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SEALIFT PROCUREMENT AND NATIONAL SECURITY (SPANS) STUDY. PART II. THE FUTURE SIZE, COMPOSITION, AND PRODUCTIVITY OF THE U. S. MERCHANT MARINE AND FORECASTS OF U. S. WATERBORNE TRADE

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SEALIFT PROCUREMENT AND NATIONAL SECURITY (SPANS) STUDY

PART II

THE FUTURE SIZE, COMPOSITION, AND PRODUCTIVITY OF THE U.S. MERCHANT MARINE AND FORECASTS OF U.S. WATERBORNE TRADE

SEALIFT PROCUREMENT AND NATIONAL SECURITY

(SPANS) STUDY

PART II-A

PROJECTION OF DOD DRY SEALIFT CARGO

FOR

FY 72 - 76

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PART II-A: PROJECTION OF DOD DRY SEALIFT CARGO FOR FY 72-76

I. INTRODUCTION

This paper sets forth the results of a projection of Department of Defense dry sealift cargo tonnage for FY 72-76 by amount, commodity, and area of the world.

This projection, undertaken as a part of the Sealift Procurement and National Security (SPANS) Study, was accomplished in two steps. First, a "basic projection," using historical indicators, was developed for (a) U.S. troop support cargo (forecast primarily on the basis of projected overseas military manpower) and (b) military assistance cargo (forecast based on projected military assistance funding). Second, a number of "other factors" were reviewed (i.e., possible changes in DOD policies, activities and operations, etc.) that could affect future cargo tonnage but which would not be indicated by the historical data; the basic projection was then revised to reflect the impact of these "other factors." The revised basic projection, therefore, represents SPANS' best estimate of DOD sealift tonnage for FY 72-76.

The major assumptions of this projection are the following:

(1) Overseas military manpower and military assistance funding currently projected by OSD for FY 72-76 are reasonably accurate reflections of future manpower and funding.

(2) The Southeast Asia (SEA) assumptions contained in the Secretary of Defense's Planning and Programming Guidance for the FY 73-77 Defense Program generally reflect future SEA activity.

Table Ia

CARGO AREA AND MOVEMENT DEFINITIONS

For convenience in describing our methodology and discussing the results of our analysis, we developed the following definitions for use in this report.

Inbound and Outbound Cargo:

Cargo inbound to CONUS and outbound from CONUS (e.g., Atlantic Area inbound and outbound refers to cargo shipped inbound from the Atlantic Area to CONUS and outbound from CONUS to the Atlantic area).

Inter/Intra Area Cargo:

All cargo movement which does not involve CONUS as either a point of origin or destination, (e.g., cargo movement from Japan to SEA, Europe, the Mediterranean, etc.).

Worldwide Cargo:

Worldwide inbound and outbound cargo plus all inter/intra area cargo.

Atlantic Area:

Refers primarily to Europe, the North Atlantic, Mediterranean, Mid-East, and Africa (see Appendix C).

Pacific Area:

Refers primarily to SEA, Japan, Korea, Ryukyu Islands, Philippines, Taiwan, Hawaii, and other Pacific Islands (see Appendix C).

Other Area:

Refers primarily to Caribbean, Central and South America, and Alaska. (Intended to encompass all areas of the world other than the Pacific and Atlantic).

Table Ib

COMMODITY CLASSIFICATION DEFINITIONS

Aircraft: Whole aircraft or complete fuselages, whether or not engines are installed. Does not include spare parts, engines, aircraft repair supplies, or boxed aircraft.

Ammunition and Explosives: Bombs, fuses, TNT blocks, caps, hand grenades, powder, dynamite, or any other commodity which must be alloted isolated and specialized stowage space in a cargo ship, or carried in an ammunition ship, or loaded and discharged at an ammunition pier because of its highly explosive nature. Does not include small arms ammunition or radioactive waste.

Bulk: Unpackaged dry or liquid cargo such as coal, grain, ore, sulphur fertilizer, and edible oils.

General: Any commodity other than aircraft, ammunition and explosives, radioactive waste, bulk, reefer, cargo-carrying trailers, privately-owned vehicles, and special cargo.

Privately-Owned Vehicle (POV): A passenger vehicle belonging to an individual rather than the Department of Defense.

Reefer: Perishable commodities such as meats, vegetables, fruits, butter, eggs, and poultry which require refrigerated (chill or freeze) storage at prescribed temperatures while in transit to prevent deterioration or loss. Does not include semi-perishable cargo stored in ventilated holds.

Special: All wheeled and tracked vehicles and any commodity which weighs more than 10,000 pounds or measures 35 feet or more in any dimension. Does not include privately-owned vehicles, uncrated aircraft or stake or van type cargo-carrying trailers.

Trailers, Cargo-Carrying: Relates primarily to cankers lifted on Military Sealift Command (MSC) controlled "roll-on/roll-off" type ships.

II. RESULTS

Projected DOD sealift cargo is presented in Tables IIa and IIb. According to this projection:*

A. In FY 72, total DOD worldwide sealift cargo will be 98,800 million ton-miles, approximately seven percent less than the FY 66 total. Of this amount approximately 73,000 million ton-miles will be Pacific in and outbound** tonnage while 16,700 million ton-miles will be Atlantic area in and outbound requirements.

B. In FY 73, total worldwide cargo will drop to 67,800 million ton-miles, approximately 19% higher than the FY 65 level. Of this total approximately 45,200 million ton-miles will be Pacific in and outbound cargo while 16,300 million will consist of Atlantic area in and outbound requirements.

C. In FY 74, 75, and 76, cargo requirements drop to approximately 48,600, 46,700, and 46,600 million ton-miles respectively -- 10 to 15% higher than the FY 61 level. Of these totals, Pacific area in and outbound requirements account for 27,300, 25,700, and 25,700 million ton-miles, while Atlantic in and outbound cargo accounts for 15,800, 15,700, and 15,700 million ton-miles.

Tables IIc through IIh present a breakout of projected cargo by commodity.

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*The tonnages discussed here do not include certain household goods cargo (TGBL Code 3 and 4) not normally handled through the Military Sealift Command system and therefore not included in the MSC data base used in developing this projection. An estimate of this excluded cargo is shown in parentheses in Tables IIa through IIh (see also Appendix I).

**See Table Ia for cargo area and movement definitions used throughout this paper.

Table IIa

PROJECTED TOTAL DOD SEALIFT CARGO a/
(M/Ton Miles in 000,000)

"Revised Projection"

	FY 72	FY 73	FY 74	FY 75	FY 76-77
In and Outbound					
Pacific	73,027 (76,149)	45,238 (47,858)	27,341 (30,034)	25,671 (28,210)	25,701 (28,243)
Atlantic	16,718 (19,081)	16,256 (18,590)	15,837 (18,164)	15,716 (18,038)	15,669 (17,984)
Other Area	2,384 (2,721)	1,633 (1,864)	1,395 (1,593)	1,370 (1,564)	1,366 (1,560)
Total In and Out	92,125 (97,951)	63,127 (68,312)	44,573 (49,791)	42,757 (47,812)	42,736 (47,787)
Inter/Intra Area					
Pacific	5,042 (5,390)	3,501 (3,749)	3,014 (3,300)	2,941 (3,219)	2,933 (3,209)
Atlantic	1,680 (1,918)	1,167 (1,332)	1,005 (1,147)	981 (1,120)	978 (1,117)
Total Inter/Intra	6,722 (7,268)	4,668 (5,079)	4,019 (4,447)	3,922 (4,339)	3,911 (4,326)
TOTAL	98,847 (105,150)	67,795 (73,405)	48,592 (54,265)	46,679 (52,180)	46,647 (52,143)

a/ Figures without parentheses ( ) do not include certain household goods cargo (TCSL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo including MTMTS household goods (TCSL Code 3 and 4) is shown in parentheses (see Appendix I).

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Table IIb

PROJECTED TOTAL DOD SEALIFT CARGO a/
(M/Tons in 000) b/

"Revised Projection"

	FY 72	FY 73	FY 74	FY 75	FY 76-77
In and Outbound					
Pacific	10,228 (10,665)	6,560 (6,940)	4,074 (4,475)	3,876 (4,258)	3,881 (4,266)
Atlantic	4,370 (4,996)	4,080 (4,663)	3,959 (4,542)	3,945 (4,528)	3,933 (4,514)
Other Areas	1,192 (1,361)	817 (932)	698 (797)	685 (782)	683 (780)
Total In and Out	15,790 (17,022)	11,457 (12,535)	8,731 (9,814)	8,506 (9,568)	8,497 (9,560)
Inter/Intra Area					
Pacific	2,420 (2,568)	1,666 (1,745)	1,435 (1,502)	1,400 (1,466)	1,396 (1,462)
Atlantic	800 (901)	557 (635)	478 (546)	467 (533)	466 (532)
Total Inter/Intra	3,220 (3,469)	2,223 (2,380)	1,913 (2,048)	1,867 (1,999)	1,862 (1,994)
TOTAL	19,010 (20,228)	13,680 (14,808)	10,644 (11,885)	10,373 (11,593)	10,359 (11,579)

a/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo including MTMTS household goods (TGBL Code 3 and 4) is shown in parentheses (see Appendix I).

b/ A Measurement Ton is equal to 40 cubic feet of cargo.

Table IIc

PROJECTED TOTAL DOD SEALIFT CARGO a/b/
(M/Ton Miles in 000,000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76-77
Household Goods	2,671 (8,974)	2,377 (7,987)	2,404 (8,077)	2,331 (7,832)	2,329 (7,825)
Reefer	2,966	2,397	2,340	2,253	2,252
Bulk	3,127	3,005	2,972	2,962	2,954
POV	6,468	6,076	5,942	5,761	5,756
Ammo	6,822	3,631	1,329	1,277	1,277
General	53,192	34,887	23,671	22,519	22,509
Trailers	831	774	757	754	752
Special	19,717	12,831	6,452	6,237	6,233
Aircraft	3,055	2,628	2,723	2,586	2,582
TOTAL	98,847 (105,150)	67,795 (73,405)	48,592 (54,265)	46,679 (52,180)	46,647 (52,143)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TCBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo <u>including MTMTS household goods (TCBL Code 3 and 4)</u> is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for <u>detailed</u> planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

Table IId

PROJECTED PACIFIC (IN AND OUTBOUND) CARGO a/b/
(M/Ton Miles in 000,000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76
Household Goods	1,323 (4,445)	1,110 (3,730)	1,141 (3,834)	1,076 (3,615)	1,077 (3,619)
Reefer	1,984	1,480	1,426	1,345	1,346
Bulk	-	-	-	-	-
POV	3,307	2,991	2,883	2,720	2,993
Ammo	5,952	2,960	856	807	808
General	42,067	25,774	15,331	14,345	14,362
Trailers	-	-	-	-	-
Special	15,740	9,444	3,423	3,227	3,231
Aircraft	2,845	2,220	2,282	2,151	2,184
TOTAL	73,027 (76,149)	45,238 (47,858)	27,341 (30,034)	25,671 (28,210)	25,701 (28,243)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo <u>including MTMTS household goods (TGBL Code 3 and 4)</u> is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for <u>detailed</u> planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

Table IIe

PROJECTED ATLANTIC (IN AND OUTBOUND) CARGO a/b/
(M/Ton Miles in 000,000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76
Household Goods	1,003 (3,370)	989 (3,323)	986 (3,313)	984 (3,306)	981 (3,296)
Reefer	669	659	657	656	654
Bulk	2,841	2,802	2,794	2,788	2,780
POV	2,340	2,400	2,393	2,388	2,381
Ammo	334	330	329	328	327
General	6,351	5,945	5,554	5,457	5,439
Trailers	669	659	657	656	654
Special	2,340	2,308	2,301	2,296	2,289
Aircraft	167	165	164	164	164
TOTAL	16,714 (19,081)	16,256 (18,590)	15,837 (18,164)	15,716 (18,038)	15,669 (17,984)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo <u>including MTMTS household goods (TGBL Code 3 and 4)</u> is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for <u>detailed</u> planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

Table IIf

PROJECTED TOTAL DOD SEALIFT CARGO a/b/
(M/Tons in 000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76
Household Goods	516 (1,734)	478 (1,606)	526 (1,767)	517 (1,737)	517 (1,737)
Reefer	572	482	512	500	500
Bulk	604	604	651	658	656
POV	1,248	1,221	1,301	1,279	1,278
Ammo	1,317	730	291	283	283
General	10,266	7,012	5,184	4,999	4,997
Trailers	160	156	166	167	167
Special	3,805	2,579	1,413	1,385	1,384
Aircraft	590	528	596	574	573
TOTAL	19,010 (20,228)	13,680 (14,808)	10,644 (11,885)	10,373 (11,593)	10,359 (11,579)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo including MTMTS household goods (TGBL Code 3 and 4) is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for detailed planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

Table IIg

PROJECTED PACIFIC (IN AND OUTBOUND) CARGO a/b/
(M/Tons in 000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76
Household Goods	185 (622)	161 (541)	170 (571)	162 (544)	163 (548)
Reefer	278	215	212	203	203
Bulk	-	-	-	-	-
POV	463	434	430	411	452
Ammo	833	429	128	122	122
General	5,889	3,737	2,284	2,166	2,169
Trailers	-	-	-	-	-
Special	2,205	1,369	510	487	488
Aircraft	370	322	340	325	325
TOTAL	10,228 (10,665)	6,560 (6,940)	4,074 (4,475)	3,876 (4,258)	3,881 (4,266)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo <u>including MTMTS household goods (TGBL Code 3 and 4)</u> is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for <u>detailed</u> planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

Table IIh

PROJECTED ATLANTIC (IN AND OUTBOUND) CARGO a/b/
(M/Tons in 000)

"Revised Projection" by Commodity

	FY 72	FY 73	FY 74	FY 75	FY 76
Household Goods	261 (877)	247 (830)	247 (830)	247 (830)	246 (827)
Reefer	174	165	165	165	164
Bulk	739	701	699	700	698
POV	608	600	598	599	598
Ammo	87	83	83	82	82
General	1,651	1,486	1,389	1,370	1,365
Trailers	174	165	164	165	164
Special	608	577	575	576	575
Aircraft	43	41	41	41	41
TOTAL	4,370 (4,996)	4,080 (4,663)	3,959 (4,542)	3,945 (4,528)	3,923 (4,514)

a/ Totals may differ from indicated sums due to rounding.

b/ Figures without parentheses ( ) do not include certain household goods cargo (TGBL Code 3 and 4) that historically has been handled exclusively by the Military Traffic Management and Terminal Service (MTMTS), and therefore is not included in the MSC data base used in developing this projection. A rough estimate of DOD cargo <u>including MTMTS household goods (TGBL Code 3 and 4)</u> is shown in parentheses (see Appendix I).

c/ The commodity figures are intended to provide a rough order of magnitude indication of the way the projected cargo total is likely to be split among commodities. These figures are not intended for use as a basis for <u>detailed</u> planning.

d/ Based on a review of actual FY 70 and FY 71 tonnages, it appears that the projected figures shown above for aircraft may be overstated.

SEALIFT PROCUREMENT AND NATIONAL SECURITY

(SPANS) STUDY

PART II-B

THE FUTURE SIZE, COMPOSITION, AND PRODUCTIVITY OF THE U.S. MERCHANT MARINE

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PART II-B: THE FUTURE SIZE, COMPOSITION, AND PRODUCTIVITY OF THE U.S. MERCHANT MARINE

I. INTRODUCTION

The purpose of this portion of the Sealift Procurement and National Security (SPANS) Study is to develop a basis for evaluating the wartime general cargo shipping capability which U.S.-flag commercial assets can provide by projecting the future size, composition, and productivity of our general cargo fleet. The year 1976 was selected for specific examination of the U.S. Merchant Marine because that is the outmost year for which the Department of Defense has projected its forces and programs in the current Five-Year Defense Program, and thus serves as the basis of the deployment analyses of SPANS Part III.

The principal output of this section of SPANS is a calculated merchant fleet that is dependent on the quantity of cargo available and the productivity of the individual ship type on specified trade routes. Since the indenendent variable within this analysis is the estimation of cargo, this aspect will be covered first. The total cargo available to U.S.-flag operators consists of commercial cargo, non-DOD government impelled cargo, and DOD cargo. These components will be examined separately and then combined to create total cargo.

II. CARGO FORECASTS

A. Foreign Trade Commercial Cargo

The waterborne commercial cargo forecast was developed from two analyses. These analyses constitute an on-going Maritime Administration effort entitled, "A Long-Run Prediction of United States Seaborne Trade from 1970-1990," which is included as Appendix A*, and a completed DOT effort entitled "Transoceanic Cargo Study."**

Both of these analyses predict the volume of U.S. foreign trade based on economic influences. The difference between the efforts lies in the manner in which overall values are subdivided into specific classes of commodities. The actual numbers used in the foreign trade cargo forecast have been generated by means of the model described in Appendix A. The study in Appendix A indicates that supply and demand are the economic factors that most influence the size and structure of trade between any two regions. Historically, demand appears to be more significant than supply when economic activity is considered. "Real income" or gross national product (GNP) is a national measure of demand, and may therefore be the principal measure for economic activity. This implies that U.S. imports depend to a given extent upon U.S. GNP, and that U.S. exports to a particular foreign region likewise depend on the "real income" or GNP of that region. This hypothesis was evaluated by data taken from the years 1963-1969 and displayed a satisfactory statistical correlation.

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* Appendix A of Part II-B represents a first step toward making long-range economic forecasts in the area of seaborne trade. As data were not always available and the state of the art of such forecasting is in its infancy, results of this study should not be taken as absolute indicators of the future and should be used carefully. The following controversial areas in economic forecasting, which directly impact on Appendix A, should be noted: (1) there are unresolved conflicts within economic theory regarding long-range economic forecasts; (2) current seaborne trade forecasts have relied on extensive extrapolations from a small data base; and (3) current seaborne trade forecasts are weakened by the inability to predict the effect of such events as dollar devaluation, Britain's entry into the Common Market, and expanded trade with Communist nations. While these controversies exist, Appendix A is the best estimate currently available and is useful in the role of providing input data for U.S. commercial shipping capability in 1976. In the SPANS Study, this data is used as an upper bound.

** Transoceanic Cargo Study, DOT-OS-A9-024, U.S. Department of Transportation, Office of Systems Requirements, Plans and Information, by Planning Research Corporation, March 1971.

This technique was used to predict annual tonnage of U.S. waterborne imports and exports for 38 commodity groups categorized by mode of shipment (i.e., general cargo, dry bulk, liquid bulk, etc.) for 19 major world regions for the years of 1972 through 1976. These regions in conjunction with CONUS origins and destinations were translated into trade routes.

Specific trade routes were selected as containing the predominant fraction of U.S. commercial trade and government impelled cargo. These routes are defined below and are described by maps in Appendix B.

Trade Route	U.S. Coastal Area	Foreign Area
4	Atlantic	Caribbean
5-7-8-9	North Atlantic	U.K. and North Europe
10	North Atlantic	Mediterranean
12	Atlantic	Far East
13	South Atlantic & Gulf	Mediterranean
18	Atlantic & Gulf	India, Persian Gulf, Red Sea
21	Gulf	U.K. and North Europe
22	Gulf	Far East
29	Pacific	Far East
32	Great Lakes	U.K. and North Europe

While the foreign trade cargo analyses provided projections for 1972-1976, only the trade data for 1976 was used for the merchant fleet analysis. The total U.S. waterborne foreign trade predicted for 1976 is 743,501,980 long tons, composed of exports of 329,494,840 and imports of 414,007,140 long tons. The trade routes of interest (4, 5-7-8-9, 10, 12, 13, 18, 21, 22, 29, and 32) carry 462,773,690 long tons, composed of exports of 236,005,140 and imports of 226,768,550 long tons. The percentages of the total foreign waterborne trade represented by the trade routes of interest are:

	Total Foreign Trade	Trade Route Group	Percent of Total
Exports	329,494,840	236,005,140	71.7
Imports	414,007,140	226,768,550	54.5
Total	743,501,980	462,773,690	62.2

The cargo was examined in detail, commodity by commodity, and segregated into the three major cargo categories of general, dry bulk, and liquid bulk. The 1972-1976 projections for general, dry bulk, and liquid bulk cargoes for the trade routes of interest are contained in Appendix C. For the analysis, only the 1976 general cargo projections were of interest.* In 1976, the percentage of total long tons of foreign trade general cargo projected to move on the trade routes of interest are:

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*With one exception: Industry advisors have indicated that they expect to carry one percent of the dry bulk cargo exports on Trade Route 29. This cargo totals 56,844,800 long tons; one percent of this figure with a M/T to L/T ratio of 1.25 equals 710,560 M/T. This amount of cargo is added into Trade Route 29 totals in Figure IIa.

	Total Foreign Trade General Cargo	Trade Route Group General Cargo	Percent of Total
Exports	41,933,670	25,748,590	61.4
Imports	63,554,780	40,156,290	63.2
Total	105,488,450	65,904,880	62.5

Since long tonnage is not a usable yardstick for measuring required shipping capacity for the projected cargoes, it was necessary to convert the long tons to measurement tons (a capacity measurement). A well established reference* was updated to provide appropriate long ton to measurement ton conversions for different commodities. These conversion factors, expressed in terms of measurement tons (M/T) per long ton (L/T), are as follows:

Commodity Group	Stowage Factor a/
Fresh Foods	2.25
Dried Foods	1.50
Live Animals	10.00
Other Farm Feed	1.75
Beverages	1.40
Crude and Semi-Finished Textiles	4.00
Finished Textiles	2.50
Paper	2.50
Other Vegetable Fibers	4.00
Industrial Chemicals	1.25
Hides and Skins	1.50
Rubber	1.70
Finished & Semi-Finished Steel Mill Products	.50
Finished Metal Products	4.00
Other Finished Metal	2.50
Electrical Machinery	4.00
Construction Machinery	2.00
Industrial Machinery	2.00
Agricultural Machinery	2.00
Civilian Aircraft	15.00
Trucks and Busses	15.00
Textiles	5.00
Medicinal	3.00
Other Non-Durable	3.00
Household	6.00
Other Durable Goods	3.00
Other (Not Elsewhere Classified)	3.00

a/ These stowage factors are dependent on the mix of cargoes within the commodity group. In specific cases, the mix variations are sufficient to create modified stowage factors between exports and imports and between trade routes. These exceptions are shown in Appendix D.

The detailed conversion from long tons to measurement tons for each of the trade routes of interest for 1976 is presented in Appendix D. The aggregate long ton and measurement ton levels of general cargo commodities for 1976 are displayed in Figure IIa.

* Modern Ship Stowage, Joseph Leeming, Bureau of Foreign and Domestic Commerce, U.S. Department of Commerce, 1942.

Figure IIa

1976 FOREIGN TRADE GENERAL CARGO

Trade Route	Imports		Exports	
	L/T	M/T	L/T	M/T
4	6,613,460	10,517,340	3,200,510	12,398,520
5-7-8-9	6,038,070	20,510,350	2,750,910	7,316,300
10	2,145,150	5,126,400	1,194,530	2,677,960
12	6,220,190	18,009,150	1,288,380	3,140,260
13	826,150	1,746,500	2,502,590	4,944,090
18	1,214,220	2,346,320	938,330	2,635,400
21	3,107,780	7,110,000	7,421,490	11,583,100
22	3,280,780	5,975,380	1,189,640	2,437,190
29	7,158,190	22,212,610	5,047,758	10,355,720
32	3,672,750	5,481,700	782,900	1,372,580

* Certain ships provide service over multiple trade routes. Although the ships might be carrying cargo in a non-direct route this cargo would be allocated to its appropriate trade route. As an example, consider a ship loading cargo in the Mediterranean for the Gulf but first transiting to Northern Europe to collect cargo for New York. The ship itinerary could be Mediterranean-Northern Europe-U.S. North Atlantic-U.S. Gulf. The cargo would be properly apportioned between Trade Route 5-7-8-9 and Trade Route 13.

Since the waterborne trade projections are based on Census Bureau data, these projections include all government impelled cargo with the exception of Department of Defense cargo. The DOD cargo is not foreign trade and is excluded by its nature. However, Department of Agriculture Public Law 480 cargo, sometimes called "Food for Peace," was specifically screened out of the Census data base because the P.L. 480 exports are dependent on a much different set of influence factors than normal trade. The DOD and P.L. 480 cargoes will be addressed in subsequent paragraphs.

B. Public Law 480 Cargo

P.L. 480 is concerned with exports of U.S. agricultural commodities shipped under authority of the Agricultural Trade Development and Assistance Act of 1954 and subsequent amendments. Over the past 10 years, yearly P.L. 480 shipments have fluctuated from a high of over 17,000,000 long tons to a low of approximately 10,000,000 long tons. Over the same 10-year span, shipments of wheat have consisted of over 70% of total commodities exported under this law. The second largest commodity, rice, has totaled 10% or less of the wheat exported. Informal discussions with the Foreign Agriculture Service of the Department of Agriculture have indicated that total P.L. 480 shipments are expected to approximate 10,000,000 long tons annually through 1976 and that wheat shipments will comprise an equal or larger fraction than before. The predicted destinations and tonnages of the 1976 P.L. 480 exports are:

Destination	Tons	Trade Route a/
South Asia (India, Pakistan, Thailand, Vietnam)	4,000,000	18
Middle East (Turkey, Israel, Arab Nations)	2,000,000	13
Far East (Korea, Taiwan, Japan)	1,500,000	22
Latin America	1,500,000	1, 2
Africa	500,000	14, 15
Misc.	500,000	

a/ The trade routes shown are based upon expected origins and destinations. Other trade routes such as TR 29 carry small quantities and are included in Misc.

Trade routes 18, 13, and 22 are analyzed in this study, and so the P.L. 480 cargoes on these routes will be considered for their impact. Over the past seven years (1964-1970) approximately 50% of the P.L. 480 shipments have been carried by U.S.-flag ships; during this same period of time, 62% of U.S. carriage was in general cargo ships. Under normal circumstances, this same percentage (62% of 50%) could be considered in effect in 1976. However, the U.S. is currently in the process of developing a fleet of bulk cargo ships which could be more appropriate for shipments of part of these cargoes. To account for this, it is assumed that not more than 50% of U.S.-flag P.L. 480 carriage will be on general cargo ships. These factors give rise to tonnages of 1,000,000 long tons on TR 18, 500,000 long tons on TR 13, and 375,000 long tons on TR 22. A conservative stowage factor of 1.1 produces measurement tons of 1,100,000, 550,000, and 412,500 to be added to TR 18, TR 13, and TR 22, respectively.

C. DOD Cargo

The projections of the Department of Defense peacetime shipping requirements for the period of 1972 to 1976 are presented in Part II-A of the SPANS Study. The following additional procedures were necessary so that the data could be used in the merchant fleet analyses:

1. identification of the split between inbound and outbound DOD shipping, and

2. the establishment of relationships between ports of origin and ports of destination.

This latter item permitted the final step of inserting DOD shipping requirements into trade routes.

Because much of the DOD cargo projection data is classified, the details are presented in Appendix E to keep the body of Part II-B unclassified. It is useful here to present the steps performed in the DOD cargo analyses and relate them to Appendix E.

1. The inbound and outbound distribution of cargo between CONUS-Pacific shows a distinct difference between the 1960-1965 average and the 1960-1970 average. The 1960-1965 average was utilized in order to reduce any bias created by the Vietnam conflict. This data is shown in Appendix E, Tables 1, 2a, and 2b.

2. The projections of the percentage of troop support and percentage of military assistance by area are shown in Appendix E, Table 3, while the conversions to measurement tons, also by area, are in Table 4.

3. The percentage split of DOD cargo by CONUS origin, obtained from FY 64 and 65, is shown in Table 5.

4. Tables 6a and 6b applied the percentage of shipping split by origin to the cargo required at the destination.

5. Assuming all military assistance cargo is outbound, and applying the split between outbound and inbound cargo for troop support derived earlier, Tables 7a and 7b show the quantity of measurement tons outbound for each destination and origin pair.

6. Tables 7a and 7b also show the relationship of specific trade routes to origin and destination pairs.

7. Dry bulk going to the Atlantic is assumed 100% outbound but is relatively small under any circumstances.

8. The conversion from fiscal year data to calendar year data was performed by selecting 50% of each adjoining fiscal year and adding to create a calendar year.

Some interesting observations pertinent to the DOD cargo are self-evident from the CY 1976 projection of DOD cargo. The largest fraction of the DOD general cargo is outbound; on the trade routes examined, approximately 80% is outbound. Conversely, the larger fraction of commercial cargo is inbound; on the same trade routes, approximately 63% is inbound. On all of the trade routes of interest, except Trade Route 21 and Hawaii/Guam, the majority of DOD general cargo runs counter to the majority of commercial general cargo.

The outbound DOD cargo shows the following relationship to outbound commercial cargo for those trade routes carrying a significant volume of DOD cargo (expressed in thousands of measurement tons).

Trade Route	Commercial Exports With PL-480	Outbound DOD	DOD Percent Add-on
5-7-8-9	7,316	1,973	27.0
10	2,678	440	16.4
12	3,140	317	10.1
13	5,494	124	2.1
21	11,583	290	2.5
22	2,850	234	8.2
29	10,356	2,335	22.5
Hawaii/Guam	4,706	462	9.8

The inbound DOD cargo on the same routes shows the following relationship to the inbound commercial cargo.

Trade Route	Commercial Imports	Inbound DOD	DOD Percent Add-on
5-7-8-9	20,510	589	2.9%
10	5,126	95	1.9
12	18,009	61	0.37
13	1,747	37	2.1
21	7,110	87	1.2
22	5,975	48	.85
29	22,213	270	1.2
Hawaii/Guam	2,194	140	6.4

D. Domestic Commercial Cargo

In order to incorporate all routes that will contain significant shipping capability, domestic routes from CONUS to Puerto Rico and to Hawaii/Guam have been included. Comprehensive trade forecasts such as those used for foreign trade were not available. Historical data was obtained from the Office of Financial Analysis, Federal Maritime Commission. This data consisted of the waterborne trade carried by liners between CONUS and Puerto Rico and CONUS and Hawaii/Guam during the years 1963 to 1969. No data was available on irregular or tramp carriage.

The development of shipping requirements for these routes required two assumptions:

-- Current relationships between liner carriage and irregular carriage (non-bulk) will continue through 1976.

-- Current fleet operation and utilization on these routes are at least break-even.

Regression analysis of the historical trade data and subsequent projections supplied the following forecast of liner carriage for 1976.

	1969	1976
Puerto Rico	6,995,000 M/T	10,854,000 M/T
Hawaii/Guam	3,782,000 M/T	6,899,000 M/T

Utilizing the two assumptions described earlier with respect to constancy of the relationship between cargo and ships allows the computation of ships on the routes in 1976 as follows:

Trade projected in 1976
Trade carried currently X ships currently on route* = ships projected in 1976

*Only eleven of the thirteen ships on Hawaii/Guam are used as a base.

E. Total Cargo

The foreign trade commercial, DOD, P.L. 480, and domestic commercial cargoes total as follows:

Figure IId

1976 GENERAL CARGO
(000 M/T)

Trade Route	Inbound	Outbound
4	10,517	12,399
5-7-8-9	21,099	9,289
10	5,221	3,118
12	18,070	3,457
13	1,784	5,618
18	2,346	3,735
21	7,197	11,873
22	6,023	3,084
29	22,483	12,691
32	5,482	1,373
Puerto Rico	-	-
Hawaii/Guam	2,334	5,168

III. MERCHANT FLEET FORECASTS

In the past, fleet forecasts accomplished by the Maritime Administration and the Department of Defense were based upon hypothetical ship life rules. The initial effort of Part II-B was to improve the "ship-life" forecasts by ensuring that the data used were current and correct. After completion of this effort, forecasting was undertaken of the impact of the elements of supply and demand in the world shipping market on the U.S. Merchant Marine.

In all, four forecasts were developed for the SPANS Study:

(1) Pessimistic Fleet,

(2) Programmed Fleet,

(3) Economic Fleet, and

(4) Excursion of Economic Fleet

The first two fleets were based upon ship life rules; they differ from each other only in that the pessimistic fleet assumes no new construction beyond vessels currently contractually obligated whereas the programmed fleet contains general cargo ships currently programmed for construction and operation by 1976 under the President's Maritime Program. The economic fleet and its excursion, which use the programmed fleet as a base in analyzing the impact of economic factors on the U.S. Merchant Marine, differ as to the market penetration which is assumed for U.S.-flag operators.

A. Pessimistic and Programmed Fleet Forecasts

The Maritime Administration Operational Ship File and the Navy's Shipping Information System were used as a base to identify the current general cargo fleet, general cargo vessels under construction, and general cargo vessels under contract for construction. Against this information, the following shiplife rules were applied:

(1) Vessels to be phased-out 25 years from date of construction,

(2) For vessels which have undergone major reconstruction, vessels to be phased-out 15 years from date of reconstruction or 25 years from date of construction, which ever is later.

For the SPANS Study, major reconstruction was defined as any ship change which significantly modifies the ship type or ship capacity and has in the past exceeded $2.25 million.

Applying these rules against the current fleet provided a forecast for 1976 which was divided into shipping company fleets. The fleets of each of 15 companies were sent to that company for verification or correction. The following companies responded to this information request:

American Mail Line, Ltd.
American President Lines, Inc.
Lykes Bros. Steamship Co., Inc.
Moore-McCormack Lines, Inc.
Pacific Far East Line, Inc.
Prudential-Grace Lines, Inc.
Sea-Land Service, Inc.
Seatrain Lines, Inc.
States Marine-Isthmian Agency, Inc.
States Steamship Company
United States Lines, Inc.
Waterman Steamship Corporation

The information from these companies was integrated into the original forecast along with the most recent periodic reports from the Maritime Administration Office of Ship Construction, "Shipbuilders Progress Report" and the Maritime Administration Division of Statistics, "Quarterly Ship Employment Report" and "Monthly Status of the Merchant Marine". The result was the pessimistic forecast summarized in Figure IIIa.

The vessels added to the pessimistic fleet to form the programmed fleet are those for which the Maritime Administration has received substantial corporate interest and in some cases preliminary subsidy applications. These additions are:

Number	Type	Design
6	Containership	SL-7
5	LASH	C8-S-81d
2	LASH	C8-S-81b
4	RO/RO	Ponce de Leon Class

The programmed fleet is also shown in Figure IIIa.

Figure IIIa

1976 U.S. FLAG GENERAL CARGO FLEET

Ship Type	Pessimistic Fleet	Programmed Fleet
Freighter	143	143
Containership	118	124
Partial Containership	18	18
Combination Passenger/Cargo Ship	4 a/	4 a/
Barge Carrier	21	28
Roll-On/Roll-Off Ship	5	9
	309	326

a/ Two ships, the Monterey and the Mariposa, are not included.

B. Economic Fleet Forecast

The economic fleet developed for the SPANS Study can be defined as a U.S. general cargo fleet which is economically supportable through available cargoes on each trade route over which that fleet is distributed.

In addition to the projection of cargoes already described, the creation of the economic fleet required:

-- identification of the number of vessels of the programmed fleet which are to be operated on the different trade routes;

-- measurement of the annual cargo carrying capability of each ship type on each trade route;

-- estimation of the market penetration which U.S. Flag general cargo ships can achieve on each trade route;

-- calculation of the breakeven vessel utilization (% of annual carrying capacity realized)for every trade route; and

-- identification of the vessels which are most compatible with the cargoes of each trade route.

With this information, calculations can be made showing whether there is an excess of U.S. Flag general cargo vessels on the various trade routes or whether a deficit exists. Vessels can be shifted from one trade route to another to offset any imbalances. The specifics of the development of this information are presented in the next several sections.

It should be noted at this point that the economic fleet forecast involved 13 of 62 U.S. foreign trade routes and the domestic routes to Puerto Rico and Hawaii/Guam. These 13 trade routes represented 62.5% of all foreign trade general cargo moving in and out of the United States as projected for 1976, and 2/3 of the U.S. foreign trade general cargo fleet. For the remainder of the trade routes, the pessimistic/programmed fleet forecast was used. (On these other trade routes, there was no differences between the pessimistic and programmed fleets.)

1. Vessel Distribution Over Trade Routes of Interest

The number and types of vessels expected to be operating on the trade routes of interest, based upon current or proposed operations, are as follows:

Figure IIIb

Programmed Fleet on Foreign and Domestic Trade Routes of Interest a/

Vessel Type	Trade Routes												
	4	5-7-8-9	10	12	13	18	21	22	29	32	Puerto Rico	Hawaii /Guam	Total
Freighter	2	0	7	7	5	0	0	15	24	0	0	0	60
Containership	0	24	9	16	0	0	0	0	29	0	17	13	108
Partial Containership	0	0	0	0	2	2	3	4	2	0	0	0	13
Barge Carrier	0	0	5	0	0	5	9	0	6	0	0	0	25
Roll-On/ Roll-Off Ship	0	0	0	0	0	0	0	0	4	0	3	0	7
Total	2	24	21	23	7	7	12	19	65	0	20	13	213

a/ The differences between the programmed and pessimistic fleet on these routes are the addition of six containerships (SL-7) on Trade Route 12, six LASH ships on Trade Route 21, one LASH ship on Trade Route 18, and four roll-on/roll-off ships on Trade Route 29. The containerships and LASHs have been arbitrarily distributed, based on a preliminary assessment of excess cargo on routes suitable for these classes of ships. The roll-on/roll-off ships placements are based on actual subsidy applications which have been filed with the Maritime Administration.

2. Annual Carrying Capacity

The productive capacity of these ships can be calculated in two basic ways. The first method generates a theoretical maximum capability and is based on the following assumptions:

(a) Each trade route consists of a two port itinerary;

(b) Port time depends solely on load/off-load capability of the ships;

(c) Each trade route has a mean distance as follows:

Figure IIIc

Trade Route	One Way in Nautical Miles
4	1,400
5-7-8-9	3,500
10	5,000
12	12,200
13	6,300
18	15,500
21	6,200
22	11,600
29	7,000
32	4,000

(d) Sea time is proportional to ship speed and mean distance.

The second method is based on historical data for actual voyage times of specific ships on specific routes. The annual productive capacities were totaled for each ship type for each route. Specific historical data and sources are listed in Appendix F. The voyages per year, a measure of annual productivity, for each method are shown in Figure IIId. It is important to note that for a fixed number of ships, a substantial variation in fleet annual capacity can be obtained by shifting ships onto different trade routes. The number of voyages per year is directly proportional to annual capacity; longer routes generate lower capacities.

For the remainder of this analysis, the current practice factors will be used. These voyages/year calculations result in the annual carrying capacities, as shown in Figure IIIe.

3. Penetration

Current data have been obtained relative to U.S. Flag penetration (percent of total cargo carried) into the commercial cargo. Since the President's Maritime Program of shipbuilding instituted a major effort in market development, it can be assumed that by 1976 U.S. Flag penetration would increase. Extensive discussions with industry representatives have set the projected trade penetration factors as reasonable standards. Figure IIIf shows the current penetration compared to the projected penetration for each of the trade routes.

Figure IIId

Trade Route	Vessels	Voyages/Year Current Practice b/	Theoretical
4	Freighter	13.4	22.0
5-7-8-9	Containership	12.5	19.9
	Freighter	7.5	14.6
10	Containership	10.0	14.7
	Freighter	6.1	10.6
	Barge Carrier	9.7	16.0
12	Containership	7.0	7.2
	Freighter	5.6	5.3
13	Freighter/Partial Containership	4.7	9.0
18	Partial Containership	2.5	4.1
	Barge Carrier	3.75	5.7
21	Freighter	6.25	8.7
	Barge Carrier	10.0	13.2
22	Containership	8.75	8.7
	Freighter	3.6	6.0
29	Containership	12.0	12.4
	Freighter	4.8	8.9
	Barge Carrier	8.3	11.9
32	Freighter	6.0 a/	

a/ Since there are no U.S.-Flag operators currently on Trade Route 32, last available data (1967) was used.

b/ An apparent discrepancy exists between the current practice on Trade Route 29 and Trade Route 12. Although Trade Route 12 sea distance is considerably greater than Trade Route 29 there are more voyages per year shown on Trade Route 12. This fact stems from the extensive time spent between foreign ports on TR 29. These ships are probably spending an inordinate amount of time servicing Southeast Asia. All companies that reported data showed similar situations.

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Figure IIIe

ONE-WAY ANNUAL CARRYING CAPACITY
(000 M/T)

Trade Routes

Ship Type	4	5-7-8-9	10	12	13	18	21	22	29	32	Puerto Rico	Hawaii/ Guam
Freighter	547	0	568	568	1,118	0	0	777	1,923	0	0	0
Containership	0	6,442	2,047	2,130	0	0	0	0	7,362	0	17,365	9,511
Partial Containership	0	0	0	0	603	91	315	589	0	0	0	0
Barge Carrier	0	0	1,254	0	0	692	3,183	0	1,290	0	0	0
Roll/On-Roll-Off Ship	0	0	0	0	0	0	0	0	1,016	0	8,031	0
TOTAL	547	6,442	3,869	2,698	1,721	783	3,498	1,366	11,591	0	25,396	9,511

Figure IIIf

Trade Route	Current Penetration	Projected Penetration
4	14.5%	20%
5-7-8-9	24.9%	30%
10	26.8%	30%
12	15.6%	20%
13	20.3%	20%
18	32.0%	35%
21	3.0%	10%
22	16.3%	20%
29	23.5%	25%
32	0.0%	20%
Puerto Rico a/	100.0%	100%
Hawaii/Guam a/	100.0%	100%

a/ Protected by cabotage laws.

In order to illuminate the impact of varying levels of penetration, a set of penetration levels ranging from 20 to 45 percent is used. The fleet utilization, in terms of percentage of annual carrying capacity which will be utilized, is displayed as a function of penetration into the commercial cargo projected. The equation used to derive this table is:

$$\% \text{ utilization} = \frac{(\% \text{ penetration})(\text{M/T of trade route cargo})}{(\text{M/T of annual carrying capability of all ships in trade route})}$$

Figure IIIg

1976 PERCENT PROGRAMMED FLEET UTILIZATION

COMMERCIAL EXPORTS

Trade Route	4	5-7-8-9	10	12	13	18	21	22	29	32
% Penetration										
20	100	22.7	13.8	23.3	57.7	67.5	66.2	35.7	16.6	100
30		34.1	20.8	35.0	86.3	100	99.3	53.6	24.9	
40		45.4	27.6	46.6	100		100	71.4	33.2	
45		51.1	31.1	52.4				80.3	37.4	

COMMERCIAL IMPORTS

20	100	63.6	26.2	100	20.1	59.9	37.1	87.5	38.2	100
30		95.5	39.5		30.1	89.9	60.6	100	57.3	
40		100	52.4		40.2	100	74.2		76.4	
45			59.1		45.2		83.5		86.0	

The inclusion of PL-480 cargo projected to be carried on U.S.-Flag general cargo ships, as well as the estimated dry bulk carried on Trade Route 29 (on general cargo ships), generates the following modified utilization rates:

Figure IIIh

1976 PERCENT PROGRAMMED FLEET UTILIZATION

COMMERCIAL EXPORTS PLUS PL-480

Trade Route	13	18	22	29
% Penetration				
20	89.1	100	65.9	22.8
30	100		82.4	31.1
40			100	39.4
45				43.6

U.S.-Flag commercial shipping will carry between 50 and 100% of the DOD cargo; the 50% minimum is a legislative mandate. To demonstrate the impact of DOD cargo, a matrix can be created showing percent DOD cargo carried as one axis, percent penetration into commercial trade as the other, with the result being fleet utilization at the intersection. For this effort, Trade Routes 5-7-8-9, 10, and 29 were selected. (See Figure IIIi) In the economic fleet analysis, 75% of DOD cargo on each route was assumed to be carried by U.S.-Flag general cargo commercial ships.

4. Economic Utilization

To determine the appropriate number of ships for the economic fleet on each trade route, break-even utilization factors were calculated. The initial set of breakeven factors was calculated from the economic analysis accompanying subsidy applications from industry. These values were modified by industry analysis and the new numbers were critically evaluated.* Since many trade routes contained a mix of ships, a weighted factor was developed. One additional limit was imposed. A lower bound of 50% was established in order to maintain a conservative approach. These utilization factors are shown in Table II-1.

5. Compatibility of Vessels and Trade Route Cargoes

When vessels were to be added or deleted from a trade route, the following priorities (most desired to least desired vessel type) were used:

*Appendix F list factors and their industry sources.

Figure IIIi

% of DOD Cargo	% Commercial Penetration 20	30	40	45
Trade Route 5-7-8-9 Exports				
0	22.7	34.1	45.4	51.1
50	38.0	49.4	60.8	66.4
75	45.6	57.0	68.5	74.0
100	53.3	64.7	76.1	81.7
Trade Route 5-7-8-9 Imports				
0	63.6	95.5	100	100
50	68.2	100		
75	70.5			
100	72.8			
Trade Route 10 Exports				
0	13.8	20.8	27.6	31.1
50	19.5	26.5	33.4	36.8
75	22.4	29.3	36.3	39.7
100	25.2	32.1	39.1	42.5
Trade Route 10 Imports				
0	26.2	39.5	52.4	59.1
50	27.6	40.9	54.0	60.6
75	-	-	-	-
100	29.0	42.2	55.5	62.1
Trade Route 29 Exports				
0	22.8	31.1	39.4	43.6
50	32.4	41.2	49.5	53.7
75	37.9	46.2	54.5	58.7
100	42.9	51.2	59.6	63.7
Trade Route 29 Imports				
0	38.2	57.3	76.4	86.0
50	59.5	58.6	77.7	87.3
75	-	-	-	-
100	40.7	59.8	79.0	88.6

Figure IIIj

Vessel Type	Trade Routes 4	5-7-8-9	10	12	13	18	21	22	29	32	Puerto Rico	Hawaii /Guam
Freighter	1	3	2	2	3	3	3	3	2	1	3	2
Partial Containership	2	2	3	2	3	2	2	2	3	2	-	-
Containership	-	1	1	1	2	-	-	-	1	-	1	1
Barge Carrier	-	-	1	1	1	1	1	1	1	-	-	-
Roll-On/Roll-Off Ship	-	-	-	-	-	-	-	-	2	-	2	-

6. Analysis

The number and type of ships required for each trade route were determined by a simulation technique wherein each trade route commenced with the programmed fleet as a baseline, with high priority ships added or low priority ships deleted, one by one, until the required utilization was reached. This process has been plotted on Table H-1 and the graphs in Appendix H. Of the trade routes analyzed, seven required more ships than are currently scheduled to operate on that route, based on the programmed fleet projections and distributions. The remaining five routes required fewer vessels. The seven trade routes required 63 additional vessels and the five trade routes had an excess of 25 vessels. These 25 vessels were shifted to one of the seven trade routes to offset imbalances. Also, an additional 38 new construction vessels were required to meet the cargo movement demands. All of the old vessel redistributions and new vessel allocations were based upon the vessel priorities established in Figure IIIj.

Figure IIIk shows the economic fleet by trade route and ship type developed through the above procedure. For comparison purposes, the programmed fleet, which was the baseline mix, is shown in parentheses. An excursion analysis was conducted to test the sensitivity of the results to predicted market penetration levels. Appendix G shows the economic fleet by trade route and ship type assuming that current penetration levels are maintained and not increased through 1976.

The last step in this analysis is the inclusion of vessels from all other foreign and domestic trade routes not included in the economic fleet analysis. The vessels to be included are those projected in the programmed fleet projection. However, the programmed fleet vessels include 27 freighters, 4 containerships, and 2 RO/ROs currently under time charter to the Military Sealift Command and not supported on the other trade routes. These vessels are therefore subtracted from the programmed fleet. (See Figure IIII)

Figure IIIk

ECONOMIC FLEET WITH PROJECTED PENETRATION
(Programmed Fleet in Parentheses)

Trade Route	Penetration	Utilization	Freighters	P. Containers	Containers	Barge Carriers	Ro/Ro	Total
4	20%	80%	10 (2)	0 (0)	0 (0)	0 (0)	0 (0)	10 (2)
5-7-8-9	30%	85%	0 (0)	0 (0)	22 (24)	0 (0)	0 (0)	22 (24)
10	30%	70%	1 (7)	0 (0)	5 (9)	2 (5)	0 (0)	8 (21)
12	20%	50%	7 (7)	0 (0)	23 (16)	7 (0)	0 (0)	37 (23)
13	20%	70%	5 (5)	1 (2)	0 (0)	0 (0)	0 (0)	6 (7)
18	35%	50%	0 (0)	2 (2)	0 (0)	18 (5)	0 (0)	20 (7)
21	10%	70%	0 (0)	0 (3)	0 (0)	5 (9)	0 (0)	5 (12)
22	20%	50%	15 (15)	4 (4)	0 (0)	4 (0)	0 (0)	23 (19)
29	25%	50%	13 (24)	0 (2)	33 (29)	13 (6)	4 (4)	63 (65)
32	20%	90%	6 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (0)
Puerto Rico	100%		0 (0)	0 (0)	28 (17)	0 (0)	3 (3)	31 (20)
Hawaii/Guam	100%		0 (0)	0 (0)	20 (13)	0 (0)	0 (0)	20 (13)
TOTALS			57 (60)	7 (13)	131 (108)	49 (25)	7 (7)	251 (213)

Figure IIIl

Ship Type	Programmed Fleet Vessel from Non-Analyzed Trade Routes		Currently Non-Supported Time Chartered Vessels		Vessels to be added to Economic Fleet
Freighter	83		27		56
Containership	16		4		12
Partial Containership	5		0		5
Combination Passenger/ Cargo Ship	4	(less)	0	(equals)	4
Barge Carrier	3		0		3
Roll-On/Roll-Off Ship	2		2		0
	113		33		80

IV. RESULTS

The economic fleet analysis and excursion have produced the following results regarding the size, composition, and productivity of the U.S. Merchant Marine in 1976. These results are compared against the pessimistic and programmed fleet projection in number of ships; all four fleets are compared against the latest type of breakbulk freighter C5-S-75a, on a hypothetical route. The basic differences in composition between the fleets created through age rules (Pessimistic, Programmed) and the fleets generated through economic analysis (Economic, Excursion) are the elimination of low productivity ship types and replacement or addition of high productivity ship types.

The construction of 15 (Excursion) to 31 (Economic) barge carriers can be easily accomplished through the use of Avondale Shipyards, Inc. (15 by 1976), Sun Shipbuilding and Dry Dock Co., National Steel and Shipbuilding Co., and the Quincy Shipbuilding Division of General Dynamics.

These ships could be procured by Prudential-Grace (5) and Waterman (2) for trade route 12; American Export Lines (4), American President Lines (6), Central Gulf (1), Waterman (2) for trade route 18; Lykes (1), and Waterman (3) for trade route 22; and Pacific Far East (2) States Steamship (2), American President Lines (2) and Waterman (1) for trade route 29.

Figure IVa

FLEET FORECASTS

	Pessimistic		Programmed		Economic		Excursion	
Ship Type	Number	Equiv a/	Number	Equiv a/	Number	Equiv a/	Number	Equiv a/
Freighter	143	87.61	143	87.61	113	73.81	100	67.19
Containership	118	120.96	124	133.38	143	172.71	133	152.01
Partial Containership	18	12.20	18	12.20	12	8.30	12	8.30
Comb. Pass./ Cargo Ship	4	2.60	4	2.60	4	2.60	4	2.60
Barge Carrier	21	35.18	28	49.67	52	99.35	36	66.23
Roll-on/Roll-off	5	10.23	9	17.03	7	14.83	7	14.83
Total	309	268.78	326	302.49	331	371.60	292	311.16

a/ C-5-S-75a ship equivalents. The calculation concerning the numbers of C-5-S-75a equivalents is based on a one way trade route of 10,000 miles, a two port itinerary, minimum possible port time, and a 350-day year. In all calculations, actual ship capabilities were used.

V. SUMMARY

Part II of the Sealift Procurement and National Security (SPANS) Study generates four possible merchant fleets for the year 1976. These fleets can be ranked in the following order.

1. The Pessimistic fleet consists of the merchant fleet in operation in 1971 (including ships under construction) projected to 1976. Ships over 25 years of age are phased out except in cases where major conversions have taken place, thus increasing presumed useful life by 15 years. This fleet has been further modified by accepting industry information with respect to additional phaseouts or trade route changes. No additional requirements for ships have been considered.

2. The Programmed fleet is the Pessimistic fleet plus certain additional ships planned for construction under the President's Maritime Program for which there exist replacement obligations, subsidy applications, or serious statements of intent to construct.

3. The Excursion fleet starts with the Programmed fleet as its base, projects U.S. waterborne trade to 1976, maintains current U.S. share of market, establishes the ship utilization requirements in order to break-even (point at which revenues cover full costs) on specific routes, and determines the merchant fleet size and composition in 1976 based on these assumptions.

4. The Economic fleet is derived in a manner similar to that which produced the Excursion fleet. It is assumed that a limited increase in U.S. market share is achieved as a result of accelerated government/industry cargo promotion programs.

Figure IVa indicates that the fleet productivities measured in C5-S-75a ship equivalents rank in the same order as above although the fleet sizes in terms of numbers of ships do not.

The analytic techniques developed to create the Economic fleet and the excursion on the Economic fleet represent a more sophisticated form of fleet forecasting.

The Economic fleet forecast is driven by the following variables:

-- market penetration

-- breakeven rates for ship types

-- annual carrying capacity (involving transit times and numbers of port calls)

-- redistribution of vessel types to different routes based on cargo mix

-- addition of new technology vessel types to different routes based on cargo mix

All of the variables involve assumptions that are subject to error, although they have been checked with industry sources and against historical experience for reasonableness.

The market penetration assumption was considered to be particularly significant. An excursion was therefore performed to illustrate the difference between penetration (market share) based on the National Maritime Program and current U.S.-Flag penetration based on the various trade routes.

The break-even assumption involves a paradox. Break-even operations (zero profit or loss), if experienced for any length of time by the entire industry, would represent an unhealthy situation. The break-even assumption is necessary, however, because it represents the level of activity which will maintain a ship in operation at least for the short run. Break-even operations create an environment in which it is probable that existing ships would be retained, but unlikely that additional ships would be built. Therefore, the number of ships a given pool of cargo can sustain, and the number of ships such cargo would cause to come into existence are, in all likelihood, quite different.

The other variables exercise similar influence over the forecasted fleet size and therefore the validity of the forecast must always be considered as constrained by their amplitude.

Part III of SPANS is constructed to accept a range of merchant fleets for examination. In order to insure analysis of the most conservative nature, Part III should employ the "Pessimistic" fleet as a lower productivity boundary and the "Economic" fleet as an upper boundary for the same measure.

APPENDIX A

TRADE FORECASTING MODEL

A LONG-RUN PREDICTION OF UNITED STATES SEABORNE TRADE FROM 1970 TO 1990

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CHAPTER I

Summary

A. Summary of Results

This report sets forth predictions of annual tonnage of U.S. Waterborne foreign trade for 39 commodity groups with 19 major regions of the world for the next 20 years. These predictions have been translated into a forecast of movements over 39 of the major U.S. foreign trade routes.

The trade predictions were based on an analysis of U.S. foreign trade between 1963 and 1969. This analysis assumed that Gross National Product (GNP) is the major determinant of the demand for imports. Accordingly, recent historical relationships between various U.S. import flows and the U.S. GNP were examined along with the relationships between various U.S. export flows and the appropriate foreign GNP's. Subsequently, forecasts of the GNP's of the U.S. and of foreign countries were made and U.S. foreign trade was predicted annually for two time periods: 1970 to 1975 and 1976 to 1990. The 1970 to 1975 period prediction depends very heavily on the 1963 to 1969 historical relationships between trade and GNP. The longer term prediction, from 1976 to 1990, is based on predicted changes in the relationships between GNP and trade as well as on the historical relationship of the 1963 to 1969 period.

The results of this forecasting technique allow the user to obtain an overview of total U.S. foreign trade; make predictions of the composition of that trade by commodities and regions; and understand

the major causes of the predictions. This approach makes it possible to include predictions of U.S. foreign trade for a large number of individual commodities to individual regions. By the inclusion of predictions for many commodities that were previously considered too unimportant and numerous to be taken into account, a more realistic forecast should result.

Tables 1 and 2 present the total tonnages of U.S. seaborne imports and exports for major regions of the world in 1969, predictions of them for 1975 and 1990, and the average annual growth rates of these items from 1969 - 1975 and 1975 - 1990. Total U.S. foreign trade is predicted to grow slightly faster than U.S. GNP. The total tonnages of U.S. exports and imports are expected to grow at roughly the same rates although the commodity and regional contributions to each varies substantially.

The annual percentage increases in trade broken out by region show the areas from which the tonnages of U.S. trade are growing most rapidly. U.S. import tonnages from Eastern Asia, the Caribbean, Developing Africa, Mediterranean Europe, North Europe and Central America are predicted to have relatively high growth rates. U.S. imports from East Coast South America, West Coast South America, North Africa, and the Middle East are predicted to grow more slowly. Growth rates of U.S. tonnage exports to Japan, East Asia and the Caribbean are predicted to grow most rapidly while those for Canada and Northern Europe are predicted to grow more slowly.

Trends in total U.S. imports and exports can be analyzed by considering the trends in U.S. imports and exports for four major commodity groups: Food, feed and beverages; industrial supplies; capital goods; and consumer goods. Table 3 presents total tonnages of U.S. imports and exports by these commodity groups and Tables 4-1 to 4-8 contain summaries of trade in these commodity groups by major would areas.

Total U.S. imports of food, feed, and beverages are predicted to grow at roughly the rate of U.S. GNP but are expected to have a declining share in the percentage of total U.S. imports. Total tonnage imports of food, feed and beverages show large increases from such areas as East Coast South America, West Coast South America, Central America, and the Caribbean because of a projected large increase in U.S. demand for fresh foods from these areas. U.S. imports of food, feed and beverages show similarly large increases from such developed areas as North Europe, Mediterranean Europe and Japan because of projected increases in the demand for manufactured foods from these areas.

U.S. imports of capital goods are predicted to come primarily from developed regions of the world which have the capability to deal with high technology products and which have cheaper labor than the United States. U.S. imports of capital goods are predicted to continue to rise rapidly although at a slowly decreasing rate over the next 15 years. The average rate of growth of capital goods during the 1963 to 1969 period was roughly 12% per year and it is predicted that this rate of growth will drop to about 7 to 8% in 1975 and to about 6% by

1985. The most striking increases are projected to come from Japan and East Asia.

Substantial increases in U.S. imports of consumer goods are predicted, particularly from developed areas of the world. The U.S. has historically shown a high propensity to buy finished consumer goods out of its additional income. Although the rates of growth projected for these items are smaller than they have been during the past seven years, U.S. imports of consumer goods should continue to grow rapidly with increases in U.S. GNP.

U.S. exports of food, feed and beverages were predicted to grow at about the rate of increase of world GNP (around 6% per year). As U.S. processed foods take a larger and larger share of U.S. exports in this commodity group, the rate of growth of exports of this group should increase. U.S. exports of food, feed and beverages to most regions grow at a moderately high rate because high growth rates for U.S. exports of manufactured foods are predicted in addition to the more moderate growth rates for U.S. exports of grain and crude materials. The most substantial increases in U.S. exports in tonnage terms are those to East Coast South America, Japan, and East and South Asia. The increases in U.S. exports to Japan are caused primarily by the prediction of high GNP growth rates for Japan during the next two decades.

U.S. exports of industrial supplies depend very heavily on the assumptions that are made about U.S. exports of coal, iron and semi-finished building materials such as plywood. Coal and iron exports were generally predicted to increase at rates of growth just below

the rates of growth predicted for foreign economies. U.S. exports of semiprocessed materials, particularly to Japan and East Asia, were expected to increase at faster rates. Consequently, large increases were predicted for U.S. exports of industrial supplies to Japan. Most of these exports consist of coal and building materials such as plywood. Other areas that are predicted to have large increases in U.S. seaborne exports are East and West Coast South America, the Caribbean, and East Asia.

U.S. exports of capital goods declined substantially during the 1963 to 1969 period. It appears that this was due to the heavy demands on U.S. capital goods industries from the U.S. domestic economy and a substantial increase in foreign competition in the capital goods market during this period. For this reason, a decline in U.S. exports of capital goods was predicted for the next 5 years. Because advancing U.S. technology was assumed to provide markets for U.S. capital goods in the future, this trend was reversed and, by 1985, it was predicted that U.S. exports of capital goods will once again begin to grow. Modest increases are shown for East and West Coast South America and East Asia.

U.S. exports of consumer goods, particularly household goods grew spectacularly (by as much as 20 to 25% annually) during the 1963 to 1969 period, it was assumed that these growth rates would taper off in the future. Nevertheless, these exports will continue to constitute one of the largest sources of growth of U.S. total exports. Large increases in U.S. exports are predicted for the Caribbean, Middle East, East Asia and the East Coast of South America. Northern Europe and Mediterranean Europe are also predicted to substantially increase their imports of U.S. consumer goods.

CHAPTER II

AN ANAYSIS OF RECENT U.S. OCEANBORNE TRADE

The quality of the predictions provided in this report depends on three operations: an examination of the causes of U.S. foreign trade in the past; a prediction methodology that properly uses both of the previous elements. This chapter analyses and discusses the causes of recent U.S. oceanborne trade by commodities and regions which have been used as the basis for making predictions of similar trade in the future.

The prediction of future U.S. foreign trade requires the specification and measurement of elements of causation in economic activity. Although the causes of foreign trade encompass a large variety of influences including economic, social, political and psychological considerations, the scope of the research for this project has been limited to economic influences. This approach was taken partly because expansion of the research to include other considerations is technically impractical from a standpoint of data gathering, and partly because the primary influences are economic ones.

Economic factors which influence the size and configuration of foreign trade consist primarily of demand and supply variables. Past research in the measurement of causation of foreign trade suggests that the demand elements are more important than supply factors. Such research also suggests that the primary determinant of the demand for imports is a region's real income or gross national product (GNP).

er demand variables (such as prices or capacity utilization) may in theory also be included as determinants of import demand. However, future values of these variables are difficult to predict. Because of this difficulty and because other independent research has demonstrated that the influence of these variables has not been great, they have been excluded. Accordingly, the economic demand for imports has been assumed to cause U.S. foreign trade and GNP has been assumed to be the primary determinant of that demand. This implies that U.S. imports depend on U.S. GNP and U.S. exports to a given foreign region depend on the GNP of that particular region.

The Concept of Income Elasticities:

In economic jargon and "elasticity" is defined as the dimensionless ratio of the percentage change in a given entity which corresponds to a given percentage change in a related entity. An "income elasticity" is defined as the percentage change in some entity which corresponds to (or is brought about by) each 1% change in National Income or Gross National Product (GNP). In this study, income elasticities have been used to express the relationship between imports and GNP. An income elasticity is a number that relates a percentage change in U.S. foreign trade to a percentage change in GNP. For example, and income elasticity of 1 means that as income rises 1%, that imports rise by 1%. An elasticity of 2 implies that for 1% GNP increases, imports will increase by 2%. An income elasticity of zero means that imports of the commodity will remain constant no matter what changes occur in GNP: GNP will have no effect in imports.. An elasticity of minus 1 means that for

a 1% GNP increase, imports will decline by 1%.

It is useful to examine the economic significance of these four examples and to point out places where such elasticities are found. One might expect to find an elasticity of around 1 for imports of raw materials that grow in proportion to national output. An example of such a commodity might be one that was required as an input to key sectors of an economy and could not be obtained domestically.

Since people frequently spend more than a proportional amount of an increase in their income on luxury items, one would expect to find an income elasticity of 2 or 3 for items such as finished consumer products.

An elasticity of zero would be expected for an import that filled a demand that was not growing.

When demand declines as GNP increases, negative elasticities are discovered. For example, an elasticity of -1 for a given import implies that for every 1% increase in GNP there is a 1% decline in that import. Cases of negative growth are expected to occur infrequently. It is rare that a consumer wants less of any commodity as his income rises. However, there may be several reasons for this phenomenon to occur in U.S. foreign trade. In the case of U.S. exports one may find negative elasticities. For example, a trading partner of the United States could increase its total imports of a certain commodity and simultaneously reduce the U.S. share of such imports. Hence, a negative elasticity for the foreign demand for U.S. capital goods may reflect more a change in competitive position than a change in the total demand for imported capital goods. On the other hand, a negative demand for

imports of capital goods may occur if a country has developed the domestic capability to produce those same commodities and has introduced a set of tariffs to discriminate against all foreign imports. For both of these cases, either negative elasticities, zero elasticities or small positive elasticities may be found.

The Choice of the Data:

The first step in testing the hypothesis that GNP is the major determinant of the commodity by region tonnages of U.S. foreign trade consisted of finding a suitable data base. Time series data on U.S. foreign trade disaggregated by commodity and region were required for the longest time period available. Particular interest in the ability to study the division of U.S. trade between air and sea transportation in the future required comparable commodity and regional data on trade carried by both of these modes.

Since the Department of Commerce recently changed the commodity classifications, time series data for five to seven years for U.S. foreign trade on a highly disaggregated commodity basis that allowed homogenous commodity groupings for air and sea modes of carriage were not available from that source. The most recent Department of Commerce data were carefully analysed. The updated time series data in this form were obtained from the Planning Research Corporation for a seven year time period (1963-1969), PRC also provided insturctions which will be used to update this data base for future use. GNP data were obtained by adding various national GNP's obtained from standard sources into regional GNP's.

The Choice of Commodity Groups:

Two different sets of commodity groupings have been used repeatedly in this report. Items in the first set have been called "final end use commodities". Final end use commodities consist primarily of four major commodity groupings: food, feed and beverage; industrial supplies; capital goods; and consumer goods. "Government" and "all other " are two residual categories. Both of these categories are small and are only rarely of interest.

The second set of commodity groups has been called "intermediate end use commodities." This group consists of 37 major commodity groupings and the two residual groups that are in the final end use group. The end use commodity categories attempt to separate commodities into moderately homogenous aggregates according to the ultimate consumers in an economy. (Table 7 shows how the intermediate end use commodity groups can be summed to form the final end use commodity groups).

The Choice of Economic Regions:

In order to reduce the scope of this project to a more manageable level the various nations were aggregated into economic (or trade) regions. These regions were chosen carefully on the basis of the similarity of their development levels, their demand patterns, and their geographical proximity. The resulting regions are: U.S.A; Canada; Eastern South America; Western South America; Caribbean; Mexico; Northern Europe; Mediterranean Europe; United Kingdom; North Africa; Developing Africa; Republic of South Africa; Middle East; Japan; East Asia; South

Asia; Communist Asia; Communist Europe; and Oceania.

Tests of the Income Elasticities:

The assumption that GNP determines the demand for imports with a constant income elasticity was tested by utilizing regression analysis the technique used consisted of fitting a straight line to a series of the logarithms of both GNP and the various commodity trade flows under consideration to determine the nature and strength of the relationship between the percentage changes in both variables. By definition, the slope of the fitted regression line is the income elasticity for that commodity.

The 1963-1969 income elasticities obtained as results of these regressions were accepted and used as a basis for making the prediction in the initial years if the regression results obtained were judged to be statistically significant. (Tables 8 and 9 contain the regression results). A standard "t statistic" test was utilized to make the determination of significance by examining whether the least squares fit income elasticity was different from zero. If the elasticity is zero, no relationship between GNP and trade is indicated. Since the available trade data base consisted of seven observations and was analyzed using one causal variable, a statistic of 2.0 or greater (which indicated that the income elasticity was different from zero with a probability of less than 95%) was accepted as a strong level of significance and 1.5 was used as a minimum level of acceptance.

Tables 8 and 9 present U.S. GNP import elasticities and foreign GNP export elasticities for 1963 to 1969 for the six major final end use commodity groups for all regions that were accepted. The non-

underlined numbers are the elasticities for which the "t statistics" of the corresponding regressions were 2.0 or greater. The numbers that are underlined are the income elasticities for those cases where the "t statistic" was greater than 1.5 but less than 2.0. For those cases where the "t statistic" was less than 1.5, the corresponding income elasticity was left blank in the tables. There were few cases where significant regression results were not obtained.

Table 1

Total U.S. Oceanborne Imports from Major World Areas in 1969, 1975 and 1990
(In Thousand of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	33,338.6	36,871.3	66,415.7	1.7	4.0
Eastern South America	89,221.4	113,157.7	327,230.9	4.0	7.4
Western South America	6,263.9	7,589.1	20,303.3	3.3	6.8
Caribbean	56,866.2	75,712.7	218,946.9	4.9	7.3
Central America	2,891.8	3,891.9	10,790.2	5.1	7.0
Mexico	6,219.1	6,731.2	10,243.5	1.3	2.8
Northern Europe	13,587.5	17,643.2	36,476.0	4.4	5.0
Mediterranean Europe	7,904.0	11,095.1	21,910.1	5.8	4.8
United Kingdom	3,193.8	4,700.9	10,933.3	6.7	5.8
North Africa	7,424.3	10,381.9	30,569.0	5.7	7.4
Developing Africa	8,862.7	13,063.5	39,240.7	6.7	7.4
Republic of South Africa	978.0	1,103.5	2,101.4	2.0	4.4
Middle East	17,044.3	22,088.8	63,876.6	4.4	7.3
Japan	9,109.2	12,193.4	31,841.2	5.0	6.8
East Asia	8,997.9	10,541,7	18,087.3	2.7	3.4
South Asia	884.5	1,035.2	1,776.1	2.7	3.4
Communist Europe	945.7	1,535.2	4,555.6	8.4	7.5
Oceania	3,073.1	4,561,4	11,354.2	6.8	6.3
Total	276,805.7	353,897.7	926,652.0	4.2	6.6

Table 2

Total U.S. Oceanborne Exports to Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	26,554.7	31,265.9	61,849.8	2.8	4.7
Eastern South America	8,204.9	13,109.7	38,617.3	8.2	7.5
Western South America	1,830.6	3,008.4	9,507.4	8.6	8.0
Caribbean	2,942.1	8,778.9	45,848.3	20.0	11.6
Central America	1,179.0	1,741.2	5,032.1	6.7	7.3
Mexico	1,189.4	1,679.5	4,963.9	5.9	7.5
Northern Europe	32,491.3	36,652.7	81,384.1	2.0	5.5
Mediterranean Europe	17,158.1	19,749.3	51,035.0	2.4	6.5
United Kingdom	5,129.5	5,298.3	8,335.4	.5	3.1
North Africa	674.2	845.0	1,755.9	3.8	5.0
Developing Africa	1,029.4	1,507.8	5,308.1	6.6	8.8
Republic of South Africa	597.4	743.5	2,470.1	3.7	8.3
Middle East	1,728.5	2,281.1	8,029.5	4.8	8.8
Japan	55,822.5	111,422.4	401,844.1	12.2	8.9
East Asia	7,073.5	11,930.5	36,902.5	9.1	7.8
South Asia	2,977.9	4,527.7	12,134.1	7.3	11.0
Communist Europe	1,694.0	1,846.8	3,468.8	1.5	4.3
Oceania	1,673.7	2,452.2	5,705.2	6.6	5.8
Total	169,950.7	258,860.9	784,188.6	7.3	7.7

Table 3

Total U.S. Oceanborne Imports and Exports of Major Commodity Groups for 1969, 1975 and 1990 (In Thousand of Long Tons) 1/

U.S. IMPORTS

Commodity Group	Tonnages 1969	1975	1990	Average Annual Percentage Increase 1969-1975	1975-1990
Food, Feed and Beverages	13,556.1	16,278.8	32,488.7	3.1	4.7
Industrial Supplies	258,495.0	330,295.9	1,011,973.0	4.2	7.7
Capital Goods	2,680.6	4,169.1	13,544.9	7.6	8.2
Consumer Goods	1,721.6	3,252.4	13,707.7	11.2	10.1
Total	276,453.3	353.996.2	1,071,714.3	4.2	7.7

U.S. EXPORTS

Commodity Group	Tonnages 1969	1975	1990	Average Annual Percentage Increase 1969-1975	1975-1990
Food, Feed and Beverages	31,924.2	42,506.5	91,708.1	4.9	5.3
Industrial Supplies	135,245.9	201,481.9	624,897.1	6.9	7.9
Capital Goods	1,611.4	1,748.6	4,190.4	1.4	6.0
Consumer Goods	1,159.2	3,188.2	15,442.7	18.4	11.1
Total	169,940.7	248,925.2	736,238.3	6.6	7.5

1/ The totals of U.S. trade for the four major commodity groups are not equal the totals for U.S. trade in Tables 1 and 2 because there are two additional minor commodity groups, "Government" and "All Other" which are not included in Table 3 and because the total imports and exports for each region on Tables 1 and 2 were obtained from a direct calculation that does not necessarily equal the sum of the directly calculated six major commodity groups.

Table 4-1

Total U.S. Oceanborne Imports of Food, Feed and Beverages
From Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	345.1	356.3	536.2	.6	2.8
Eastern South America	1,774.8	2,130.2	3,734.7	3.1	3.8
Western South America	1,112.4	1,159.7	1,448.1	.7	1.5
Caribbean	1,480.0	1,614.0	2,272.3	1.5	2.3
Central America	2,179.7	3,008.7	8,523.5	5.5	7.2
Mexico	1,124.7	1,316.3	2,075.8	2.7	3.1
Northern Europe	822.9	1,093.5	2,763.9	4.8	6.6
Mediterranean Europe	563.0	788.6	2,385.8	5.8	7.7
United Kingdom	394.0	549.1	1,512.6	5.7	7.0
North Africa	18.5	36.9	184.6	12.2	11.3
Developing Africa	696.1	858.5	1,620.7	3.6	4.4
Republic of South Africa	140.9	140.9	189.2		2.0
Middle East	60.5	70.4	126.1	2.6	4.0
Japan	245.5	315.9	704.1	4.3	5.5
East Asia	1,626.5	1,686.5	2,291.2	.6	2.0
South Asia	176.3	169.7	184.7	- .7	.6
Communist Europe	53.1	84.2	336.1	8.0	9.7
Oceania	742.1	899.4	1,599.1	3.2	3.9

Table 4-2

Total U.S. Oceanborne Imports of Industrial Supplies
From Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	32,788.3	36,262.8	62,623.4	1.7	3.7
Eastern South America	87,417.4	110,869.7	320,614.4	4.0	7.3
Western South America	5,143.4	6,231.6	16,671.53	3.3	6.8
Caribbean	55,359.6	73,706.8	213,146.1	4.9	7.3
Central America	703.4	765.4	1,215.0	3.0	3.1
Mexico	5,090.7	5,193.7	8,006.9	.3	2.9
Northern Europe	11,206.7	14,551.7	30,084.7	4.4	5.0
Mediterranean Europe	6,973.7	9,728.9	18,064.4	5.7	4.2
United Kingdom	2,361.5	3,552.7	7,842.0	7.0	5.4
North Africa	7,404.9	10,354.8	30,489.3	5.7	7.5
Developing Africa	8,155.4	12,105.0	36,269.4	6.8	7.6
Republic of South Africa	830.0	988.5	1,800.8	2.9	4.1
Middle East	16,973.4	21,996.9	63,610.9	4.4	7.3
Japan	7,283.2	10,151.5	23,886.9	5.7	5.9
East Asia	6,929.4	8,122.7	13,936.9	2.7	3.7
South Asia	692.1	824.2	1,501.6	2.9	4.1
Communist Europe	964.4	1,392.2	3,795.3	8.3	6.9
Oceania	2,312.5	3,496.8	8,369.7	7.1	6.0

Table 4-3

Total U.S. Oceanborne Imports of Capital Goods
From Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	29.8	60.0	222.2	12.4	9.1
Eastern South America	5.2	9.3	29.0	10.2	7.9
Western South America	1.0	2.7	8.3	18.0	7.8
Caribbean	.4	.5	.8	3.8	3.1
Central America	1.0	1.7	5.9	9.3	8.6
Mexico	.2	.2	.3		2.7
Northern Europe	1,211.5	1,929.2	7,142.4	8.1	9.1
Mediterranean Europe	207.6	349.5	1,147.1	9.1	8.2
United Kingdom	281.6	399.4	1,073.7	6.0	5.1
North Africa	0.0	0.0	0.0		
Developing Africa	1.5	3.4	9.8	14.6	7.3
Republic of South Africa	1.3	1.5	3.3	2.4	5.4
Middle East	5.1	11.1	32.3	13.9	7.4
Japan	858.5	1,269.7	3,456.5	6.7	6.9
East Asia	59.0	102.2	326.4	9.6	8.0
South Asia	1.8	3.5	10.9	11.7	7.9
Communist Europe	7.0	9.5	27.9	5.2	7.4
Oceania	8.1	15.7	48.1	11.7	7.7

Table 4-4

Total U.S. Oceanborne Imports of Consumer Goods
From Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	148.6	272.1	1,113.8	10.6	10.0
Eastern South America	14.9	27.2	112.0	10.6	9.9
Western South America	1.9	2.9	8.7	7.3	7.6
Caribbean	2.1	2.7	6.4	4.3	5.9
Central America	.5	.7	2.1	5.8	7.6
Mexico	1.7	3.1	11.6	10.5	9.2
Northern Europe	188.2	314.2	1,073.1	8.9	8.5
Mediterranean Europe	137.5	257.5	1,013.9	11.0	9.6
United Kingdom	122.5	218.3	833.4	10.1	9.3
North Africa	.5	.9	3.6	10.3	9.7
Developing Africa	1.0	1.5	4.3	7.0	7.3
Republic of South Africa	.3	.4	1.1	4.9	7.0
Middle East	3.0	3.0	10.7	0.0	8.8
Japan	703.2	1,283.7	5,288.3	10.6	9.9
East Asia	363.0	811.2	4,019.9	14.3	11.3
South Asia	11.6	19.0	61.8	8.5	8.2
Communist Europe	18.2	28.5	120.2	7.8	10.1
Oceania	2.9	5.5	22.8	11.3	9.9

Table 4-5

Total U.S. Oceanborne Exports of Food, Feed and Beverages
To Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	2,346.9	2,257.2	2,877.4	- .7	1.6
Eastern South America	1,627.3	2,347.1	4,059.2	6.3	3.7
Western South America	220.8	239.7	375.9	1.4	3.1
Caribbean	633.4	1,514.0	6,984.3	15.6	10.7
Central America	367.2	522.1	1,181.5	6.1	5.6
Mexico	5.1	5.4	9.0	.9	3.4
Northern Europe	7,940.1	8,077.9	9,818.4	.3	1.3
Mediterranean Europe	3,285.2	3,394.9	4.311.8	.5	1.6
United Kingdom	1,921.5	1,959.1	2,249.9	.3	.9
North Africa	437.2	539.3	994.3	3.6	4.2
Developing Africa	443.4	471.3	782.5	1.0	3.4
Republic of South Africa	95.1	96.9	130.1	.3	2.0
Middle East	813.9	957.4	1,436.7	2.7	2.7
Japan	8,459.9	14,596.6	36,829.8	9.2	6.5
East Asia	2,116.8	4,190.8	16,731.9	12.1	9.7
South Asia	397.9	871.4	2,007.4	14.0	5.7
Communist Europe	750.5	568.5	705.6	-4.8	1.5
Oceania	62.0	96.9	222.4	7.7	5.7

Table 4-6

Total U.S. Oceanborne Exports of Industrial Supplies
To Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	24,201.4	27,551.4	51,418.0	2.2	4.2
Eastern South America	6,170.4	10,062.1	32,018.9	8.5	8.0
Western South America	1,444.9	2,408.6	7,544.4	8.9	7.9
Caribbean	2,146.3	5,864.2	23,356.3	18.2	9.6
Central America	696.1	1,028.0	2,970.9	6.7	7.3
Mexico	1,164.3	1,693.7	5,006.5	6.4	7.5
Northern Europe	24,062.2	26,731.8	60,386.3	1.8	5.6
Mediterranean Europe	13,704.9	15,590.9	40,288.9	2.2	6.5
United Kingdom	3,095.5	3,302.5	5.476.5	1.1	3.4
North Africa	186.2	242.2	621.4	4.5	6.5
Developing Africa	491.3	767.2	2,772.7	7.7	8.9
Republic of South Africa	391.2	464.8	1,196.0	2.9	6.5
Middle East	711.7	871.8	2,976.8	3.4	8.5
Japan	47,206.2	99,369.2	348,019.2	13.2	8.7
East Asia	4,673.0	7,361.8	22,932.3	7.9	7.9
South Asia	2,531.4	3,810.2	10,601.7	7.1	7.0
Communist Europe	933.2	1,258.0	2,638.1	5.1	5.1
Oceania	1,435.7	2,103.5	4,672.2	6.6	5.5

Table 4-7

Total U.S. Oceanborne Exports of Capital Goods
To Major World Areas in 1969, 1975 and 1990
(In Thousands of Long Tons)

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	3.2	3.9	13.2	3.3	8.5
Eastern South America	270.2	286.5	495.9	1.0	3.7
Western South America	112.0	118.8	205.6	1.0	3.7
Caribbean	70.6	75.0	163.0	1.0	5.3
Central America	59.8	64.6	228.2	1.3	8.8
Mexico	15.1	14.8	62.1	- .3	10.0
Northern Europe	260.6	232.4	424.5	-2.0	4.1
Mediterranean Europe	93.7	92.7	239.4	- .1	6.5
United Kingdom	53.7	54.5	85.8	.2	3.1
North Africa	27.8	36.8	113.5	4.8	7.8
Developing Africa	60.4	85.4	453.5	5.9	11.8
Republic of South Africa	74.0	80.0	146.3	1.3	4.1
Middle East	130.2	144.1	458.2	1.7	8.0
Japan	61.2	117.5	465.3	11.4	9.6
East Asia	163.6	189.3	292.0	2.5	2.9
South Asia	32.4	14.3	17.6	-14.6	1.4
Communist Europe	4.3	7.9	25.0	10.7	8.0
Oceania	118.6	130.1	300.3	1.6	5.7

Table 4-8

Total U.S. Oceanborne Exports of Consumer Goods
To Major World Areas in 1969, 1975 and 1990

Region	Tonnages			Average Annual Percentage Increase	
	1969	1975	1990	1969-1975	1975-1990
Canada	3.2	8.8	35.1	18.4	9.7
Eastern South America	135.9	311.9	1,661.9	14.8	11.8
Western South America	52.1	98.8	321.5	11.2	8.2
Caribbean	91.1	665.0	3,886.6	39.0	12.5
Central America	55.5	151.5	920.3	18.2	12.8
Mexico	4.8	15.1	106.4	21.0	13.9
Northern Europe	227.6	508.8	1,968.9	14.3	9.4
Mediterranean Europe	74.0	153.0	477.4	12.8	7.9
United Kingdom	58.9	89.2	196.8	7.1	5.4
North Africa	22.8	62.4	284.5	18.3	10.6
Developing Africa	33.3	116.0	854.3	23.0	14.2
Republic of South Africa	37.0	103.0	580.9	18.6	12.2
Middle East	71.9	230.4	1,154.4	21.0	11.3
Japan	95.2	219.2	846.6	14.9	9.4
East Asia	117.2	265.9	1,310.3	14.6	11.7
South Asia	15.5	11.8	22.6	-4.7	4.4
Communist Europe	5.9	10.9	44.8	10.8	9.8
Oceania	57.3	166.5	769.4	19.5	10.7

Table 5

High and Low Predictions of
Total U.S. Oceanborne Imports
From Major World Areas

(In Thousands of Long Tons)

Region	Actual 1969	Low Estimate 1/ 1975	Low Estimate 1/ 1990	High Estimate 1/ 1975	High Estimate 1/ 1990
Canada	33338.6	36121.3	58088.1	37631.3	75859.8
Eastern South America	89221.4	107805.4	254004.1	118733.9	420758.8
Western South America	6263.9	7298.6	16150.3	7888.9	25479.9
Caribbean	56866.2	71401.3	168231.2	80250.5	284384.8
Central America	2891.8	3662.0	8339.3	4134.5	13934.1
Mexico	6219.1	6624.1	9296.1	6899.1	11279.1
Northern Europe	13587.5	16714.5	30036.5	18616.3	44231.5
Mediterranean Europe	7904.0	10335.4	17897.3	11904.7	26782.2
United Kingdom	3193.5	4339.7	8575.1	5089.3	13914.8
North Africa	7424.3	9683.1	23148.5	11125.5	40283.9
Developing Africa	8862.7	12059.6	29296.6	14142.9	52444.9
Republic of South Africa	978.0	1076.8	1747.3	1130.7	2310.7
Middle East	17044.3	20949.1	49358.8	23281.6	82503.3
Japan	9109.2	11479.5	24908.9	12946.0	40627.5
East Asia	8997.9	10204.5	15776.7	10887.6	20715.1
South Asia	884.5	1002.3	1549.6	1068.8	2033.5
Communist Europe	945.7	1389.5	3341.7	1695.1	6196.1
Oceania	3073.1	4204.3	8775.5	4946.0	14662.5
Total	276,805.7	336,351.0	728,521.6	372,302.7	

1/ Based on maximum error of 20%.

Table 6

High and Low Predictions of
Total U.S. Oceanborne Exports
From Major World Areas
(In Thousands of Long Tons)

Region	Actual 1969	Low Estimate 1/ 1975	Low Estimate 1/ 1990	High Estimate 1/ 1975	High Estimate 1/ 1990
Canada	26554.7	30285.3	51703.5	32269.9	72976.2
Eastern South America	8204.9	11911.6	28132.7	14415.0	52850.1
Western South America	1830.6	2715.8	6788.1	3326.8	13273.5
Caribbean	2942.1	7084.7	26754.8	10856.2	78167.8
Central America	1179.0	1608.5	3746.3	1883.3	6738.7
Mexico	1189.4	1569.9	3754.9	1795.0	6541.5
Northern Europe	32491.3	35731.1	67604.3	37549.0	97839.7
Mediterranean Europe	17158.1	19189.4	40837.3	20320.1	63644.3
United Kingdom	5129.5	5270.1	7625.8	5336.0	9151.3
North Africa	674.2	809.3	1448.1	882.0	2129.4
Developing Africa	1029.4	1399.4	3852.5	1623.1	7289.2
Republic of South Africa	597.4	711.4	1851.5	776.6	3299.1
Middle East	1728.5	2161.2	5954.6	2406.0	10789.2
Japan	55822.5	97530.3	273911.5	127008.4	586409.2
East Asia	7073.5	10786.6	26722.5	13224.8	50774
South Asia	2977.9	4159.5	9257.8	4924.5	15863.4
Communist Europe	1694.0	1817.2	3030.9	1876.7	3959.1
Oceania	1673.7	2276.3	4491.7	2639.5	7230.4
Total	169950.9	237017.6	567468.8	283112.9	1088888.7

1/ Based on maximum statistical error of 20%.

Table 7

Commodity Group Definitions for
Final and Intermediate End Use Category

Total Trade	Final End Use Category	Intermediate End Use Category
Total Trade With World Area	Food, Feed and Beverages	Cereals
		Fresh Food
		Dried Food
		Live Animals
		Other Farm Feed Stuff
		Beverages
	Industrial Supplies	Petroleum, Lubricants
		Coal
		Gas
		Crude, Semifinished Textiles
		Finished
		Paper, Paper Base Stocks
		Other
		Industrial Chemicals
		Hides, Skins
		Rubber
		Agricultural Supplies
		Natural Chemicals
		Iron, Steelmaking Raw Materials
		Semifinished Steel Mill Products
		Nonferrous and other Metals
		Semifinished Building Materials
		Steel Mill Products Finished
		Metal Parts, Supplies and Components Finished
		Finished Building Materials
		Other Finished Material
	Capital Goods	Electrical
		Construction
		Industrial
		Agricultural
		Civilian Aircraft Equip.
		Trucks, Buses, Merchant Vessels, etc.
	Consumer Goods	Textiles Manufact.
		Medicinal, Pharmaceut.
		Other Nondurable Goods

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Continued

Table 7 Continued

Total Trade	Final End Use Category	Intermediate End Use Category
	Consumer Goods	Household Wares
		Other Durable Goods
	Government	Government
	Other Non-Classified	Other Non-Classified Elsewhere

Table 8

Summary of U.S. Income Elasticities for U.S. Imports from Major World Areas for Major Commodity Groups 1/

Region	Total	Commodity Group: Food, Feed and Beverages	Industrial Supplies	Capital Goods	Consumer Goods	Other	Government
Canada	.255*	-.236*	.256*	9.135	5.131		
East Coast South America	.584	1.200	.574	5.395	5.006	-.254	
West Coast South America	.202	.120*	.189*	14.058			
Caribbean	1.471	.490	1.506		1.441	4.40	
Central America	1.169	1.992	.001*	3.706		.355*	
Mexico	-.106	.554	-.267	-2.315	4.756	.214*	
Northern Europe	2.937	1.660	2.993	3.147	3.989	5.543	17.603
Mediterranean Europe	5.933	2.000	6.743	4.163	5.879	-.49*	3.750
United Kingdom	4.107	1.898	4.870	2.030	4.601	4.564	-12.137
Northern Africa	5.635	5.232	5.638	-14.725			
Developing Africa	3.643	1.222	3.753	11.610		4.899	14.477
Republic of South Africa				.415*	2.328	7.469	
Middle East				11.503	-5.954		
Japan	3.738	1.595	3.817	3.138	5.031		
East Asia	1.097	.035	1.193	6.332	10.538		13.721
South Asia		-.682		7.299	3.754	13.179	11.825
Communist Asia	-1.178		-1.114				
Communist Europe	3.976	3.083	4.208		2.720		
Oceania	3.840	1.139	5.894	7.467	5.629	5.843	
World Total	1.056	.911	1.030	3.137	5.348		

1/ An asterisk indicates an income elasticity of less than .5 that was accepted without using the normal criteria.

Table 9

Summary of Foreign Income Elasticities for U.S. Exports to Major World Areas for Major Commodity Groups 1/

Region	Total	Commodity Group: Food, Feed and Beverage	Industrial Supplies	Capital Goods	Consumer Goods	Other	Government
Canada	0.31		0.43		6.21		
East Coast South America	1.75	2.04	1.76	-.20*	3.35	3.65	
West Coast South America	1.92		2.10	-.15*	2.84	-2.10	
Caribbean	5.24	3.95	5.7	-.16*	13.96		
Central America	1.16	1.24	1.18	-0.80	4.08	.09*	
Mexico	0.53		0.95	-2.17			
Northern Europe		-.09*	-0.25*	-1.24	1.38		
Mediterranean Europe	-.21	+.02*	-.26*	-1.47		-7.86	
United Kingdom				-.43*	5.89		
Northern Africa			0.55	.23*	5.10	-3.05	
Developing Africa	0.76		1.05		4.63		
Republic of South Africa	-.03*		+.15*	-.07*	3.96	-.44*	
Middle East	.09*	.36*	-.22*	-0.79	5.28		
Japan	1.33	0.96	1.42	-	1.73	-.26	
East Asia	1.50	2.21	1.26	.03*	2.75		
South Asia	1.57	6.22	1.48	-6.95	-3.00		
Communist Asia							
Communist Europe	-2.7		3.3		13.9		
Oceania		1.35		-.15*	3.79	-6.23*	
World Total	1.036	0.73	1.12	-8.48	4.038		

1/ * Indicates an income elasticity of less than .5 that was accepted with [illegible] criteria.

CHAPTER III

PREDICTION OPERATIONS

The analysis of the causes of recent U.S. foreign trade discussed in Chapter II provides a cornerstone for the prediction of this trade in the future. To complete the prediction, the causes of U.S. foreign trade in the future need to be projected and a proper method of incorporating these causes into a trade prediction established. Both items are discussed in this chapter.

Assumptions About Future Causes of U.S. Foreign Trade:

This prediction of U.S. foreign trade has been obtained by examining the demand for internationally traded commodities. The primary determinant of the U.S. demand for imports is the level of national income of the United States. The primary determinants of the demand for United States exports to foreign regions are the levels of aggregate national incomes in the foreign regions. Consequently, a forecast of the growth rates of income or gross national product (GNP) in various regions of the world has been made and used as a forecast of the causes of U.S. foreign trade. These predictions of the growth rates of GNP for the various regions are then used in conjunction with predictions of income elasticities to forecast the levels of corresponding demand-determined imports.

Forecast of Gross National Product:

Gross National Products for each of the 20 trading regions

were predicted in three distinct scenarios based on differing assumptions in order to estimate the range of possible deviation in the trade prediction. The first scenario considers economic growth rates that reflect maximum development. Here, national planning goals are taken as a measure of potential. The second considers the most probable level of economic development based on historical performance and estimates of regional specialists. The third considers a more pessimistic estimate of economic development.

The selected set of GNP forecasts for major regions of the world drive the rest of the trade prediction. Table 10 presents the growth rates of GNP that were projected for selected years from 1970 through 1990 for each region and used in the "best" predictions. The high scenario contained a full employment GNP estimate for the developed countries and a high rate of growth assumption for the developing countries. The medium growth rate scenario contained a set of assumptions about what growth rates would be if the high growth rate assumptions slipped by a moderate amount; this is the case where policy errors are made or where the economic conditions leading to the highest possible growth rates are not met. Although the growth rate assumptions were subjectively made by the authors of this study, in most cases attempts were made to relate these forecasts to other published work and to historical growth rate experience. The medium growth rate scenario that has been used to generate the best prediction for this study, is the result of an attempt to provide a conservative forecast.

The ability to forecast accurately growth rates in GNP differs

enormously over the long time period for which forecast will be made. Consideration of cyclical swings in national product of different regions have been excluded for the 1975 to 1990 period and a stable long term growth rate has been predicted. No account is made for explicit war situations or other extreme non-economic contingencies.

Predictions of the Import and Export GNP Elasticities:

Two sets of import elasticities are required to make the dema determined forecast. The first set of elasticities relates U.S. imports to U.S. GNP. The second set of elasticities relates U.S. exports to foreign GNP. Because historical data of commodity income elasticities is useful in providing a forecaster insight, the historical income elasticities that were derived from the data on U.S. foreign trade between 1963 and 1969 were used as a basis for predicting U.S. foreign trade in the immediate future.

One of the most important exercises for making the predictions in this project consisted of forming a set of expectations about what long term income elasticities should be for the various portions of U.S. foreign trade. These expectations were predominately based on a set of long term U.S. import and export elasticities derived by Houthakker and Magee in a paper published in the Review of Economics and Statistics[1] in 1969.

1/ Houthakker, H.S. and Magee, S.P. "Income and Price Elasticities in World Trade", The Review of Economics and Statistics, Vol. LI, No. 2, May 1969, (pp. 111-125).

Tables 11, 12, and 13 present the import and export income elasticities that were obtained by Houthakker and Magee. The long run income elasticities for total U.S. imports and exports are 1.4 and 1.1 respectively. This implies that the quantity of U.S. trade has tended to increase more rapidly than U.S. and world GNP in the past. It is quite reasonable to expect that this will continue in the future. Crude materials have had very low income elasticities in the range of 0 to .3 and consumer goods have had rather high elasticities in the range of 1.2 to 3.6. These values are reasonable and seem likely to continue in the future.

Table 14 presents a summary of the decisions that were made on what U.S. import and export elasticities were for the four major final end use commodity groups in 1970, 1975 and 1985. These decisions form the basis for elasticity predictions for each of the intermediate years and the years from 1985 to 1990.

The 1970 elasticities were set equal to the elasticities obtained from regression analyses of total U.S. exports or imports of these commodities from all regions of the world. The estimate of a 1975 elasticity was made by interpolating the 1970 and 1985 elasticities. In general, the 1985 elasticities were set very close to the long run expected elasticities and they were generally close to the Houthakker

and Magee results. The 1985 elasticity for imports of food, feed and beverages is expected to be around .7. This elasticity is roughly half way between the Houthakker and Magee elasticity of .3 for crude foods and 1.3 for manufactured foods. Although tonnages of U.S. imports of crude foods are much larger than tonnages of U.S. imports of manufactured foods at the present time, the higher income elasticity for manufactured foods will cause imports of these commodities to be a constantly increasing share of the total future imports of food, feed, and beverages. It is expected that, by 1985, U.S. imports of these foods will have grown sufficiently to cause the average elasticity of food, feed, and beverages to be .7.

The 1985 industrial supplies elasticity of 1.0 lies between the Houthakker and Magee elasticities of crude materials of .6 and the elasticity for semi-manufactures of 1.1. The predicted elasticity is based primarily on the assumption that while there will be some oil import restrictions still in effect in 1985, they will be relaxed substantially from present values. The results that are presented in this prediction have been designed so that they correspond closely to the results that were predicted by the Presidents' Commission on Oil Imports. 1/

The elasticity for U.S. imports of capital goods in 1985 is slightly higher than the Houthakker and Magee elasticity for semi-manufactures of 1.1. This upward shift reflects the assumption that the very high income elasticity for 1963 to 1969 reflects a fundamental change in trend and will cause the long run income elasticity to shift upward.

1/ Cabinet Task Force on Oil Import Control, The Oil Import Question, A Report on the Relationship of Oil Imports to the National Security, (Washington, D.C.; U.S. Government Printing Office, February 1970).

The long run expected income elasticity of 2.0 for U.S. imports reflects the opinion that U.S. imports of consumer goods will comprise the Houthakker and Magee category of finished manufactures (with an elasticity of 2.6) as well as some commodities in the semi-manufactured goods category (which has a long run elasticity of 1.1). This judgment also reflects the assumption that the widespread introduction of large cargo airplanes during the 1970 to 1990 period will slightly reduce the propensity of the U.S. to import consumer goods by ship.

The 1985 elasticity of .9 for U.S. exports of food, feed and beverages is very close to the Houthakker and Magee elasticities for both crude foods and for manufactured foods. The income elasticity for industrial supplies was held constant at the 1970 elasticity of 1.1. An elasticity of .8 was predicted for U.S. long run exports of capital goods. It was also assumed that the negative elasticity observed during the 1963 to 1969 period would remove any of the noncompetitive U.S. capital goods export items from foreign markets and that, for the goods that are exported after 1975, slow growth would be observed because of U.S. technological and production advantages in this trade category.

U.S. exports of consumer goods were assumed to have a long run elasticity of 1.6 compared to an elasticity of 1.2 for finished manufactures provided by Houthakker and Magee. The Houthakker and Magee long run elasticity was shifted upward to reflect the fact that the household goods component of U.S. exports (which in general has had an export elasticity of around 2.0) will comprise a larger portion of the 1985 exports of consumer goods than they did during the 1951 to 1966 period over which Houthakker and Magee made their analysis.

The Method of Predicting Future U.S. Trade:

The use of import income elasticities makes the operation involved in making the prediction relatively straightforward. It allows a forecast of the level of imports in any year to be obtained by multiplying the previous imports times the quantity growth rate (one plus the income of the importing region) taken to the elasticity power. The exact formulation of the equation showing tonnage movements as a function of a constant income elasticity holds that tonnage movements in any future year equal tonnage movements in the previous year multiplied by one plus the relevant GNP growth rate taken to the income elasticity power. Specifically the equation is as follows:

$$M(N) = M(N-1)\ (1.0 + GR(N))^{E(N)}$$

where

M(N) = tonnage of imports for time period N.

M(N-1) = tonnage of imports for time period preceding N.

GR(N) = percentage growth rate of GNP for time period N.

E(N) = Income elasticity for time period N.

Because an import elasticity relates a percentage change in income to a comparable percentage change in imports, if one knows the growth rate of income, the elasticity, and the previous year's imports,

one can calculate the level of any future year's imports.

For this study the starting point for the prediction was the 1969 value of each trade flow. Predictions in each of the years beyond 1970 used the previous year's prediction as a starting point. This method places a premium on making predictions of GNP growth rates and income elasticities that are accurate over the long run because errors in this predictions that are not offset by errors in the opposite direction are carried through to future trade predictions.[1/] Appendix 1 contains an examination of the implications of continuous errors of different sizes.

The regression analysis of U.S. foreign trade for the 1963-69 time period previously discussed resulted in a set of estimates of import income elasticities. These values were used as the prediction of income elasticities for the first forecast year (1970). The 1975 elasticity prediction was heavily weighted by the historical values computed by regression analysis and by estimates of the economic environment predicted to exist in that year. The prediction of the income elasticity for the year 1985 was based primarily on expectations of what the long run income elasticities would be. Income elasticities for intermediate years were calculated by extrapolation formula using the 1970, 1975 and 1985 values as starting points.

1/ The percentage errors in trade flows approximately equal the sum of the percentage errors in the GNP growth rate and the income elasticity multiplied by the number of years, and the values of the GNP growth rate and the income elasticity. Specifically, ME=(T)(E)(GR) (EE+GRE) where ME is the percentage error in imports, T is the number of years after the uncompensated error is made until the year of the prediction in question, E is the elasticity, EE is the percentage error in the elasticity, GR is the GNP growth rate, and GRE is the percentage error in the GNP growth rate.

U.S. Seaborne Trade Excluded From This Prediction:

Several components of U.S. foreign oceanborne trade have not been predicted in this project because they should not be examined with the methods that have been used here. Demand determined income elasticities are not useful when there is no historical demand-determined trade to analyze or when reasonable assumptions about the nature of public policy in the future cannot be made; accordingly, both PL-480 "Food-For-Peace" shipmen of agricultural surplus commodities and military "Special Category" shipments have been excluded from this analysis. For these cases, predictions must be obtained from other sources and added to the results obtained by this forecast.

Although a case can be made for excluding U.S. trade with Communist Europe on the grounds that much of this trade is policy as well as demand-determined, it has been decided that better predictions can be made for this region with income elasticities than without them. Even though recent U.S. decisions on trade with this area should result in higher trade levels than have been observed in the past, it appears to be possible to incorporate assumptions about the effects of these policy changes into the set of 1963-1969 historical income elasticities and these techniques have been used.

In addition, U.S. trade with Communist Asia has not been predicted in this project. Such trade has not been of sufficient quantity in the recent past to provide an adequate data base from which to obtain significant income elasticities. Recent policy changes to increase this

trade will have implications on the validity of this forecast. These implications must be evaluated by examining other sources and modifying the results of this forecast accordingly.

Table 10

Summary of Predicted Growth Rates of Gross National Product for Economic Regions

Region	GNP GROWTH RATE ASSUMED IN DIFFERENT YEARS			
	1970	1975	1980	1990
United States	-.4	4.1	4.1	4.1
Canada	4.0	4.5	4.5	4.5
Eastern South America	4.8	4.8	4.8	4.8
Western South America	4.8	4.8	4.8	4.8
Caribbean	5.0	5.0	5.0	5.0
Central America	5.3	5.3	5.3	5.3
Mexico	6.3	6.0	6.0	6.0
Northern Europe	3.9	3.9	3.9	3.9
Mediterranean Europe	4.8	4.8	4.8	4.8
United Kingdom	1.5	2.0	2.6	2.6
North Africa	4.7	4.8	4.8	4.8
Developing Africa	6.0	6.0	6.0	6.0
Republic of South Africa	5.6	5.3	5.3	5.3
Middle East	7.0	7.0	7.0	7.0
Japan	10.1	8.5	7.0	5.0
East Asia	6.0	6.0	6.0	6.0
South Asia	4.8	5.0	5.2	5.2
Communist Asia	4.9	4.9	4.9	4.9
Communist Europe	4.2	4.2	4.2	4.2
Oceania	8.6	4.6	4.6	4.5

Table 11

Income Elasticities for
United States Imports

(Quarterly Data, 1947-66) 1/

	Long-Run Elasticities		
	Income	Price	R^2
Crude Materials	.61	-.18	.832
Crude Foods	.30	-.21	.535
Manufactured Foods	1.28	-1.40	.910
Semimanufactures	1.11	-1.83	.950
Finished Manufactures	2.63	-4.05	.995
Total Imports	1.42	-.88	.981

1/ Houthakker and Magee (24), Table 6, P. 121

Table 12

Income Elasticities for United States Exports
(Annual Data, 1951-1966)1/

Dependent Variable		Elasticity: Constant	World Income	Relative Price	US Long Term Capital Outflow	R2	Standard Error	D.W.
Total Exports	(a)	4.40	1.11	-1.46		.925	.061	1.35
		(1.93)	(9.61)	(-2.46)				
	(b)	4.62	.77	-1.24	.22	.967	.040	1.59
		(3.05)	(7.00)	(-3.15)	(4.22)			
Agricultural Exports								
	(a)	1.13	1.02	-.96		.907	.097	1.25
		(.59)	(8.13)	(-2.96)				
	(b)	2.17	.51	-.82	.39	.974	.051	1.12
		(2.13)	(4.72)	4.71)	(5.86)			
Nonagricultural Exports								
	(a)	2.03	1.12	-1.03		.898	.068	1.21
		(1.79)	(8.69)	(2.96)				
	(b)	2.60	.90	-.98	.15	.916	.061	1.14
		(2.44)	(5.43)	(-3.10)	(1.96)			
		Five Commodity Classes						
Crude Materials		8.42		-.31	.44	.793	.088	1.71
		(1.44)		(-.24)	(6.41)			
Crude Foods		2.03	.97		.45	.879	.145	.90
		(1.78)	(3.25)		(2.41)			
Manufactured Foods								
	(a)	11.90	.86	-1.91		.901	.097	1.23
		(3.56)	(5.86)	(-3.13)				
	(b)	9.44	.68	-1.29	.20	.907	.094	1.22
		(2.57)	(3.50)	(-1.71)	(1.33)			
Semimanufactures		3.12	.90		.37	.949	.081	1.92
		(4.94)	(5.44)		(3.56)			
Finished Manufactures								
	(a)	9.35	1.17	-1.22		.964	.035	1.62
		(14.88)	(13.48)	(-5.74)				
	(b)	9.64	1.07	-1.20	.07	.969	.033	1.74
		(15.72)	(10.48)	(-6.04)	(1.67)			

1/ Houthakker and Magee, (24)
Table 7, p. 122

Note: The number in parenthesis below each coefficient is a t-ratio.

Table 13

Summary of U.S. Total Import and Export Income Elasticities by Country

(Annual Data, 1951-1966)[1/]

Country	Import Income Elasticity	Export Income Elasticity
Canada	1.9	1.1
Mexico		.4
West Germany	2.8	2.0
France	2.0	2.3
Netherlands	.7	1.9
Italy	2.0	2.3
Portugal	1.9	1.1
United Kingdom	1.8	2.6
Republic of South Africa	1.8	.9
Japan	3.5	3.7
India	.8	3.2
Australia	1.6	2.4

1/ Houthakker and Magee, (24), Table 4, pp. 116-117.

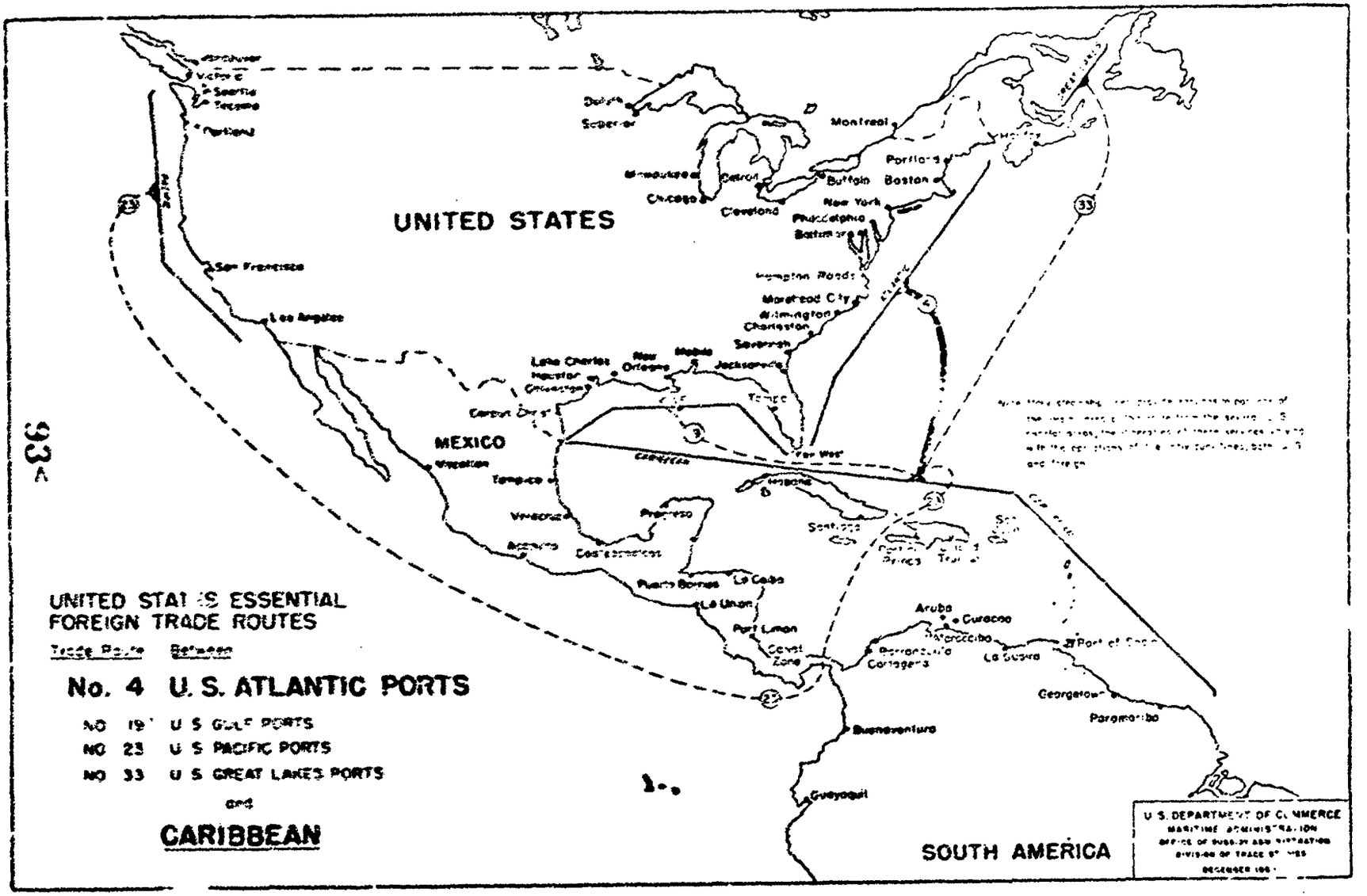
Table 14

Predictions of Final End Use Commodity
Income Elasticities for U.S. Exports and Imports

	Elasticity In		
U.S. Imports	1970	1975	1985
Food, Feed and Beverages	.91	.85	.7
Industrial Supplies	1.03	1.7	1.7
Capital Goods	3.14	2.5	1.5
Consumer Goods	5.35	3.0	2.0
U.S. Exports			
Food, Feed and Beverages	.73	.8	.9
Industrial Supplies	1.12	1.1	1.1
Capital Goods	-.85	0.0	.8
Consumer Goods	4.04	2.8	1.6

APPENDIX B

TRADE ROUTE DESCRIPTION


UNITED STATES
MEXICO
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
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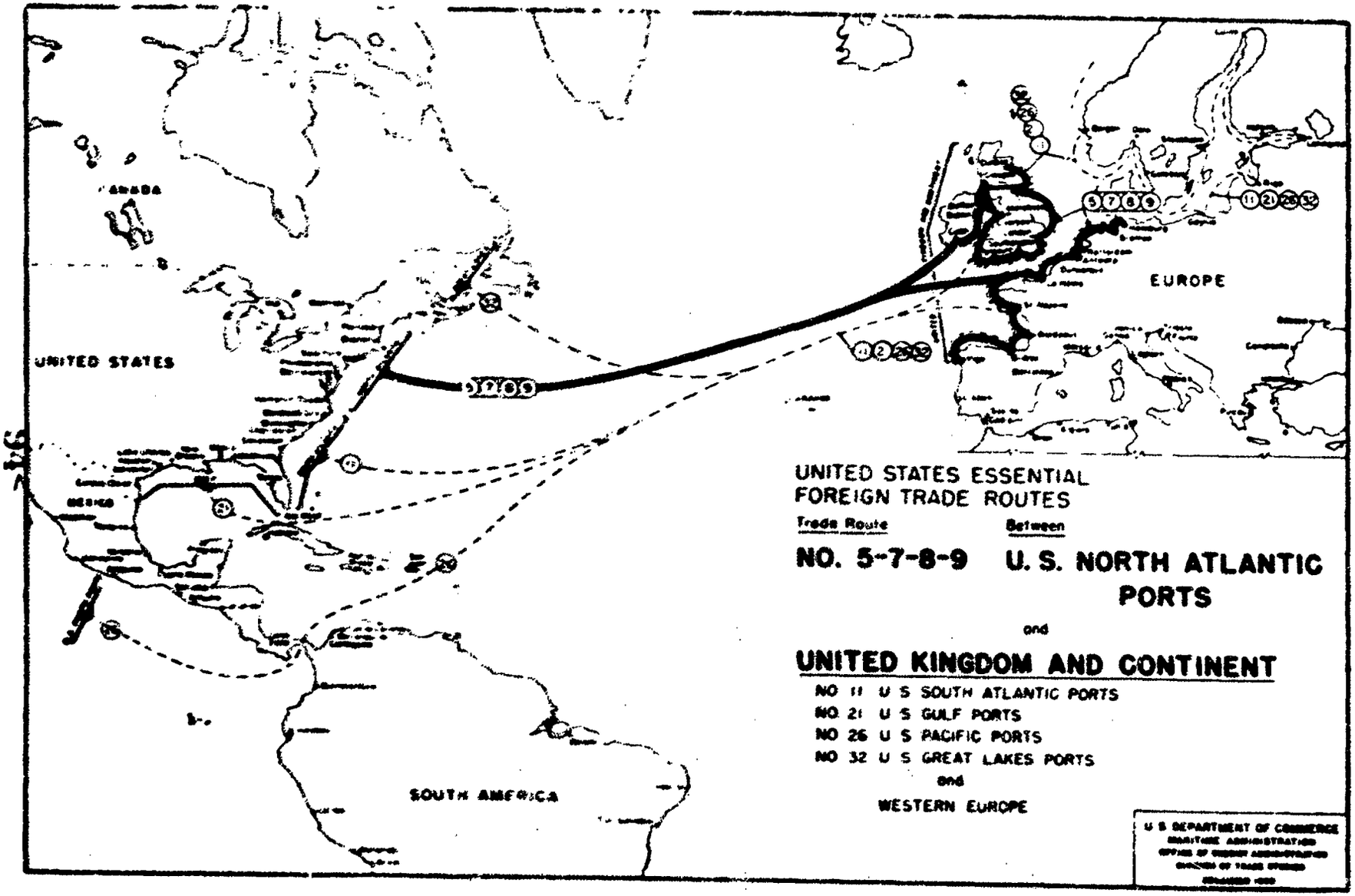
NO 19 U S GULF PORTS
NO 23 U S PACIFIC PORTS
NO 33 U S GREAT LAKES PORTS
and
CARIBBEAN
SOUTH AMERICA
U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
93A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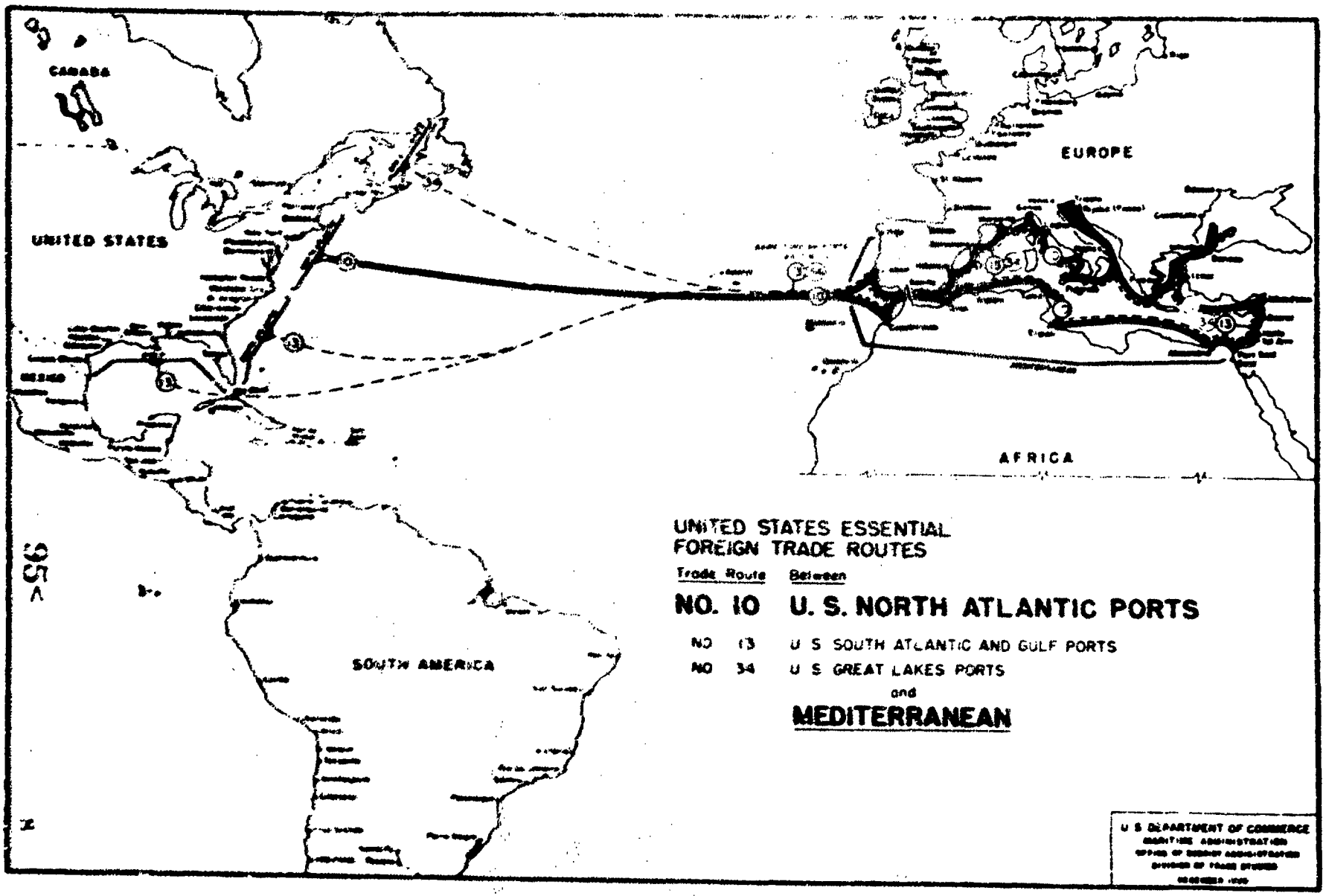
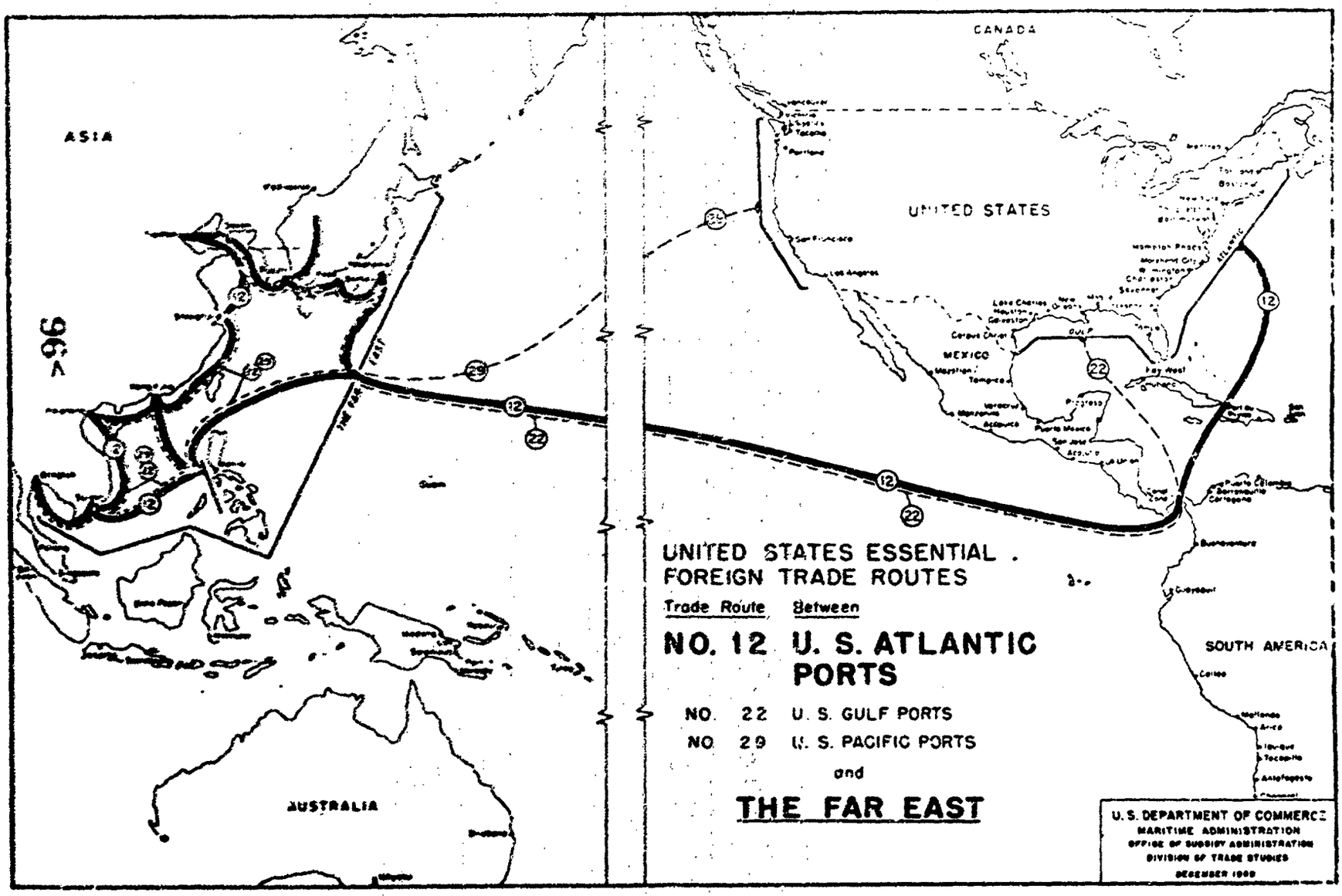
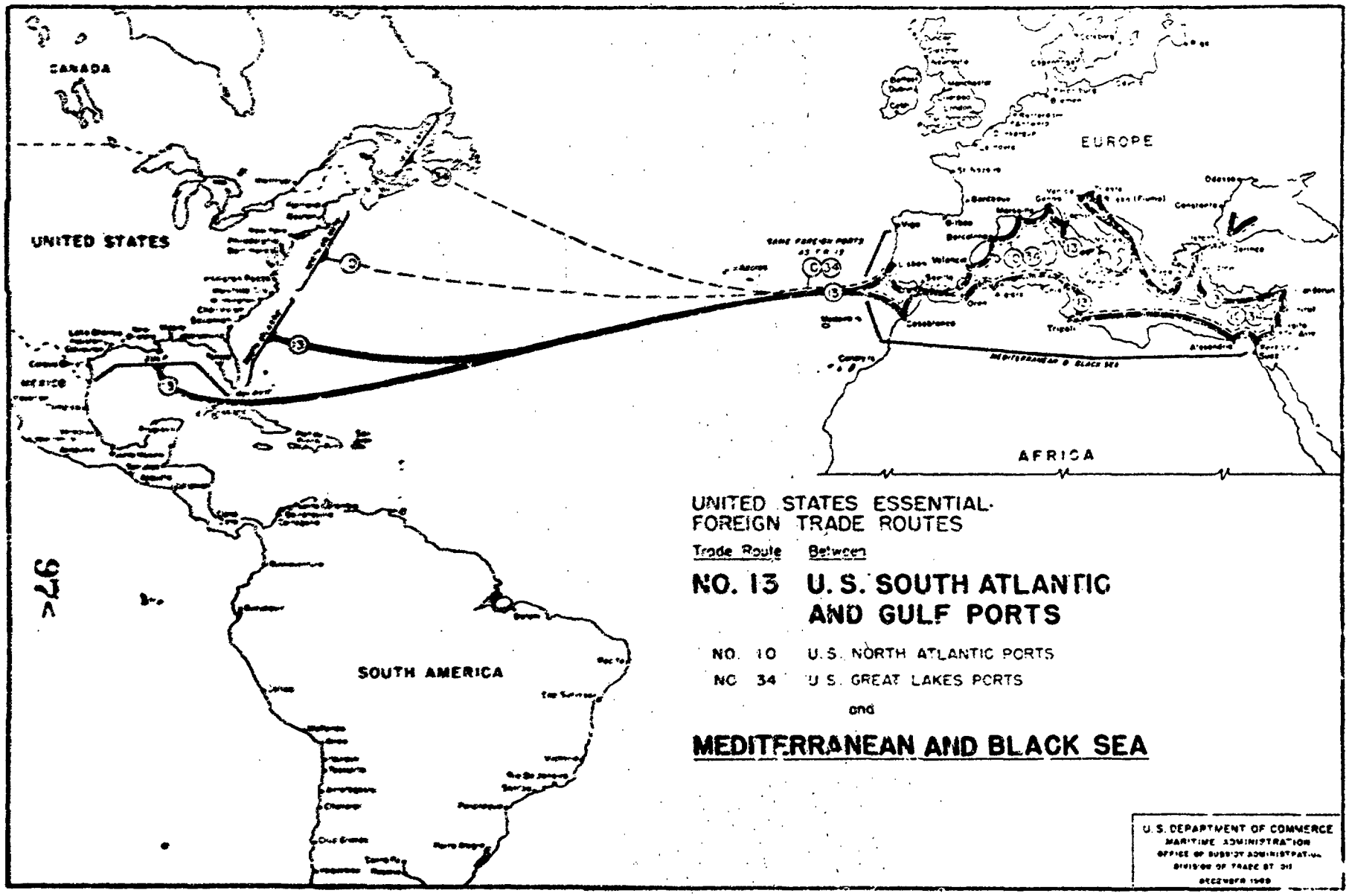
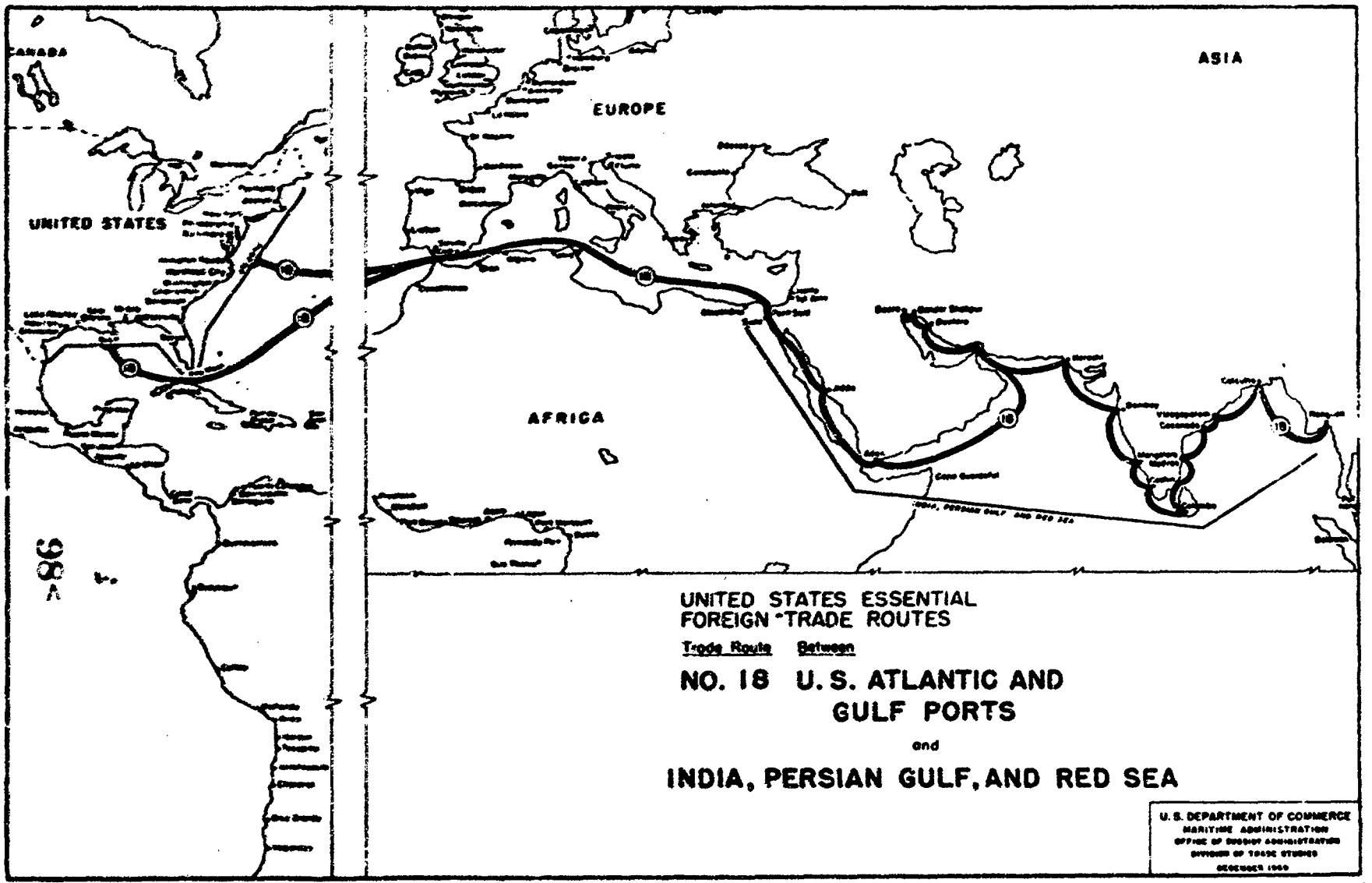
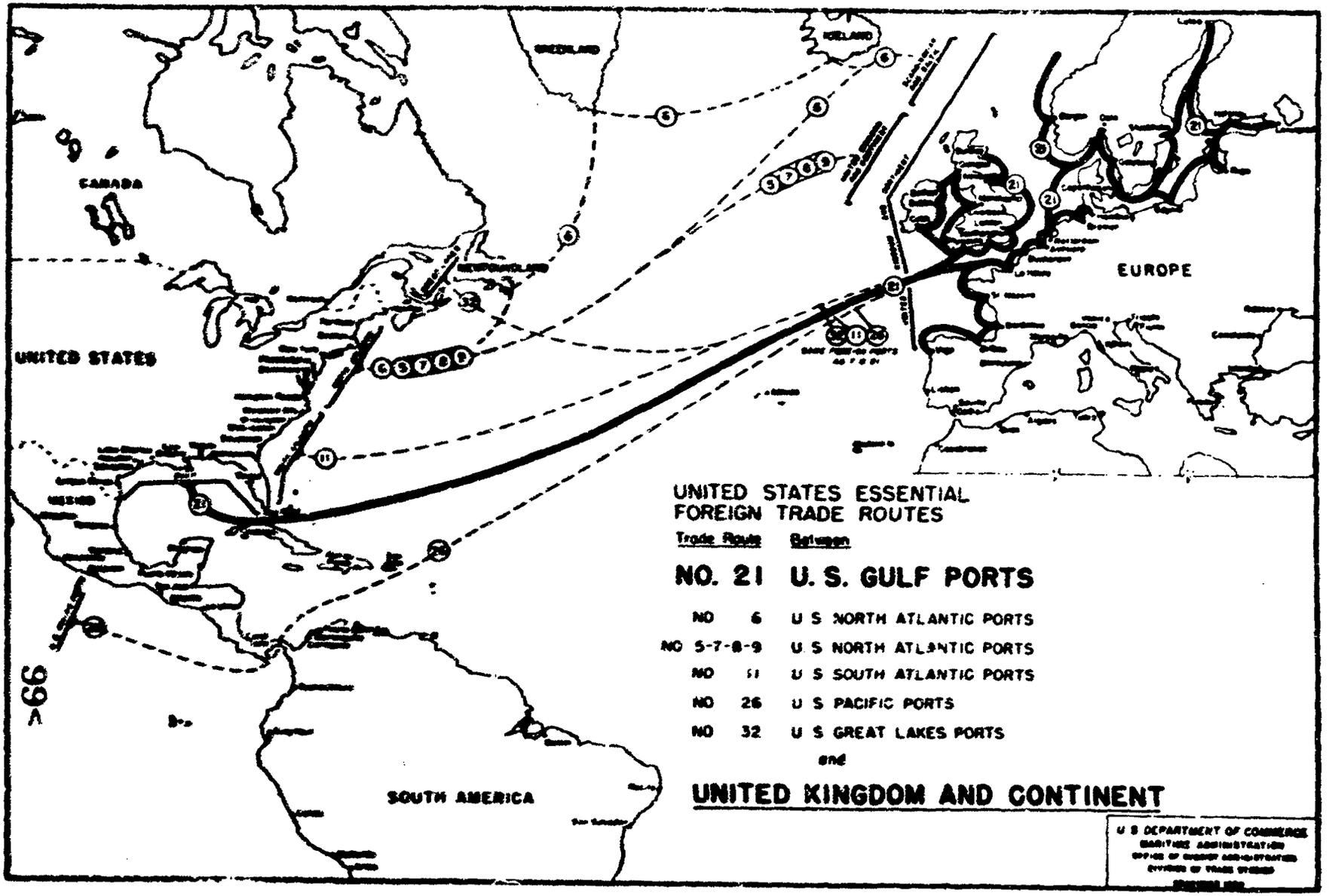
UNITED STATES
MEXICO
SOUTH AMERICA
EUROPE
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route
Between
NO. 5-7-8-9
U. S. NORTH ATLANTIC PORTS
and
UNITED KINGDOM AND CONTINENT
NO 11 U S SOUTH ATLANTIC PORTS
NO 21 U S GULF PORTS
NO 26 U S PACIFIC PORTS
NO 32 U S GREAT LAKES PORTS
and
WESTERN EUROPE
U S DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION

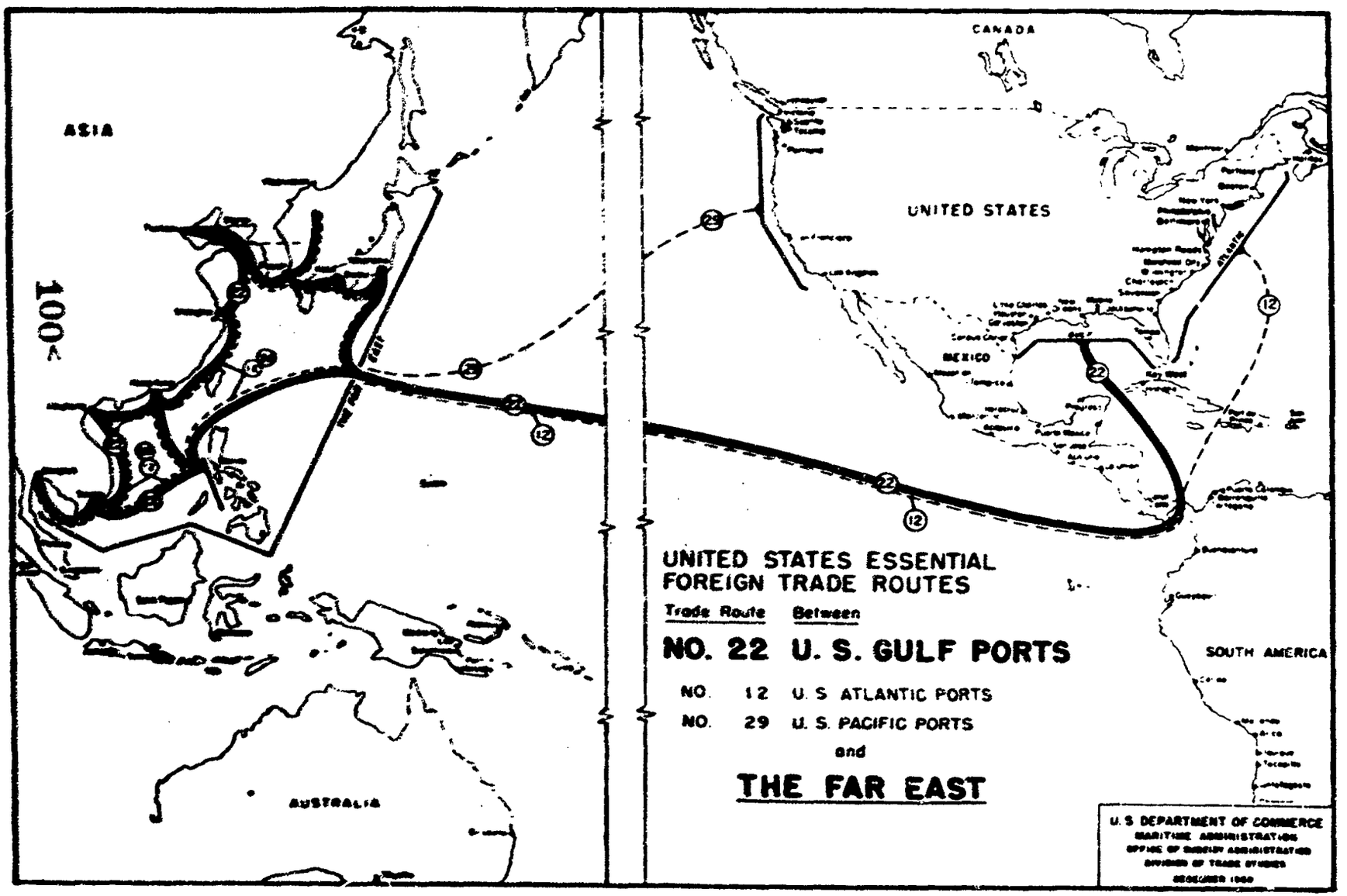

CANADA
UNITED STATES
EUROPE
AFRICA
SOUTH AMERICA
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route
Between
NO. 10
U. S. NORTH ATLANTIC PORTS
NO 13
U S SOUTH ATLANTIC AND GULF PORTS
NO 34
U S GREAT LAKES PORTS
and
MEDITERRANEAN
U S DEPARTMENT OF COMMERCE

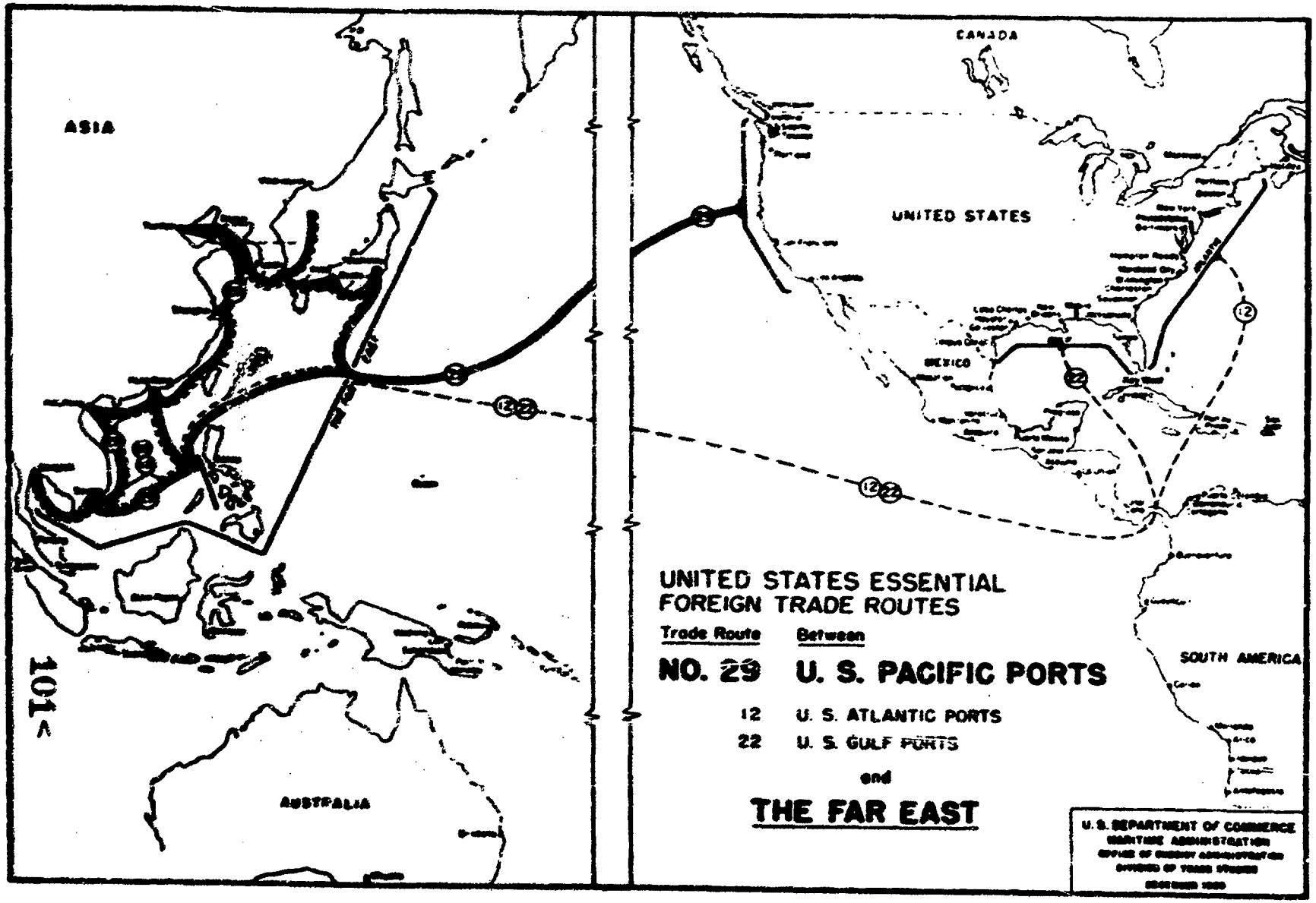

ASIA
CANADA
UNITED STATES
MEXICO
GULF
SOUTH AMERICA
AUSTRALIA
ATLANTIC
PACIFIC
12
22
24
29
96
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
NO. 12 U. S. ATLANTIC PORTS
NO. 22 U. S. GULF PORTS
NO. 29 U. S. PACIFIC PORTS
and
THE FAR EAST
U. S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
OFFICE OF SUBSIDY ADMINISTRATION
DIVISION OF TRADE STUDIES
DECEMBER 1969


CANADA
UNITED STATES
EUROPE
AFRICA
SOUTH AMERICA
MEXICO
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
NO. 13 U.S. SOUTH ATLANTIC AND GULF PORTS
NO. 10 U.S. NORTH ATLANTIC PORTS
NO. 34 U.S. GREAT LAKES PORTS
and
MEDITERRANEAN AND BLACK SEA
U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
DECEMBER 1969


CANADA
UNITED STATES
EUROPE
ASIA
AFRICA
INDIA, PERSIAN GULF AND RED SEA
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
NO. 18 U.S. ATLANTIC AND
GULF PORTS
and
INDIA, PERSIAN GULF, AND RED SEA
U.S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION
OFFICE OF SHIPPING ADMINISTRATION
DIVISION OF TRADE STUDIES
DECEMBER 1969


ICELAND
CANADA
EUROPE
UNITED STATES
SOUTH AMERICA
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
NO. 21 U. S. GULF PORTS
NO 6 U S NORTH ATLANTIC PORTS
NO 5-7-8-9 U S NORTH ATLANTIC PORTS
NO 11 U S SOUTH ATLANTIC PORTS
NO 26 U S PACIFIC PORTS
NO 32 U S GREAT LAKES PORTS
and
UNITED KINGDOM AND CONTINENT
U S DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION


ASIA
100°
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
AUSTRALIA
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route Between
NO. 22 U. S. GULF PORTS
NO. 12 U. S ATLANTIC PORTS
NO. 29 U. S. PACIFIC PORTS
and
THE FAR EAST
U. S DEPARTMENT OF COMMERCE


ASIA
AUSTRALIA
CANADA
UNITED STATES
MEXICO
SOUTH AMERICA
101°
UNITED STATES ESSENTIAL
FOREIGN TRADE ROUTES
Trade Route
Between
NO. 29
U. S. PACIFIC PORTS
12
U. S. ATLANTIC PORTS
22
U. S. GULF PORTS
and
THE FAR EAST
U. S. DEPARTMENT OF COMMERCE
MARITIME ADMINISTRATION

APPENDIX C

GENERAL CARGO IMPORTS AND EXPORTS

FOR SELECTED TRADE ROUTES

4.

Imports
(Long Tons)

Trade Route	Commodity	CY '72	CY '73	CY '74	CY '75	CY '76
4	General Cargo	4,980,180	5,355,790	5,760,440	6,175,300	6,613,460
	Dry Bulk	13,113,630	13,687,880	14,305,970	14,936,290	15,595,670
	Liquid Bulk	106,552,350	111,608,000	117,806,470	124,988,780	133,509,570
	Total	124,646,600	130,651,670	137,872,880	146,100,370	155,718,700
5-7-8-9	General Cargo	7,381,030	4,777,790	5,192,550	5,607,620	6,038,070
	Dry Bulk	614,030	628,400	645,300	663,990	2,826,610
	Liquid Bulk	5,513,210	6,324,600	7,018,850	7,591,200	8,084,140
	Total	10,508,270	11,730,790	12,856,700	13,862,810	16,951,820
10	General Cargo	1,439,260	1,709,020	1,785,650	1,961,940	2,145,150
	Dry Bulk	1,067,620	1,162,680	1,257,280	1,347,490	1,436,920
	Liquid Bulk	16,361,810	18,666,220	20,509,090	21,953,500	23,182,810
	Total	18,868,690	21,437,920	23,552,020	25,262,930	26,764,880
12	General Cargo	4,609,050	5,004,360	5,407,750	5,806,820	6,220,190
	Dry Bulk	757,160	802,550	852,120	903,280	957,420
	Liquid Bulk	070	070	070	070	070
	Total	5,366,280	5,806,980	6,259,940	6,710,170	7,177,680
18	General Cargo	932,130	1,004,800	1,077,740	1,146,720	1,214,220
	Dry Bulk	182,030	180,000	179,230	179,730	181,460
	Liquid Bulk	12,532,720	13,146,750	13,886,720	14,732,030	15,903,950
	Total	13,646,880	14,331,550	15,143,690	16,058,480	17,299,630
21	General Cargo	2,264,180	2,466,480	2,677,320	2,888,410	3,107,780
	Dry Bulk	366,040	377,830	390,710	404,040	418,240
	Liquid Bulk	52,380	62,730	72,310	80,660	88,150
	Total	2,682,600	2,907,040	3,140,340	3,373,110	3,614,170

5.

Imports
(Long Tons)

Trade Route	Commodity	CY '72	CY '73	CY '74	CY '75	CY '76
22	General Cargo	2,563,330	2,737,940	2,915,340	3,093,600	3,280,780
	Dry Bulk	399,540	422,120	447,010	472,870	500,340
	Liquid Bulk	0	0	0	0	0
	Total	2,962,870	3,159,760	3,362,350	3,566,470	3,781,120
29	General Cargo	5,177,860	5,659,460	6,153,290	6,645,600	7,158,190
	Dry Bulk	1,136,980	1,220,620	1,309,630	1,399,600	1,493,130
	Liquid Bulk	85,540	90,290	95,420	100,680	106,220
	Total	6,400,380	6,970,370	7,558,340	8,145,880	8,757,540
32	General Cargo	2,690,500	2,930,020	3,176,600	3,420,990	3,672,750
	Dry Bulk	315,700	328,450	342,020	355,820	370,320
	Liquid Bulk	57,280	64,060	69,230	73,070	76,110
	Total	3,063,480	3,322,530	3,587,850	3,849,880	4,119,180
13	General Cargo	571.07	629.08	692.06	757.07	826.15
	Dry Bulk	1,051.58	1,110.84	1,172.68	1,234.34	1,297.98
	Liquid Bulk	3.30	3.74	4.05	4.27	4.43
	Total	1,625.95	1,743.66	1,868.79	1,995.68	2,128.56

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C-2

6.

Exports
(Long Tons)

Trade Route	Commodity	CY '72	CY '73	CY '74	CY '75	CY '76
4	General Cargo	1,840,420	2,151,220	2,486,450	2,837,320	3,200,510
	Dry Bulk	1,110,860	1,267,970	1,432,510	1,597,400	1,766,110
	Liquid Bulk	100,500	105,330	110,430	115,820	121,510
	Total	3,041,780	3,524,520	4,029,390	4,550,540	5,088,130
5-7-8-9	General Cargo	2,262,640	2,369,950	2,505,400	2,614,340	2,750,910
	Dry Bulk	15,332,700	14,926,610	14,730,420	14,728,930	14,916,830
	Liquid Bulk	404,080	421,260	439,230	458,050	477,800
	Total	17,999,420	17,717,810	17,675,050	17,801,350	18,145,540
10	General Cargo	1,040,700	1,071,700	1,107,520	1,148,390	1,194,530
	Dry Bulk	6,867,000	6,784,840	6,803,370	6,918,920	7,133,180
	Liquid Bulk	303,630	331,420	361,510	394,020	429,100
	Total	8,211,330	8,187,960	8,272,400	8,461,330	8,756,810
12	General Cargo	974,560	1,045,290	1,121,130	1,202,100	1,288,380
	Dry Bulk	37,253,670	42,695,640	48,528,980	54,751,420	61,358,880
	Liquid Bulk	120,070	127,020	134,160	141,390	148,620
	Total	38,348,300	43,867,950	49,784,270	56,094,910	62,795,880
18	General Cargo	909,030	901,140	904,330	916,980	938,330
	Dry Bulk	2,843,280	3,363,420	3,908,720	4,479,630	5,088,900
	Liquid Bulk	191,640	194,550	198,150	202,350	207,220
	Total	3,943,950	4,459,110	5,011,200	5,598,960	6,234,450
21	General Cargo	5,861,320	6,223,670	6,603,780	7,002,550	7,421,490
	Dry Bulk	15,006,750	15,658,800	16,343,490	17,064,480	17,826,300
	Liquid Bulk	1,539,260	1,619,850	1,700,650	1,781,950	1,864,400
	Total	22,407,330	23,502,320	24,647,920	25,848,980	27,112,190

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Exports
(Long Tons)

Trade Route	Commodity	CY '72	CY '73	CY '74	CY '75	CY '76
22	General Cargo	1,030,860	1,065,470	1,103,520	1,144,920	1,189,640
	Dry Bulk	15,912,350	17,206,420	18,565,270	19,986,510	21,469,700
	Liquid Bulk	1,680,530	1,972,500	2,276,600	2,584,640	2,891,370
	Total	18,623,740	20,244,890	21,945,390	23,716,070	25,550,710
29	General Cargo	3,502,360	3,723,300	3,959,600	4,211,500	4,479,310
	Dry Bulk	34,127,470	39,373,870	44,910,050	50,732,830	56,844,800
	Liquid Bulk	4,686,580	5,183,610	5,697,850	6,217,470	6,734,810
	Total	42,316,410	48,280,780	54,567,500	61,161,800	68,058,920
32	General Cargo	779,970	769,770	767,720	772,390	782,900
	Dry Bulk	5,029,480	5,144,570	5,271,230	5,490,870	5,560,970
	Liquid Bulk	13,280	13,840	14,410	15,000	15,620
	Total	5,822,730	5,928,180	6,053,360	6,197,260	6,360,490
13	General Cargo	1,955.95	2,081.10	2,212.85	2,352.89	2,502.59
	Dry Bulk	8,101.98	8,645.92	9,223.55	9,836.36	10,485.91
	Liquid Bulk	770.42	855.90	947.81	1,045.57	1,148.94
	Total	10,828.35	11,582.92	12,384.21	13,234.82	14,137.44

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APPENDIX D

LONG TON TO MEASUREMENT TON CONVERSIONS

1976

General Cargo
Imports
Selected Trade Routes

Commodity	Stowage Factor	4 L/T	4 M/T	5-7-8-9 L/T	5-7-8-9 M/T	10 L/T	10 M/T
Fresh Foods	2.25	790.99	1,779.73	174.29	392.15	49.51	111.40
Dried Foods	1.50	1,658.95	2,488.42	422.50	633.75	525.22	787.83
Live Animals	10.00	0	0	.16	16.00	.01	.10
Oth. Farm Feed	1.75	1.58	2.76	45.12	78.96	4.16	7.28
Beverages	1.40	12.39	17.34	530.22	742.31	126.43	177.00
Crude & Semi Txt.	4.00	12.49	49.96	40.32	161.28	19.63	78.48
Fin. Txt.	2.50	64.25	160.62	175.65	439.13	164.87	412.17
Paper	2.50	628.30	1,570.75	47.21	118.02	5.04	12.60
Oth. Veg. Fiber	4.00	10.37	41.48	2.90	11.60	27.49	109.96
Ind. Chem.	1.25	3,377.34	4.221.67	568.75	710.94	384.87	481.09
Hides & Skins	1.50	1.25	1.88	8.12	12.18	4.09	6.14
Rubber	1.70	.54	.92	3.13	5.32	.54	.92
Semi Stl. Ml. Prd.	.50	0	0	4.80	2.40	.11	.06
Steel Mill Prod., Fin	.50	.09	.04	1,784.06	892.03	149.04	74.52
Metal Prts., Fin	4.00	.22	.88	24.31	97.24	.86	3.44
Oth. Fin. Mtl.	2.50	.28	.70	51.72	129.30	3.26	8.15
Electrical Mach.	4.00	.11	.44	69.87	279.48	51.50	206.00
Const. Mach.	2.00	0	0	15.89	31.68	2.86	5.72
Indust. Mach.	2.00	1.18	2.36	485.93	971.86	129.96	259.92
Agric. Mach.	2.00	.47	.94	22.73	45.46	4.01	8.02
Civ. Air	15.00	.04	.60	.23	3.45	.02	.30
Trks., Busses	15.00	.62	9.30	770.57	11,558.55	49.68	745.20
Textiles	5.00	1.00	5.00	8.59	42.95	3.37	16.85
Medicinal	3.00	.10	.30	20.84	62.52	.20	.60
Oth. Nondurable	3.00	1.79	5.37	348.11	1,044.33	302.89	908.67
Household	6.00	2.86	17.16	232.05	1,392.30	96.25	577.50
Oth. Dur. Goods	3.00	5.01	15.03	126.97	380.91	32.64	97.92
Oth. NEC	3.00	41.23	123.69	84.75	254.25	9.52	28.56
Total		6,613.45	10,517.34	6,021.81	20.510.35	2,148.02	5,126.40

General Cargo
Imports
Selected Trade Routes

Commodity	Stowage Factor	12 L/T	12 M/T	13 L/T	13 M/T	Stowage Factor	18 L/T	18 M/T
Fresh Foods	2.25	134.63	302.92	8.75	19.69	2.25	43.78	98.51
Dried Foods	1.50	1,161,94	1,742.91	57.25	85.88	1.50	278.80	418.20
Live Animals	10.00	.08	.80	.01	.10	10.00	0	0
Oth. Farm Feed	1.75	23.60	41.30	.69	1.21	1.75	0	0
Beverages	1.40	3.35	4.69	22.09	30.93	1.40	.01	.01
Crude & Semi Txt.	4.00	21.77	87.08	10.39	41.56	4.00	20.13	80.52
Fin. Txt.	2.50	201.19	502.98	53.22	133.05	2.50	344.06	860.15
Paper	2.50	22.14	55.35	6.31	15.78	2.50	.01	.03
Oth. Veg. Fiber	4.00	47.17	188.68	2.64	10.56	2.00	252.75	505.50
Ind. Chem.	1.25	258.44	323.05	325.89	407.36	1.25	1.35	1.69
Hides & Skins	1.50	.09	.14	.03	.05	1.50	8.43	12.65
Rubber	1.70	2.52	4.28	.01	.02	1.70	7.75	13.18
Semi Stl. Ml. Prd.	.50	1.64	.82	0	0	.50	1.29	.65
Steel Mill Prod., Fin	.50	1,685.89	842.94	197.36	98.68	.50	175.33	87.67
Metal Prts., Fin	4.00	52.52	210.08	.51	2.04	4.00	.41	.84
Oth. Fin. Mtl.	2.50	25.42	63.55	.22	.55	2.50	.89	2.23
Electrical Mach	4.00	204.67	818.68	20.71	82.84	4.00	.16	.64
Const. Mach.	2.00	5.85	11.70	.85	1.70	2.00	1.00	2.00
Indust. Mach.	2.00	242.71	485.42	32.08	64.16	2.00	3.32	6.64
Agric. Mach.	2.00	53.21	106.42	7.07	14.14	2.00	.27	.54
Civ. Air	15.00	0	0	.26	3.90	15.00	0	0
Trks., Busses	15.00	340.04	5,100.60	37.73	565.95	15.00	1.47	22.05
Textiles	2.50	254.89	1,274.45	.09	.45	5.00	1.50	7.50
Medicinal	3.00	1.39	4.17	.07	.21	3.00	.06	.18
Oth. Nondurable	3.00	532.13	1,596.39	21.33	63.99	3.00	61.74	185.22
Household	6.00	479.36	2,876.16	13.30	79.80	6.00	3.63	21.78
Oth. Dur. Goods	3.00	460.00	1,380.00	5.20	15.60	3.00	.98	2.94
Other NEC	3.00	3.53	10.59	2.10	6.30	3.00	5.00	15.00
Total		6,220.17	18,009.15	826.16	1,746.50		1,214.12	2,346.32

General Cargo
Imports
Selected Trade Routes

Commodity	Stowage Factor	21 L/T	21 M/T	22 L/T	22 M/T	29 L/T	29 M/T
Fresh Foods	2.25	13.04	29.34	19.24	43.29	162.53	365.69
Dried Foods	1.50	55.00	82.50	291.23	436.84	247.63	371.44
Live Animals	10.00	0	0	0	0	0	0
Oth. Farm Feed	1.75	33.89	59.31	10.94	19.14	63.82	111.68
Beverages	1.40	73.70	103.18	.27	.38	12.57	17.60
Crude & Semi Txt.	4.00	1.93	7.72	.46	1.84	11.87	47.48
Fin. Txt.	2.50	21.12	53.80	14.32	35.80	118.28	295.70
Paper	2.50	78.92	197.30	2.85	7.12	29.80	74.50
Oth. Veg. Fiber	4.00	.67	2.68	7.74	30.96	11.62	46.48
Ind. Chem	1.25	364.57	455.71	183.09	228.86	351.58	439.48
Hides & Skins	1.50	.13	.20	0	0	.05	.08
Rubber	1.70	.37	.63	4.58	7.78	.54	.92
Semi Stl. Ml. Prd.	.50	.15	.08	.45	.22	4.61	2.30
Steel Mill Prod., Fin	.50	1,779.31	889.65	2,247.54	1,123.77	3,197.20	1,598.60
Metal Prts., Fin	4.00	64.01	256.04	55.62	222.48	62.56	250.24
Oth. Fin. Mtl.	2.50	.32	.55	2.41	6.02	21.34	53.35
Electrical Mach	4.00	171.68	686.72	26.28	105.12	414.93	1,659.72
Const. Mach.	2.00	3.61	7.22	.94	1.88	7.58	15.16
Indust. Mach.	2.00	52.84	105.68	29.41	58.82	257.67	515.34
Agric. Mach	2.00	21.99	43.98	.86	1.72	14.44	28.88
Civ. Air	15.00	.78	11.70	0	0	.37	5.55
Trks., Busses	15.00	234.91	3,523.65	193.84	2,907.60	667.73	10,015.95
Textiles	5.00	.31	1.55	9.46	47.30	134.54	672.70
Medicinal	3.00	.39	1.17	.10	.30	.65	1.95
Oth. Nondurable	3.00	43.62	130.86	60.12	120.36	261.57	784.71
Household	6.00	64.76	388.56	70.24	421.44	509.67	3,058.02
Oth. Dur. Goods	3.00	6.54	19.62	47.59	142.77	582.67	1,748.01
Oth. NEC	3.00	17.20	51.60	1.19	3.57	10.36	31.08
Total		3,105.66	7,110.00	3,280.77	5,975.38	7,158.18	22,212.61

General Cargo
Imports
Selected Trade Routes

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Commodity	Stowage Factor	L/T	M/T
Fresh Foods	2.25	4.63	10.42
Dried Foods	1.50	20.74	31.11
Live Animals	10.00	0	0
Oth. Farm Prod	1.75	.81	1.42
Beverages	1.40	86.74	121.44
Crude & Semi Txt.	4.00	.33	1.32
Fin. Txt.	2.50	46.92	117.30
Paper	2.50	25.39	63.48
Oth. Veg. Fiber	4.00	2.18	8.72
Ind. Chem	1.25	120.51	150.64
Hides & Skins	1.50	.46	.69
Rubber	1.70	.47	.80
Semi Stl. Ml. Prd	.50	1.50	.95
Steel Mill Prod., Fin	.50	2,961.32	1,480.66
Metal Prts., Fin	4.00	10.95	43.80
Oth. Fin. Mtl.	2.50	.15	.38
Electrical Mach.	4.00	9.10	36.40
Const. Mach.	2.00	1.86	3.72
Indust. Mach.	2.00	95.94	191.88
Agric. Mach.	2.00	14.04	28.08
Civ. Air	15.00	.01	.15
Trks,. Busses	15.00	194.16	2,912.40
Textiles	5.00	.19	.95
Medicinal	3.00	.59	1.77
Oth. Nondurable	3.00	8.36	25.08
Household	6.00	19.17	115.02
Oth. Dur. Goods	3.00	6.63	19.89
Oth. NEC	3.00	37.81	134.43
Total		3,470.96	5,481.70

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1976

General Cargo
Exports
Selected Trade Routes

Commodity	Stowage Factor	4 L/T	4 M/T	5-7-8-9 L/T	5-7-8-9 M/T	10 L/T	10 M/T
Fresh Foods	2.25	145.35	327.04	51.37	115.58	1.91	4.30
Dried Foods	1.50	139.70	209.55	240.69	361.03	162.20	243.30
Live Animals	10.00	.21	2.10	.03	.30	0	0
Oth. Farm Feed	1.75	63.59	111.28	3.66	6.40	3.70	6.48
Beverages	1.40	58.10	81.34	13.96	19.54	2.09	2.93
Crude & Semi Txt.	4.00	6.96	27.84	36.41	145.64	61.82	247.28
Fin. Txt.	2.50	43.70	109.25	65.10	162.75	6.78	16.95
Paper	2.50	395.01	987.52	325.18	812.95	109.68	274.20
Oth. Veg. Fiber	4.00	0	0	0	0	0	0
Ind. Chem.	1.25	440.89	551.11	572.07	715.08	116.96	146.20
Hides & Skins	1.50	71	1.06	5.45	8.18	12.78	19.17
Rubber	1.70	3.31	5.63	4.83	8.21	3.58	6.09
Semi Stl. Ml. Prd.	.50	3.75	1.88	6.97	3.48	.72	.36
Steel Mill Prod., Fin	.50	226.51	113.25	544.91	272.45	428.75	214.38
Metal Prts., Fin	4.00	10.91	43.64	3.83	15.32	1.79	7.16
Oth. Fin. Mtl.	2.50	32.44	81.10	21.53	53.82	3.37	8.42
Electrical Mach.	4.00	29.97	119.88	47.27	189.08	16.28	65.12
Const. Mach.	2.00	19.83	39.66	4.53	9.06	.89	1.78
Indust. Mach.	2.00	65.97	131.94	95.46	190.92	38.24	76.48
Agric. Mach.	2.00	24.45	48.90	18.49	36.98	8.37	16.74
Civ. Air	35.00	.08	1.20	2.85	42.75	4.49	67.35
Trks., Busses	15.00	138.75	2,081.25	76.98	1,154.70	26.77	401.55
Textiles	2.50	35.59	88.98	13.92	34.80	5.18	12.95
Medicinal	3.00	13.08	39.24	3.04	9.12	3.55	10.65
Oth. Nondurable	3.00	196.25	588.75	191.13	573.39	70.57	211.71
Household	5.00	1,096.29	6,577.74	390.27	2,341.62	101.44	608.64
Oth. Dur. Goods	3.00	8.35	25.05	10.80	32.70	2.38	7.14
Other	3.00	.78	2.34	.15	.45	.21	.63
Total		3,200.53	12,398.52	2,750.88	7,316.30	1,195.50	2,677.96

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General Cargo
Exports
Selected Trade Routes

Commodity	Stowage Factor	12 L/T	12 M/T	13 L/T	13 M/T	Stowage Factor	18 L/T	18 M/T
Fresh Foods	2.25	[illegible]	32.49	[illegible]	.85	2.25	1.12	2.52
Dried Foods	1.50	8[illegible].58	129.87	114.88	172.32	1.50	337.30	505.95
Live Animals	10.00	0	0	0	0	10.00	0	0
Oth. Farm Feed	1.75	65.69	114.96	3.44	6.02	1.75	6.31	11.04
Beverages	1.40	.88	1.23	.20	.28	1.40	.88	1.23
Crude & Semi Txt.	4.00	16.69	66.76	40.29	161.16	4.00	3.10	12.40
Fin. Txt.	2.50	20.54	51.35	1.72	4.30	2.50	2.76	6.90
Paper	2.50	136.66	341.65	1,113.86	2,784.65	2.50	72.01	180.02
Oth. Veg. Fiber	4.00	0	0	0	0	2.00	0	0
Ind. Chem.	1.25	248.84	311.05	1,061.77	1,327.21	1.25	95.46	119.32
Hides & Skins	1.50	27.03	40.54	11.57	14.46	1.50	.06	.09
Rubber	1.70	.78	1.33	1.08	1.83	1.70	2.20	3.74
Semi Stl. Ml. Prd.	.50	5.08	2.54	4.22	2.11	.50	.14	.07
Steel Mill Prod., Fin	.50	265.66	132.83	61.23	30.62	.50	148.81	74.40
Metal Prts., Fin	4.00	2.22	8.88	.50	2.00	4.00	4.09	16.36
Oth. Fin. Mtl.	2.50	.47	1.18	7.96	19.90	2.50	.16	.40
Electrical Mach.	4.00	19.48	77.92	4.41	17.64	4.00	6.92	27.68
Const. Mach.	2.00	.74	1.48	.85	1.70	2.00	1.86	3.72
Indust. Mach.	2.00	[illegible]4.37	68.74	16.24	32.48	2.00	24.38	48.76
Agric. Mach.	2.00	7.97	15.94	1.51	3.02	2.00	5.78	11.56
Civ. Air	15.00	.73	10.95	1.21	18.15	15.00	12.58	188.70
Trks., Busses	15.00	26 39	395.85	3.26	48.90	15.00	29.37	440.55
Textiles	2.50	3.06	7.65	2.25	5.62	2.50	6.58	16.45
Medicinal	3.00	[illegible].09	12.27	.12	.36	3.00	2.40	7.20
Oth. Nondurable	3.00	[illegible]48.78	446.34	2.54	7.62	3.00	26.95	80.85
Household	6.00	137.61	825.66	46.51	279.06	6.00	144.71	868.26
Oth Dur. Goods	3.00	12.69	38.07	.53	1.59	3.00	1.29	3.87
Oth. NEC	3.00	.91	2.73	.08	.24	3.00	1.12	3.36
Total		1,288.38	3,140.26	2,502.61	4,944.09		938.33	2,635.40

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General Cargo
Exports
Selected Trade Routes

Commodity	Stowage Factor	21 L/T	21 M/T	22 L/T	22 M/T	29 L/T	29 M/T
Fresh Foods	2.25	37.15	83.59	4.73	10.64	382.35	860.29
Dried Foods	1.50	206.82	310.23	48.27	72.40	427.03	640.55
Live Animals	10.00	0	0	.10	1.00	3.85	38.50
Oth. Farm Feed	1.75	16.28	28.49	52.67	92.17	996.75	1,744.31
Beverages	1.40	1.16	1.62	.03	.04	7.66	10.72
Crude & Semi Txt.	4.00	59.76	239.04	240.60	962.40	75.62	302.48
Fin. Txt.	2.50	1.03	2.57	.28	.70	2.25	5.63
Paper	2.50	1,346.52	3,366.30	110.78	276.95	917.12	2,292.80
Oth. Veg. Fiber	4.00	0	0	0	0	0	0
Ind. Chem.	1.25	5,428.04	6,785.05	626.55	783.19	838.96	1,048.70
Hides & Skins	1.50	21.26	31.89	13.54	20.31	276.08	414.12
Rubber	1.70	1.57	2.67	.19	.32	3.09	5.25
Semi Stl. Ml. Prd.	.50	.63	.31	10.62	5.31	14.99	7.50
Steel Mill Prod., Fin	.50	145.25	72.62	39.67	19.84	115.65	57.83
Metal Prts., Fin	4.00	.50	2.00	1.01	4.04	2.36	9.44
Oth. Fin. Mtl.	2.50	15.08	37.70	.60	1.50	4.38	10.95
Electrical Mach.	4.00	50.53	202.12	3.76	15.04	18.48	73.92
Const. Mach.	2.00	.36	.72	.89	1.78	4.24	8.48
Indust. Mach	2.00	12.25	24.50	6.11	12.22	48.43	96.86
Agric. Mach	2.00	1.58	3.16	1.65	3.30	41.56	83.12
Civ. Air	15.00	.92	13.80	.51	7.65	2.91	43.65
Trks., Busses	15.00	3.13	46.95	1.01	15.15	45.10	676.50
Textiles	2.50	1.03	2.57	.32	.80	1.75	4.38
Medicinal	3.00	.22	.66	.42	1.26	3.83	11.49
Oth. Nondurable	3.00	32.31	96.93	6.59	19.77	70.86	212.58
Household	6.00	37.75	226.50	17.79	106.74	154.38	926.28
Oth. Misc. Goods	3.00	.33	.99	.70	2.10	19.20	57.60
Other	3.00	.04	.12	.25	.75	.41	1.23
Total		7,421.50	11,583.10	1,189.64	2,437.19	4,479.29	9,645.16

General Cargo

Exports
Selected Trade Routes

Commodity	Stowage Factor	L/T	M/T
Fresh Foods	2.25	39.61	89.12
Dried Foods	1.50	165.83	248.75
Live Animals	10.00	0	0
Oth.- Farm Feed	1.75	44.87	78.52
Beverages	1.40	1.98	2.77
Crude & Semi Txt.	4.00	.92	3.68
Fin. Txt.	2.50	.10	.25
Paper	2.50	11.35	28.37
Oth. Veg. Fiber	4.00	0	0
Ind. Chem.	1.25	60.56	75.70
Hides & Skins	1.50	48.90	73.35
Rubber	1.20	.45	.76
Semi Stl. Ml. Prd.	.50	1.06	.53
Steel Mill Prod., Fin	.50	298.82	149.41
Metal Prts., Fin	4.00	.12	.48
Oth. Fin. Mtl.	2.50	.20	.50
Electrical Mach.	4.00	5.65	22.60
Const. Mach.	2.00	.44	.88
Indust. Mach.	2.00	17.92	35.84
Agric. Mach.	2.00	6.61	13.22
Civ. Air	15.00	.14	2.10
Trks., Busses	15.00	13.40	201.00
Textiles	2.50	.10	.25
Medicinal	3.00	.43	1.29
Oth. Nondurable	3.00	11.21	33.61
Household	6.00	50.98	305.88
Oth. Dur. Goods	3.00	1.18	3.54
Other NEC	3.00	.06	.18
Total	8950	782.89	1,372.58

115A

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APPENDIX E

ADDITIONAL ANALYSES OF DOD CARGO PROJECTIONS

SECRET DATA EXCLUDED

(THIS APPENDIX ATTACHED AT END OF SPANS PART II-A)

APPENDIX F

KEY INDUSTRY PARAMETERS

SPECIFIC COMPANY SENSITIVE DATA

OMITTED

SPECIFIC COMPANY SENSITIVE DATA

OMITTED

APPENDIX G

PROJECTED PENETRATION FOR ECONOMIC FLEET

APPENDIX G

PROJECTED PENETRATION FOR ECONOMIC FLEET

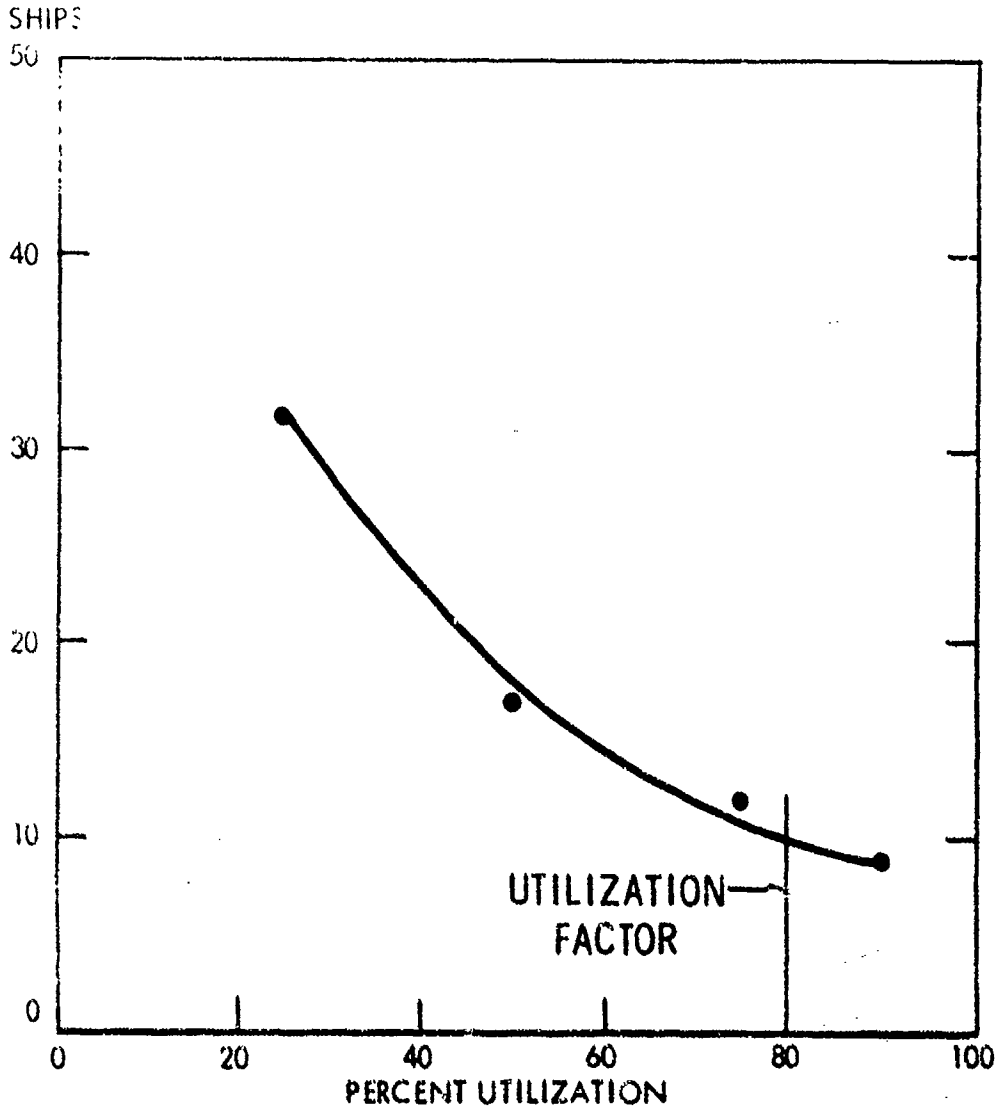
ECONOMIC FLEET WITH PROJECTED PENETRATION
(Programmed Fleet in Parentheses)

Trade Route	Penetration	Utilization	Freighters	P. Containers	Containers	Barge Carriers	Ro/Ro	Total
4	20%	85%	10 (2)	0 (0)	0 (0)	0 (0)	0 (0)	10 (2)
5-7-8-9	30%	85%	0 (0)	0 (0)	22 (24)	0 (0)	0 (0)	22 (24)
10	30%	70%	1 (7)	0 (0)	5 (9)	2 (5)	0 (0)	8 (21)
12	20%	50%	7 (7)	0 (0)	23 (16)	7 (0)	0 (0)	37 (23)
13	20%	70%	5 (5)	1 (2)	0 (0)	0 (0)	0 (0)	6 (7)
18	35%	50%	0 (0)	2 (2)	0 (0)	18 (5)	0 (0)	20 (7)
21	10%	70%	0 (0)	0 (3)	0 (0)	5 (9)	0 (0)	5 (12)
22	20%	50%	15 (15)	4 (4)	0 (0)	4 (0)	0 (0)	23 (19)
29	25%	50%	13 (24)	0 (2)	33 (29)	13 (6)	4 (4)	63 (65)
32	20%	90%	6 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (0)
Puerto Rico	100%		0 (0)	0 (0)	28 (17)	0 (0)	3 (3)	31 (20)
Hawaii/Guam	100%		0 (0)	0 (0)	20 (13)	0 (0)	0 (0)	20 (13)
TOTALS			57 (60)	7 (13)	131 (108)	49 (25)	7 (7)	251 (213)

TRADE ROUTE 4

20% COMMERCIAL CARGO PENETRATION

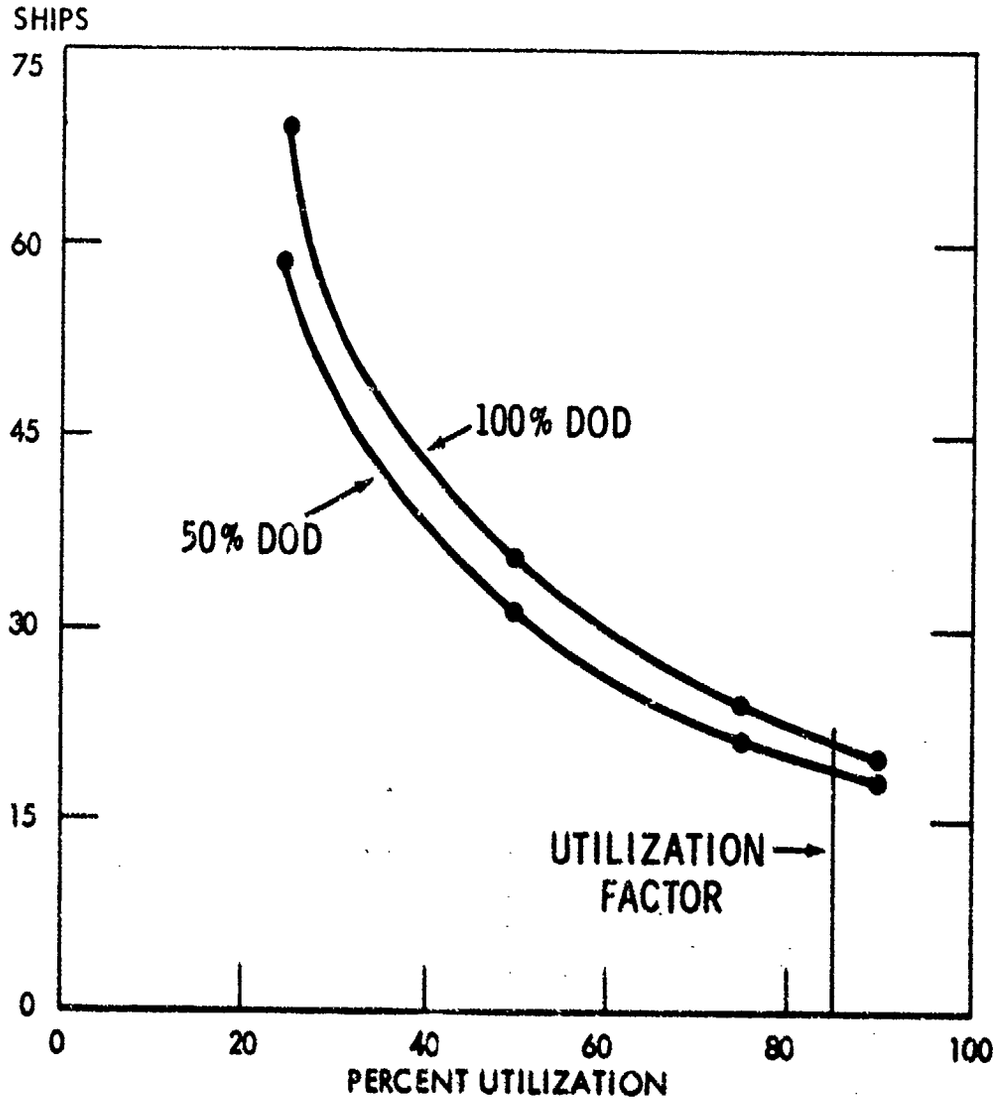
Programmed Fleet Mix: 2 Ships



TRADE ROUTE 5-7-8-9

25% COMMERCIAL CARGO PENETRATION

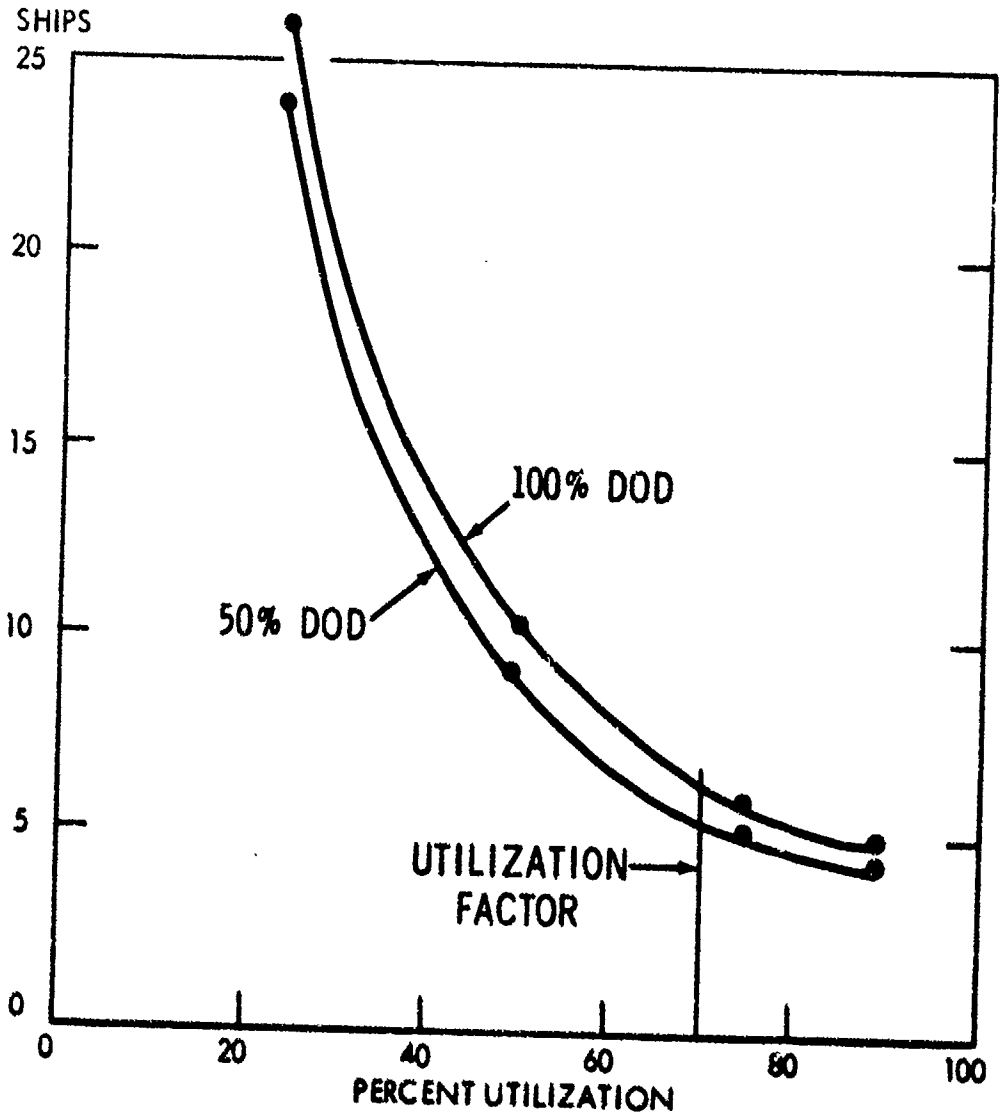
Programmed Fleet Mix: 24 Ships



TRADE ROUTE 10

27% COMMERCIAL CARGO PENETRATION

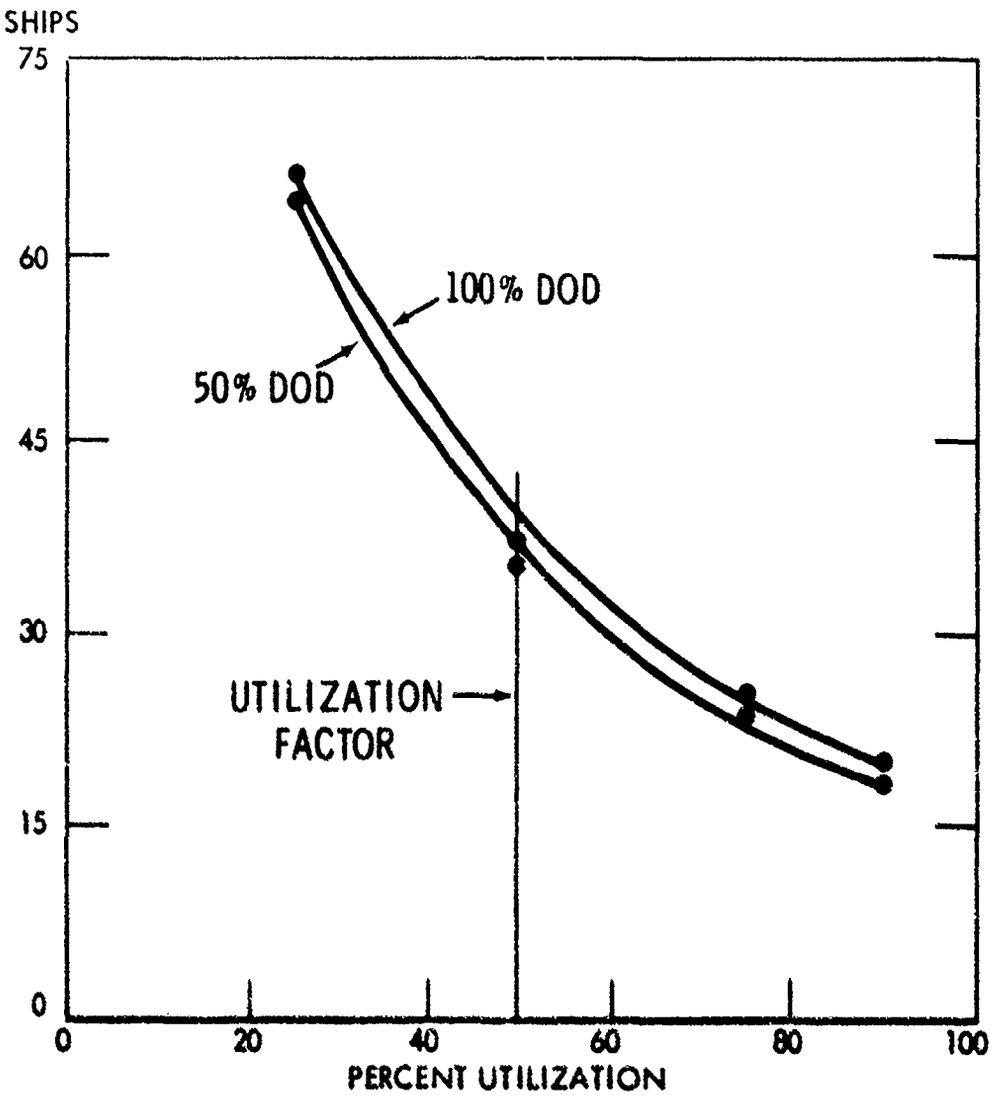
Programmed Fleet Mix: 21 Ships



TRADE ROUTE 12

20% COMMERCIAL CARGO PENETRATION

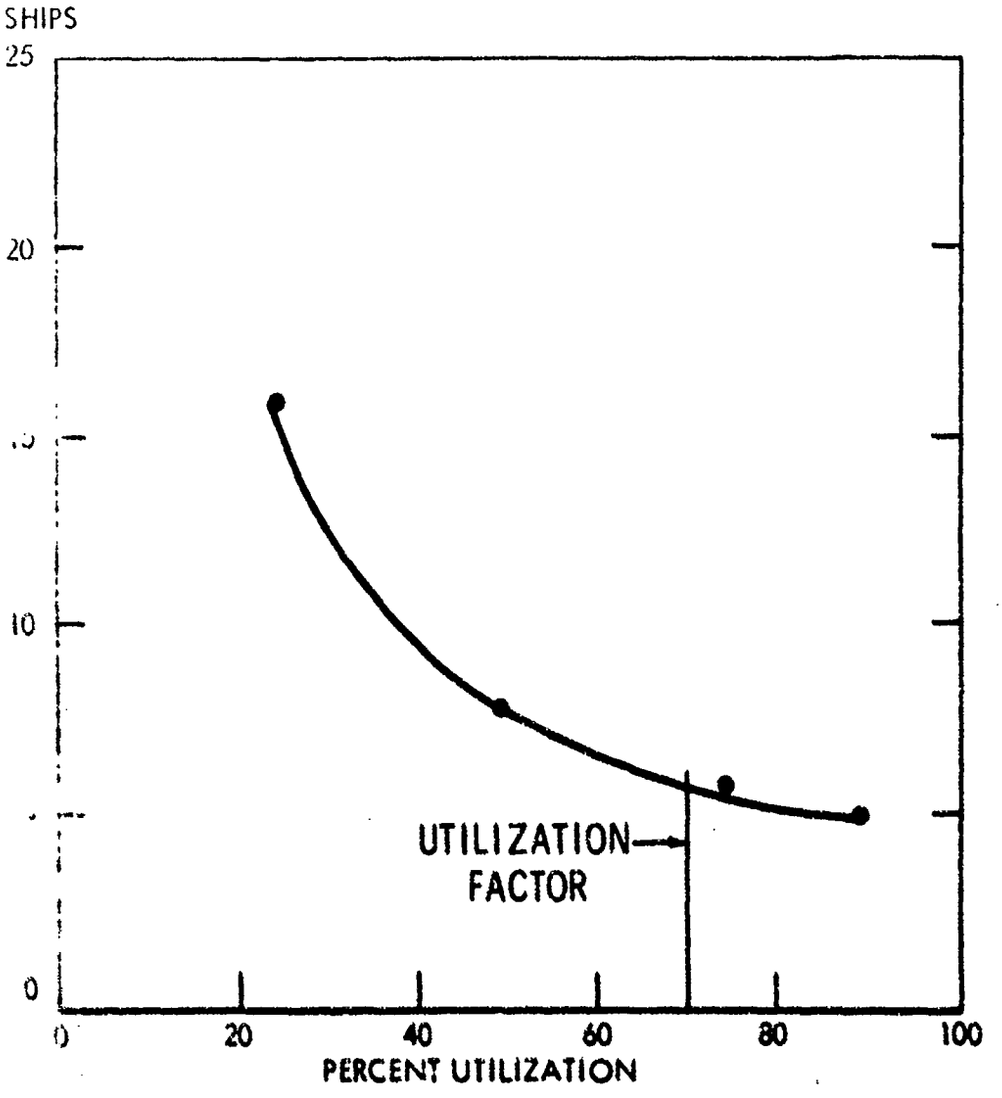
Programmed Fleet Mix: 23 Ships



TRADE ROUTE 13

20% COMMERCIAL CARGO PENETRATION

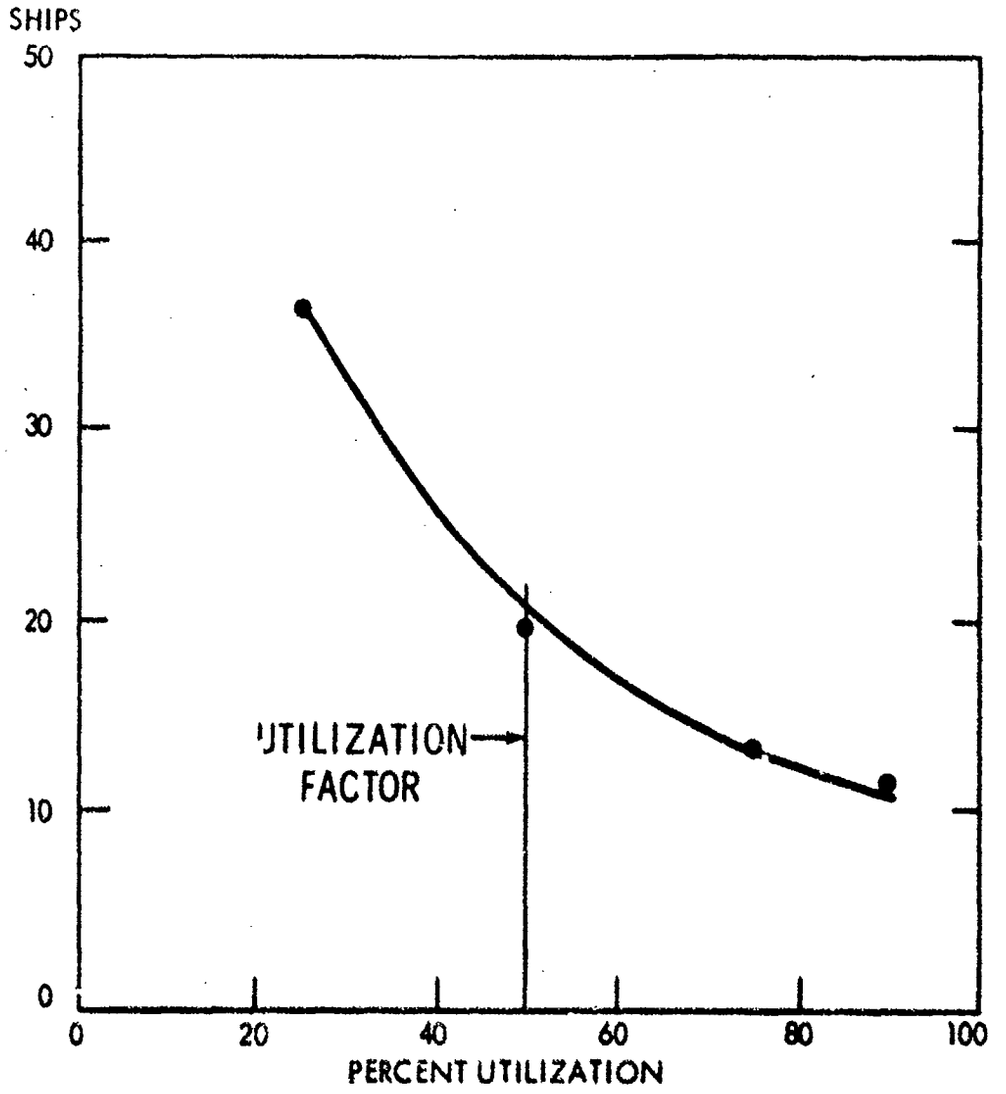
Programmed Fleet Mix: 7 Ships



TRADE ROUTE 18

35% COMMERCIAL CARGO PENETRATION

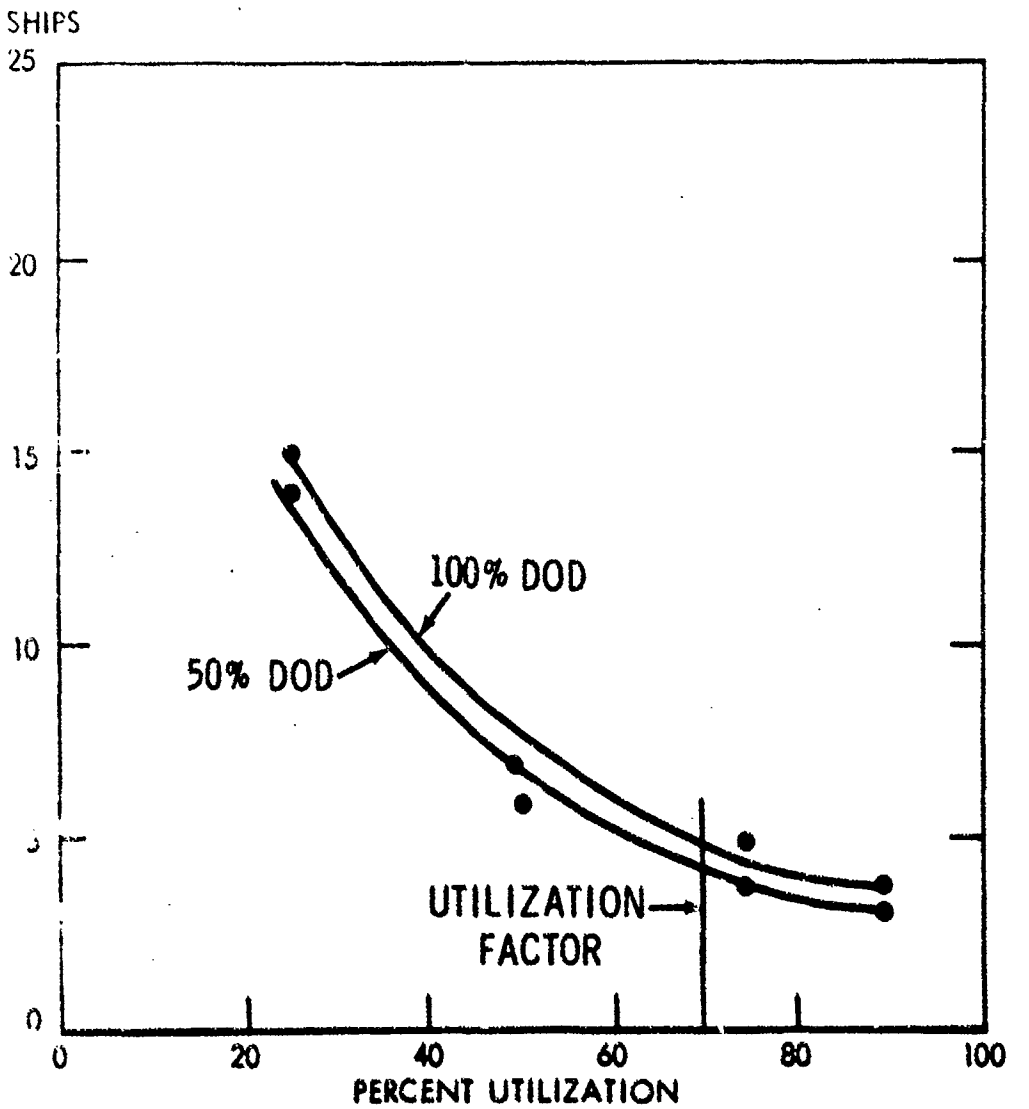
Programmed Fleet Mix: 7 Ships



TRADE ROUTE 21

10% COMMERCIAL CARGO PENETRATION

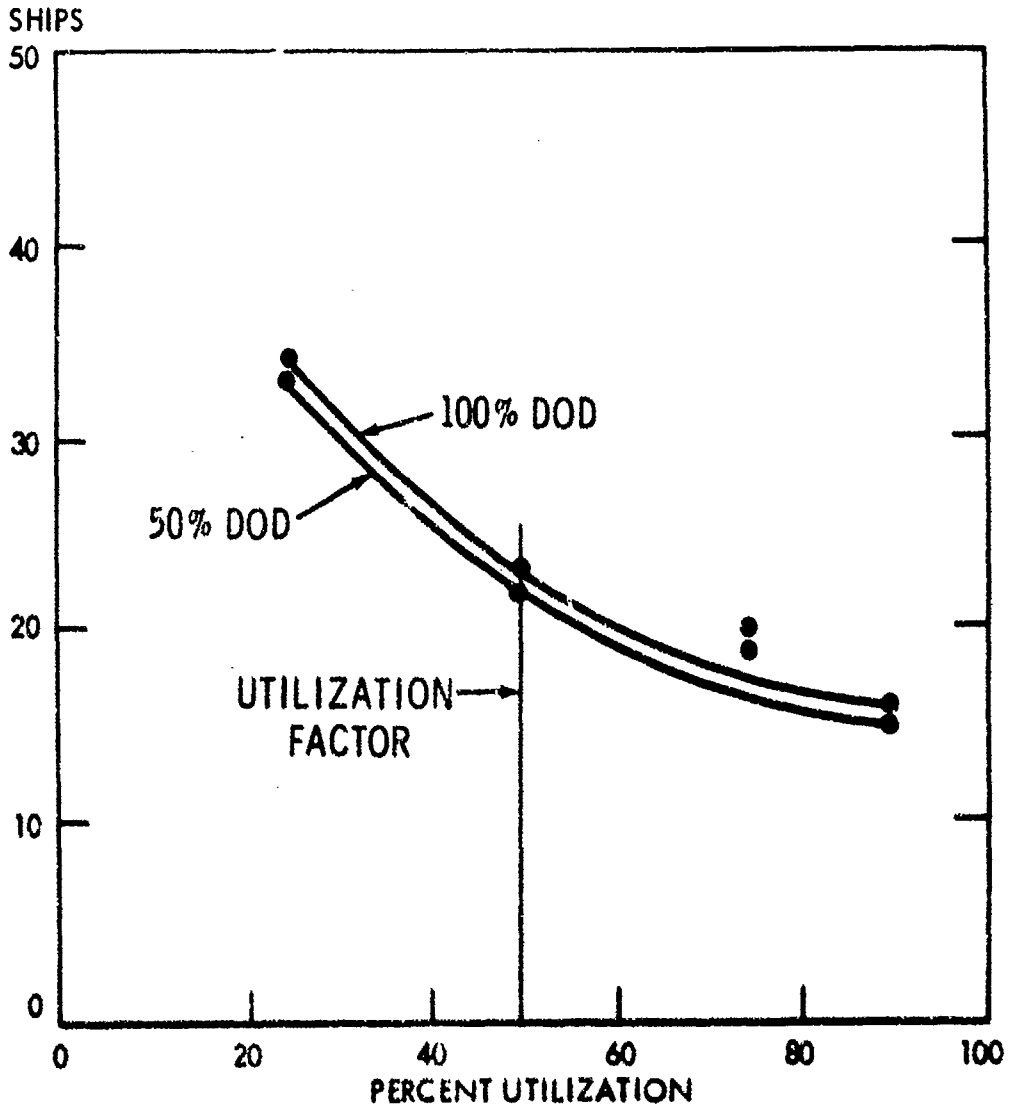
Programmed Fleet Mix: 12 Ships



TRADE ROUTE 22

20% COMMERCIAL CARGO PENETRATION

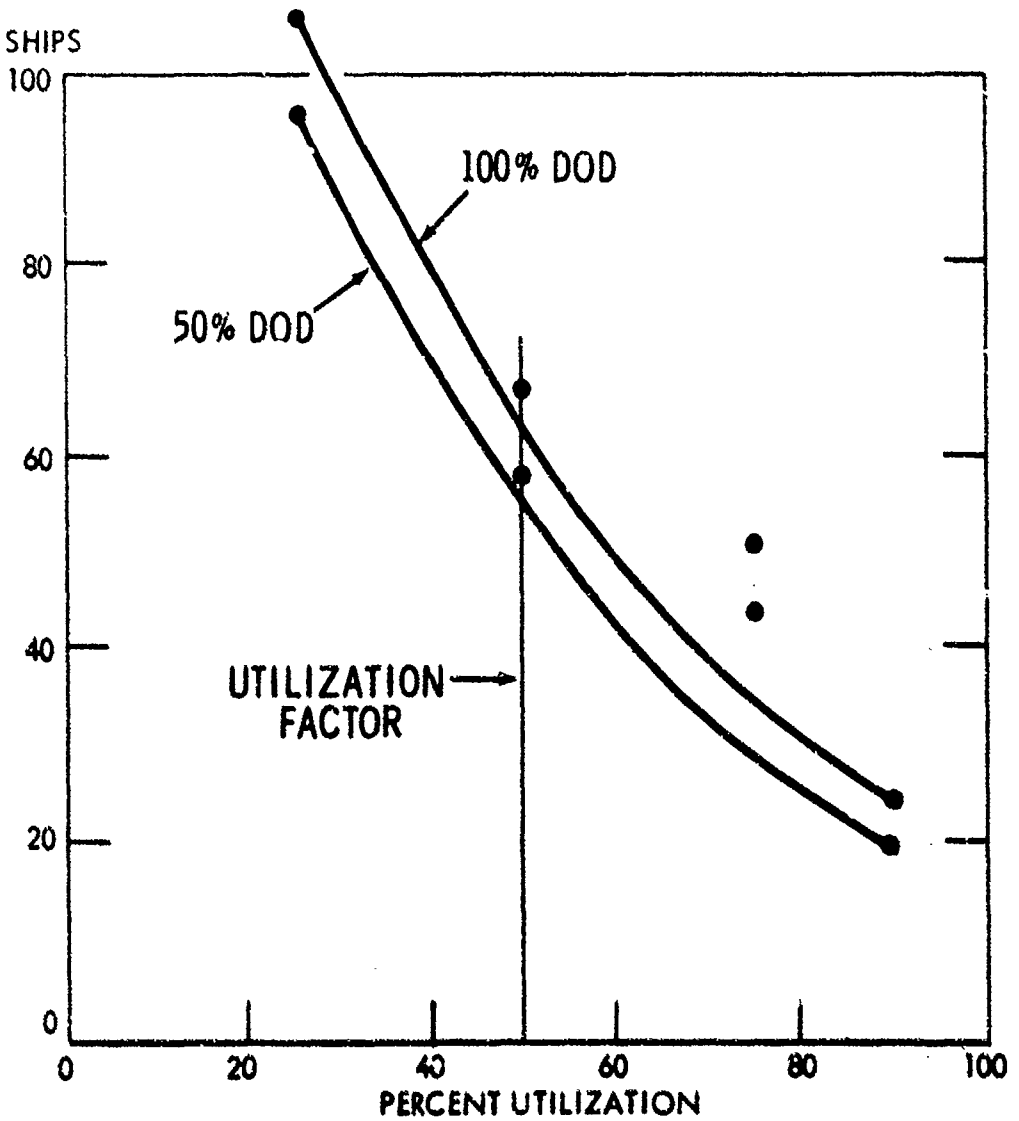
Programmed Fleet Mix: 19 Ships



TRADE ROUTE 29

25% COMMERCIAL CARGO PENETRATION

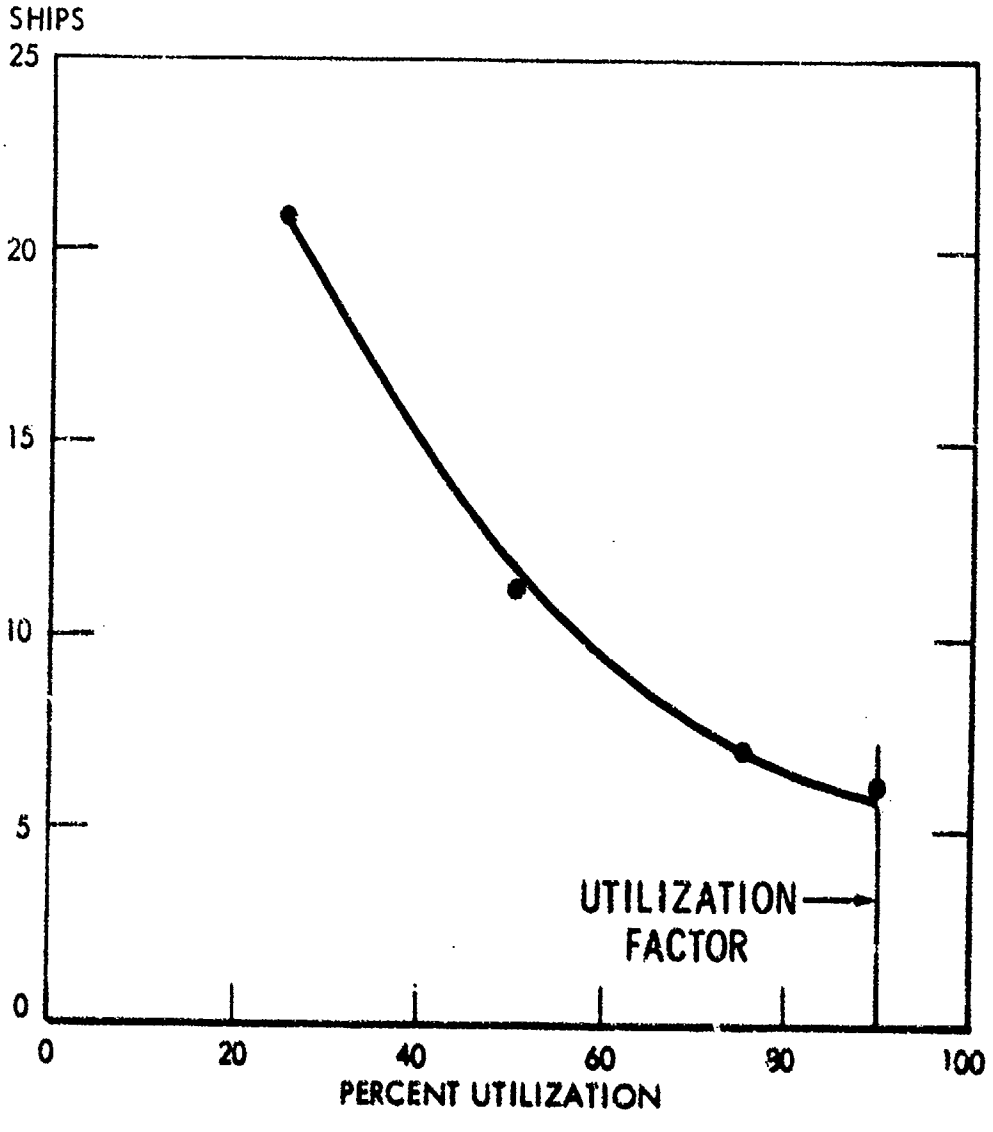
Programmed Fleet Mix: 65 Ships



TRADE ROUTE 32

20% COMMERCIAL TRADE PENETRATION

Programmed Fleet Mix: 0 Ships



APPENDIX H

CURRENT PENETRATION EXCURSION

TABLE H-1

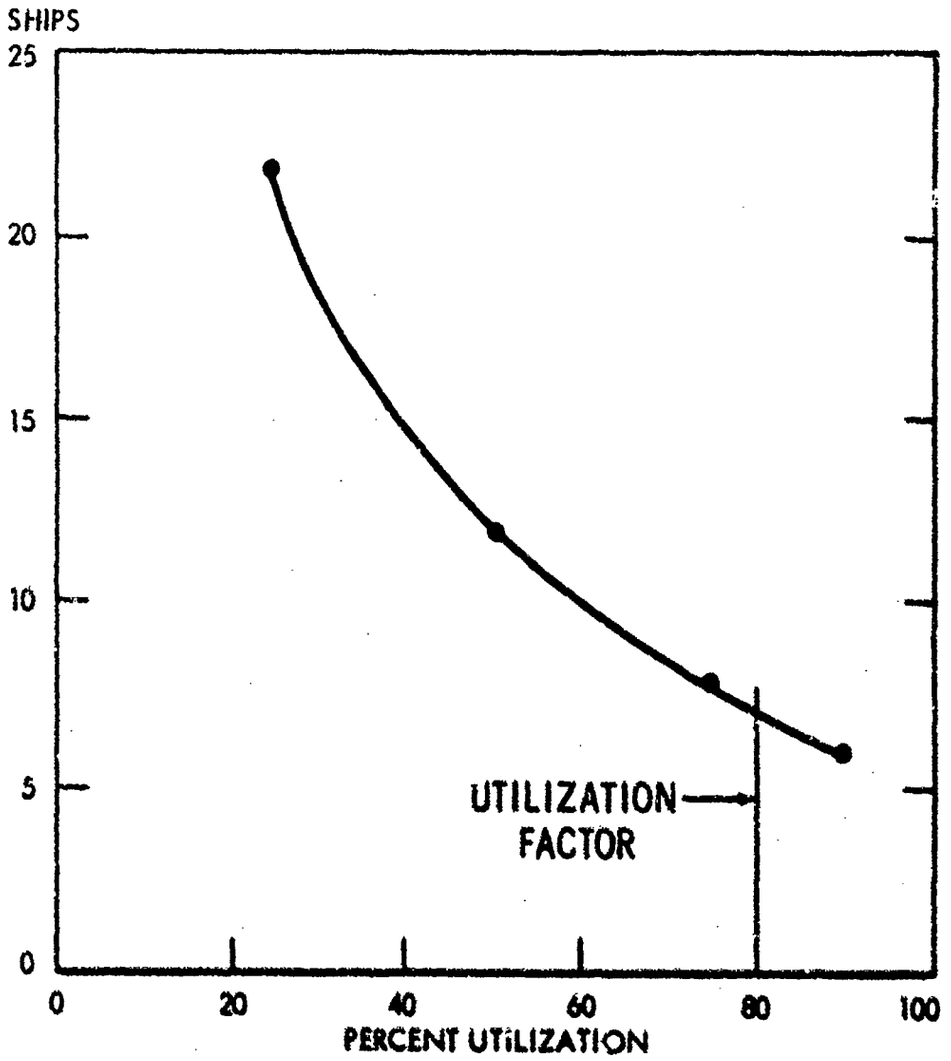
ECONOMIC FLEET EXCURSION WITH PRESENT PENETRATION
(Programmed Fleet in Parentheses)

Trade Route	Current Penetration	Utilization	Freighters	Partial Containers	Containers	Barge Carriers	Ro/Ro	Total
4	14.1%	80%	7(2)	0(0)	0(0)	0(0)	0(0)	7(2)
5-7-8-9	24.9%	85%	0(0)	0(0)	21(24)	0(0)	0(0)	21(24)
10	26.8%	70%	0(0)	0(0)	4(9)	2(5)	0(0)	6(21)
12	15.6%	50%	7(7)	0(0)	20(16)	4(0)	0(0)	31(23)
13	20.3%	70%	5(5)	1(2)	0(0)	0(0)	0(0)	6(7)
18	32.0%	50%	0(0)	2(2)	0(0)	16(5)	0(0)	18(7)
21	3%	70%	0(0)	0(3)	0(0)	2(9)	0(0)	2(12)
22	16.3%	50%	15(15)	4(4)	0(0)	3(0)	0(0)	22(19)
29	23.5%	50%	10(24)	0(2)	28(29)	6(6)	4(4)	48(65)
32	0	90%	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Puerto Rico	100%		0(0)	0(0)	28(17)	0(0)	3(3)	31(20)
Hawaii/Guam	100.0%		0(0)	0(0)	20(13)	0(0)	0(0)	20(13)
TOTAL			44(60)	7(13)	121(108)	33(25)	7(7)	212(213)

TRADE ROUTE 4

14% COMMERCIAL CARGO PENETRATION

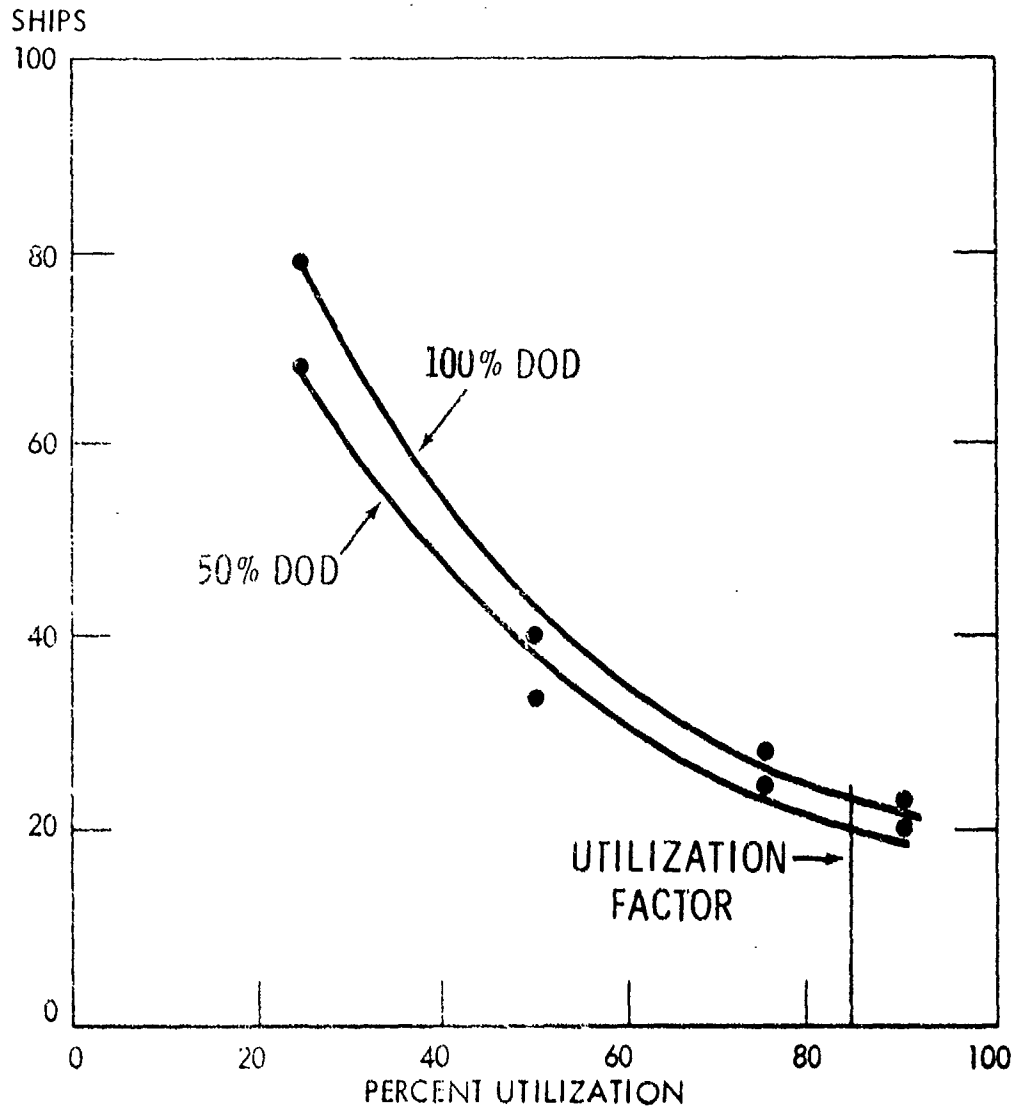
Programmed Fleet Mix: 2 Ships



TRADE ROUTE 5-7-8-9

30% COMMERCIAL CARGO PENETRATION

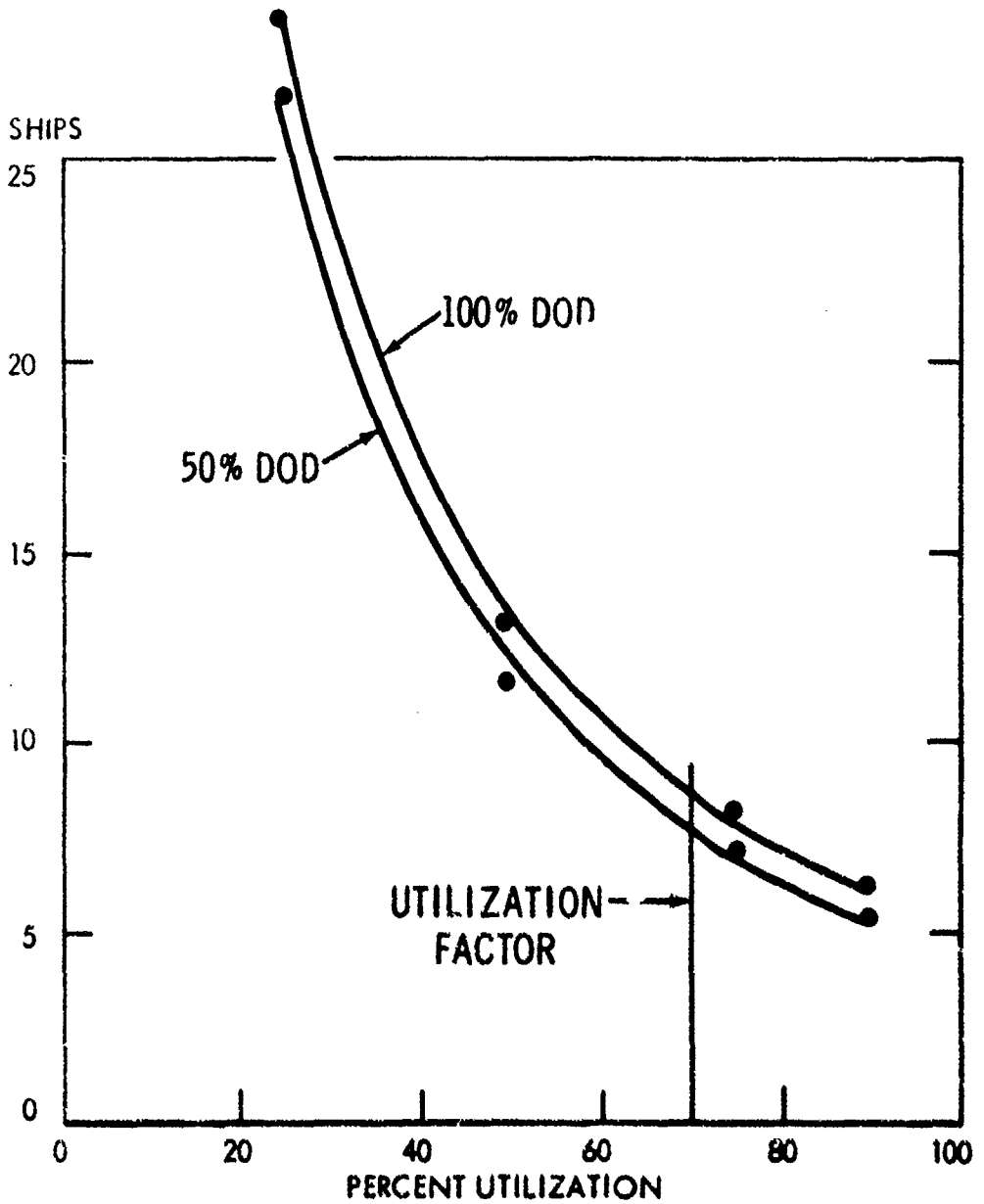
Programmed Fleet Mix: 24 Ships



TRADE ROUTE 10

30% COMMERCIAL CARGO PENETRATION

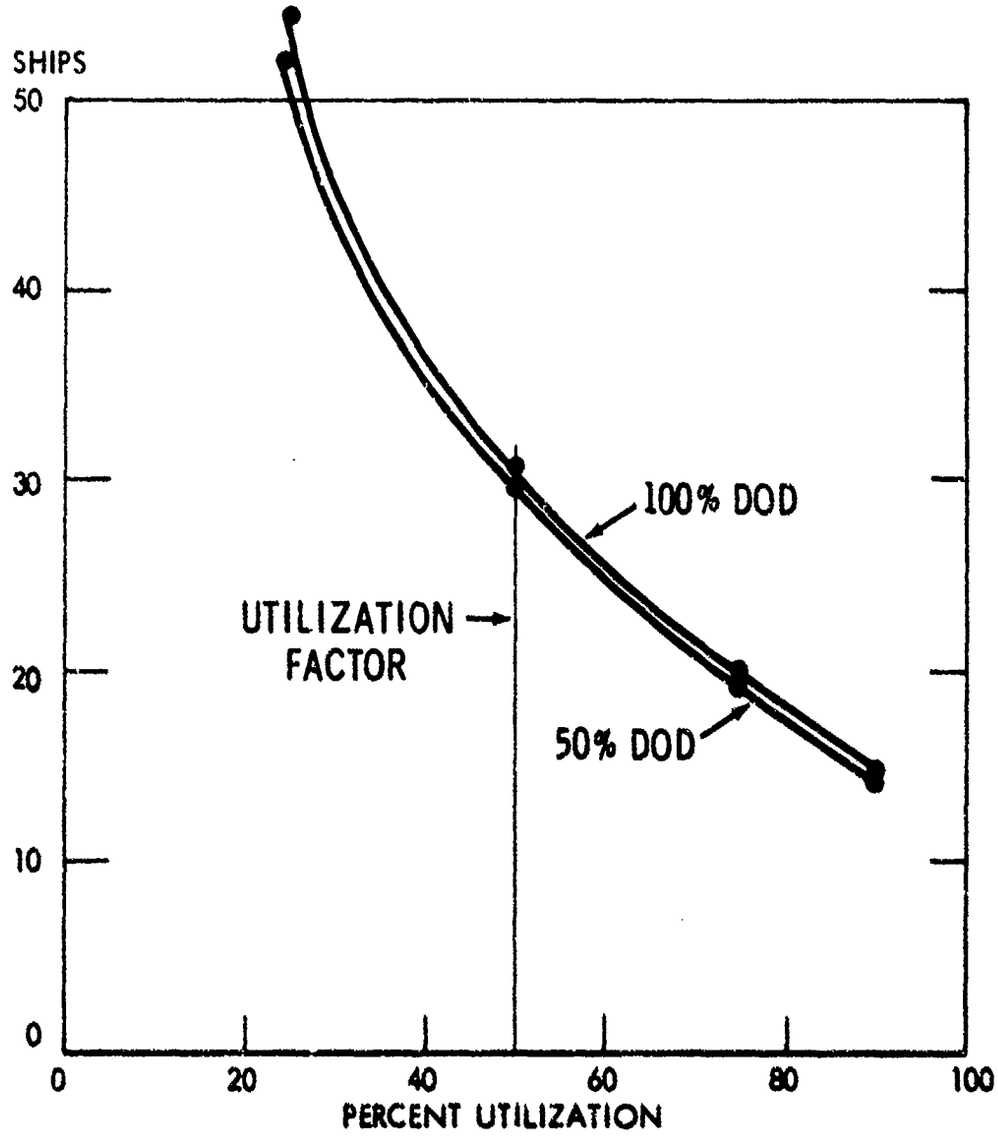
Programmed Fleet Mix: 21 Ships



TRADE ROUTE 12

16% COMMERCIAL CARGO PENETRATION

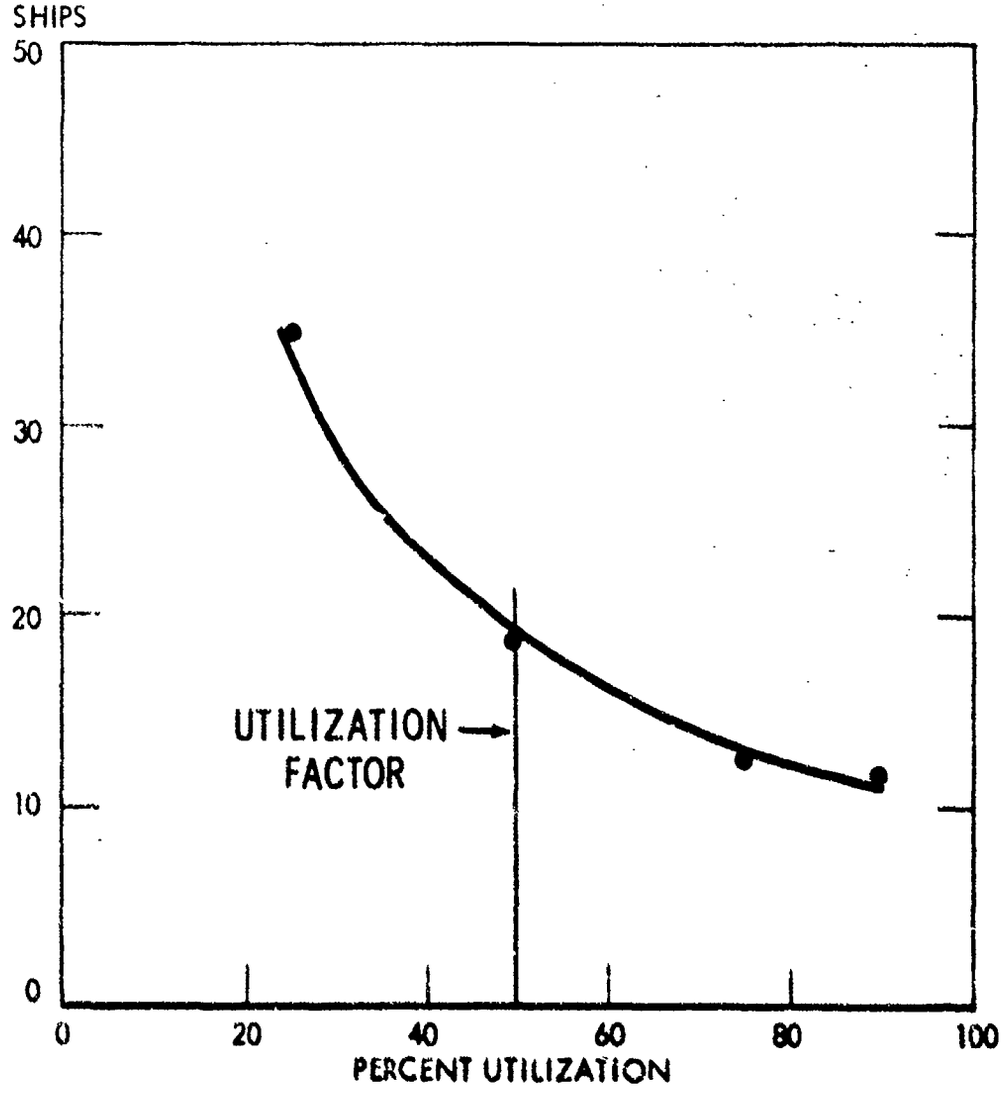
Programmed Fleet Mix: 23 Ships



TRADE ROUTE 18

32% COMMERCIAL CARGO PENETRATION

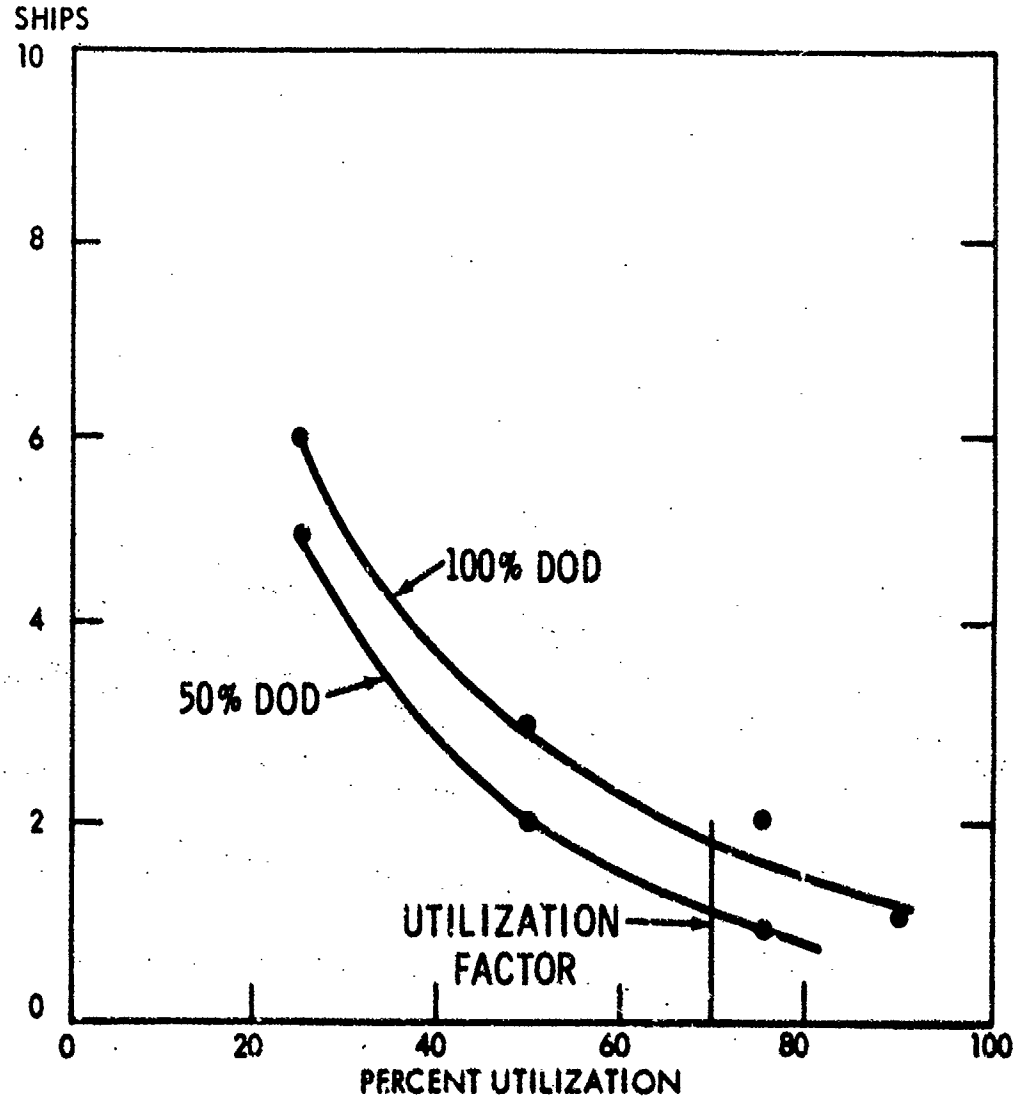
Programmed Fleet Mix: 7 Ships



TRADE ROUTE 21

3% COMMERCIAL CARGO PENETRATION

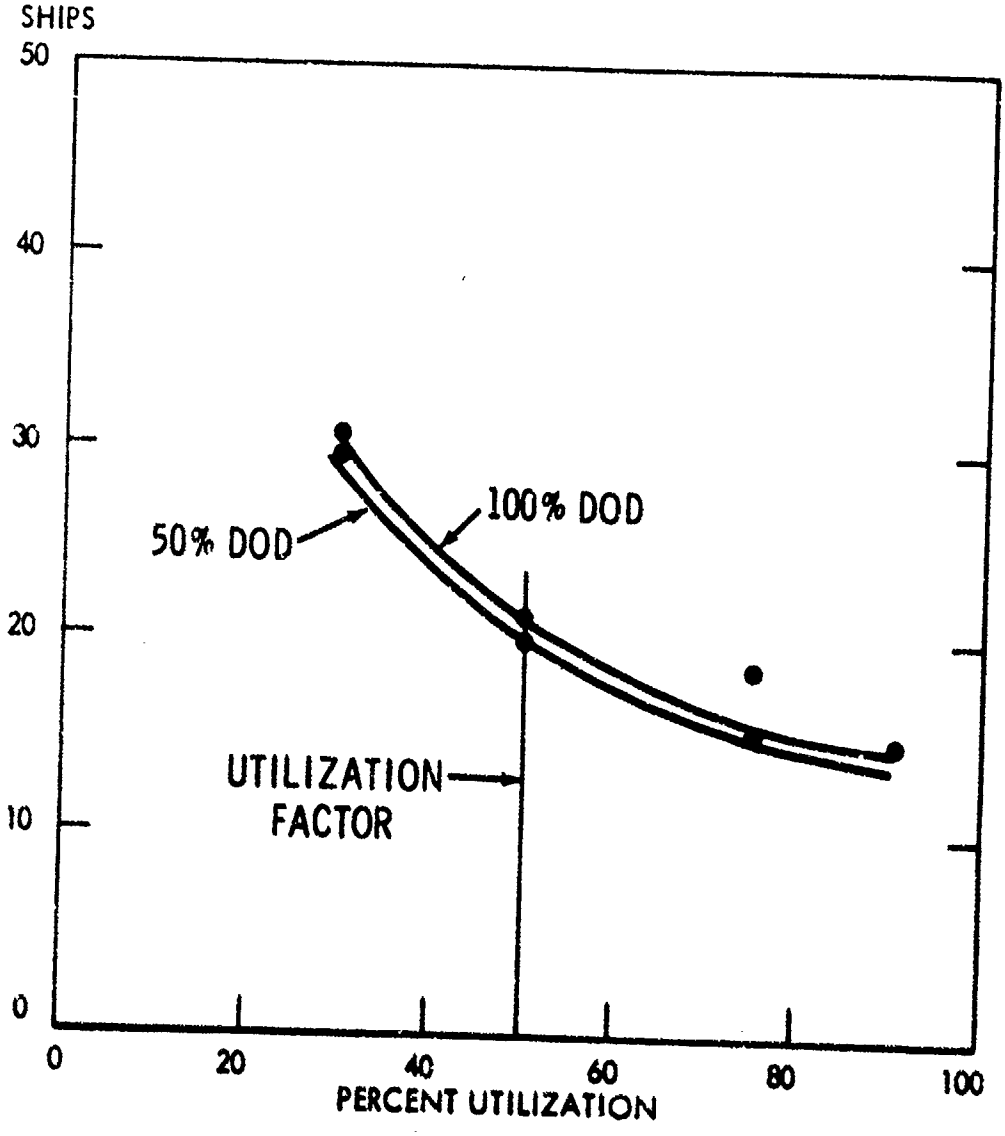
Programmed Fleet Mix: 12 Ships



TRADE ROUTE 22

16% COMMERCIAL CARGO PENETRATION

Programmed Fleet Mix: 19 Ships



TRADE ROUTE 29

23.5% COMMERCIAL CARGO PENETRATION

Programmed Fleet Mix: 65 Ships