code.

Boating Industry Associations: Manufacturers of motors, boats, boat trailers and marine accessories;

marine service organizations. To promote sale of pleasure boating equipment and the general welfare of the industry. Creates and implements national programs to help open new waterways, to develop engineering practices accepted by both the industry and government regulatory agencies. Provides research data; sponsors merchandising and management conferences; bestows awards; compiles statistics.

National Safe Boating Council: National organizations concerned with promoting recreational boating safety and in stimulating public education in boating safety habits and techniques. Major activity is observance of National Safe Boating Week. Council compiles and distributes a promotion and publicity kit to help local organizations and field units of its national membership to set up their programs, secure promotional materials and publicize the Week. Kit includes publicity suggestions for safe boating drives, posters, news releases, radio and TV spot announcements, an editorial and speech outline. Awards National Safe Boating Week Certificate of Appreciation annually. The Coast Guard acts as "Secretariat" to the Council.

Boat Owners Association of the United States: Owners or prospective owners of recreational boats. Independent, consumer-service organization offering various benefits and programs for boat owners. These include: influential representation affecting boatmen's interests including campaigns for constructive legislation; involvement in efforts to conserve natural resources; marine insurance; chart and map service; books; boating equipment; long-term financing plan; boating regulations and form service; correspondence courses on seamanship and safety; cruise planning aid; sale and chartering exchange; state and federal gasoline tax refund service; marine surveyor and admiralty lawyer reference service; assistance with individual boating problems; association flag. Maintains Consumer Protection Bureau, which utilizes comprehensive consumer experience files to pursue individual compaints or acknowedge satisfaction. Maintains library of 500 reference books and other volumes on boating subjects.

National Boating Federation: Yacht clubs, boat clubs, state and regional boating organizations and individual amateur recreational boatmen in 47 states and the District of Columbia. Purpose is to improve and strengthen amateur boating by: exchanging information among its members; promoting safety education and seamanship; encouraging development and protection of water and waterways for safer, more attractive boating; establishing understanding and cooperation between boatmen and state and federal authorities; rendering assistance to member organizations in the achievement of these objectives; providing a responsible and experienced voice for the boating public. Maintains speakers bureau. Cooperates with USCG Auxiliary and US Power Squadron in providing free classroom instruction in seamanship and small boat handling.

Port Development and Operations

American Association of Port Authorities: Port administration organizations of the U.S., Canada, and Latin America. Contributing and association members, private firms with interest in port development, water transport or accessorial services. Sets standards in such phases of port activity as modern terminal design, operations and cargo handling, fire prevention, maintenance and administration. Establishes pattern of the public board or authority from the legalistic standpoint as this pattern has evolved in the Western Hemisphere.

New York Shipping Association: Steamship lines, contracting stevedores, carpenters, cargo repair and maintenance firms, and port watching agencies in the port of New York. Seeks to negotiate and administer on the behalf of employer members, waterfront labor contracts with International Longshoremen's Association and Port Watchmen's Union. Handles maintenance of port employment and earnings records, administration of jointly managed union pension and welfare funds, promotion of safety in waterfront operations, and management of the guaranteed annual income for longshoremen. Sponsors port wide education programs.

Economic Development Administration (EDA): Primary function of EDA is the long-range economic development of areas with severe unemployment and low family income problems. Aids in development of public facilities and private enterprises to help create new, permanent jobs. Program includes public works grants and loans; economic adjustment assistance grants; business loans for industrial and commercial facilities and working capital; guarantees of leases for private industry and of private loans for industrial and commercial facilities and working capital; and technical, planning, and research assistance for areas designated as Redevelopment Areas by Assistant Secretary, redevelopment areas eligible for bonus grants for public works projects. EDA technical assistance available to help alleviate or prevent excessive unemployment, underemployment, or outmigration in any area confronted by any of these problems.

Saint Lawrence Seaway Development Corporation (Department of Transportation): Responsible for development, operation, and maintenance of that part of Seaway between Montreal and Lake Erie within territorial limits of U.S. Functions are to provide a safe, efficient, and effective water artery, both in peacetime and in time of national emergency. Charges tolls in accordance with established rates for users which it negotiates with St. Lawrence Seaway Authority of Canada. Coordinates activities with St. Lawrence Seaway Authority of Canada particularly with respect to overall operations, traffic control, safety, season extension, and related programs designed to fully develop the fourth seacoast. Also coordinates activities with various power entities in St. Lawrence River toward goal of achieving maximum beneficial use of river. Encourages development of traffic through the Great Lakes Seaway system so as to contribute significantly to the comprehensive economical and environmental development of the entire region.

Marine Towing and Transportation Employers Association: Owners and operators of tugs, lighters, oil barges, tankers in port of New York, Atlantic Coast, Long Island Sound and Great Lakes.

Maritime Association of the Port of New York: Steamship companies, towing and transportation companies, shipbuilding and drydocks, warehouses, marine sales and service companies, banks, admiralty attorneys, etc. Provides complete statistical review of vessel activities.

Maritime Personnel

International Organization of Masters, Mates and Pilots (MMP): Represents ships' masters and deck officers. Collective bargaining between MMP and ship operators is maintained on an industry-wide basis for the Atlantic, Gulf, and Pacific Coasts, covering about 5,000 jobs on ships operated by some 200 steamship companies.

American Radio Association (ARA): Represents ships' radio officers. Collective bargaining agreements cover more than 600 jobs aboard ships operated by steamship companies on Atlantic, Gulf, and Pacific Coasts.

National Maritime Union of America (NMU): Represents unlicensed personnel of deck, engine, and steward departments. Collective bargaining agreements cover approximately 195 steamship companies in the Atlantic and Gulf Coast District who operate merchant ships having an employment potential in excess of 24,000 unlicensed jobs.

Seafarer's International Union of North America (SIUNA): Is comprised of SIU-Atlantic and Gulf Districts, Sailors Union of the Pacific (SUP), Marine Firemen's Union (MFU) and the Marine Cooks and Stewards (MCS). SIU Atlantic and Gulf Districts represents the unlicensed personnel of the deck engine, and stewards departments. Collective bargaining agreements cover about 60 steamship companies operating from the Atlantic and Gulf Coasts with more than 8,500 jobs on approximately 225 ships. SUP respresents the unlicensed personnel of the deck department on dry cargo and passenger ships and all three departments on some tankers. MFU represents the personnel of the engine department and MCS represents the personnel of the stewards department. Each of these affiliated seafaring unions retains its identity and autonomy while maintaining collective bargaining agreements with approximately 35 Pacific Coast steamship companies which operate about 200 ships with an employment potential close to 10,000 jobs in the three departments. Field offices and employment centers are administered jointly by the SIU affiliates on the Atlantic, Gulf and Pacific Coasts.

National Marine Engineers' Beneficial Association (MEBA): Represents ships' engineering officers. Collective bargaining agreements between MEBA and ship operators are also maintained on an industry-wide basis for Atlantic, Gulf and Pacific Coasts, covering about 5,500 jobs on ships operated by some 190 steamship companies.

International Longshoremen's and Warehousemen's Union (ILWU): Is a federation of autonomous local unions - voluntary character. Coastal Labor Relations Committee administers the Coast longshore, ships clerks and walking bosses agreements and meets regularly with a counterpart committee from the Pacific Maritime Association which represents the employers. President of union presides at convention and board meetings, interprets constitution, directs activities of the information department, responsible for all union publications. Research department services both the international and its locals with data for negotiations, arbitrations, etc. Maintains one of finest and most complete trade union libraries in the country. Locals have complete autonomy in their affairs except for those matters for which the membership has delegated authority to the international union.

Weather Services and Navigation

Wild Goose Association: Individuals and corporations involved in the design, operation, and use of LORAN, a high-precision long range radionavigation system. Established to promote LORAN, facilitate exchange of ideas and information, recognize contributions and document history.

National Oceanic and Atmospheric Administration: Mission is to explore, map, and chart the global ocean and its living resources, to manage, use and conserve those resources and to describe, monitor and predict conditions in the atmosphere, ocean, sun and space environment, issue warnings against impending destructive natural events, develop beneficial methods of environment modification and assess the consequences of inadvertent environment modification over several scales of time. Reports weather of U.S. and its possessions and provides weather forecasts to the general public, issues warnings against destructive natural events, provides special services in support of aviation, marine activities, agriculture, forestry, urban air-quality control and other weather-sensitive activities. Also monitors and reports all non-federal weather modified activities in U.S. Prepares and issues nautical and aeronautical charts, provides precise geodetic surveys, conducts broad research programs in marine and atmospheric sciences, solar-terrestrial physics and experimental meteorology. Predicts tides, current and sea conditions, conducts biological research and surveys of the living resources of the sea, analyzes economic aspects of fisheries operations and protects marine mammals. Provides federal leadership in promoting rational and balanced management of coastal zone. Provides satellite observation of environment and conducts an integrated program of research and services relating to the oceans and inland waters, the lower and upper atmosphere, space environment and the earth to increase understanding of man's geophysical environment. Acquires, stores and disseminates worldwide environmental data, administers and directs National Sea Grant program.

National Aeronautics and Space Administration (NASA): Functions are to conduct research for the solution of problems of flight within and outside the Earth's atmosphere and develop, construct, test and operate aeronautical and space vehicles; conduct activities required for the exploration of space with manned and unmanned vehicles; arrange for the most effective utilization of the scientific and engineering resources of U.S with other nations engaged in aeronautical and space activities for peaceful purposes; and to provide for the widest practicable and appropriate dissemination of information concerning NASA's activities and their results. The Program Office, Applications of Space Research, conducts research and develops activities leading to programs that demonstrate the application of space systems, space environment and space related or derived technology for benefit of mankind. These involve disciplines such as weather and climate, pollution monitoring, earth resources survey, and earth and ocean physics.

Institute of Navigation: Members of armed services and maritime service, astronomers, cartographers, meteorologists, educators, scientists engaged in research and development, in navigation and related sciences, and practicing navigators. Promotes advancement of navigation in air, space, surface, and underseas. Coordinates the exchange of information with navigation societies in other countries. Presents annual Navigation Award to Cadet at USAF Academy. Holds two technical meetings (on aerospace, surface-undersea navigation) a year.

Environmental Protection, Conservation and Usage

Sierra Club: Purpose is to protect and conserve natural resources. Works on urgent campaigns to save threatened areas and is concerned with problems of wilderness forestry, clean air, coastal protection, energy conservation and land use. Sponsors workshops, outings, awards, exhibits.

Friends of the Earth: International conservation organization working to generate a new responsibility to environment; to make many important environmental issues receiving scant attention the subject of public debate; to select specific projects that offend environment and hit hard with every legal means possible. Lobbies Congress and state governments; generates litigation; issues publications to further environmental goals.

U.S. Fish and Wildlife Service: Responsible for wild birds, mammals (except certain marine mammals), inland sport fisheries, and specific fishery research activities. Objective is to insure maximum opportunity for American people to benefit from fish and wildlife resources as part of their natural environment. Provides leadership in the area of resource management. Biological monitoring, surveillance of pesticides, heavy metals and thermal pollution; studies of fish and wildlife populations and ecological studies; environmental impact assessment; area planning and preservation involving river basins, wilderness areas and special studies, such as oil shale and geothermal energy. Responsible for improving and maintaining fish and wildlife resources by proper management of migratory birds and other wildlife, control of population imbalances and fulfilling the public demand for recreational fishing while maintaining fisheries at a level and in a condition that will assure their continued survival.

Environmental Protection Agency: Endeavors to abate and control pollution systematically by proper integration of a variety of research, monitoring, standard setting and enforcement activities. Coordinates and supports research and antipollution activities by state and local governments, private and public groups, individuals and educational institutions. Issues environmental impact assessments. Designed to serve as public's advocate for a livable environment. Conducts air and waste management programs; water and hazardous materials programs. Responsibilities include: development of national programs, technical policies and regulations for water pollution control and water supply; water quality standards and effluent guidelines development; technical direction, support and evaluation of regional water activities; development of programs for technical aid and technology transfer; provision of training in the field of water quality; and regulation of pesticides.

Bureau of Land Management (Department of Interior): Manages the national resource lands and their resources. Also administers mineral resources connected with acquired lands and the submerged lands of the Outer Continental Shelf. Responsible for the total management of 450 million acres of national resource lands and for sub-surface resource management of additional 310 million acres where mineral rights have been reserved to Federal Government. Bureau programs provide for protection, orderly development, and use of natural resource lands and resources under principles of multiple use and sustained yield, while maintaining and enhancing the quality of the environment. Also manages watersheds to protect soil and enhance water quality; develops recreational opportunities on national reserve lands; and makes land available through sale to individuals, organizations, local governments and other Federal agencies when such transfer is in the public interest. Responsible for survey of Federal lands and maintenance of public land records.

Insurance Industry

American Institute of Marine Underwriters: Domestic and foreign companies writing ocean marine insurance in U.S. Engaged in cargo loss prevention and relations with banks, carriers, and international organizations. Four hundred representatives in principal parts of world. Issues reports on marine disasters.

Shipbuilding and Ship Propulsion

Society of Naval Architects and Marine Engineers: Purpose is to advance art, science and practice of naval architecture, shipbuilding, marine engineering and allied fields. Maintains file of 1000 volumes. Presents awards for achievement in naval architecture, marine engineering, ship research.

American Society of Naval Engineers: Professional organization of engineers (civilian and navy) interested in naval engineering including ordnance, navigation, aeronautics, motive, hull, electric and electronic, architecture and related subjects.

American Institute of Industrial Engineers: Professional society of individual engineers and student members. Concerned with design, improvement and installation of integrated systems of people, materials, equipment and energy. Draws upon specialized knowledge and skill in mathematics, physics, and social sciences together with principles and methods of engineering analysis and design, to specify, predict and evaluate the results to be obtained for such systems. Promotes professional registration of individual engineers. Conducts technical research, conferences and seminars.

Shipbuilders Council of America: Companies engaged in construction and repair of vessels and other marine craft; manufacturers of all types of propelling machinery, boilers, marine auxiliaries, marine equipment and marine supplies. Aim is to promote and maintain sound private shipbuilding and ship repair industry; to develop and maintain adequate mobilization potential of shipbuilding and ship repairing facilities, organizations and skilled personnel in time of national emergency. Compiles statistical data relating to shipbuilding and repair.

American Bureau of Shipping: Executives of steamship companies, shipbuilders, naval architects and marine underwriters. International classification society concerned with seaworthiness of vessels. Establishes universal standards by which ships and other marine structures are built and maintained.

Marine Science

Smithsonian Institution: Performs fundamental research, publishes the results of studies, explorations and investigations; preserves for study and reference over 65 million items of scientific, cultural, and historical interest; maintains exhibits representative of the arts, American history, technology, aeronautics and space exploration and natural history; participates in and engages in programs of educational and national and international cooperative research and training. The Chesapeake Bay Center for Environmental Studies, which is part of Smithsonian Institution, conducts scientific research, information transfer and environmental education; studies of estuarine processes, watershed monitoring and basic research in terrestrial ecology; and effects of historical land use on present-day natural communities. Sponsors a variety of educational programs.

National Science Foundation: Independent agency in Executive Branch concerned primarily with support of basic and applied research and education in the sciences. Funds scientific research in math, physics, biology, engineering, sociology and other sciences including unclassified research activities in matters relating to national security and international cooperation. Provides educational opportunities in science.

National Academy of Sciences: Private organization of scientists and engineers dedicated to furtherance of science and its use for the general welfare. Members are elected in recognition of existing and continuing achievements in original research. Academy acts as official adviser to federal government on matters of science and technology.

National Academy of Engineering: Private honorary organization that seeks to provide means of assessing the changing needs of the nation and the technical resources that can be applied to them; to encourage research and sponsor programs aimed at meeting these needs; to explore means for promoting cooperation in engineering in U.S. and abroad; to advise federal government, upon request, on matters pertinent to engineering, to serve nations in connection with significant problems in engineering and technology and to recognize contributions by leading experts.

American Oceanic Organization: Persons from industry, government agencies, and the U.S. Congress who are interested in the oceanic future of the U.S. Supports and encourages implementation of the U.S. program to develop and maintain a coordinating, comprehensive, and long-range national effort in the oceans. Seeks to encourage policy, plans and programs consistent with the orderly exploration of marine resources designed to contribute to national security; enhance commerce and transportation; rehabilitate domestic fisheries and increase the harvest from the sea by U.S. interests; develop seashore resources and reduce, if not abate, pollution of the Great Lakes, bays, streams and near shore waters; improve forecasting of ocean conditions and environments; supplement construction shelf sources of oil, gas and minerals and promote international understanding and cooperation through joint use of the oceans.

Commercial Shipping

New Orleans Steamship Association: Steamship operators, owners, agents and stevedores. Represent shipping interests in many diverse matters of industry-wide concern. Negotiates and administers labor contracts. Conducts first aid safety courses. Maintains library of 500 volumes of labor law, industrial relations and maritime topics.

Transportation Institute: U.S. deep sea and inland waters shipping, towing and dredging corporations devoted to research and education on a broad range of transportation problems, with particular emphasis on problems related to the nation's citizen-owned and citizen-manned Merchant Marine. Deals with the need for halting the decline of deep-sea commerce aboard vessels flying U.S. flag; the need for full development of waterborne commerce on the Great Lakes; the need for utilizing America's 25,000 mile long network of inland waterways to meet domestic transportation need of growing nations; the need for revitalizing the American fishing industry, to halt incursion of foreign fleets on our spawning grounds; the need for a national oceanographic policy to insure maximum exploitation of the wealth of the sea.

Federal Maritime Commission (FMC): Regulates the waterborne foreign and domestic offshore commerce of U.S., assures that U.S. international trade is open to all nations on fair and equitable terms, and guards against unauthorized monopoly in waterborne commerce of U.S. This is accomplished through maintaining surveillance over steamship conferences and common carriers by water; assuring that only the rates on file with FMC are charged; guaranteeing equal treatment to shippers and carriers by terminal operators, freight forwarders, and other persons subject to the shipping statutes; and ensuring that adequate levels of financial responsibility are maintained for indemnification of passengers or oil spill cleanup. FMC approves or disapproves agreements filed by common carriers; regulates practices of common carriers by water and other persons engaged in foreign and domestic offshore commerce of U.S.; accepts and rejects tariff filings of domestic offshore carriers and common carriers; has authority to set maximum or minimum rates or suspend rates; approves or disapproves requests for relief from statutory and/or FMC tariff requirements; issues or denies issuance of licences to persons, partnerships, corporations, or associations desiring to engage in ocean freight forwarding activities; administers passenger indemnity and water pollution provisions; in conjunction with Department of State conducts activities to eliminate discriminatory practices on the part of foreign governments against U.S. flag shipping; and engages in investigation, audits, and financial and economic analysis.

Maritime Administration (Department of Commerce): Administers programs to aid in development, promotion, and operation of U.S. merchant marine. Charged with organizing and directing emergency merchant ship operations. Administers subsidy programs. Provides financing guarantees for ship construction, reconstruction and reconditioning; acquires old ships for credit on construction of new ships; and enters into capital construction fund agreements. Contracts or supervises construction of merchant type ships for Federal Government. Conducts programs to assure equal opportunity in employment by Government shipbuilding, repair, and water transportation contractors. Helps industry generate increased business for U.S. ships, and conducts programs to develop ports, facilities, and intermodal transportation, and to promote domestic shipping. Conducts research and development activities to improve efficiency and economy of merchant marine.

Maintains a National Defense Reserve Fleet of Government-owned ships which operates through general agents when required in national defense interests. Regulates sales and transfers of ships (to foreign countries) which are fully or partially U.S. owned. Operates U.S. Merchant Marine Academy.

American Institute of Merchant Shipping: Tank, bulk and liquefied gas companies which own and operate over 200 vessels in U.S. foreign and domestic commerce. "Created to eliminate differences among a mangement segments with respect to maritime issues and establishment of a strong, well-balanced American flag fleet adequate to meet the needs of this Nation for both commerce and defense." Testifies before Congressional Committees to support legislation beneficial to the Merchant Marine. Maintaining liaison with 40 government agencies concerning maritime matters. Participates in numerous international forums such as the Intergovernmental Maritime Consultative Organization, United Nations Conference on Trade and Development, and North Atlantic Treaty Organization. Co-sponsors ship safety achievement awards. Maintains library of several hundred volumes on all facets of shipping and its history, labor and maritime law.

American Waterways Operators, Inc.: Operators of towboats, tugboats, barges, and inland tankers and freighters. Maintains library of books, photographs, maps and other material related to shallow draft water carriers. Develops informational resources on inland and coastal water transportation. Compiles statistics.

Federation of American Controlled Shipping (FACS) : Twenty-three U.S. companies which control 43 million DWT of Liberian and Panamanian tankers, bulk carriers and specialized vessels. FAC states "these ships registered abroad as means to meeting world competition on equal terms -- something not possible under U.S. registry because of much higher construction and operating costs." Formed to counterbalance U.S. maritime unions' efforts to discredit the economic and strategic value of American-controlled Liberian and Panamanian shipping, and to establish worldwide shipping policies and practices as they affect FACS ships, other shipping organizations, labor matters, ship operations, maritime safety and pollution prevention. Activities include: dissemination of information relating to construction, operation and service of FACS vessels; cooperation with governments of U.S., Panama, Liberia and other friendly nations; cooperation with U.S. Department of Defense and with all international defense organizations of which U.S. is member on all matters concerning availability of FACS vessels in event of war or national emergency; appearances before and provision of information to legislative committees, governmental departments and agencies; and cooperation with public and private agencies dealing with matters of maritime safety and operating standards.

Military and Emergency Services

Red Cross: Operating under congressional charter and fulfilling America's obligations under certain international treaties, the American Red Cross serves members of the armed forces, veterans and their families; aids disaster victims and assists other Red Cross societies in times of emergency. Other activities include blood services, training of volunteers for chapters, hospitals and other community agencies, community services, international activities, service opportunities for youth.

Civil Air Patrol: Civilian auxiliary of USAF. Members participate in rescue work during national disasters and cooperate with state and federal authorities in Civil Defense planning. They operate a network of approximately 24,000 fixed mobile and airborne radio stations. Sponsors education programs and awards. Maintains library of 1500 volumes on aviation, astronautics, aviation history, navigation, meteorology, astronomy and related subjects.

U.S. Navy: Primary mission is to protect the U.S. by the effective prosecution of war at sea including, with its Marine Corps component, the seizure or defense of advanced naval bases; to support, as required, the forces of all military departments of U.S.; and maintain freedom of the seas. Conducts naval research programs in oceanography, meteorology, and naval telecommunications.

U.S. Air Force: Responsible for providing an Air Force that is capable, in conjunction with the other Armed Forces, of preserving the peace and security of U.S.

U.S. Army: Mission is to organize, train and equip active duty and reserve forces for the preservation of peace, security, and defense of our Nation. Serves as part of our national military team whose members include Navy, Air Force, Marines and Coast Guard. Mission focuses on land operations; its soldiers must be trained, possess arms and equipment and be ready to respond quickly. Also administers programs aimed at protecting the environment, improving waterway navigation, flood and beach control, and water resource development. Supports National Civil Defense Program, provides military assistance to Federal, state and local government agencies, natural disaster relief assistance, and emergency medical air transportation services.

U.S. Coast Guard: Functions and Activities: Search and Rescue - maintains system of rescue vessels, aircraft stations, and radio stations around navigable waters of U.S., includes flood relief and removing hazards to navigation.

Law Enforcement - responsible for enforcing Federal laws on navigable waters of U.S. and possessions. Navigation and vessel inspection laws are specific responsibilities. CG cooperates with other agencies in law enforcement and enforces conservation and marine environmental laws.

Marine Environmental Protection - aimed at prevention, detection, and control of pollution on and adjacent to U.S. waters.

Boating Safety - administers boating safety program, establishes uniform safety standards, educates small boat operators in safety requirements.

Merchant Marine Safety - Undertakes inspection and regulation of vessels, and related equipment to provide protection for crews, passengers and cargo; licensing, regulation and protection of rights of merchant marine personnel; approval of construction, alteration and repair plans; and approval of vessel equipment and appliances; investigation and review of marine casualties and acts of incompetency or misconduct. Acts as liaison with the maritime industry and international bodies; conducts admeasurement and documentation of vessels; and publication of vessel registers.

Military Readiness - maintains a state of readiness to function as a specialized service in Navy in time of war.

Aids to Navigation - establishes and maintains aids to navigation, administers alteration of obstructive bridges, approves location, clearance and lighting of bridges over navigable waters, regulates drawbridge operations.

Port Security - enforces rules and regulations governing security of ports and the anchorage and movement of vessels in U.S. waters, supervision of loading and unloading of dangerous cargoes, development and enforcement of fire prevention measures, and control of access. Provides ice breaking services.

Safety and Port Security

U.S. Army Corps of Engineers: Engaged in water resources development activity, involving engineering works, such as dams, reservoirs, levees, harbors, waterways, locks, etc. These provide flood protection, reduce cost of transportation, supply water for municipal and industrial use, generate hydroelectric power, provide recreational opportunities for many, regulate rivers for purposes including improvement of water quality and enhancement of fish and wildlife, protect shores of oceans and lakes. Provides planning assistance to states for comprehensive management of water resources including pollution abatement works. Protects navigable waters of U.S. by legislation empowering Secretary of Army to prohibit activities which would reduce value of such waters to the Nation.

National Transportation Safety Board: Seeks to assure that all types of transportation in U.S. are conducted safely. Investigates accidents and makes recommendations to government agencies, the transportation industry, and others on safety measures and practices. Also regulates the procedures for reporting accidents and promotes the safe transport of hazardous materials by government and private industry.

Materials Transportation Bureau (part of Department of Transportation): Administers intermodal hazardous materials safety regulations and processes, recommends for issuance all intermodal and certain modal regulations, issues exemptions and interprets regulations as appropriate. Reviews and analyzes reports made by industry and by field staffs and conducts training and education programs to support the Department's regulatory system. Coordinates administration of materials safety program; ensures uniformity in hazardous materials regulations of the operating administration including rail, highway, air and water modes; establishes and provides for enforcement of safety standards for transportation of hazardous and gaseous materials by pipeline that are either in or affects interstate commerce.

Federal Bureau of Investigation: Investigates all violations of Federal laws with exception of those which have been assigned by legislative enactment or otherwise to some other Federal agency. Jurisdiction includes a wide range of responsibilities in the criminal, civil, and security fields.

Nuclear Regulatory Commission (NRC): Licenses and regulates the uses of nuclear energy to protect the public health, safety and environment. Does this by licensing persons and companies to build and operate nuclear reactors and to own and use nuclear materials. Makes rules and sets standards for these types of licenses. Also carefully inspects the activities of the persons and companies licensed to ensure that they do not violate the safety rules of the NRC.

International Bodies

International Passenger Ship Association: Passenger steamship lines operating between the East Coast of North America and European and Mediterranean ports, as well as holiday cruises throughout the world, principally from North American ports. Aim is to coordinate activities relating to passenger shipping matters and to administer lines' travel agency appointments and boarding programs.

Intergovernmental Maritime Consultative

Organization (IMCO): Aims: To provide machinery for cooperation among governments on technical matters affecting international merchant shipping and, with special responsibility for safety of life at sea, to ensure that the highest possible standards of safety at sea and of efficient navigation are achieved; to prevent pollution of the sea caused by ships and other craft operating in the marine environment; and to encourage removal of hindrances to international shipping services. Responsible for convening international maritime conferences and drafting international maritime conventions.

International Council of Marine Industry Associations: Aim: To promote boating as a leading international recreational activity by establishing the medium for the exchange of information on all matters related to the common interest, such as pollution, safety, service, quality and marinas, so as to stimulate the sale and use of boats and their equipment.

North Atlantic Treaty Organization (NATO): Aims: To reaffirm the faith of the parties to the treaty in the purposes and principles of UN charter and their desire to live in peace with all peoples and all governments; to safeguard the freedom, common heritage, and civilization of their peoples, founded on principles of democracy, individual liberty, and the rule of law; to promote stability and well-being in the North Atlantic area; and to unite their efforts for collective defense and for the preservation of peace and security.

United Nations Conference on Trade and Development (UNCTAD): Concentrates on developing fairer trade among the nations of the world. Is really a forum for lobbying efforts by Third World nations who seek to extract trade concessions and trade preferences from the developed countries. It has considered shipping, insurance, commodities, excise taxes, quotas, and other matters of special concern to poor countries. Committee on Shipping - has been particularly concerned with shipping problems affecting developing countries. Tried to establish maximum consultation between shipping conferences, representing the ship-owners, and shippers' councils, representing the ship users. Organizes conferences and study groups on economics of shipping. Examines level and structure of freight rates, conference practices, discriminatory port charges, and other matters that IMCO does not deal with. Conducts studies of development of merchant shipping fleets among developing countries and of best way of improving port operations and facilities. UNCTAD is, above all, the forum in which interests of developing countries on shipping questions can be promoted.

Maritime Communications

Federal Communications Commission: Regulates interstate and foreign communications by radio, television, wire, and cable. Responsible for the orderly development and operation of broadcast services and the provision of rapid, efficient nationwide and worldwide telephone and telegraph services at reasonable rates. This also includes the promotion of safety of life and property through radio and the use of radio and television facilities to strengthen the national defense. Regulates use of radio for such purposes as broadcast and common carrier communication. Regulates aviation, marine, amateur, public safety, industrial, land transportation and citizens radio communications services and implements compulsory provisions of laws and treaties covering the use of radio for the safety of life at sea.

Federal Aviation Administration (Department of Transportation): Issues and enforces rules, regulations and minimum standards relating to manufacture, operation, and maintenance of aircraft as well as rating and certification of airmen and certification of airports. Performs flight inspection of air navigation facilities. Provides system of registration and recordation of aircraft and research and development facilities in aviation. Responsible for operation, establishment, and maintenance of Federal air navigation facilities and for airspace and air traffic management.

Office of Telecommunications (Agency of Executive Branch): Responsible for overall supervision of national communications matters. Establishes executive branch's policies and programs pertaining to communication matters and seeks to implement them through various means, including the proposal of legislation. Coordinates planning and evaluates operation of the communications activities of executive branch which includes establishment of policies and setting of standards for Federal communications systems, and overall guidance of Federal research and development efforts. Responsible for allocation and management of that portion of radio spectrum (approximately one half) used by Federal Government. Develops mobilization plans for the nation's communications resources and is responsible for administering those resources in an emergency. The latter includes responsibility for exercise of President's war powers in communications field.

Defense Mapping Agency (Department of Defense): Provides support to Secretary of Defense, military departments, JCS, and other DOD components, as appropriate, on matters concerning mapping, charting, and geodesy.

American Radio Relay League: Membership includes licensed amateur radio operators in U.S. and Canada and others interested in U.S. amateur radio, communications, and experimentation. Maintains nationwide message handling organization, the National Traffic System with members serving as official relay stations and bulletin stations. Sponsors contests and presents awards for operating proficiency, maintains experimental equipment laboratory and publishes special booklets for beginners and others on antennas, mobile and radio fundamentals.

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