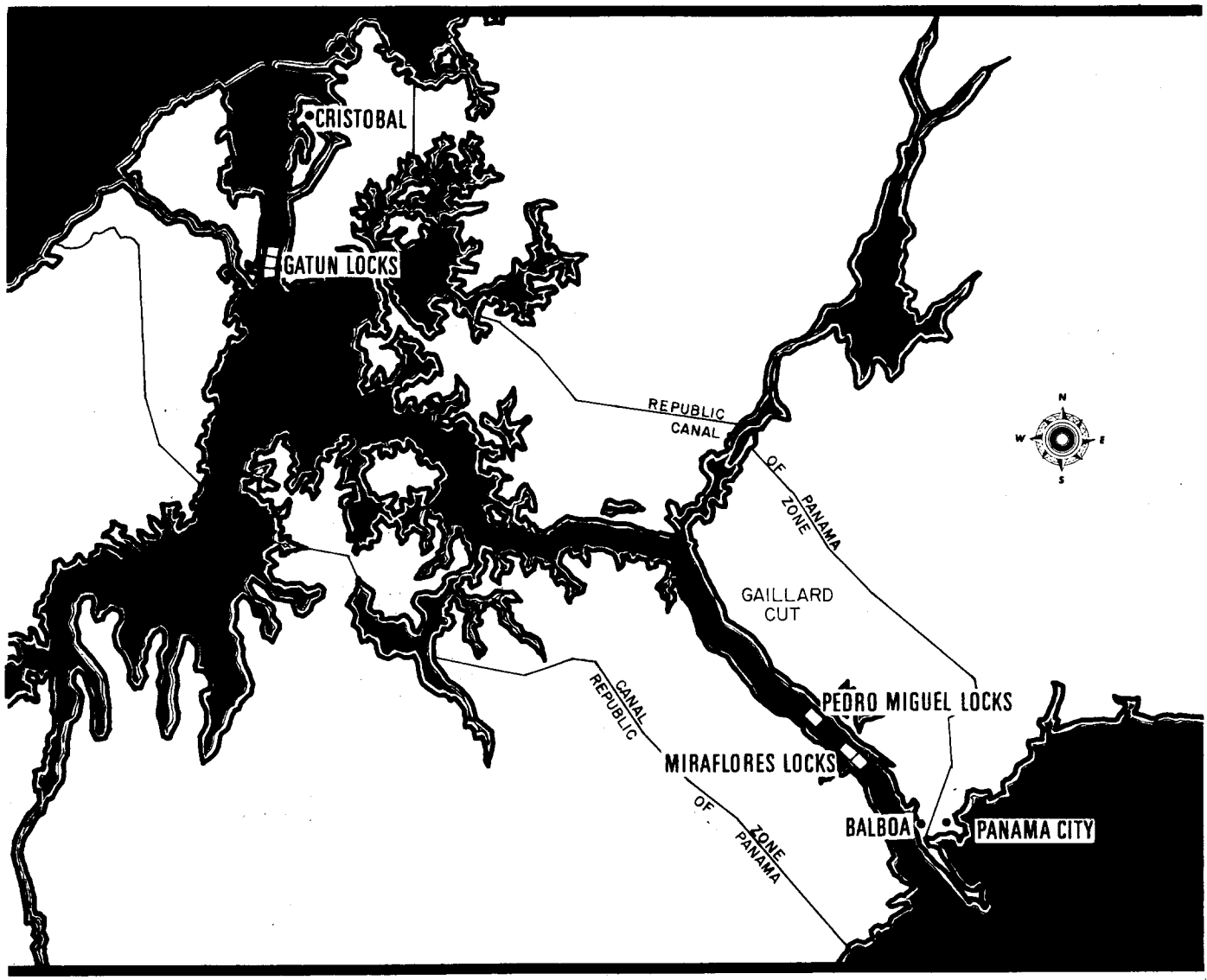
PROJECTIONS OF PANAMA CANAL COMMODITY FLOWS, TRANSITS, AND TOLLS THROUGH 1985

PREPARED FOR
THE PANAMA CANAL COMPANY



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JUNE 23, 1972

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Section I

INTRODUCTION

The Panama Canal Company is charged by the United States Government with the efficient and economic management of one of the world's most important arteries of commerce. This management covers the total operation of a complex system of waterways, locks, vessels, harbors, docks, and their concomitant maintenance and support facilities both in the Canal Zone and the United States. The entire process centers upon moving ships between the Atlantic and Pacific oceans in an orderly, expedient manner.

To ensure that the Canal is prepared to handle the volume of shipping needing its facilities at both entrances, long-term forecasts of traffic through the waterway are necessary. Occasionally, outside consultants have made such forecasts, but because of the dynamic nature of world trade, these have proved inadequate for truly effective long-range budgeting of expansion projects and funds. The Panama Canal Company, therefore, desired a forecasting system capable of immediate updating to reflect changes and to signal, at an early stage in those changes, the ultimate effects on Canal traffic.

Accordingly, the Company retained Economics Research Associates in 1969 to develop both a static long-range disaggregate forecast and a computer forecast system. The results of the static forecast were to be incorporated in the model in such a way that detailed traffic analyses and

modifications could be readily made. The research objectives of the study team were to forecast oceangoing commercial traffic through the Canal[1/] for fiscal years 1971 through 1975 and for 1980 and 1985. This information would include long tons of cargo by: (1) major commodity category,[2/] (2) major trade routes, and (3) type and size of ships for the milestone years. The computer system would then expand this basic data to generate total transits by commodity, vessel length, beam and draft, and tolls income under the present system and rates.

The first comparisons of the original ERA forecasts and Panama Canal traffic data were available in 1971. Actual results were fairly close to projections in many cases, and the Panama Canal Company authorized ERA to analyze the relationships of historical to forecast data and update the forecasts where necessary. The following report represents the results of these analyses for the years 1972 to 1985.

RESEARCH SCOPE

The forecast analyses delineate the commodities that flow through the Canal, identify their geographical areas of origin and destination, and describe the ships in which they move. Those commodities carried in large volume are analyzed individually, while the remaining tonnage is projected on the basis of general trade patterns among various areas in the world.

1/ Does not include government and noncargo-carrying vessels.
2/ Commodities (or related commodities) that move in large volume through the Canal.

As they effect traffic forecasts, the following factors were studied and analyzed to arrive at a forecast of transits through the Canal:

1. Current sources of commodities and their future stabilities.
2. Emerging sources of commodities and their opportunities in world commerce.
3. Present demand for commodities in specific countries as well as future demand, considering the economic growth.
4. Trends in types and sizes of ships.
5. Port and harbor developments.
6. Alternate shipping routes.
7. Alternative means of transportation.

All analyses of commodity traffic through the Canal assumed the present toll rates and measurement systems. Additionally, the analysis did not specifically consider the potential impact of any significant increase in trade between mainland China and the United States. This could be a significant factor by 1985 in certain commodities such as grain and coal, but due to current political uncertainties and the wide variation in estimates of projected impact, no specific projections were developed for this trade route.

RESEARCH METHODOLOGY

The project team analyzed all traffic data accumulated by the Canal Company over the past 20 years and in particular the years 1969 to 1971. Based on this analysis, team members were each assigned specific commodities for intensive study and evaluation. Those commodities for which 1971 results differed significantly from forecasts were the subject of special

attention, however, all commodities were reviewed. Team members then collected significant economic information as well as statistics on commodity production, movement, and use. Besides agencies of the United Nations and of the United States Government, international shipowner, commodity, and trade associations were personally contacted. In addition, important companies that produce, ship, and/or consume goods moving in world commerce were interviewed.

The study's emphasis was on acquiring quantitative data, both of a historical and forecast nature. Import-export trends and the factors which determine them were examined and discussed with experts. The possible diversion of commodity sources by economic or political means was analyzed, and future source development projected.

The results of the commodity tonnage forecasts and the discussion of the derivations appear in the following report. The attached computer report presents the forecasts in detail by commodity, trade route, and type and size of ship. Section II contains the summary and conclusions of the research study while Sections III through XX, present the individual commodity studies. The primary market research team consisted of Clive B. Jones, project leader, Jill Gold, and G. Christopher Davis. Administrative supervision was supplied by Harrison A. Price, President of Economics Research Associates, and John A. Greiner, Vice President of ERA. ERA acknowledges gratefully the great assistance rendered by Hugh Norris and other members of the Panama Canal Company. Thanks are also due the many persons in the business firms and government agencies who gave time and valuable information to the project team.

Section II

SUMMARY

METHODOLOGY

As mentioned earlier, a disaggregate approach has been used in the projection of Canal traffic through 1985. This method was selected instead of a general one (such as historical trend or regression analysis) because of the Canal's need to review and update forecasts for specific commodities. The Canal's traffic derives largely from particular components of trade (commodities and trade routes), rather than from world trade in general or from trade among the major developed countries. The flow of traffic by commodity is strongly influenced by the condition of supply in the exporting countries and the change in demand arising in the importing countries. These circumstances cannot be accurately analyzed by the aggregate method. The disaggregate approach permits the inclusion of changes in technology, politics, and commerce peculiar to a specific trade route and commodity. Most important, it allows periodic review of projections using historical data to isolate changing developments and interrelationships in one or more specific areas of the forecast. Deviations from the forecast can then be classed as temporary or fundamental and projections revised accordingly.

As will be discussed in subsequent sections, many factors were identified and analyzed for each commodity and its major trade routes. An attempt was made to identify the major influences on traffic within each commodity category and to evaluate them to the maximum extent possible

within the time constraint. The chief problem in this type of approach is the probability of the emergence of important new commodities or new sources of existing commodities that cannot be identified at this time. In order to compensate for this contingency, tonnage projections for the commodity category of general cargo included an allowance for these unforeseeable events.

It was assumed for purposes of the forecast that the developed nations will continue to expand their economies in line with recent experience and that no major depressions will occur. It was also assumed that the underdeveloped countries will continue to progress toward their goals of increased output and higher living standards. In addition, the projections reflect a draft limitation of 39 feet for the Canal's waters.

Summarized below are ERA's projections of tonnages by major commodity group and the resulting transits and tolls, based on the expected frequency distributions of ship type and size, for these products and their trade routes. The accompanying computer reports, the Forecast System Input Report and the Forecast System Output Report, should be referred to for detailed results of ERA's study.

ANALYSIS OF ERA 1969 FORECAST

On an overall basis, ERA's projections for tonnage, transits and tolls in 1971 compared favorably to actual results. Summary Table 1 presents a summary comparison of actual to projected traffic along with the percentage difference for each category. As shown, total tonnage was low by about 2.4 percent, while total tolls and transits were within 1 percent. For Atlantic-

Summary Table 1

COMPARISONS OF ERA PROJECTIONS TO
PANAMA CANAL 1971 TRAFFIC FIGURES

	Actual	Projected	Percentage Difference
Total Traffic			
Number of Transits	13,757	13,677	- 0.58
Long Tons of Cargo (thousands)	118,627	115,818	- 2.36
Tolls (thousands)	$97,380	$97,194	- 0.19
Panama Canal Net Tonnage (thousands)	111,006	111,344	+ 0.34
Atlantic to Pacific			
Laden Transits			
Number	6,238	5,953	- 4.6
Long Tons of Cargo (thousands)	74,170	74,106	- 0.1
Tolls (thousands)	$48,460	$47,454	- 2.1
Panama Canal Tonnage (thousands)	53,845	54,425	+ 1.1
Ballast Transits			
Number	823	873	+ 5.7
Tolls (thousands)	$3,453	$3,704	+ 7.3
Panama Canal Tonnage (thousands)	4,795	5,146	+ 7.3
Pacific to Atlantic			
Laden Transits			
Number	5,579	5,605	+ 0.5
Long Tons of Cargo (thousands)	44,097	41,712	- 5.4
Tolls (thousands)	$37,908	$36,122	- 4.7
Panama Canal Tonnage (thousands)	42,121	40,189	- 4.6
Ballast Transits			
Number	1,117	1,266	+13.4
Tolls (thousands)	$6,749	$8,339	+23.6
Panama Canal Tonnage (thousands)	9,373	11,584	+23.6

Source: Economics Research Associates.

to-Pacific traffic, the tonnage forecast was within 0.1 percent while the number of laden transits was 4.6 percent low. Ballast transits were overestimated by 5.7 percent.

For Pacific-to-Atlantic traffic, the tonnage was underestimated by 5.4 percent, but laden transits were within 0.5 percent. Ballast transits again were overstated at 13.4 percent.

In general, the results show that tonnage projections were relatively accurate, but some adjustments are necessary to more precisely relate tonnage to transits, tolls and PCC tons, and ballast returns. The revised forecast has adjustments intended to more accurately reflect these relationships.

Finally, the projected distribution of Canal cargo by ship type was comparable to actual data as shown below:

Type of Ship	Percentage of Total Canal Cargo	
	1971 Actual	1971 Projected
General Cargo	33.0%	30.8%
Reefer	2.8	1.8
Container	1.2	1.7
Passenger	0.4	0.6
Tanker	15.1	16.3
Dry Bulk Carrier	44.6	43.5
Combination Carrier	2.5	4.2
Other	0.7	1.1

PROJECTIONS OF COMMODITY TONNAGE TRAVERSING THE PANAMA CANAL

The Panama Canal is expected to experience significant growth in traffic from its 1971[1/] total of 118.6 million long tons. In 1972, 111.0 million long tons of cargo are projected to pass through the Canal, increasing to 128.7 million long tons by 1975 and reaching over 174 million long tons by 1985. Summary Table 2 presents the tonnage estimated to transit the Canal for each major commodity or group of commodities by trade route direction for the years 1972, 1975, 1980, and 1985. As can be seen, the increase in total Canal traffic is attributable to most of the commodity categories, the exceptions being coal, bauxite-alumina, and scrap metal. Petroleum, petroleum products, manufactures of iron and steel, coarse grains, and the general-cargo commodity category[2/] are projected to experience the largest absolute increases.

Increases in crude petroleum are a result of the oil discoveries on the Alaskan North Slope and in South America. ERA projects that about 3.0 million long tons of North Slope crude will transit annually during the 1978 to 1985 period. Shipments of South American oil to ports on the Gulf and East Coasts of the United States are expected to total 10.0 million long tons by 1975 and 11.0 million by 1985.

1/ Any reference to a year refers to the Canal's fiscal year, July 1 to June 30.
2/ Includes all commodities not isolated for special study.

Summary Table 2

PROJECTED CANAL TRAFFIC BY YEAR, COMMODITY, AND ROUTE DIRECTION
(Thousands of Long Tons)

Commodity Description	Fiscal Year 1972[1/]			Fiscal Year 1975			Fiscal Year 1980			Fiscal Year 1985		
	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total	Atlantic to Pacific	Pacific to Atlantic	Total
Wheat	1,882	306	2,188	1,808	375	2,183	1,862	375	2,237	1,943	375	2,318
Coarse Grains	5,610	991	6,601	8,490	1,090	9,580	9,935	1,140	11,075	11,420	1,170	12,590
Bananas	12	1,107	1,119	25	1,190	1,215	30	1,340	1,370	35	1,500	1,535
Sugar	2,463	3,439	5,902	1,900	3,800	5,700	2,100	4,100	6,200	2,550	4,500	7,050
Soybeans	3,704	37	3,741	3,620	70	3,690	4,040	100	4,140	4,560	100	4,660
Lumber	105	5,286	5,391	100	5,900	6,000	100	6,525	6,625	100	7,300	7,400
Pulp, Paper, and Paper Products	1,078	2,041	3,119	1,210	2,675	3,885	1,425	3,355	4,780	1,580	4,050	5,630
Phosphates	4,526	8	4,534	4,656	25	4,681	4,880	25	4,905	4,496	25	4,521
Potash, Fish Meal, and Fertilizers	1,571	2,503	4,074	1,630	2,900	4,530	1,855	2,850	4,705	1,885	2,950	4,835
Iron Ore	587	2,041	2,628	650	2,488	3,138	750	2,535	3,385	800	2,535	3,435
Miscellaneous Ores	665	1,999	2,664	1,020	2,100	3,120	1,410	2,440	3,850	1,560	2,940	4,500
Scrap Metal	1,700	20	1,720	2,100	25	2,125	1,150	25	1,175	600	25	625
Alumina and Bauxite	1,500	850	2,350	1,020	600	1,620	750	20	770	700	20	720
Miscellaneous Metals	595	1,539	2,134	680	1,525	2,205	780	1,690	2,470	860	1,800	2,660
Coal	15,000	382	15,382	11,055	400	11,455	11,136	425	11,561	11,800	450	12,250
Crude Petroleum	4,300	1,975	6,275	2,700	12,700	15,400	2,100	15,000	17,100	2,100	16,500	18,600
Petroleum Products	8,600	1,800	10,400	9,900	2,700	12,600	11,400	3,000	14,400	12,900	3,500	16,400
Chemicals	1,738	818	2,556	2,025	1,200	3,225	3,095	2,080	5,175	7,620	4,750	12,370
Iron and Steel Manufactures	1,870	7,148	9,018	1,900	7,700	9,600	1,900	8,500	10,400	1,900	9,500	11,400
Autos and Trucks	670	694	1,364	705	1,076	1,781	770	1,340	2,110	805	1,468	2,273
General Cargo	6,902	10,847	17,749	8,600	12,400	21,000	12,000	16,200	28,200	16,200	22,300	38,500
Total	65,078	45,831	110,909	65,794	62,939	128,733	73,468	73,065	146,533	86,414	87,758	174,172

1/ Computer output adjusted to reflect estimated impact of U.S. dock strikes in FY 1972.

Source: Economics Research Associates.

Shipments of manufactures of iron and steel are projected to grow from 9.0 million long tons in 1972 to 11.4 million in 1985, primarily because of Japan's exports to the United States and Europe. Japanese imports are also responsible for the large projected increase in coarse grains traffic. Rapid growth in corn and sorghum imports is expected to last through 1985 as they continue their shift to meat consumption.

Substantial increases in the general-cargo commodity category, from 17.7 million long tons in 1972, to 38.5 million long tons by 1985, are estimated. Significant growth has been forecast for most of the major trade routes; traffic on the United States-Asia trade route in particular is projected to rise 6 to 8 percent annually until 1985. Also included in this category are the unknown factors--new sources and new commodities--which have been estimated to equal approximately 11 million long tons together by 1985.

The traffic in coal from Hampton Roads, United States, to Japan is projected to decrease sharply from its 1972 level of 15.0 million long tons to 11.1 million long tons by 1975. About 50 percent of the coal sent to Japan will probably bypass the Canal by 1975 and 60 percent by 1985 as the large oil-bulk-ore (O.B.O.) ships of 100,000 DWT (dead weight tonnage) and more travel around the Cape of Good Hope to Japan. Less important are the projected decreases in scrap metal shipments to Japan from 1.7 million long tons to 600,000 long tons by 1985 and in bauxite-alumina shipments from 2.4 million long tons in 1972 to almost 700,000 long tons in 1985.

As shown in Summary Table 2, ERA projects the growth in Canal traffic to occur primarily in the northbound direction (Pacific to Atlantic) while the southbound trade remains relatively constant until 1980. The currently uneven balance of trade, therefore, is expected to go from a 7:4 ratio in favor of the southbound traffic to an essentially balanced condition by 1985. Practically all commodity groups are projected to experience traffic growth in the northbound direction while the southbound trade increases are substantially offset by the decline in coal tonnage.

The Canal traffic is projected to increase moderately during the period from 1972 to 1975, primarily due to exports of South American crude oil, as shown below:

	1972	1973	1974	1975
Total Canal Tonnage (thousands of long tons)	110,909	122,853	127,692	128,733

As mentioned earlier, the coal bypass will probably cause a drastic decline in Atlantic-Pacific Canal traffic but this is offset by projected crude petroleum transiting the Canal in the Pacific-to-Atlantic direction.

Considerable coal and iron ore traffic will probably bypass the Canal because of its inability to handle the large O.B.O. ships carrying these commodities. Total bypass volume is estimated to be 16.4 million long tons in 1972, 26.7 million in 1975, and 33.6 million in 1985. Figure 1 presents the projected Canal traffic through 1985 and the total potential long tons if the Canal were not limited as to ship size.

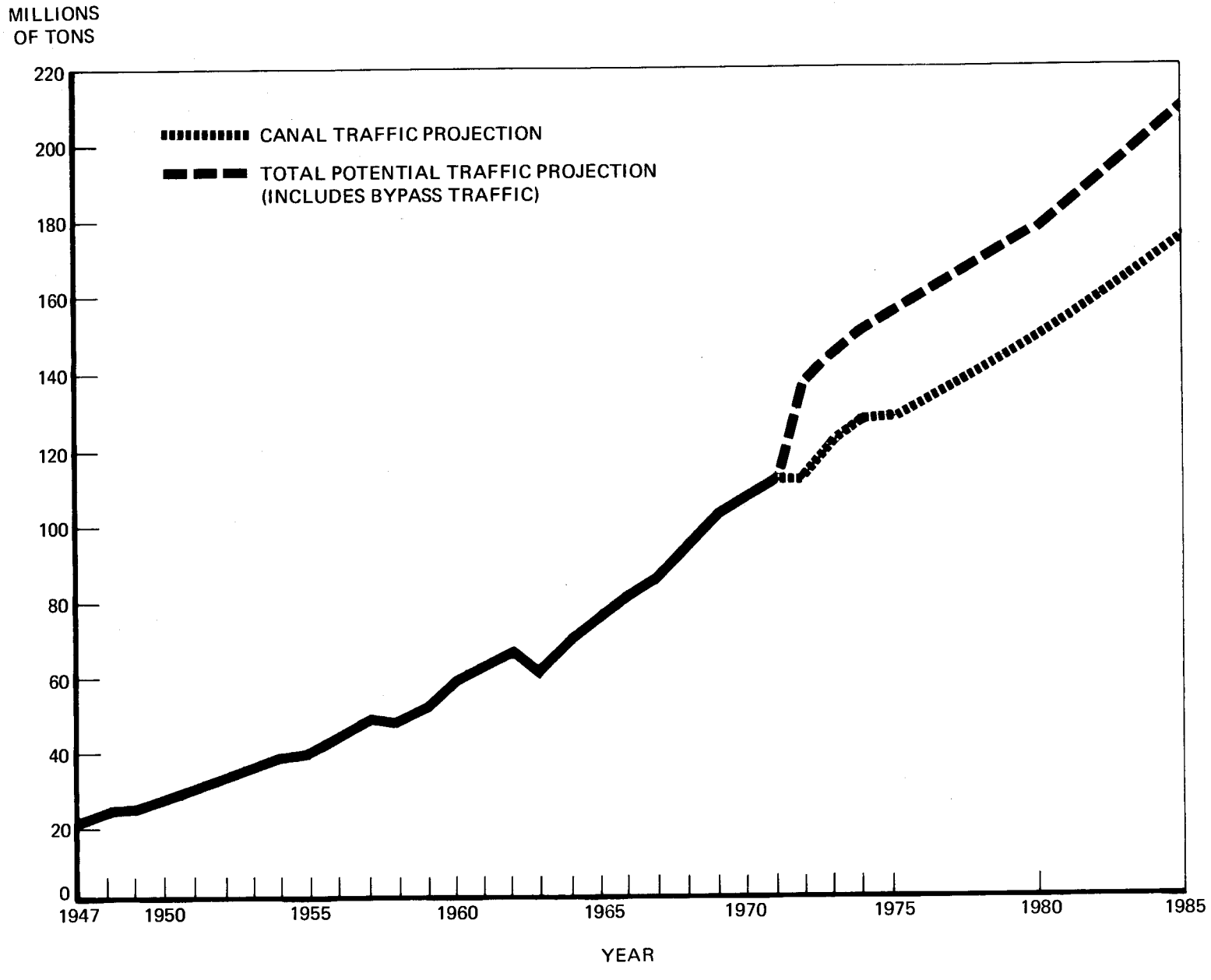


Figure 1

PROJECTED PANAMA CANAL COMMERCIAL AND BYPASS TRAFFIC, LONG TONS OF CARGO

TRANSITS

The projections of Canal transits have been derived from the commodity tonnage projections and through an analysis of the types and sizes of ships that can be expected to carry the various commodities. Another element in these forecasts is the extent to which the available cargo capacity of the transiting ships will actually be used (load factor). In addition, the number of ballast transits associated with the movement of a commodity was estimated. The estimates of type and size of ships, of the load factor, and of the ballast factor are shown in detail for each trade route in the System Input Report. The results of those estimates and summary conclusions are presented below. The System Output Report should be consulted for detail transit results.

Total Canal commercial transits are projected to increase from about 13,722 in 1972 to 15,235 in 1980 and 17,443 in 1985. Summary Table 3 presents the number of laden and ballast transits for selected years in the period 1972 to 1985. Ballast transits are expected to increase to about 2,000 per year by 1980 and to increase only modestly through 1985. The proportion of ballast transits is expected to decline from 14.0 percent in 1971 to 13.0 percent by 1985.

Figure 2 presents the projected number of transits through the Canal from 1972 to 1985.

TOLLS

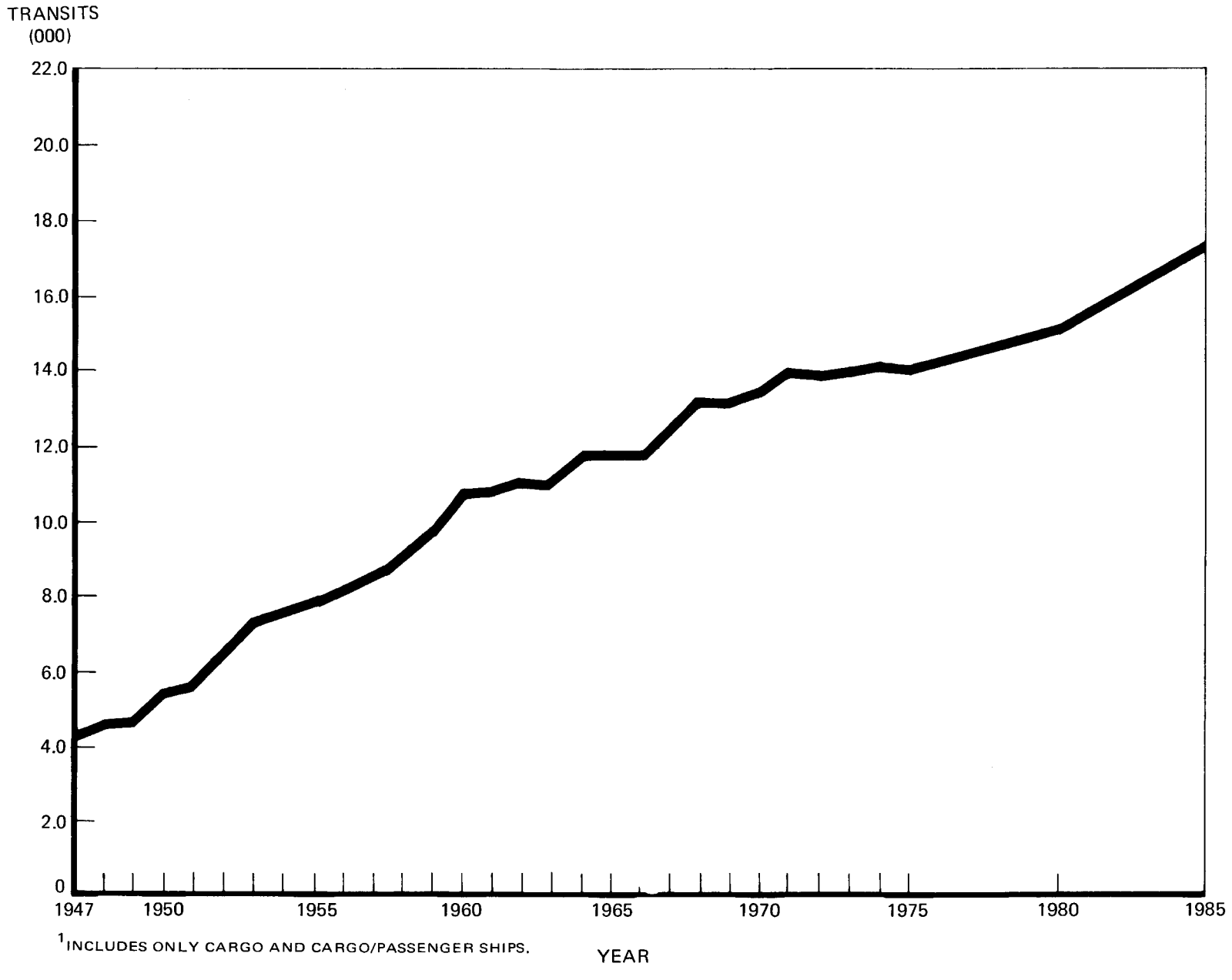
Basing its analysis on the type, size, and number of ships passing through the Canal and the number of laden and ballast transits related to

Summary Table 3

SUMMARY OF CANAL TRANSIT PROJECTIONS
1972-1985

Year	Atlantic to Pacific			Pacific to Atlantic			Total Transits		
	Laden	Ballast	Total	Laden	Ballast	Total	Laden	Ballast	Total
1972	5,928	730	6,658	6,081	983	7,064	12,009	1,713	13,722
1973	5,823	848	6,671	6,323	954	7,277	12,146	1,802	13,948
1974	5,757	960	6,685	6,533	930	7,463	12,258	1,890	14,148
1975	5,613	962	6,565	6,638	900	7,538	12,251	1,862	14,113
1980	6,017	1,007	7,024	7,233	978	8,211	13,250	1,985	15,235
1985	6,848	1,164	8,012	8,316	1,115	9,431	15,164	2,279	17,443

Source: Economics Research Associates.



[1] INCLUDES ONLY CARGO AND CARGO/PASSENGER SHIPS.

Figure 2

PROJECTED PANAMA CANAL COMMERCIAL TRANSITS[1]

each, ERA has derived the expected toll revenue for the Canal from 1972 through 1985.1/ Summary Table 4 presents the estimated Canal revenue from tolls for selected years from 1972 to 1985 and the toll revenue that will be lost from bypass transits. Tolls are estimated to increase from $99.4 million in 1972 to 154.9 million in 1985. Revenue lost from bypass transits is forecast to grow from almost $7.4 million in 1971 to about $15.3 million in 1985.

1/ Tolls are calculated at a rate of $0.90 per laden Panama Canal ton and $0.72 per ballast Panama Canal ton.

Summary Table 4

PROJECTED TOLL REVENUES
1972-1985
(Thousands)

Year	Canal Revenue	Lost Bypass Revenue
1972	$ 99,428	$ 7,446
1973	104,750	9,096
1974	110,619	10,674
1975	113,246	12,181
1980	129,769	13,563
1985	154,895	15,345

Source: Economics Research Associates.

Section III

WHEAT AND WHEAT FLOUR

ANALYSIS OF 1969 ERA PROJECTIONS

Figure 3 presents actual and projected long tonnage of wheat and wheat flour traversing the Panama Canal from the Atlantic to Pacific and the Pacific to Atlantic from 1960 to 1985. As can be seen from the figure, projected traffic traveling from the Pacific to Atlantic is understated in 1970 and 1971; traffic traveling from the Atlantic to Pacific through the Canal is understated in 1971.

Table 1 presents the component wheat and wheat flour trade routes of traffic through the Canal since 1969. Historically, commodity traffic has fluctuated greatly both by direction and trade route. ERA's 1971 projections for Atlantic to Pacific tonnage understated this traffic by 34 percent due mainly to greater than expected tonnage traveling the East Coast Canada and East Coast United States to Asia trade routes. The other 1971 component trade route projections were close to actual tonnage passing through the Canal.

The increased 1971 wheat traffic on the East Coast of the United States to Asia trade route is due to two principal factors. First is the increased demand for bread type wheats from Korea, Japan, Taiwan and the Phillipines. With improved standards of living, many Asian countries are switching from rice economies to bread economies. In particular, Asians have switched from consumption of noodles and other soft wheat foods imported from the West Coast of the United States to hard bread wheats. The Western Wheat Associates,

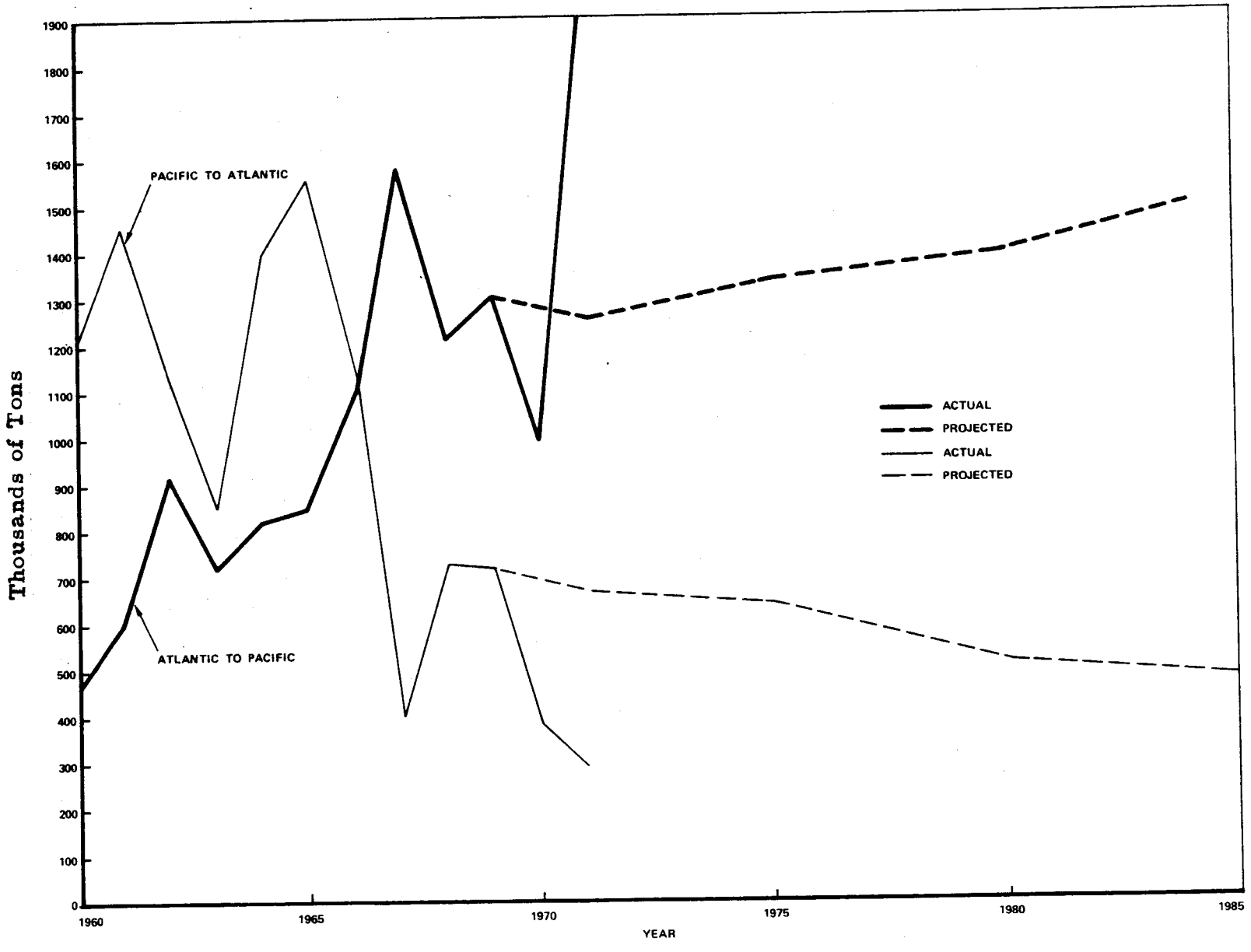


Figure 3

WHEAT AND WHEAT FLOUR TRAFFIC TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 1

SUMMARY OF WHEAT AND WHEAT FLOUR SHIPMENTS
THROUGH THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States and Canada to Asia	771	506	1,217	570
East Coast United States to West Coast South America	395	375	539	540
Other	134	121	150	140
Subtotal	1,300	1,002	1,906	1,250
Pacific to Atlantic				
West Coast United States and Canada to Europe	485	199	46	350
West Coast Central America to Europe	0	16	0	40
West Coast Canada to East Coast South America	60	20	9	80
West Coast Canada to Africa	0	0	94	40
Other	172	142	134	160
Subtotal	717	377	283	670
Total Traffic	2,017	1,379	2,187	1,920

Source: Panama Canal Company and Economics Research Associates.

a promotional organization with offices in Tokyo, Taipei, Manila and New Delhi, is operating an educational program to familiarize Asians with wheat and wheat products. The second factor was the increased 1971 United States wheat harvest. United States production increased 10 million long tons, from 37 million in 1970 to 47 million in 1971. A large part of this increased harvest went to Asia.

U. S. exports of wheat and wheat flour to Asia go principally to Japan, India, Korea, and Pakistan, while Canadian wheat bound for Asia goes mainly to Mainland China and Japan. Wheat exports from the U. S. to Japan have erratically increased over the last few years as shown below:

	Thousands of Long Tons			
	1968	1969	1970	1971
U. S. Wheat Shipments to Japan	2, 011	2, 033	2, 762	2, 254

In terms of Pacific to Atlantic traffic, ERA's projections for 1971 are high by nearly 400, 000 tons due to a more rapid than expected drop-off in European wheat imports.

This is due primarily to two factors. First, the relatively bad soft wheat United States harvests in 1969 and 1970 caused total exports to drop. The average annual production for 1964-1968 was 199 million bushels, while 1969 to 1971 U. S. production was as follows:

1969	1970	1971
181 million bushels	179 million bushels	205 million bushels

The second factor in the decline in European imports was the growth and quality improvement of France's wheat production and the entrance of

the United Kingdom into the European Economic Community. Recently, France's hard wheat production has increased and, in addition, her milling techniques have improved so that lower quality wheat can be milled and combined with other wheats for making bread.

CANAL WHEAT TRAFFIC

During the past 12 years, the quantity of wheat and wheat flour passing through the Panama Canal has not kept pace with the worldwide growth in volume of imports of these commodities. The Canal's share of world volume has declined from 6.5 percent to 3.2 percent during this period. Total world trade rose from 30 million long tons in 1959 to 57.68 million long tons in 1966, before diminishing to 43 million in 1970. The volume of wheat and flour traversing the Canal rose from 1.96 million long tons in 1959 to 2.41 million in 1965, before diminishing to 1.4 million long tons in 1970. In 1971, Canal traffic rose to nearly 2.2 million tons, still less than 1965-1966 traffic.

Two primary factors account for this divergence. First was the rapid buildup in the volume of concessional wheat and wheat flour shipments from the United States to India and Pakistan between 1963 and 1968. This traffic reached a volume of 7.71[1/] million long tons during 1968, or 15.8 percent of total world exports that year. Since grain moving from the United States to India and Pakistan passes from Gulf ports around the Cape of Good Hope, the Canal was not affected.

1/ Source: Food and Agricultural Organization, World Grain Trade Statistics.

Second, wheat and flour shipments from the East Coast of Canada to Europe and Africa have been increasing in relation to total Canadian exports because of the construction of additional grain-handling facilities on the St. Lawrence Seaway. In addition, the Canadian share of the European import market, particularly the United Kingdom, has been declining.

The Panama Canal bridges eight important trade routes which, between 1960 and 1971, carried approximately 84 percent of the total volume of wheat and flour shipped through the Canal. Historically, annual volume on these trade routes fluctuates widely.

WHEAT CONSUMPTION, PRODUCTION, AND TRADE

Europe

Between 1959-1962 and 1965-1970, total European wheat and wheat flour imports, excluding the Union of Soviet Socialist Republics, declined from an annual average of 14.4 million metric tons to 13.5 million metric tons. In the same intervals Eastern Europe's average annual imports rose from 982 thousand metric tons to 2.2 million metric tons.[1/] This rapid increase, however, was more than offset by the decline in Western European imports. Import requirements of Western European countries not members of the European Economic Community fell more sharply than needs of member countries. This was partly the result of a higher demand for hard wheat among EEC members than among nonmember states, despite higher output of all wheat in countries of the EEC.

1/ Source: Food and Agricultural Organization, World Grain Trade Statistics.

The North American share of the West European market remained relatively constant from 1959 to 1969. Since 1969, however, imports to Europe have declined as the EEC has been capturing a larger share of the wheat market in the United Kingdom and Western Europe. Eastern Europe has increased its import requirements, despite rather satisfactory progress in production, which increased from an annual average of 17 million tons between 1960 and 1964, to 23 million tons between 1965 and 1968. The United States-Canadian joint share of this growing market, however, has deteriorated during the past decade, primarily because of the cessation of shipments under Public Law 480. The prime beneficiary of this shift in market shares has been the EEC, whose portion rose from 6 percent between 1959 and 1962, to 40 percent between 1965 and 1968.

Based on FAO projections, it is expected that European wheat and wheat flour requirements will diminish to 9.5 million long tons in 1975 and 6.9 million long tons in 1985. Import needs will be less, particularly in the EEC and Eastern Europe. France, the major West European producer, is striving to increase production of hard wheat. Eastern Europe is expected to devote more land to wheat production and to increase its wheat yields in the future.

ERA projected that the United States and Canadian shares of the European market would diminish and a rapid fall off has been seen since 1969. Production of higher quality wheat in the EEC tends to reduce the North American shares of this market as well as its total import requirements.

During the past decade, the volume of Canadian wheat and wheat flour shipped to Europe from West Coast ports has diminished considerably, primarily because of the construction of additional handling facilities on the St. Lawrence Seaway.

Latin America

Imports of wheat and wheat flour by countries on the West Coast of South America have increased markedly during the decade beginning with 1959. Chile and Peru, the major importers, absorbed an annual average of 486,000 metric tons between 1959 and 1962, and 842,000 metric tons between 1965 and 1968.[1/]

ERA estimates, based upon an interpolation of FAO's projections, that total imports of wheat and wheat flour by countries on the West Coast of South America will be 2.0 million long tons in 1975. Imports are projected to decline to 1.5 million long tons by 1985. The United States presently supplies approximately 50 percent of the wheat and wheat flour imported through South American ports on the Pacific Coast. However, the United States' share of this market is expected to decrease in the future because of an anticipated decline in shipments of these products to Chile under United States Public Law 480 and increased competition from Argentinian wheat.

Imports of wheat and flour by South America's East Coast countries have increased at a slower rate than those of the West Coast nations during the decade beginning with 1959. Recently, Guyana has become self-sufficient

in wheat production. Venezuela and Brazil, the major importers, imported an average of 2.3 million metric tons annually between 1958-1959 and 1961-1962, and 3 million metric tons between 1964-1965 and 1967-1968. Interpolating FAO's projections, ERA anticipates that total wheat and wheat flour imports to the East Coast of South America will be 5.6 million long tons in 1975. Between 1975 and 1985 ERA expects the area's import requirements to level off and then diminish to 5.0 million long tons by 1985.

Since 1964, Mexico has gained temporary prominence as a wheat and wheat flour exporter, whereas prior to that, the country shipped out none at all. Exceptional production, which reached 2.09 million tons in 1965 and 2.06 million tons in 1967, made shipments possible. As a new exporter, with no historical ties in international trade, the destinations of Mexico's shipments have been erratic.

Asia

Based on the Food and Agricultural Organization's World Grain Statistics and Agricultural Commodity Projections, 1970-1980, ERA projects that Asian implied wheat and wheat flour import requirements will remain relatively constant from 1970 to 1975 at 17.7 million tons, increase slightly to 18.4 million tons in 1980, and reach 19.2 million tons by 1985. Table 2 presents the breakdown of these requirements. Asia and the Far East, including Ceylon, India, Nepal, Pakistan, Burma, Taiwan, Hong Kong, Indonesia, Republic of Korea, Laos, Malaysia, Singapore, Thailand, and the Republic of Vietnam wheat and wheat flour import requirements

Table 2

ASIAN IMPLIED IMPORT REQUIREMENTS OF WHEAT
(Thousands of Tons)

	1970	1975	1980	1985
Asia and the Far East	7,428	6,000	4,837	3,675
Asian Centrally Planned Economics	5,507	5,962	6,445	6,977
Japan	4,800	5,835	7,075	8,566
Total	17,735	17,800	18,357	19,218

Source: FAO Agricultural Commodity Projections, 1970-1980, and Economics Research Associates.

are projected to decrease from 7.4 million tons in 1970 to 6.0 million tons in 1975, dropping to 3.7 million tons in 1985. This large decrease is due largely to India's new self-sufficiency in wheat production. Her wheat import requirement is projected to decrease from 3 million in 1970 to zero by 1980. Wheat import requirements of the Asian centrally planned economies which include Mainland China, North Korea, Mongolia, and North Vietnam are projected to increase slightly from 5.5 million tons in 1970 to 6.4 million tons in 1980 and to 7.0 million tons in 1985. Japan's wheat import requirements are projected to increase at a rate of about 3.95 percent from 4.8 million tons in 1970 to 5.8 million tons in 1975 to 8.6 million tons in 1985.

PROJECTED WHEAT AND WHEAT FLOUR TRAFFIC THROUGH THE CANAL

Future Ship Size

Currently, 40 percent of wheat tonnage transits the Canal in general cargo ships, 50 percent in bulkers and auto-bulkers and 10 percent in tankers. The largest bulkers carrying wheat through the Canal are in the 35,000 to 40,000 DWT range. Because of merchandising and distribution constraints, the future size of the bulkers is not expected to exceed the Canal's limits by 1985. The percentage of tonnage carried by general cargo ships is expected to decline as the bulkers and tankers are projected to handle an increasing share of the wheat shipments.

Atlantic to Pacific

ERA projects that annual shipments of wheat through the Canal from the United States and Canada to Asia will increase gradually from 1.07 million

long tons in 1975 to 1.10 million long tons in 1980, and 1.15 million long tons in 1985. These estimated tonnages represent a 6 percent U.S. and Canadian market share of Asian wheat requirements.

Trade from the United States to South America is projected to remain relatively constant at about 540,000 long tons through 1985, although total wheat imports are expected to increase by 300,000 long tons from 1971 to 1975. The United States currently supplies 50 percent of the imports, a market share estimated to decrease to 36 percent by 1975.

Six trade routes carry the remaining Atlantic-to-Pacific shipments of wheat and wheat flour through the Canal. Volume reached a peak of 181,000 long tons in 1968 when trade from Europe to South America occurred for the first time. Traffic on this route should continue as Europe expands its export markets in Latin America. ERA projects the tonnage to be 180,000 long tons in 1975 and 260,000 long tons by 1985.

Pacific to Atlantic

Shipments from the United States and Canada to Europe and from the U.S. to the East Coast of South America declined drastically from 1969 to 1971, the latter decreasing from 108,000 to 5,000 long tons in that period, and the former declining from 485,000 to 50,000 long tons. Increasing yields and higher quality wheat production in the European common market countries and in Brazil have reduced the need for wheat from North America. Table 3

Table 3

WHEAT AND WHEAT FLOUR EXPORTS FROM THE UNITED STATES TO BRAZIL
1967-1971

Year	Thousands of Long Tons
1967	1,179
1968	1,009
1969	917
1970	634
1971	828

Source: U.S. Department of Commerce and Economics Research Associates.

presents U.S. exports of wheat and wheat flour to Brazil from 1967 to 1971. Since 1967, wheat imported into Brazil has decreased by 42 percent. On an overall basis, Pacific to Atlantic wheat traffic traversing the Canal is forecast to remain at about 375,000 long tons through 1985.

SUMMARY

Shipments of wheat and wheat flour through the Canal are summarized in Table 4 and are not projected to increase significantly during the next 15 years.

	Long Tons (thousands)			
	1971	1975	1980	1985
Atlantic to Pacific	1,906	1,810	1,860	1,940
Pacific to Atlantic	283	375	375	375
Total	2,189	2,185	2,235	2,315

Table 4

PROJECTED WHEAT AND WHEAT FLOUR TRAFFIC
THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
East Coast United States and Canada to Asia	1,217	1,070	1,100	1,150
East Coast United States to West Coast South America	539	560	540	530
Other	150	180	220	260
Subtotal	1,906	1,810	1,860	1,940
Pacific to Atlantic	283	375	375	375
Total Traffic	2,189	2,185	2,235	2,315

Source: Panama Canal Company and Economics Research Associates.

Section IV

COARSE GRAINS

ANALYSIS OF 1969 FORECAST

ERA projections for 1971 coarse grain traffic through the Canal were about 17 percent lower than actual traffic figures. Although ERA had forecast a trade increase of 23 percent from 4.7 million tons in 1969 to 5.85 million tons in 1971, this proved to be conservative as actual trade increased 51 percent to 7.1 million tons in 1971. Figure 4 presents a summary of actual traffic and the 1969 ERA projections. Two factors account for most of the variation between projections and actuals. The Atlantic to Pacific trade was understated due to a faster than expected increase in shipments of corn and grain sorghum to Asia. The Pacific to Atlantic trade increase was due to a marked resumption in barley trade from the West Coast of Canada and United States to Europe. This barley trade had declined from 2 million tons in 1960 to 200 thousand tons in 1969 but has since increased to 932 thousand tons in 1971. Summaries of Canal traffic statistics since 1969 and ERA's 1971 projections are provided in Table 5 .

Inadvertently omitted from the 1969 ERA grain forecasts were rice and miscellaneous grains. Traffic in these commodities for the past three years are shown on the following page.

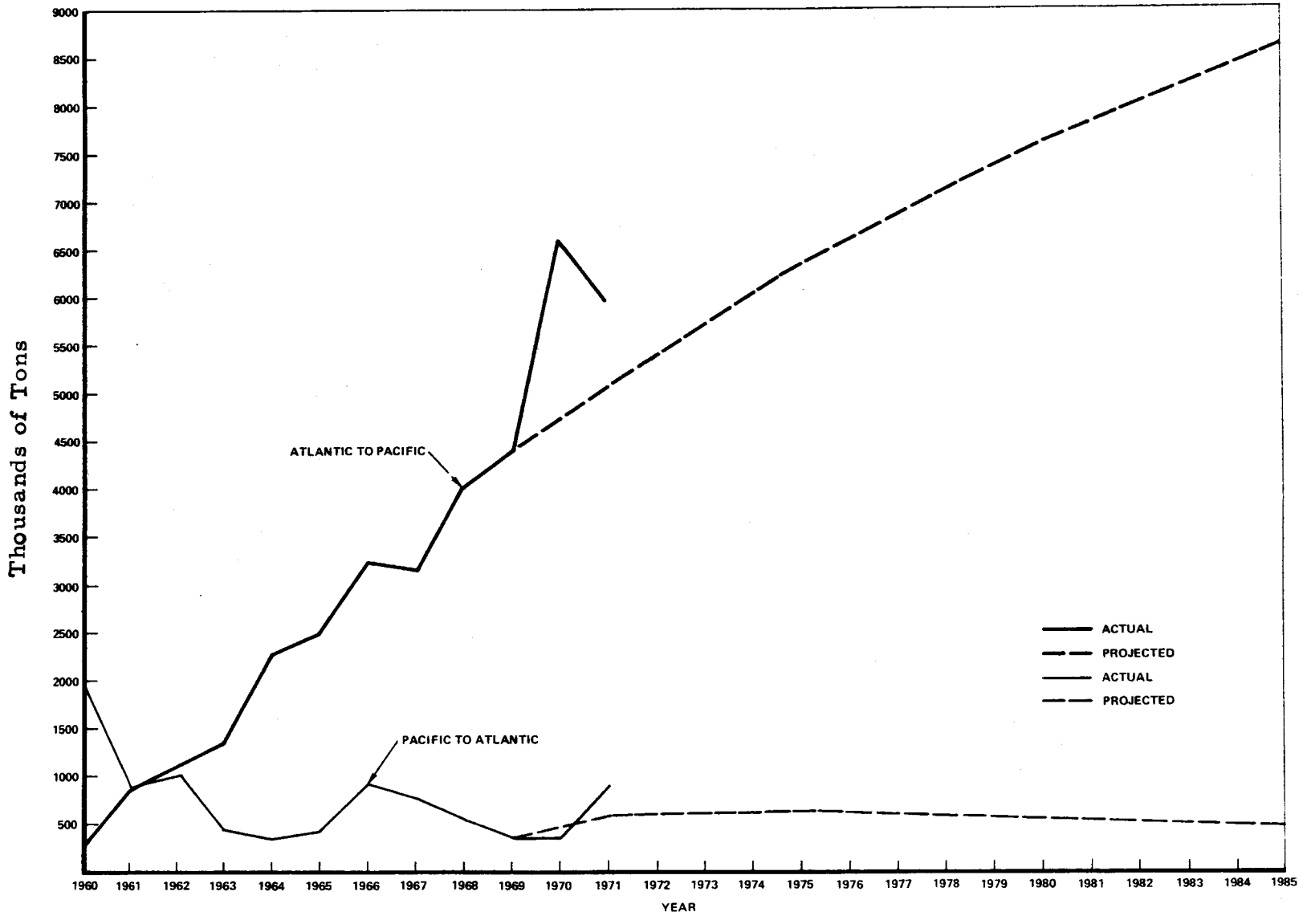


Figure 4

VOLUME OF COARSE GRAINS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 5

SUMMARY OF COARSE GRAIN SHIPMENTS
THROUGH THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to Asia	4,256	6,572	5,987	5,100
Other	154	263	197	180
Subtotal	4,410	6,835	6,184	5,280
Pacific to Atlantic				
West Coast United States to Europe	--	--	515	180
Canada to Europe	153	317	320	240
Other	170	53	89	150
Subtotal	323	370	924	570
Total Traffic	4,733	7,205	7,108	5,850

Source: Panama Canal Company and Economics Research Associates.

	Thousands of Long Tons					
	Atlantic to Pacific			Pacific to Atlantic		
	1969	1970	1971	1969	1970	1971
Rice	552	850	648	323	247	363
Miscellaneous Grains	158	62	144	16	7	37
Total	710	912	792	339	254	400

Approximately 90 percent of the Atlantic to Pacific rice shipments have been from the East Coast U.S. to Asia, while the Pacific to Atlantic traffic is made up of shipments to the West Indies from the West Coast of the U.S. and Asia.

RECENT MARKET TRENDS

During the past few years, Japan has markedly increased its coarse grain imports from the U.S. As shown in Table 5 , the percentage of U.S. corn exports going to Japan has risen from 16.4 percent in 1965 to 30 percent in 1970. Similarly, the percentage of U.S. sorghum exports going to Japan has increased from 29 percent in 1968 to 67 percent in 1970 as shown in Table 6 . In this regard, the United States has improved its market position in the light of expected competition. In corn, Argentina, Brazil, and South Africa have each improved their corn production, however, as a combined total they still represent less than 30 percent of U.S. production. In sorghum, Argentina increased production 40 million bushels to 190 million bushels in 1971. This is about 28 percent of the U.S. 1971 production of 697 million bushels.

In the barley trades, U.S. exports increased in 1971 as shown on on page IV-7.

Table 6

SUMMARY OF UNITED STATES CORN EXPORTS
1965-1970
(Millions of Bushels)

Year	Total	To Japan	Japan as a Percentage of Total
1965	549.4	90.2	16.4%
1966	669.4	94.3	14.1
1967	465.5	61.4	13.2
1968	613.1	102.4	16.7
1969	520.0	121.2	23.4
1970	601.0	180.3	30.0

Source: U.S. Department of Commerce and Economics Research Associates.

Table 7

SUMMARY OF UNITED STATES SORGHUM EXPORTS
1966-1970
(Millions of Bushels)

Year	Total	To Japan	Japan as a Percentage of Total
1966	266.0	76.9	28.9%
1967	248.4	89.8	36.1
1968	166.2	81.2	48.9
1969	106.4	70.4	66.1
1970	125.4	83.9	67.0

Source: U.S. Department of Commerce and Economics Research Associates.

Year	U.S. Barley Exports (millions of bushels)
1964	70
1965	61
1966	77
1967	45
1968	31
1969	13
1970	17
1971	60

This increase was reflected in Canal traffic as 40 percent of barley exports passed through the Canal. These were destined primarily for Europe, which had declines in barley production as shown in Table 8.

Atlantic to Pacific rice shipments through the Canal have historically been to Japan from the Gulf Coast of the U.S. In the past three years, however, Japan has had good harvests and Korea has become a major Asian importer of U.S. rice. Other shipments to Asia are under public assistance programs to Vietnam, India, and other southeast Asian countries. In terms of Pacific to Atlantic traffic, increased grain shipments from Australia to Europe are expected due to preferences created by U.K.'s entrance into the Common Market.

Table 8

BARLEY PRODUCTION IN SELECTED COUNTRIES
1969-1971
(Millions of Metric Tons)

Year	Country					World Total
	United States	Canada	France	West Germany	United Kingdom	
1969	9.2	7.1	9.1	4.8	8.2	113.2
1970	9.1	8.2	9.4	5.1	8.7	116.9
1971	8.9	9.0	8.0	4.8	8.0	117.0

Source: Commodity Yearbook and Economics Research Associates.

PROJECTED COARSE GRAIN TRAFFIC THROUGH THE CANAL

Atlantic to Pacific

The U.S. is expected to retain about 65 percent of the Japanese corn-importing market through 1975 and then experience a slight decline to 60 percent in 1980 and 1985. Argentina is expected to provide the only competition for the Japanese sorghum market and the U.S. should hold its penetration at 75 percent. Based on these penetration rates, the following coarse grain shipments from the United States to Asia are expected.

	Long Tons (thousands)			
	1971	1975	1980	1985
U.S. to Japan	6,250	8,100	9,800	11,400
U.S. to Other Southeast Asian Countries	400	250	100	100
Total	6,650	8,350	9,900	11,500

Ninety percent of the coarse grain shipments to Asia currently pass through the Panama Canal, primarily from Gulf ports, with some sorghum shipments from California bypassing the Canal. On the basis of this pattern, 6 million tons traversed the Canal in 1971. In 1975, this is projected to increase to 7.5 million tons increasing to 8.9 and 10.3 million tons in 1980 and 1985, respectively. Other southbound shipments, destined primarily for Central America, are expected to experience modest growth from their present level of about 300,000 tons to 420,000 tons in 1985. Southbound rice shipments are expected to increase in the near term as Korean imports increase dramatically (approximately 1 million tons from the U.S. projected for 1973). Approximately one-half of this requirement will be filled from Gulf ports.

Pacific to Atlantic

ERA considers the recent rise in barley shipments to Europe to be short-term in nature due to an unusually low European harvest in 1971. On a long-term basis, the original ERA projections are still thought to be valid and a return to annual shipments in the 400,000 ton to 500,000 ton range is projected. Rice shipments to the West Indies should continue at about the 350,000 ton level, while other shipments, primarily Australian rice to Europe, should approach a similar level. Table 9 presents a summary of the projected coarse grain traffic through the Canal by direction and major trade route.

Table 9

PROJECTED COARSE GRAIN TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
East Coast United States to Asia	6,633	8,150	9,550	11,000
Other	343	340	380	420
Subtotal	6,976	8,490	9,930	11,420
Pacific to Atlantic				
West Coast United States to Europe	516	200	200	200
West Coast Canada to Europe	351	240	240	220
Asia to West Indies	255	250	250	250
West Coast United States to West Indies	105	100	100	100
Other	97	300	350	400
Subtotal	1,324	1,090	1,140	1,170
Total Traffic	8,300	9,580	11,070	12,590

Source: Panama Canal Company and Economics Research Associates.

Section V

BANANAS

ANALYSIS OF 1969 FORECAST

Banana traffic through the Canal has declined over 20 percent since 1969 as Ecuador continued to have difficulty in competing with other banana producing countries. In 1969, ERA had projected that the decline in Ecuador banana exports had leveled off and that a small rise in exports was expected.

The ERA projections for banana traffic through the Canal were about 460, 000 tons high. The Pacific to Atlantic projection was high by 320, 000 tons due to the continued drop in bananas from Ecuador. The Atlantic to Pacific projection was high by about 140, 000 tons as shipments from the East Coast of Central America to Asia did not grow as expected. A summary of Canal traffic and the 1969 ERA projections is presented in Figure 5 . In terms of trade routes, Table 10 presents a summary of banana traffic for the past three years as well as a breakdown of the 1969 ERA projection for 1971. As shown, there has been relatively little change in the proportioning of traffic among the various trade routes.

RECENT MARKET TRENDS

As indicated above, Ecuador banana production has declined over the past several years such that production in 1970 was at about the same level as in 1966. These statistics are shown on page V-4.

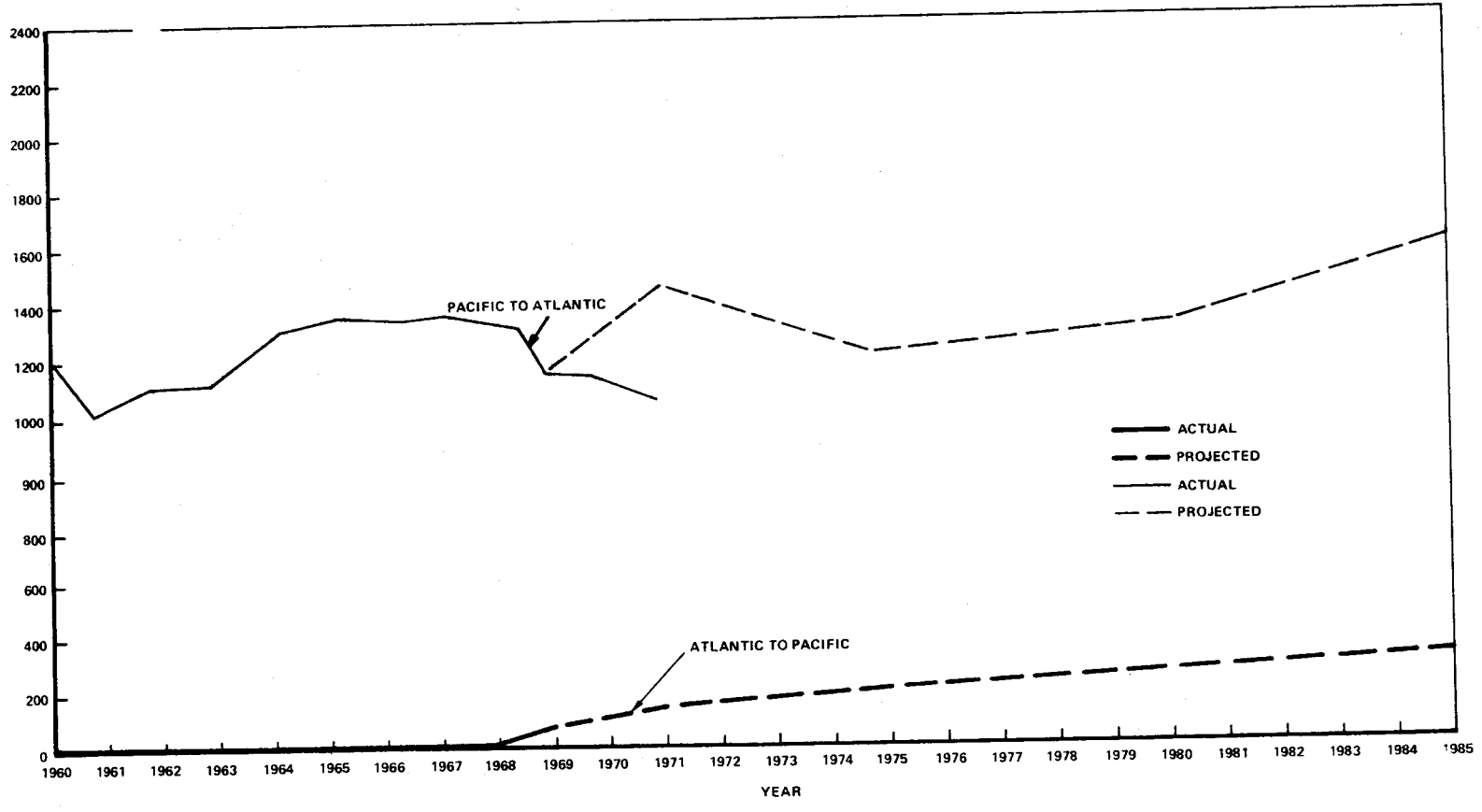


Figure 5

VOLUME OF BANANAS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 10

SUMMARY OF BANANA SHIPMENTS THROUGH
THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific	93	80	8	150
Pacific to Atlantic				
Central America to United States	373	328	338	420
South America to United States	230	234	178	330
South America to Europe	533	512	465	650
Other	25	83	98	--
Subtotal	1,161	1,157	1,079	1,400
Total Traffic	1,254	1,237	1,087	1,550

Source: Panama Canal Company and Economics Research Associates.

Year	Ecuador Banana Production (metric tons)
1966	2,618,000
1968	2,962,000
1970	2,663,000

Bananas shipped through the Canal from South America are grown primarily in Ecuador, where the Standard Fruit Company is the major producer. During the last decade, Ecuador's banana exports have not kept pace with increased consumption in the United States and Europe. The primary reason has been the United Fruit Company's[1/] progressive marketing techniques and improvement of its banana plantations in Colombia and Honduras. The company has also pioneered improved shipping and handling methods leading to lower transportation costs. In addition, most of their banana plantations are on the Atlantic side of the Canal, lowering transportation costs even further through avoidance of toll charges. The result has been far more favorable banana prices for the United States and European consumer. United Fruit Company has also captured consumer interest by successfully advertising their brand name, "Chiquita."

The growth in demand for bananas depends on income level and population growth. After annual per capita income reaches about $2,800, consumption of banana remains relatively constant. Banana intake in the United States, about 19 pounds per person annually, has practically reached a saturation point, and is expected to increase only slightly from a current level of about 1.8 million tons to about 2.4 million tons in 1985.

1/ Standard Fruit Company's major competitor.

Estimated consumption in the countries of the European Economic Community (EEC) was 1.45 million tons for 1970. It is expected to increase annually at about 5.5 percent till 1975 and then level off at about a 3 percent growth rate. By 1975 total banana consumption is estimated to be 1.9 million tons and to be 2.4 million tons by 1985. Ecuador's portion of European demand has declined from 34 percent in 1969 to 30 percent in 1971.

PROJECTED BANANA TRAFFIC THROUGH THE CANAL

Atlantic to Pacific

Shipments of bananas from the East Coast of Central America to Asia reached nearly 100,000 tons in 1969 but dropped off to only 8 thousand tons in 1971 as Pacific sources supplied nearly all the Asian demand. ERA expects that Atlantic to Pacific shipment will remain relatively insignificant at from 0 to 100,000 tons through 1985.

Pacific to Atlantic

Shipments from West Coasts of South America and Central America to the East Coast United States currently account for about 26 percent of U.S. consumption as compared to 30 percent in 1969. ERA expects that this decline in market share will continue to about 22 percent by 1975 and hold constant at about that point. This leads to the following trade projections:

Source	Thousands of Tons			
	1971	1975	1980	1985
Central America	340	320	340	360
South America	180	170	180	190
Total	520	490	520	550

Trade restrictions and the popularity of the Chiquita banana in Europe are expected to reduce the Ecuadorian share of the Western European market from about 30 percent to 26 percent by 1975. This leads to the following traffic projections:

Thousands of Tons			
1971	1975	1980	1985
460	500	590	680

Shipments to Eastern Europe are also expected to increase over this period such that total European shipments could reach 800, 000 tons by 1985. A summary of projected banana traffic through the Canal is presented in Table 11.

Table 11

PROJECTED BANANA TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific	8	25	30	35
Pacific to Atlantic				
Central America to United States	338	320	340	360
South America to United States	178	170	180	190
South America to Europe	465	550	670	800
Other	98	150	150	150
Subtotal	1,079	1,190	1,340	1,500
Total Traffic	1,087	1,215	1,370	1,535

Source: Economics Research Associates.

Section VI

SUGAR

ANALYSIS OF 1969 ERA PROJECTIONS

Figure 6 presents actual and projected long tonnage of sugar traversing the Panama Canal from the Atlantic to Pacific and the Pacific to Atlantic. As can be seen from the figure, ERA's projections for 1971 traffic in both directions were understated.

Table 12 presents the component trade routes of sugar traffic through the canal. ERA's projections for 1971 sugar traffic in the Pacific to Atlantic direction were understated by 26 percent. This greater than expected increase in sugar traffic occurred principally on two major trade routes: Hawaii to the East Coast United States and Asia to East Coast United States. Between 1969 and 1971, sugar traffic from Hawaii to the East Coast United States increased from 142,000 long tons in 1969 to 434,000 long tons in 1971, accounting for an additional 292,000 long tons of sugar passing through the canal. In the same time period, traffic on the Asia to East Coast U.S. trade route increased 32 percent from 1,004,000 long tons in 1969 to 1,322,000 long tons in 1971, accounting for 318,000 additional long tons.

ERA's projection of sugar traffic traversing the Canal from the Atlantic to the Pacific was also understated with 1971 projected tonnage at 1,170,000 and actual tonnage of 2,662,000. As can be seen in Table 12, the West Indies to Asia is the major Atlantic to Pacific sugar route. This traffic increased by 44 percent from 1959 to 1970 and by 66 percent from 1970 to 1971. Increased production of Cuban sugar exported to the Asian Communist countries

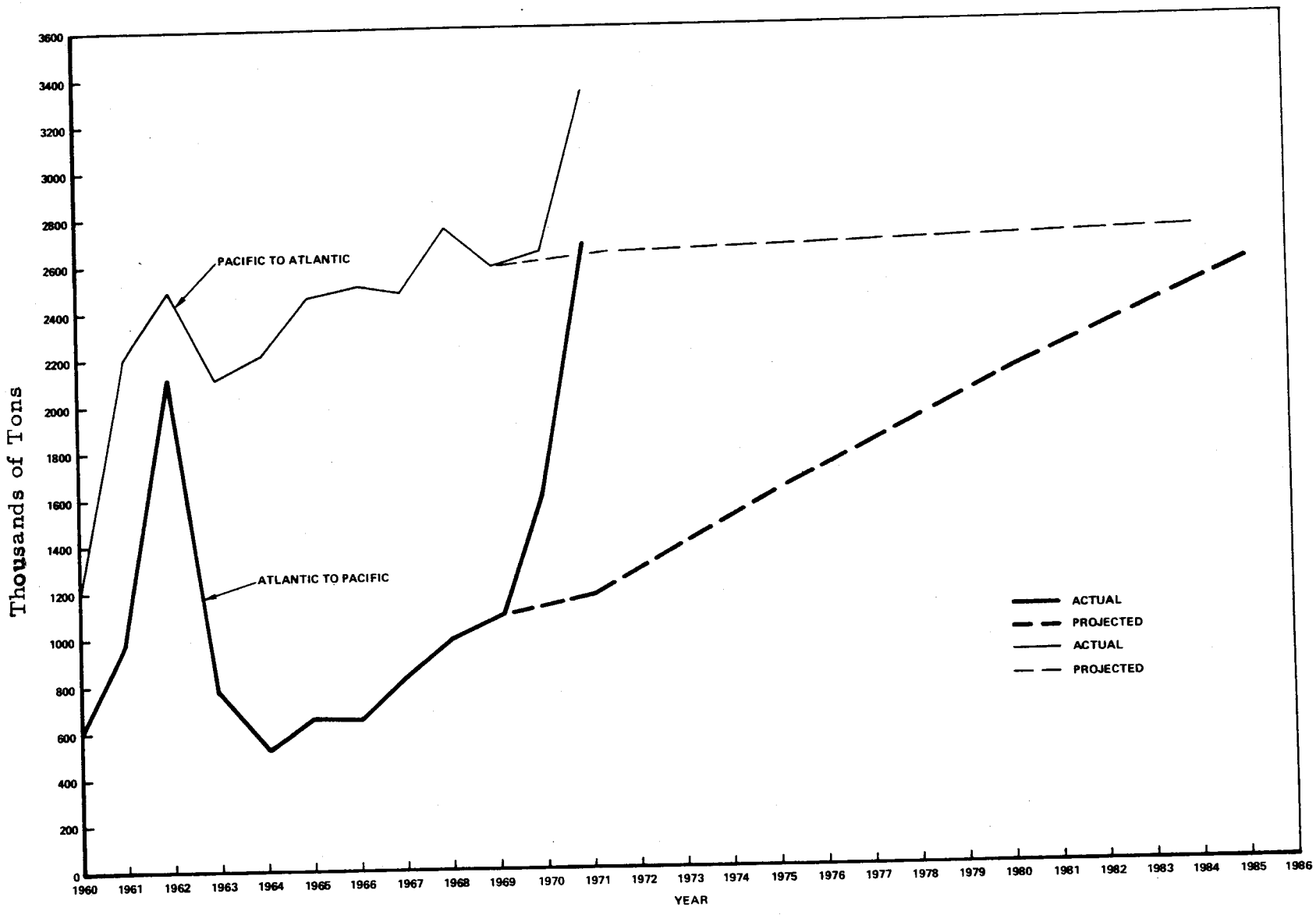


Figure 6

VOLUME OF SUGAR TRAVERSING THE PANAMA CANAL BY MAJOR TRADE ROUTES
1960-1985
(Thousands of Long Tons)

Table 12

SUMMARY OF SUGAR SHIPMENTS THROUGH
THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
West Indies to Asia	1,016	1,466	2,437	1,090
Other	58	115	225	80
Subtotal	1,074	1,581	2,662	1,170
Pacific to Atlantic				
To the United States from:				
Philippines	1,004	948	1,322	1,000
South America	488	501	517	500
Central America	287	297	277	300
Hawaii	142	374	434	250
Oceania	224	202	242	200
Oceania to Europe	198	201	205	150
Oceania to Canada	206	103	308	130
Other	19	--	12	100
Subtotal	2,568	2,626	3,317	2,630
Total Traffic	3,642	4,207	5,979	3,800

Source: Panama Canal Company and Economics Research Associates.

and Japan make up the great part of this growth. In 1971, major Cuban exports to Asia through the Panama Canal were as follows:

	To Asia (thousands of tons)					
From	Japan	China	USSR	North Korea	Other	Total
Cuba	1, 348, 000	550, 000	90, 000	304, 000	47, 000	2, 339, 000

Eighty-five percent of all Cuban exports are sugar. Recent increases in traffic along the Cuba to Asia trade route were due to a greatly increased 1969-1970 Cuban sugar harvest. Table 13 presents production figures for Cuban sugar in the period 1962-1971. Average production from 1962-1967 was 5.3 million metric tons. From 1967 to 1969, sugar production remained fairly constant, varying from 5.5 million metric tons in 1967-1968 to 5.2 million in 1968-1969. In the harvest year, 1969-1970, Cuba's sugar production increased 81 percent from 5.2 million metric tons to 9.4 million metric tons. This was reflected in the 1970-1971 increases in sugar traffic through the Canal on the West Indies to Asia trade route. (The time lag that makes the increased 1969-1970 production appear in Canal tonnage figures for 1970-1971 is due to comparing the harvest year with fiscal year figures.) In 1970-1971, Cuban sugar production leveled off to 6.5 million metric tons, and projections for 1971-1972 are around 6 million metric tons.

The primary destination of Pacific-to-Atlantic sugar movements has been the East Coast of the United States, accounting for about 80 percent of the tonnage. A number of different countries, primarily in the Pacific, supply sugar to the United States, the most important being the Philippines, which

Table 13

SUMMARY OF
CUBAN SUGAR PRODUCTION ESTIMATES
1962-1972

Year	Millions of Metric Tons
1962 to 1967	5.3 (average)
1968	5.5
1969	5.2
1970	9.4
1971	6.5
1972 projected	6.0

Source: United States Department of Agriculture and Economics Research Associates.

sends about 1.0 million long tons each year. Australia, Peru, Mexico, and the Dominican Republic have also become increasingly significant in the sugar movement since the United States turned to other sugar sources to satisfy its market needs. Other northbound traffic consists primarily of Australian shipments to Canada and Europe. Shipments to Canada have remained relatively constant while trade to Europe has increased steadily.

SUGAR CONSUMPTION, PRODUCTION, AND TRADE

United States

Historical

During the past 10 years, the United States has been the primary destination of sugar moving through the Canal, accounting for more than 50 percent of the total tonnage. Sugar is used in the United States almost entirely for human food--livestock feed and alcohol production absorb about 1 percent. Per capita sugar consumption is at a saturated level of about 47 kilograms per year. Thus, during the past 10 years, the annual rate of growth in consumption of 1 percent has approximated the population growth. Total United States consumption averaged 8.1 million long tons per year from 1956 to 1958 and about 9.6 million long tons per year from 1966 to 1968 and 10.2 million long tons from 1969 to 1971. Over the same period, production has increased from 4.11 million long tons to 5.5 million long tons or at an annual rate of 1.95 percent.

Both domestic production and foreign imports are governed by the Sugar Act of 1948, as amended, which determines the percentage of consumption

to be filled by domestic sources, and the quantity of sugar that foreign countries may export to the United States during a certain year. Import quotas have been allocated to specific countries; in addition, a "global quota" of 1.5 million long tons has been established (one-half of Cuba's former sugar shipments to the United States) to be prorated, primarily among countries in the Western Hemisphere.

Future

It is estimated that consumption of sugar will continue to follow very closely the growth in population; elasticities in per capita income and price demand of sugar in the United States are about zero. Recent violent fluctuation in U.S. sugar consumption has been due in part to U.S. government regulations banning the use of cyclamates in food products.
An annual growth rate in population of 1.5 percent has been assumed for the next 15 years. Sugar consumption was at 10.5 million long tons in 1970, and is projected to increase to about 13.2 million long tons by 1985. These totals assume that sugar consumption will expand at a rate of 1.6 percent until 1975 and then at 1.5 percent until 1985.

The new Sugar Act of 1971 will determine the rate of expansion of sugar production in the United States and the sugar quotas for domestic producers and import quotas for foreign producers. Since 1968, foreign producers have been given between 45 and 47 percent of the total U.S. sugar requirement. According to sugar officials, increases in sugar demand will be absorbed by foreign producers since domestic quotas are ample to cover

production of domestic sugar. In the future, Puerto Rico will get increasingly less of the domestic quota, since her sugar production has been down for some years. Hawaii is also expected to lose some of its production capabilities due to increased production costs and sugar land being used for other purposes. Environmental factors will also play a part; the sugar processing fiber residue is difficult to dispose of since it cannot be burned and only a certain amount can be dumped in the ocean without polluting the water. It is expected that a few Hawaiian factories will close down after the 1972 growing season due to these factors.

Because of these reasons, domestic production should grow at an annual rate of 1.2 percent from 5.8 billion long tons in 1970 to 6.9 million long tons in 1985. Foreign producers will continue to get an increasingly larger market share, growing from 45 percent in 1970 to 48 percent of total U.S. sugar consumption in 1985.

	Long Tons (millions)			
	1970 (Actual)	1975	1980	1985
Estimated U.S. Sugar Consumption	10.5	11.4	12.3	13.2
Estimated U.S. Production	5.8	6.2	6.6	6.9
Sugar Imports	4.7	5.2	5.7	6.3

Western Europe

In Western Europe, production is expected to increase more rapidly than consumption, so that net imports will probably decrease. The United Kingdom, whose per capita sugar consumption of more than 54 kilograms is the highest in the world, is not expected to increase its total net import demand over the next 15 years. The FAO estimates that the rate of annual growth in production will slightly exceed growth in consumption.

Asia

The two primary countries that influence Canal trade are Japan and Communist China, both importers of Cuban sugar. Japan has the lowest per capita consumption of sugar (less than 20 kilograms) of any developed country in the world. Based on the FAO study, it is estimated that consumption will increase at an annual rate of 4.5 percent. Imports are expected to increase at this same rate as production increases offset the population increase. Communist China is an unknown factor. The FAO has estimated that Chinese consumption will increase from the 1965 total of 2.2 million tons to between 5.0 million and 6.5 million tons by 1985. Imports and consumption, however, depend on government policies. There has been a drastic reduction of tonnage from Cuba to China since the 1961 to 1962 period. Shipments of sugar from Cuba to China may fluctuate a great deal in years to come as China varies its import policies.

PROJECTED CANAL SUGAR TRAFFIC

Future Ship Size

Most of the sugar trade has been dominated by Liberty-type vessels with load sizes well below 10,000 tons. However, on some of the longer hauls, larger ships carrying 20,000 to 30,000 tons have become common. It is expected that the economy of using larger ships will prevail in future sugar trade. However, the volume of traffic on any route and the distribution limitation will not make bulk-handling terminals and storage economical for ships in excess of 50,000 DWT. Freighters are expected to play an important role in future sugar trade, particularly in shipments from Cuba and Latin America.

Pacific to Atlantic

Because of the projected increase in U.S. imports of sugar through 1985, ERA predicts that tonnage of sugar traversing the Canal bound for the United States will increase from actual 1971 tonnage of 2, 792, 000 to 3, 100, 000 in 1975 to 3, 800, 000 long tons in 1985. Traffic from Oceania to Europe is projected to increase slightly to 250, 000 long tons in 1975, then level off for the next 10 years. Traffic along the Oceania to Canada route is projected to increase to 350, 000 long tons in 1975, then remain constant until 1985.

Atlantic to Pacific

On the basis of more normal harvests, ERA projects that Canal tonnage figures for Cuban sugar will return to their long term trend lines, dropping back to 1,600,000 long tons in 1975, then increasing to 2, 450, 000 long tons in 1985.

Summary

Projected sugar tonnage moving through the Canal is summarized below in thousands of long tons and shown in Table 14.

	Long Tons (thousands)			
	1971	1975	1980	1985
Pacific to Atlantic	2, 651	1, 700	2, 100	2, 550
Atlantic to Pacific	3, 317	3, 800	4, 100	4, 500
Total	5, 968	5, 500	6, 200	7, 050

Table 14

PROJECTED SUGAR TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
West Indies to Asia	2,437	1,600	2,000	2,450
Other	214	100	100	100
Subtotal	2,651	1,700	2,100	2,550
Pacific to Atlantic				
To the United States from:				
Philippines and Asia	1,322	1,420	1,550	1,760
South America	517	590	650	700
Central America	277	310	350	380
Hawaii	434	500	550	610
Oceania	242	280	300	350
Oceania to:				
Europe	218	250	250	250
Canada	308	350	350	350
Other	--	100	100	100
Subtotal	3,317	3,800	4,100	4,500
Total Traffic	5,968	5,500	6,200	7,050

Source: Panama Canal Company and Economics Research Associates.

The areas of uncertainty are Communist China's trade with Cuba and the possibility of renewed trade between Cuba and the United States. The effect of the latter event would be to reduce potential sugar tonnage traversing the Canal by as much as two million long tons.

Section VII

SOYBEANS

ANALYSIS OF ERA 1969 FORECAST

Figure 7 presents actual and projected long tonnage of soybeans traversing the Panama Canal from 1960-1985. ERA's projection for traffic traveling from the Pacific to Atlantic was slightly high, but traffic in that direction is relatively minimal (26,000 long tons in 1971). Soybean traffic flowing from the Atlantic to Pacific, however, was underestimated.

Table 15 presents a breakdown of the component trade routes of traffic flowing through the Canal from the Atlantic to Pacific. Actual traffic in 1970 and 1971 was 3,292,000 long tons and 3,732,000 long tons respectively. ERA's projection for 1971 was understated due to a change in the soybean supply sources available to Japan and increased U.S. soybean production. The two major soybean suppliers to Japan are the United States and Mainland China. In 1970, China experienced a soybean famine and could not supply Japan with a normal share of soybeans; this unsatisfied demand went to the United States whose soybean exports increased 43 percent from 1969 to 1970, and 19 percent from 1969 to 1971, as described on the table below:

	From the United States (000 Long Tons)				
To Japan:	1967	1968	1969	1970	1971 (November)
Soybeans, exclusive of Roasted Coffee Substitute	1,640	2,140	2,070	2,970	2,460

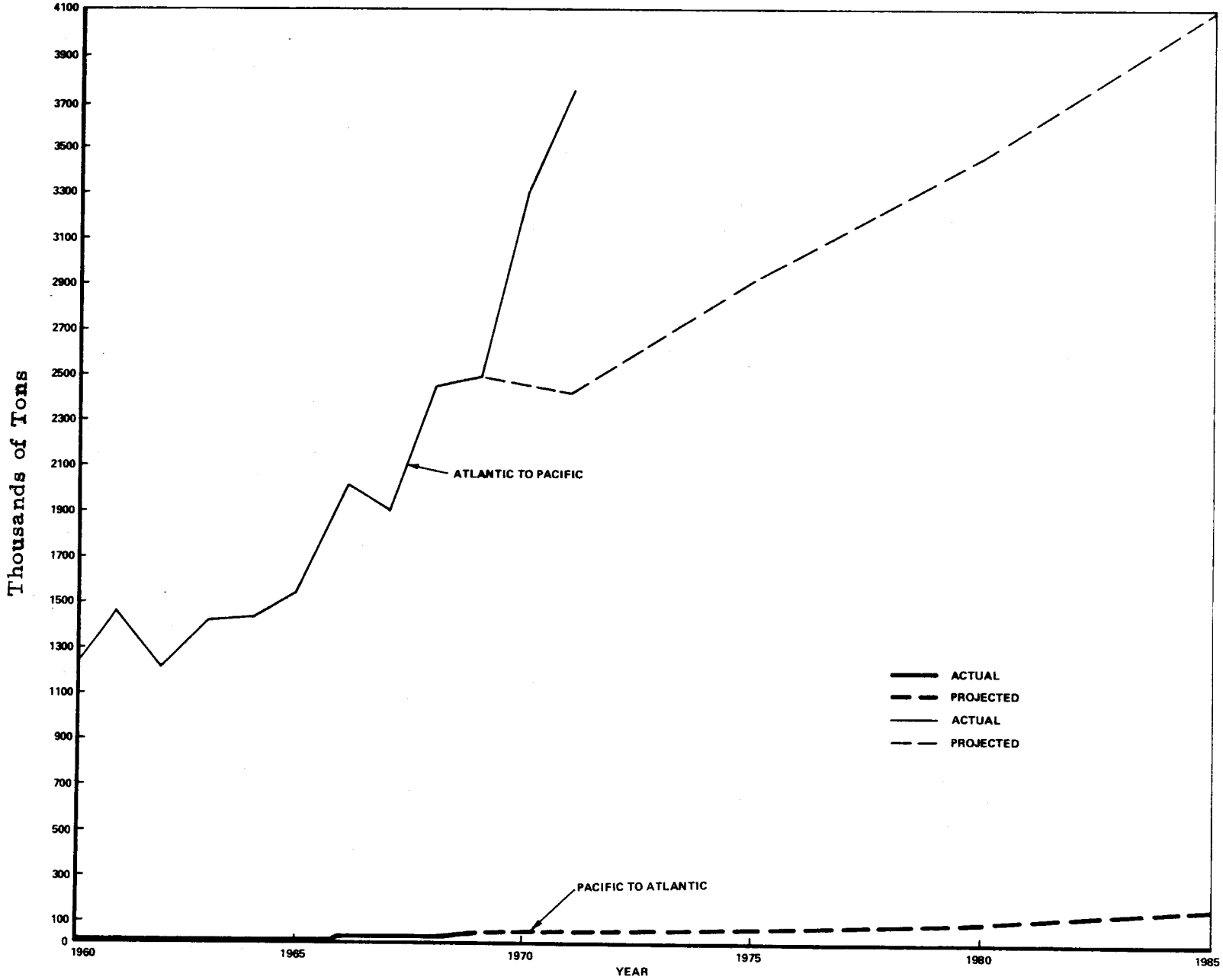


Figure 7

VOLUME OF SOYBEANS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 15

SUMMARY OF SOYBEAN SHIPMENTS THROUGH
THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to Asia	2,359	3,029	3,484	2,310
Other	142	163	248	120
Subtotal	2,501	3,292	3,732	2,430
Pacific to Atlantic	51	--	26	50
Total Traffic	2,552	3,292	3,758	2,480

Source: Panama Canal Company and Economics Research Associates.

Japan's soybean imports from Communist China decreased 20 percent from 1969 to 1970 (1971 figures are not yet available)

	From Mainland China (Metric Tons)			
To Japan:	1967	1968	1969	1970
Soybeans	392,000	361,000	377,000	313,000

In addition, United States soybean production increased from 1.10 billion bushels in 1969 to 1.14 billion bushels in 1971. Most of this increase has come from expanded production in the Southeastern United States. Historically, the corn belt states of Illinois, Indiana, Nebraska, and Ohio have produced most of the United States soybeans. Since 1969, the Carolinas, Mississippi, Louisiana, Georgia, and Alabama have switched some of their cotton producing lands to soybean producing lands. Areas cultivated and production in the Southeastern United States in 1969 and 1971 was as follows:

	1969	1971
Areas cultivated	3,189,000 acres	3,503,000 acres
Production	71 million bushels	79 million bushels

This represents a 4.8 percent increase in acres planted and a 5.5 percent increase in production. These states have a transportation advantage since they are closer to the Gulf ports and can therefore export crops cheaper than Midwestern states.

SOYBEAN PRODUCTION, CONSUMPTION, AND TRADE

Production of soybeans is concentrated primarily in the United States and Mainland China, although several other countries also produce this legume. The United States at present grows approximately 70 percent of the world total, and Mainland China approximately 20 percent. Demand for soybeans arises primarily in North America, Europe, and the Far East. Since 1959, Japan and the Federal Republic of Germany have been the major importers; Denmark, Italy, Netherlands, Spain, and Canada have also been consistently large importers of soybeans. Table 16 indicates total world imports of soybeans and their end products, as well as intake by the two major importing areas.

Between 1958 and 1966, European and Japanese imports of soybeans increased rapidly, along with the rapid increase in demand for this high protein food, particularly as livestock feed. Table 16 suggests that European demand for oil, used primarily for cooking and salad oil, has reached such a level of saturation that increasing demand for soybean cake and meal has had to be met by imports of processed cake and meal rather than through crushing operations. On the other hand, the table suggests that the increasing Japanese demand for soybean cake, meal, and oil has been met by the increasing amount crushed. Although Europe is the most significant market for soybeans, European demand does not affect shipment of soybeans through the Panama Canal. Production in the United States is concentrated in the Midwest, East, and South, and the surplus destined for export is shipped via Atlantic and Gulf ports.

Table 16

IMPORTS OF SOYBEANS AND THEIR END PRODUCTS
WORLD TOTAL AND MAJOR IMPORTING AREAS
1958-1966
(Thousands of Metric Tons)

	1958	1959	1960	1961	1962	1963	1964	1965	1966
World Total									
Soybeans	3,370	4,530	5,117	4,032	4,948	5,226	6,142	6,641	7,670
Soybean Cake and Meal	526	999	1,156	1,034	1,645	1,730	2,014	2,446	2,984
Soybean Oil	439	503	579	442	659	637	691	673	437
Japan									
Soybeans	905	998	1,128	1,158	1,293	1,544	1,607	1,847	2,168
Soybean Cake and Meal	15	11	1	56	15	2	13	46	7
Soybean Oil						1	1	1	
Europe									
Soybeans	1,446	2,193	2,861	2,181	2,830	2,813	3,483	3,712	4,466
Soybean Cake and Meal[1/]	400	734	952	780	1,319	1,462	1,740	2,133	2,732
Soybean Oil	330	358	385	299	336	264	296	254	145

1/ Because of unavailability of data, excludes small imports of soybean cake and meal from 1958 to 1960 by Czechoslovakia, Democratic Republic of Germany, Greece, Hungary, Iceland, Italy, Poland, Portugal, Spain, Switzerland, and Yugoslavia.

Source: Food and Agricultural Organization Trade Yearbook.

Since trade between the East Coast of the United States and Asia is the only major soybean route affecting the Canal, and Japan is the primary market in Asia, the Japanese supply-demand situation has been stressed in the analysis. Japanese consumption of all oilseed meals is projected to increase in the next ten years. The 1963-1965 average meal consumption was 1.9 million metric tons, or 4.8 percent of total world consumption. United States Department of Agriculture projections forecast this consumption to increase to 4.9 million metric tons by 1980, or 7.4 percent of the world total consumption. This represents an annual growth rate of 6.5 percent. Japan's soybean meal consumption is approximately 3/4 her total meal consumption. The 1963-1965 average soybean meal consumption was 1.425 million metric tons, which is forecast to increase to 3.675 million metric tons by 1980.

Japanese production of soybeans has fallen sharply in recent years, from an average of 12.5 million bushels between 1960 and 1964, to 7.3 million, 7.0 million, and 6.2 million bushels, respectively, in 1966, 1967, and 1968.[1/] This decrease stemmed from sharply reduced acreage, which dropped from a 1960-1964 average of 647,000 planted acres, to 302,000 in 1968. ERA projects that Japanese soybean acreage will remain constant at the 1968 level, but that yields[2/] will increase slightly to 1985. Although yields are considerably higher in other parts of the world, particularly in North America, prospects for attaining such production rates in Japan do not seem particularly good. Moreover, Japanese soybean production, like Japanese agricultural production in general, should continue to reflect the high opportunity cost of labor with respect to alternative labor uses.

1/ Source: USDA, World Agricultural Production and Trade and World Supply and Demand for Oilseeds and Oilseed Products in 1980.
2/ 20.3 bushels per acre in 1968.

Although Japan is the most important importer of soybeans in East Asia, accounting for approximately 90 percent of total imports, other countries in the region must also be considered in the analysis. The Republic of China, in particular, is increasing its soybean requirements because of a developing livestock industry. Imports of soybeans into the region, excluding Japan, increased at an average annual rate of 6 percent between 1948 and 1966. Primary use for soybeans is as a livestock feed. As detailed statistics on the determinants of demand are not readily available, the region's future import requirements have been extrapolated from past trends.

The United States presently fills approximately 80 percent of East Asia's requirements for soybean imports. Approximately 16 percent is supplied by Mainland China, and approximately 3 percent by Canada. ERA expects the United States-Canadian joint share of the East Asian market to remain the same during the next 15 years.

PROJECTED SOYBEAN TRAFFIC THROUGH THE CANAL

Future Ship Size

The movement of soybeans is divided evenly between general cargo ships and bulk carriers. The latter are primarily in the 20, 000 to 30, 000 DWT range. It is anticipated that future transits of soybeans will not be made by bulk carriers larger than 40, 000 DWT and that a gradual shift toward the use of bulk carriers for the shipment of soybeans to Japan will be seen.

Projected Soybean Traffic Through the Canal

ERA believes that the disproportional increase of soybean imports into Asia from the United States in 1970 and 1971 is a result of increased U.S. production, increased Japanese demand and the Chinese soybean crop failure which caused Japan to look to the U.S. for its unsatisfied soybean demand. ERA predicts that after 1972 soybean traffic from the United States to Asia along the Atlantic to Pacific route will be 3.5 million tons in 1975, 4.0 million tons in 1980 and 4.4 million tons in 1985. Traffic in the Pacific to Atlantic direction will remain relatively small with slow growth increasing from 26,000 long tons in 1975 to 100,000 long tons in 1985.

SUMMARY

Traffic in soybeans is expected to continue almost exclusively in the southbound direction as summarized below and shown in Table 17.

	Long Tons (thousands)			
	1971	1975	1980	1985
Atlantic to Pacific	3,732	3,620	4,040	4,560
Pacific to Atlantic	26	70	100	100
Total	3,758	3,690	4,140	4,660

Table 17

PROJECTED SOYBEAN TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
United States to Asia	3,484	3,500	3,920	4,440
Other	248	120	120	120
Subtotal	3,732	3,620	4,040	4,560
Pacific to Atlantic	26	70	100	100
Total Traffic	3,758	3,690	4,140	4,660

Source: Panama Canal Company and Economics Research Associates.

Section VIII

LUMBER

ANALYSIS OF 1969 FORECAST

ERA projections of lumber traffic through the Panama Canal in 1971 were within 4 percent of actual traffic. The total projected tonnage was 5.4 million tons as compared to actual traffic of 5.2 million tons. A summary of Canal historical data and a comparison to the 1969 ERA projections are presented in Figure 8.

Traffic along Pacific to Atlantic trade routes continued to represent nearly all the lumber tonnage traversing the Canal. Atlantic to Pacific traffic accounted for only 106,000 tons in 1971. A summary of lumber traffic by trade route for the past three years is shown in Table 18. As shown, the ERA projections were within 200,000 tons of actual figures for all trade routes.

PROJECTED LUMBER TRAFFIC THROUGH THE CANAL

In view of the relative accuracy shown in the 1969 ERA forecast and no apparently significant demand or supply changes, no revisions have been made to the lumber traffic forecasts.

Future Ship Size

Lumber is transported about equally in general cargo ships and bulk carriers. The bulk carriers are generally in the 15,000 to 25,000 DWT range; it is anticipated that their average size will increase to about

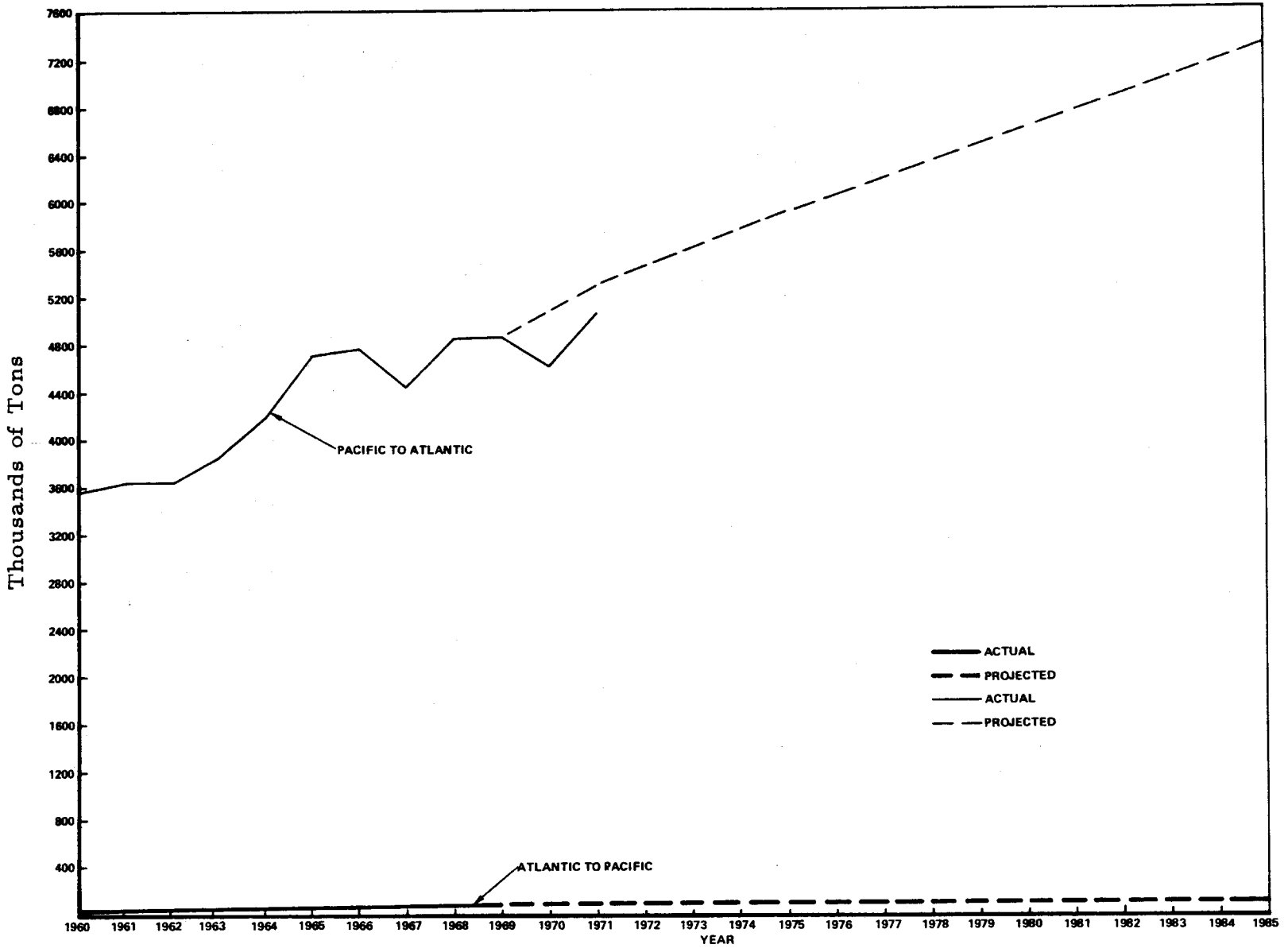


Figure 8

VOLUME OF LUMBER TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 18

SUMMARY OF LUMBER SHIPMENTS THROUGH
THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific	99	114	106	100
Pacific to Atlantic				
West Coast United States to:				
United States	558	394	586	500
Europe	314	392	302	400
West Coast Canada to:				
United States	1,730	1,299	1,510	1,700
Europe	984	1,331	1,223	1,400
Asia to United States	697	629	782	800
Other	569	579	678	500
Subtotal	4,852	4,624	5,081	5,300
Total Traffic	4,951	4,738	5,189	5,400

Source: Panama Canal Company and Economics Research Associates.

30, 000 DWT by 1985. The bulkers are not expected to exceed 45, 000 DWT; thus, no problems are foreseen as far as ships bypassing the Canal. The bulk carriers are expected to account for almost 70 percent of the tonnage from Canada by 1985. Unitized train shipments of lumber to the East Coast of the United States from the West Coast of Canada are being investigated as a future mode of transportation. Since indications are that the larger bulk carrier shipments to the East Coast will be the more economical method of transportation, ERA estimates that no significant diversion will occur.

Atlantic to Pacific

An annual traffic of approximately 100, 000 long tons is projected for the next 15 years.

Pacific to Atlantic

ERA estimates that softwood timber tonnage to the East Coast of the United States will increase at an annual rate of 1 percent. Shipments from Canada will continue to absorb a larger share of the total market than those from the United States' West Coast, with total Canadian imports expected to increase from a current level of 7.2 billion board feet to 7.7 billion board feet by 1975.

The following traffic to the East Coast United States is projected:

Source	Long Tons (thousands)			
	1971 actual	1975	1980	1985
Canada	1, 510	1, 900	2, 100	2, 300
United States	586	400	300	200
Total	2, 096	2, 300	2, 400	2, 500

Future imports of hardwood veneer from Asia are expected to increase at about 5 percent per year through 1975, and to level off at 4 percent thereafter. A total of 800,000 long tons of hardwood is projected to pass through the Canal by 1971, increasing to 1.0 million long tons by 1975, and 1.5 million by 1985.

Total exports from the West Coasts of Canada and the United States to Europe are estimated to grow modestly through 1985 as net imports in Europe continue to increase. The Union of Soviet Socialist Republics is expected to capture only a partial share of the expanded imports. A rise of about 3 percent per year through 1985 is projected for Canal traffic leading to a total of 2.8 million long tons for 1985.

Source	Long Tons (thousands)			
	1971 actual	1975	1980	1985
United States	302	450	500	550
Canada	1,223	1,650	1,900	2,250
Total	1,523	2,100	2,400	2,800

The West Indies and Africa, the other main destinations for lumber shipments, have shown no significant growth trends. There has been a moderate increase in softwood shipments to the West Indies, while shipments to Africa have declined during the past 10 years. Trade to and from Latin America has also remained relatively constant. Total traffic of about 500,000 long tons per year is estimated for these areas.

Summary

Moderate growth is projected for lumber traffic through the Canal; tonnage is estimated to reach 6 million long tons by 1975 and 7.4 million long tons by 1985, as summarized below and shown in Table 19.

Source	Long Tons (thousands)			
	1971 actual	1975	1980	1985
Atlantic to Pacific	106	100	100	100
Pacific to Atlantic	5,081	5,900	6,525	7,300
Total	5,187	6,000	6,625	7,400

Table 19

PROJECTED LUMBER TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific	106	100	100	100
Pacific to Atlantic				
From Canada to:				
United States	1,510	1,900	2,100	2,300
Europe	1,223	1,650	1,900	2,250
From United States to:				
United States	586	400	300	200
Europe	302	450	500	550
From Asia to United States	782	1,000	1,225	1,500
Other	678	500	500	500
Subtotal	5,081	5,900	6,525	7,300
Total Traffic	5,189	6,000	6,625	7,400

Source: Economics Research Associates.

Section IX

WOOD PULP, PAPER, AND PAPER PRODUCTS

ANALYSIS OF ERA 1969 PROJECTION

ERA's projections for 1971 Canal traffic in wood pulp, paper, and paper products were within 1 percent of actual Canal traffic. For the Atlantic to Pacific trade route, the projections were 3.9 percent low at 1.0 million tons versus 1.04 million tons of actual traffic, while for the Pacific to Atlantic trade route the projections were 3.8 percent high at 2.9 million tons versus 2.87 million tons actual traffic. A summary comparison of the projections to actual traffic is shown in Figure 9. On an analysis of commodity traffic, a similarly good comparison between actual and projected traffic is found in that none of the paper or wood pulp projections were off by more than 30,000 tons. These figures are summarized in Table 20 which shows actual Canal traffic from 1969 to 1971 as well as the ERA 1971 projections.

PROJECTED WOOD PULP AND PAPER TRAFFIC THROUGH THE CANAL

In view of the accuracy shown in the ERA 1969 forecast, few changes are required in terms of update. The only area in which a modification is required is a shift in the relative supply of wood pulp to Europe from the United States and Canada. The United States captured about 26 percent of this demand in 1971 as compared to 18 percent in 1969. The projected figures have been adjusted to reflect the greater importance of the West Coast United States as a wood pulp supplier to Europe. There is

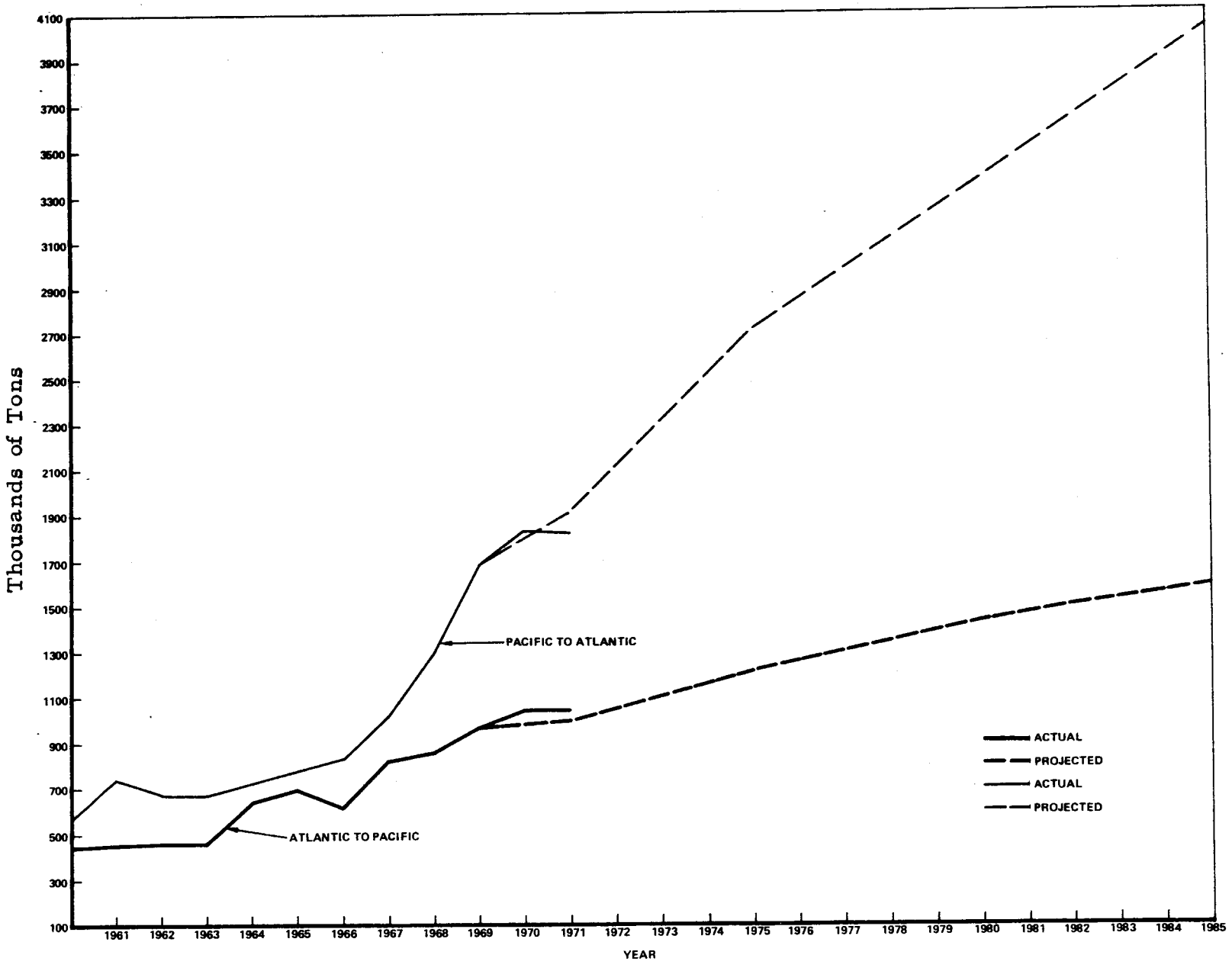


Figure 9

VOLUME OF WOOD PULP AND PAPER PRODUCTS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 20

SUMMARY OF WOOD PULP, PAPER,
AND PAPER PRODUCTS SHIPMENTS
THROUGH THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
Paper	814	846	829	820
Wood Pulp	149	192	210	180
Subtotal	963	1,038	1,039	1,000
Pacific to Atlantic				
Paper	418	578	534	500
Wood Pulp	1,241	1,231	1,297	1,400
Subtotal	1,659	1,809	1,831	1,900
Total Traffic	2,622	2,847	2,870	2,900

Source: Panama Canal Company and Economics Research Associates.

currently an oversupply of wood pulp on the West Coast as Japanese imports have been reduced to reflect their economic slowdown. A summary of the projected traffic in wood pulp, paper, and paper products is presented in Table 21.

Table 21

PROJECTED PAPER AND WOOD PULP TRAFFIC THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
Paper				
United States to Latin America	168	240	290	350
United States to Asia	115	160	210	260
Canada to Oceania	107	150	175	175
Canada to Asia	129	225	275	300
Europe to United States and Latin America	152	120	120	120
Other	153	75	75	75
Subtotal	829	970	1,145	1,280
Wood Pulp				
United States to Asia	104	140	160	160
Other	106	100	120	140
Subtotal	210	240	280	300
Total Paper and Wood Pulp	1,039	1,210	1,425	1,580
Pacific to Atlantic				
Paper				
United States to Europe	125	100	100	100
Canada to Europe	195	225	225	250
Other	214	250	275	300
Subtotal	534	575	600	650
Wood Pulp				
United States to Europe	310	500	650	825
Canada to Europe	886	1,500	2,000	2,475
Other	100	100	100	100
Subtotal	1,297	2,100	2,750	3,400
Total Paper and Wood Pulp	1,831	2,675	3,350	4,050
Total Traffic	2,870	3,885	4,775	5,630

Source: Economics Research Associates.

Section X

PHOSPHATES

ERA's projection for 1971 Canal traffic in phosphates was within 7 percent of actual Canal tonnage. Projections were high in both directions with 4.5 million actual long tons and 4.7 million projected long tons on the Atlantic to Pacific trade routes and 2,000 actual long tons compared to 100,000 projected long tons in the Pacific to Atlantic direction. Figure 10 presents a summary comparison of the projections to actual traffic and Table 22 presents these comparisons numerically.

PHOSPHATE CONSUMPTION, PRODUCTION, AND TRADE

The United States is the world's largest producer of phosphate rock, while Morocco and the Union of Soviet Socialist Republics are the world's other two major sources. The trend toward "super" concentrated phosphate fertilizer compounds is expected to increase trade in processed fertilizers. However, because the major phosphate rock importers have such large investments in fertilizer plants, it is expected that the rock itself will continue to dominate the trade. The high transportation costs relative to the phosphate rock's price at its origin dictate that, when politically feasible, it be imported from its nearest source.

The major importing countries of phosphate rock are Japan and Australia. Australia satisfies most of her demand through the captive sources of the Ocean, Nauru, and Christmas islands. Japan, on the other hand, imports about 70 percent of its phosphate rock from the United

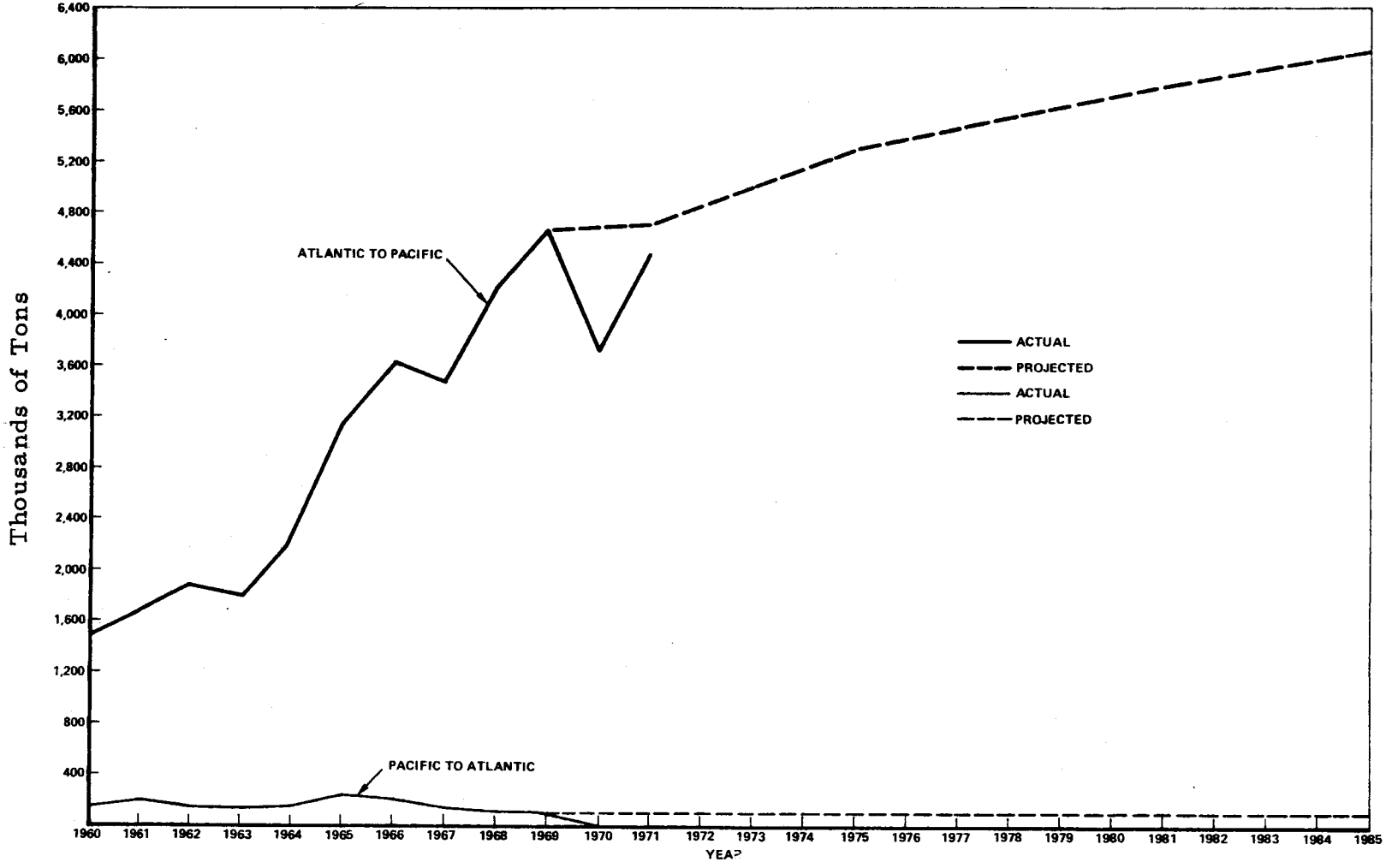


Figure 10

VOLUME OF PHOSPHATES TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 22

SUMMARY OF PHOSPHATES
TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
From East Coast United States to:				
Asia	3,043	2,745	2,882	3,200
Oceania	415	45	22	600
Canada	513	302	666	200
South America	213	180	172	200
United States	94	99	155	--
From Africa to Asia	238	171	3[illegible]	400
Other	146	190	193	100
Subtotal	4,662	3,732	4,472	4,700
Pacific to Atlantic				
From Oceania to Europe	85	--	--	100
Other	8	6	2	0
Subtotal	93	6	2	100
Total Traffic	4,755	3,738	4,474	4,800

Source: Panama Canal Company and Economics Research Associates.

States. Both Oceania and Japan consume almost 100 percent of the rock they import, but Japan has exported small amounts of phosphate fertilizers.

Australia has a rich phosphate deposit owned partly by Broken Hill South Inc. and International Minerals and Chemical Corporation. These large reserves in Queensland are 300 miles from the ocean over a single line railroad. The cost of moving the mineral this way is prohibitive. In order to economically extract the rock, a railroad must be built 175 miles to the Gulf of Carpenteria. In addition, a 5 mile long pier must be constructed since the gulf water is too shallow to allow large ships to enter. Since the investment for the railroad and pier is so large, no construction is expected until at least 1978. In addition 3 to 5 years are required for the plant to be built. ERA projects that this deposit in Australia will not produce until 1980, probably at a level of 1 million tons. By 1985, or 1986, this deposit will be producing 5 million tons, 50 percent of which is expected to go to Asia. This will substantially affect Florida's Asian market.

High grade phosphate rock on the West Coast of Africa in Spanish Sahara is another important deposit. By 1974 extraction should begin and by 1975, 3 million tons are expected to be produced. Fifteen to 20 percent of this should be exported to Asia. By 1980, this deposit is projected to produce 8 or 9 million tons and by 1985, 10 million tons. Thus, in 1975, 600,000 tons are expected to be exported to Asia, 1.7 million in 1980, and 2 million tons in 1985. This Spanish Sahara deposit should substantially decrease Florida's market in Asia. This ore may be transported on vessels that bypass the canal; however, since the uncertainty of ship size is so great, ERA has assumed that 40% of this ore will travel through the canal. In

addition, reserves in Florida are getting lower in quality as more of the rock is mined. ERA feels that Florida's production is now peaking at around 25 million tons annually and will probably remain at this level.

Japan's consumption of phosphate rock has increased more than 6% per year during the past 10 years, but is not expected to continue at this rate in the future. Recently Japan has closed several furnace plants due to air pollution problems. More and more, Japan is expected to import processed phosphate products. In 1971, Japan imported 50,000 tons of elemental phosphorous (equivalent to 300,000 tons of phosphate) from Russia. After 1980, phosphate consumption in Japan is expected to level at 3.58 million tons. Japan will then be using as much fertilizer as she can and farm lands will probably be increasingly diverted to other uses. However, the Japanese are still expected to export some fertilizer. Thus, an annual growth rate of 3% gradually decreasing to 2% is projected for phosphate rock imports until 1985.

Canada's consumption of phosphate rock is growing much more rapidly than Japan's. At the present, they are consuming some 2.2 million tons annually. The United States supplies all Canadian phosphate demand. Of this 2.2 million tons, 650,000 tons traverse the canal, 1 million tons go by internal water routes and the rest travels in winter by rail. Canada has just begun to use fertilizer since the virgin richness of her soil, especially in Quebec and Ontario where tomatoes and potatoes are grown, has not been depleted. Fertilizer use is more familiar, however, in the wheat growing regions of the country. Thus ERA projects that Canada's consumption of phosphate will increase 5% annually until 1985.

Europe will continue to import its phosphate from Africa, although the British Isles will most likely continue to import a small amount of rock from Nauru Island.

PROJECTED PHOSPHATE TRAFFIC THROUGH THE CANAL

Ship Size

Currently, the ships carrying phosphate rock are relatively small. In 1971 general-cargo ships carried 60 percent of the phosphate tonnage, while bulkers accounted for 40 percent. The bulkers were generally less than 25,000 DWT. The Japanese plants processing phosphate rock are generally not large and tend to be scattered throughout the islands. As a result, distribution problems have dictated limited lot sizes and comparatively small ships. Japanese officials do not anticipate a concentration of plants in the next 15 years, so that bulk shipments will tend to remain small, and certainly within the limits of the Panama Canal. With the possible exception of Africa, none of the other trade routes is expected to generate any phosphate traffic that could economically bypass the Canal with large bulkers. However, shipments from Africa are marginal from an economic standpoint. Based on ERA's computer analysis, it is projected that bulkers in excess of 20,000 DWT will bypass the Canal from Africa. Therefore, the Canal trade route tonnages discussed below take into account the African trade route bypass.

Phosphate Traffic

In view of the accuracy shown in the 1969 forecast few changes are required for an update. The only area in which a modification is required is the supply of phosphates to Oceania, Canada and Asia from the United States.

It appears that until 1980, practically all of Asia's phosphate rock will come from either Florida or West Africa. About that time, the impact of Australian phosphate rock exports should affect the Canal. Until the late 1970s, West Africa and the United States are expected to supply about 85 to 95 percent of Asia's needs and, together with Australia, should provide 95 percent of the imports till 1985.

ERA projects that traffic in phosphates from the United States to Asia will increase to 3.2 million tons in 1975. By 1980, total Asian demand will be at approximately 6.1 million tons, 500,000 of which are projected to be supplied by Australia and 1.7 million of which will come from Africa. Of the remaining 3.9 million demand, the U.S. is projected to supply 70 percent, or 2.8 million long tons. By 1980, Asian demand is forecast at 7.4 million, 2 million of which will be supplied by Africa and 2.5 million of which will come from Australia. Of the remaining 2.9 million demand, the U.S. is forecast to capture 2.1 million. Oceania's imports from the United States declined faster than expected; ERA projected 600,000 long tons would be shipped through the Canal while 22,000 actual long tons traversed the Canal. ERA no longer considers this a major trade route and its traffic is included in "other" in the 1975-1985 projections.

The Food and Agricultural Organization (FAO) estimates that Latin America will increase its consumption of fertilizers during the next decade at an annual rate of 10 percent. However, Latin America is expected to emphasize the development of its own phosphate reserves, such as those in Colombia and Peru. As a result, imports are estimated to grow only modestly from 250,000 long tons in 1975 to 300,000 by 1985.

Traffic from Africa to Asia is still uncertain and may bypass the Canal entirely. However, for purposes of this report ERA assumed that 40% of the African ore would traverse the Canal. Thus, traffic is projected at 240,000 long tons in 1975 increasing to 815,000 long tons in 1985.

Traffic on the East Coast United States to Canada trade route is growing at approximately 5% annually and ERA forecasts that it will approximate 600,000 long tons in 1975 increasing to 775,000 in 1980 and 990,000 long tons in 1985. Pacific to Atlantic traffic is relatively minor for phosphates and is projected to remain at 25,000 long tons through 1985.

Summary

Total traffic through the Canal is expected to continue to increase, although more slowly than during the past decade. The following total traffic is projected and shown in Table 23 by major trade route:

	Long Tons (thousands)			
	Actual 1971	1975	1980	1985
Total Traffic	4,474	4,690	4,930	4,565

Table 23

PROJECTED PHOSPHATE TRAFFIC
THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	1971	1975	1980	1985
Atlantic to Pacific				
From United States to:				
Asia	2,882	3,200	2,800	2,060
Canada	666	600	775	990
Latin America	172	250	275	300
Africa to Asia	382	240	680	815
Other	370	375	375	375
Subtotal	4,472	4,665	4,905	4,540
Pacific to Atlantic	2	25	25	25
Total Traffic	4,474	4,690	4,930	4,565

Source: Economics Research Associates.

Section XI

FERTILIZERS

ANALYSIS OF 1969 FORECAST

ERA overstated Canal traffic of fertilizers in 1971 by 10 percent, with actual tonnage at 3.9 million long tons and projected tonnage at 4.3 million long tons. Figure 11 presents a summary comparison of actual and projected traffic from 1960 to 1971. Projections for fertilizer cargo traveling in the Atlantic to Pacific direction were low by 275,000 long tons with actual traffic at 1.55 million long tons and projected at 1.27 million long tons. Traffic traveling on the East Coast of the United States to Asia trade route was understated by 128,000 long tons, with ERA's projection at 175,000 long tons and actual tonnage at 303,000. Traffic on the "other" trade routes was underestimated by approximately 200,000 long tons due mainly to the growth of the Europe to Asia route, which increased from 61,000 long tons in 1969 to 189,000 long tons in 1971.

Traffic in the Pacific to Atlantic direction was overstated by 26 percent, with actual traffic at 2.4 million long tons and projected at 2.9 million long tons. ERA overstated the traffic of fish meal traveling from South America to the United States and Europe. Actual traffic was 1.3 million long tons with the ERA forecast at 1.7 million long tons. Because United States fishmeal production increased greatly from 1970 to 1971, imports from South America dropped. United States production tonnage was as follows for 1968 to 1971:

1968	1969	1970	1971
235,136	252,664	269,200	292,400

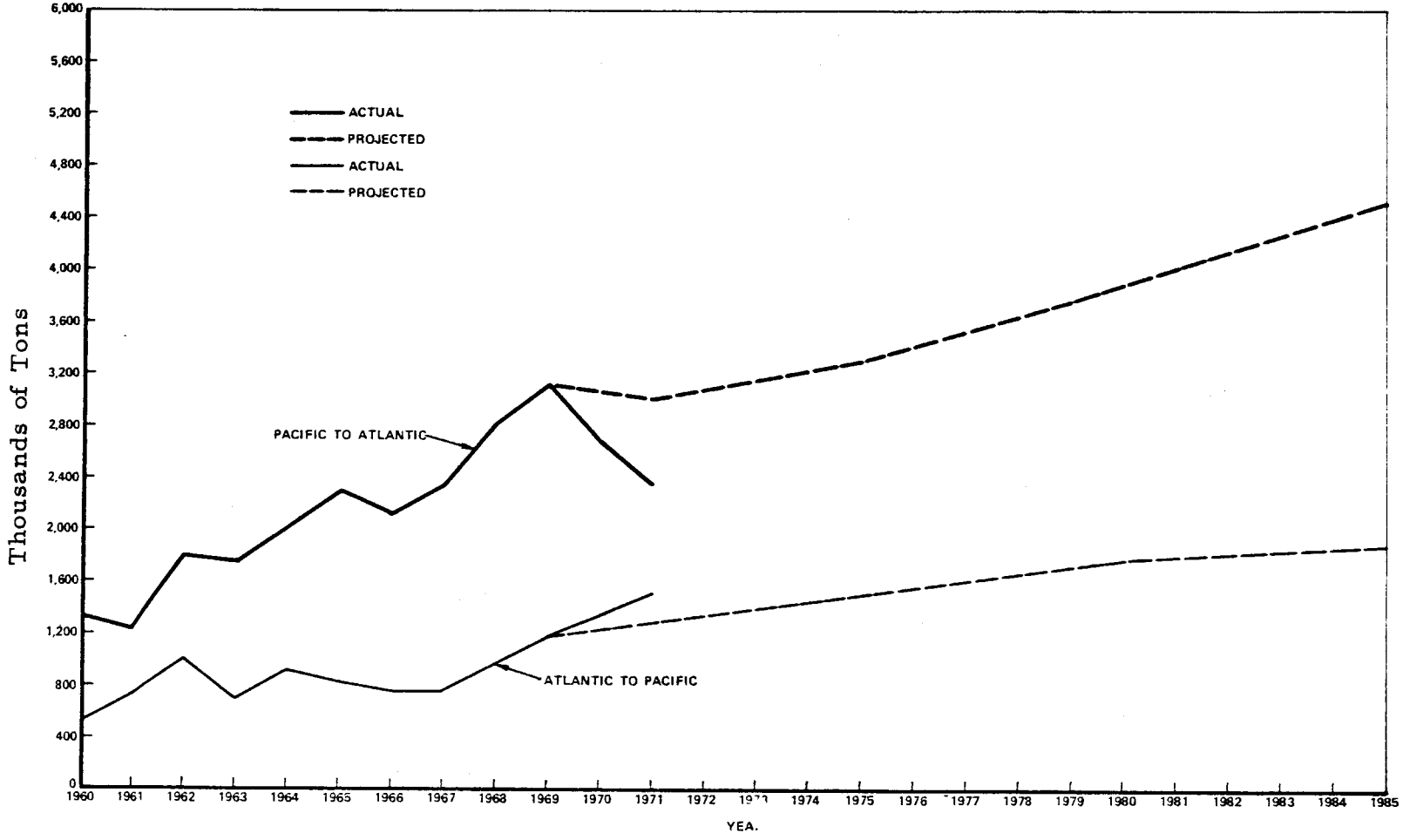


Figure 11

VOLUME OF FERTILIZERS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

A summary of Canal traffic by trade route for the past three years and a comparison to ERA projections is presented in Table 24.

CANAL FERTILIZER TRAFFIC

This commodity category includes various fertilizers, potash, as well as fish meal, which occasionally serves as a fertilizer, but is almost always used as a protein additive to livestock and poultry feed. For convenience of analysis, fish meal is discussed separately. These various commodities have generated significant traffic in both directions, although recently the northbound movement has been far more important because of the trade in fish meal and potash. The growth from the 1962 tonnage of 2.8 million long tons to the 1971 tonnage of 3.9 million long tons occurred primarily in these two commodities.

In terms of tonnage, there are no major Atlantic-to-Pacific trade routes. The three routes carrying the most fertilizers are from the United States to Asia, and from Europe and the United States to Central and South America. The southbound traffic consists primarily of nitrogeneous fertilizer shipments; approximately 100,000 long tons of potash per year is shipped from the East Coast of the United States to Latin America, Asia, and Oceania.

The Pacific-to-Atlantic trade consists primarily of fish meal shipments to the United States and Europe from Peru, and potash shipments from the West Coast of Canada to the United States and Europe. Since 1963, when trade data on fish meal were first available, traffic increased from 1.007 million long tons to the 1969 figure of 1.975 million long tons. Since 1969, traffic has declined and 1971 traffic amounted to less than 1.4 million tons. Europe, which imported 1.2 million long tons in 1971, has been the major destination for South American fish meal.

Table 24

SUMMARY OF FERTILIZER[1/]
TRAVERSING THE PANAMA CANAL
FROM 1969 TO 1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
From East Coast of United States to Asia	186	362	303	175
From Europe to Central America and South America	365	408	527	600
Other	638	547	714	500
Subtotal	1,189	1,317	1,544	1,275
Pacific to Atlantic				
From West Coast of South America to East Coast of United States and Europe				
Fertilizer	362	363	454	350
Fish Meal	1,875	1,495	1,309	1,720
From West Coast of Canada to:				
United States	204	216	342	225
Europe	384	253	65	450
Other	304	368	200	250
Subtotal	3,129	2,695	2,370	2,995
Total Traffic	4,318	4,012	3,914	4,270

1/ Includes ammonium compounds, potash, unclassified fertilizers, fish meal, and nitrate of soda.

Source: Panama Canal Company and Economics Research Associates.

Potash has been a major Canal commodity only for the past few years. Since the discovery of the Saskatchewan potash reserve in 1963, Canada has become one of the world's major exporters of potash. The other source of northbound transits is nitrate of soda shipped from Chile to the United States and Europe.

WORLD CONSUMPTION, PRODUCTION, AND TRADE

Fertilizers

The worldwide use of nitrogeneous fertilizers, exclusive of sodium nitrate, has shown a substantial annual rate of growth in the 1960s of about 10 percent per year. There has been a trend toward more highly concentrated liquid fertilizers and a resulting reduction in the use of sodium nitrate, whose nitrogen content is low. In both shipment and soil application, nitrate of soda is more expensive than the synthetic fertilizers. Just prior to World War II, sodium nitrate comprised 8 percent of the nitrogen fertilizer used in the world. It has now fallen to less than 1 percent of the world's total, which was estimated at more than 21 million tons in 1967.

The trend toward applying synthetic nitrogen fertilizers has tended to stimulate local production rather than to increase fertilizer imports to meet the increased need. Raw materials for synthetic nitrogen are readily available, and its production process is relatively simple. Even if the raw materials are not available domestically, importing them for conversion to the fertilizer product is more economical than importing the processed fertilizer. This same situation also is true for phosphate fertilizers. As a result, world fertilizer trade has not grown in proportion to world fertilizer

consumption. This is certainly evident from Canal statistics, as there has been no appreciable growth in fertilizer tonnage moving from the developed countries to the developing countries since 1962.

ERA anticipates a slow rate of growth in fertilizer traffic through the Canal. Latin America, the primary destination for exported fertilizers, is seen as increasing its annual consumption by 8 to 10 percent during the next decade. However, imports will probably rise at a much slower rate as the countries continue to develop more of their indigenous materials for fertilizers. Asia's increased fertilizer needs are expected to be supplied either through increased domestic production or by Japan.

The consumption of nitrogen fertilizers in Asia (excluding Japan) has been greater than its production since 1965. India and Pakistan mainly have scheduled increases in production capability that will reach 4.4 million metric tons by 1975, triple the 1969 capability of 1.5 million tons. In 1968 and 1969, production capability was only half of the total consumption. Future capacity additions will increase production capabilities so that Asia will be able to fill 80 percent of her projected fertilizer demand.

Japanese fertilizer production has increased rapidly in the past few years, and it is expected that she will continue to increase her capacity. Nitrogen consumption is not expected to keep pace with this rapid increase in production capability resulting in increasing exports of nitrogeneous fertilizers and phosphates from Japan. An average of half the nitrogen production is exported annually. Japan is second only to Western Europe in net nitrogen exports.

In addition, a large part of U.S. fertilizer exports to Asia are nitrogen and ammonia compounds and potassium chloride AID shipments to India, South Vietnam and Pakistan. Value of these shipments has been decreasing since 1968, as shown in Table 25. ERA feels that, while it is extremely difficult to predict the AID budget or the proportion of it allocated to fertilizers, the 1971 level of $41 million will not decline significantly in the next 15 years. In addition, while total fertilizer allocations have decreased since 1968, the proportion going to Vietnam has increased 40 percent from $11,725,000 in 1968 to $16,512,000. It is expected that funds to Vietnam will increase or remain at the same level even after the Vietnam war has ended.

The world used almost 13 million metric tons of potash in 1967. Europe, the leading producer of potash, is also its major user, absorbing 46 percent of the world total. Canada, shipping more than 2 million tons, has become the world's largest exporter of potash. Its reserve in Saskatchewan is estimated to exceed 5 billion tons. Future Canadian trade in potash which affects the Canal is expected to be directed primarily to Europe and the United States, while considerable trade to Asia is also expected. However, European demand for Canadian potash is not expected to grow due to a new mine being developed in Yorkshire, England. By December, 1973, 3 million tons are expected to be produced. This deposit is only 1 mile from the sea near deep water so that transportation will be extremely easy. During the 1960s, Europe's use of potash increased 5 percent per year, while imports rose 8 percent. The estimated expansion in European

Table 25

AID FERTILIZER PURCHASES BY ASIAN COUNTRIES, 1968-1971
($000)

	1968	1969	1970	1971
India	107,300	68,090	40,188	14,773
Pakistan	14,674	11,729	30,529	8,834
South Vietnam	11,725	6,951	14,646	16,512
Other	11,582	1,345	8,136[1/]	820
Total	145,281	88,115	93,499	40,939

1/ Thailand took $7,526 of fertilizer in 1970--in other years, the amount was minimal.

Source: AID, and Economics Research Associates.

consumption is about 5 percent per year during the 1970s, while that of the United States is about 4 percent annually.

Fish Meal

Fish meal provides an excellent protein additive for livestock and poultry. Peru, although a major source only since the early 1960s, is by far the largest producer, accounting for about one-third of the world's total. Chile is a minor supplier. Fish meal for Europe, the world's largest consumer, is primarily furnished by Peru and Norway. The supply and cost competitiveness of fish meal appear to be the major determinants of its future trade. Future growth of Peru's commerce in this product is expected to increase moderately, but subject to wide fluctuation arising from the inconsistency of the fishing industry.

PROJECTED FERTILIZER AND FISH MEAL TRAFFIC THROUGH THE PANAMA CANAL

Future Ship Size

Fertilizers (other than potash) and fish meal are currently transported primarily in general-cargo ships, but small bulkers may transport fish meal in the future. Potash is carried about 75 percent of the time on bulkers generally ranging from 35,000 to 45,000 DWT. Ships in excess of the Canal's limits are not expected during the next 15 years. Bulk carriers with potash will probably not exceed 50,000 to 55,000 DWT.

Atlantic to Pacific

Trade will continue to flow primarily to Latin America from the United States and Europe. Tonnage is expected to increase only slightly

as the countries keep satisfying most of their increased fertilizer needs with domestic production. ERA projects that Latin America will import 840,000 long tons in 1975, 970,000 by 1980, and 1,000,000 by 1985. Shipments from the U.S. to Asia are projected to decline due to decreased U.S. AID shipments and fertilizer production expansion in Asia. Tonnage of 200,000 is estimated for 1975, remaining at this level through 1985. Shipments from the United States and Europe to Oceania are seen as increasing from 140,000 long tons in 1975 to 175,000 long tons by 1980. The other trade routes, although all relatively small, have shown steady growth during the past 10 years, a trend expected to continue as farming techniques in the developing countries become more sophisticated. The miscellaneous trade routes are projected to grow from 450,000 long tons in 1975 to 510,000 by 1985.

Pacific to Atlantic

Since synthetic fertilizers are far superior to Chile's nitrate of soda, there is little reason to expect any significant use of sodium nitrate in the future. The 350,000 long tons estimated to pass through the Canal in 1975 should decrease to 150,000 by 1985. These shipments will be probably somewhat equally divided between the United States and Europe.

Fish meal traffic is estimated to grow at a rate of between 3 and 4 percent per year, but could be subject to drastic fluctuations resulting from a poor fishing season. South America's shipments to Europe are expected to be the dominant trade route, as shown on the following page.

	Long Tons (thousands)			
	1971	1975	1980	1985
United States	85	100	100	100
Europe	1,224	1,350	1,500	1,600

Potash trade from Canada to Europe decreased in 1971 from 253,000 in 1970 to 65,000 long tons in 1971 due to the 1970 Canadian potash proration program which allocated Canadian production to world market demand and established a minimum price for potash. As a result of this increased price and production quotas, Canada lost some of its European market. Shipments are now increasing due to a 1971-1973 trade agreement between Canada and European distributors for the purchase of 300,000 tons of potash per year. However, the aforementioned British potash deposit should reduce these shipments by 1980. ERA projects that traffic along this route will increase to 350,000 long tons in 1975, then decrease 200,000 long tons in 1980, and further decrease to 150,000 long tons in 1985.

Potash traffic from Canada to the U.S. has been increasing critically jumping from 204,000 long tons in 1969 to 216,000 long tons in 1970 to 342,000 long tons in 1971. ERA projects that traffic will continue to increase to 450,000 long tons in 1975, and reach 550,000 long tons in 1985.

Summary

Total tonnage of fertilizer and fish meal passing through the Canal is estimated to be as follows:

	Long Tons (thousands)			
	Actual 1971	1975	1980	1985
Atlantic to Pacific	1,551	1,630	1,855	1,855
Pacific to Atlantic	2,370	2,900	2,850	2,950
Total	3,921	4,530	4,705	4,805

As shown in Table 26, increased traffic in fertilizer is projected through 1985, however, at a relatively slow average growth rate of 1.8 percent.

Table 26

PROJECTED FERTILIZER[1/] TRAFFIC
THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
United States and Europe to:				
Latin America	743	840	970	1,000
Oceania	106	140	175	175
United States to Asia	310	200	200	200
Other	392	450	510	510
Subtotal	1,551	1,630	1,855	1,855
Pacific to Atlantic				
South America to United States and Europe				
Fertilizer	454	350	200	150
Fish Meal	1,309	1,450	1,600	1,700
Canada to:				
United States	342	450	500	550
Europe	65	350	200	150
Other	200	300	350	400
Subtotal	2,370	2,900	2,850	2,950
Total Traffic	3,921	4,530	4,705	4,805

1/ Includes fish meal.

Source: Economics Research Associates.

Section XII

IRON ORE

ANALYSIS OF 1969 FORECAST

ERA's 1969 forecast for iron ore traversing the Canal was low by 20 percent with projected tonnage at 3.4 million long tons and actual tonnage at 4.1 million long tons. Figure 12 presents a summary comparison of actual and projected tonnage of iron ore Canal traffic from 1960 to 1971. Table 27 presents a comparison of iron ore traffic by major trade route from 1969 to 1971. Iron ore traffic traveling northbound from the Pacific to Atlantic was understated slightly by 8 percent, with projected tonnage at 3.2 million and actual tonnage at 3.5 million. ERA underestimated the amount of tonnage traveling the West Coast of South America to Europe trade route. Traffic on this route was at 764,000 long tons in 1971, while ERA forecast tonnage at 300,000 long tons. Traffic traveling from the Atlantic to Pacific was also understated, with actual tonnage at 566,000 long tons and projected tonnage at 140,000 long tons. A spot shipment of iron ore from the East Coast of South America to the West Coast of the United States increased tonnage from approximately 10,000 long tons to 150,000 long tons. Another spot shipment from Venezuela to Japan accounted for 91,000 long tons and Canadian iron ore exports to Japan accounted for more than 280,000 long tons.

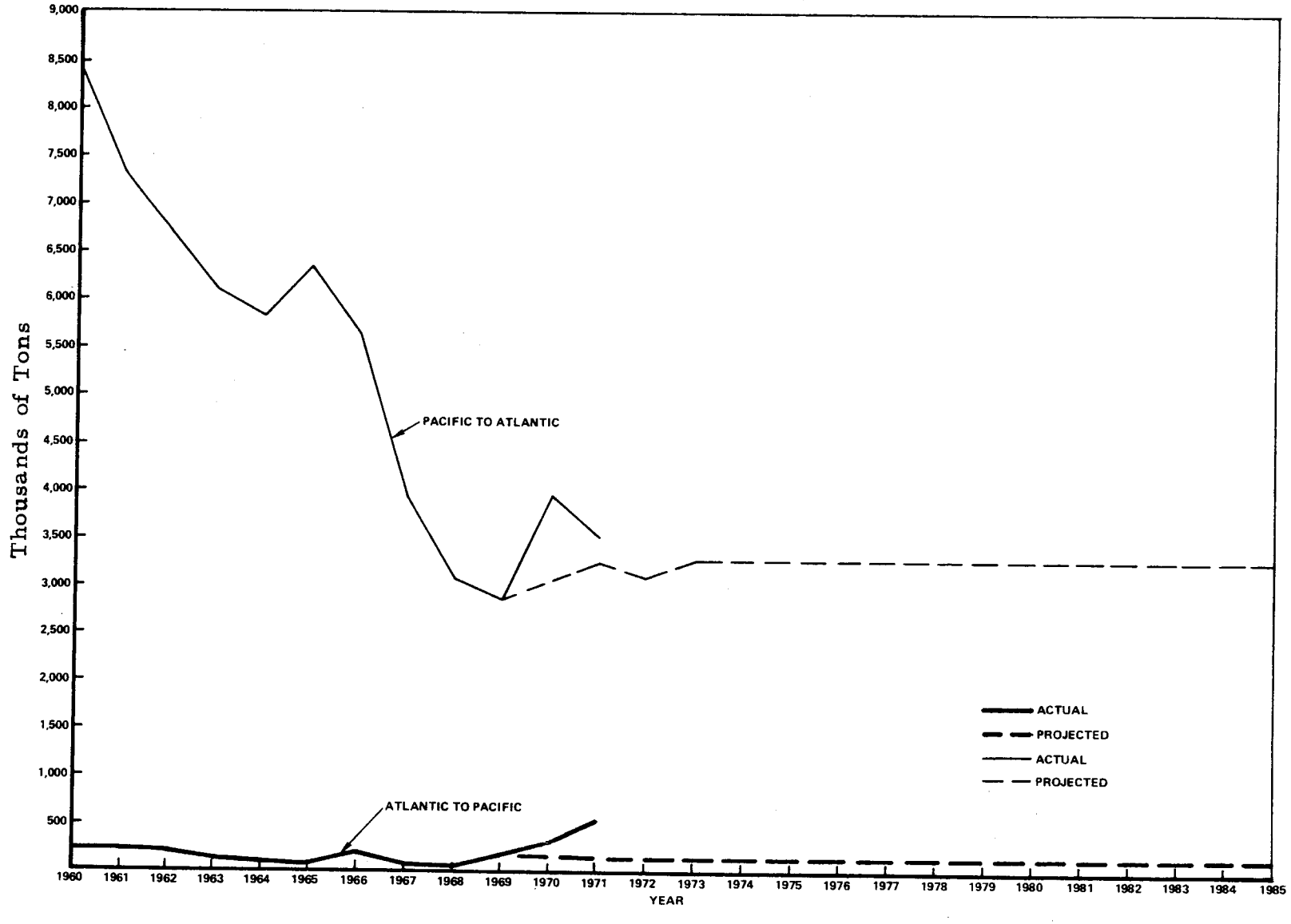


Figure 12

VOLUME OF IRON ORE TRAVERSING THE PANAMA CANAL
1960-1971
(Thousands of Long Tons)

Table 27

SUMMARY OF IRON ORE
TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Pacific to Atlantic				
West Coast South America to East Coast United States	2,390	2,808	2,709	2,900
West Coast South America to Europe	452	966	764	300
Miscellaneous	37	156	28	50
Subtotal	2,879	3,930	3,501	3,250
Atlantic to Pacific				
East Coast South America to West Coast United States	--	10	150	1/
East Coast South America to Asia	--	13	108	1/
Canada to Asia	--	220	283	1/
Other	176	41	25	140
Subtotal	176	284	566	140
Total Traffic	3,055	4,214	4,067	3,390

1/ Not included in ERA 1969 forecast.

Source: Panama Canal Company and Economics Research Associates.

IRON ORE WORLD PRODUCTION AND DEMAND

World demand for iron ore will move approximately in parallel with world production of steel. Recently, growth in the world steel industry has slowed as witnessed in the decline in growth of steel production in major steel producing nations such as Japan. Estimates for 1980 world iron ore production are around the 1.1 billion metric ton level. In the period 1970-1980, a growth rate of 6.2 percent is projected for Asia, Africa, and Oceania. A growth rate of 2.5 percent is foreseen for the same period in the U.S. It is reasonable to assume that steel production and iron ore requirements will continue to increase in the 1970s, at average annual increments of approximately 5 percent.

The United Nation's Survey of Iron Ore Reserves puts total world iron ore resources at 782 billion tons, 251 billion tons classified as reserves and 531 billion tons classified as potential ore.

WORLD IMPORT DEMAND

Extensive iron ore reserves still exist in several major steel producing countries of Western Europe, notably France, the United Kingdom and Germany. These low-grade reserves are finding it increasingly difficult to compete with higher grade imported ore. Recent estimates project that production in France, Germany, and the United Kingdom may show an aggregate decline of 16 percent by 1975 from its 1972 level of 76 million tons. Other estimates state that Europe's total iron ore requirements in 1975 may be 300 million tons, of which Eastern Europe (excluding the U.S.S.R.) might account for 55 to 60 million tons. Considering a continued increase

in iron ore production in Sweden and perhaps Spain and Norway, it is projected that Western Europe's net import needs may be 100 to 105 million tons by 1975 and Eastern Europe's needs 40 million tons by 1975. It is expected that the U.S.S.R. will continue to supply the Eastern European countries.

Import requirements of Japan are almost the same as its total requirements since domestic iron ore production is very small. If steel output in 1975 is projected to be between 110 to 130 million long-tons, iron ore requirements will be 126 to 150 million long-tons. The various estimates made above would make total world iron ore trade in 1975 between 371-410 million tons. Estimates of 1980 trade volume range from 460 to 525 million tons. Table 28 presents a summary of import requirements by area. Projected increases in production capacity for each of the major iron ore areas are shown in Table 29.

IRON ORE EXPANSION PROGRAMS

Before projecting iron ore traffic, a look at expansion plans of major exporters is necessary. Large scale investments in Australia, Brazil, and Canada are currently being undertaken to meet the growing international demand. Most of this expanded ore production will bypass the Canal in ships too large to be accommodated by the Canal. In Australia, each of the three export companies in the Pilbara region of Western Australia is engaged in expansion programs. The Hamersley Co., whose mine at Mt. Tom Price is currently producing 18 million tons of ore annually, is developing a new major mine in the same region. By 1975, it is expected that the three together will

Table 28

IRON ORE IMPORT REQUIREMENTS
1950-1980
(Million Tons)

	1950	1960	1970	Projected 1975	Projected 1980
Japan	1	15	102	126-150	167-184
Western Europe (excluding intra-trade)	6	34	80	100-105	130-150
Western Europe (intra-trade)	18	47	54	50	50
Eastern Europe	5	19	35	40	50- 55
United States	8	35	45	50- 55	60- 75
Other	4	6	4	5	10
Total	42	156	320	371-405	467-524

Source: UNCFD Secretariat Report "Problems of the World Market for Iron Ore," April 1971, and Economics Research Associates.

Table 29

SOME MAJOR IRON ORE EXPORTING ENTERPRISES:
PRODUCTION IN 1970 AND EXPECTED PRODUCTION CAPACITY BY 1975[a]
(Million Tons, Actual Weight)

Name of Company or Mine	Production in 1970	Expected Production Capacity by 1975	Increase 1970-1975
Algeria			
Sonarem	2.9	+	+
Angela			
Cassinga	6.0	+	+
Australia			
Hamersley	16.8	38	21
Mt. Goldworthy	6.6	8	1
Mt. Newman	11.6	36	24
Robe River	--	10	10
Brazil			
CVRD	21.5	45	23
MBR	1.2	10	9
Trindade	3.0	+	+
Canada			
IOC	20.1	33	13
Quebec-Cartier	8.9	16	7
Wabush	5.5	+	+
Chile			
Romeral	2.6	(4)	(1)
CAP	3.3	5	2
Santa Clara	--	(2)	(2)
Santa Fe/Santa Barbara	4.6	(12)	(7)
India			
Bailadila	4.5	8	3
Donimalai	--	4	4
Kudremukh	--	(7)	(7)
Liberia			
Bomi Hills	2.1	=	=
Bong	5.4	=	=
Lamco	11.1	+	+
Mano River	4.7	+	+
Lisco	--	(10)	(10)
Mauritania			
Miferwa	9.0	+	+
Norway			
Sydvaranger	2.4	3-4	1-2
Peru			
Marcona	10.0	11	1
Sierra Leone			
Marampa	2.4	=	=
Swaziland			
SIODC	3.1	=	=
Sweden			
Grangesberg	3.4	+	+
LKAB	24.2	35	11
Venezuela			
IMC	2.9	=	=
Orinoco	18.5	+	+
San Isidro	0.4	(5)	(5)

Symbols

+ means that some increase is expected, but the scale is not known.
= means that no significant increase appears to be expected.
( ) data in parentheses indicate that there appears to be some doubt whether expansion will proceed as indicated.

Notes:

[a] It is emphasized that this table is in no way intended to give a full picture of the probable expansion of world iron ore export capacity by 1975. First, no account has been taken of expansion in the socialist countries of Eastern Europe and Asia. Second, some major projects may have been omitted for lack of information. Third, no account has been taken of smaller-scale expansions; cumulatively, these could yield a large increase in world capacity. Fourth, many of the projects listed deliver significant quantities of ore to domestic steel plants; in most cases, these quantities will increase in the future. Fifth, some of the projects listed may be significantly modified before completion. Finally, major projects not yet fully investigated may yield additional export capacity by 1975.

Source: UNCTAD and Economics Research Associates.

be able to produce 38 million tons annually, all of which will be exported. The Mt. Newman group, shipping at an annual rate of greater than 11 million tons, is continuously expanding and hopes to increase output to 36 million tons a year by 1975. Eleven percent of this is expected to be consumed domestically, while the rest will be exported, mostly to Japan. A small amount may be shipped to the Gulf U.S., perhaps 250,000 to 500,000 tons per year. Europe may be another main export destination, but the ore would travel through the Indian Ocean and therefore not affect the Canal. Mt. Goldworthy, is planning to reduce output at their one existing mine, but develop two new mines in the same area. Output from Goldworthy is expected to be 8 million tons in 1975, all of which is intended for export. A fourth venture in the Pilbara region is operated by the Robe River consortium in 1972 and is expected to ship 10 million tons annually by 1975. Several other major prospects are under consideration.

Brazil is also expanding production. The government-controlled Compenbia Vale de Rio Doce, shipping ore at 20 million tons annually is expanding its operations to double its export capacity by 1975. In addition, the United States Steel Corporation and the Brazilian government recently tapped one of the largest iron ore deposits in the world. The ores run as high as 67 percent in richness. Known deposits in the Carajas mountain range and 1.6 billion metric tons, indicated reserves at 2.9 billion tons and presumed reserves at 6.6 billion tons. The deposits are in a remote part of Para State, south of the mouth of the Amazon River. Both the government and United States Steel are studying practical ways to mine the ore. The

development of these mines is several years away; however, the PCC should follow developments as to their potential effect on iron ore traffic. The Mineracoes Brasileiras Reunidas Co. (MBR) is also expanding with a new mine at Aguas Clares in Minas Gerais and a new port at Seputiba Bay, south of Rio de Janeiro. Ten million tons of ore are expected to be exported from this mine in 1975. This tonnage is not expected to be shipped in vessels small enough to traverse the Canal. Already, the Brazilian deposit is shipping 9 million tons of ore to Japan that bypass the Canal.

Canadian expansion is being undertaken by the Iron Ore Co. of Canada (operated by a group of U.S. and Canadian companies) and the Quebec Cartier Co. (a subsidiary of U.S. Steel Corp.). Both projects are in the Quebec-Labrador region. The Iron Ore Co. of Canada expects to be shipping at a rate of 33 million tons by 1975 and the Quebec-Cartier at 16 million in 1975.

The Quebec Cartier Co. has a 1971-1975 contract to ship 1.2 million tons of iron ore annually to Japan. The contract calls for ore to be shipped in 135,000-150,000 DWT carriers which will bypass the Canal. Because of delays in ship construction, some of the 1971 ore was sent on smaller ships that traversed the Canal; the larger ships are expected to be finished by 1972 so that only a small amount of Canada-to-Asia ore traffic will be sent through the Canal. A second large contract begins in 1972 between Hanna Mining and Japan. The contract calls for the Hanna-Carol Lake Deposit to send 1.85 million tons in 1972 and 5 million tons a year thereafter, for

15 years. This tonnage is contracted to be shipped in 200,000 DWT vessels and will therefore bypass the Canal.

CANAL IRON ORE TRAFFIC

Total Panama Canal traffic in iron ore declined steadily from 8.65 million tons in 1960 to 3.06 million tons in 1969. For 1970 to 1971, however, traffic increased to over 4 million tons.

The decrease in iron ore trade through the Canal has resulted from changing trade patterns and not from a fall in consumption or production. During the past decade, Japan has become the major importer of iron ore from Chile and Peru, replacing the United States as the primary destination of South American iron ore exports. This changed trading pattern is a result of Japan's increased need for iron ore and her willingness to make it more profitable for Chile and Peru to shift their export patterns. In the past two years Japan's economy has been depressed and as a result, steel production has declined. Iron ore from Chile and Peru which is normally sent to Japan has gone to Europe because of this recession. ERA forecasts that shipments to Japan will again increase as the Japanese economy strengthens itself.

PROJECTED IRON ORE TRAFFIC THROUGH THE PANAMA CANAL

Future Ship Size

Iron ore is transported through the Canal in primarily bulk carriers and combination auto-bulk and bulk-tanker ships of 30,000 to 45,000 DWT. Because of harbor improvements at the South American ports (influenced by Japanese trade), bulk carriers in excess of the Canal limits are certainly a

possibility on the South America-to-United States trade route. The relative nearness of the Chilean ports to the Cape Horn creates a distinct possibility that iron ore from Chile will not traverse the Canal. However, discussions with the mine operators lead to the conclusion that iron ore ships will continue to transit the Canal and only consider a bypass if the Canal's draft limitations are abnormally low. For other large tonnage trade routes such as shipments from Brazil and Canada to Asia, bulk carriers of 100,000 DWTs or more will be used for the majority of shipments except for occasional backhauls.

Projected Traffic

Pacific to Atlantic

The trade route from the West Coast of South America to the East Coast of the United States is extremely important. Recently, Chile nationalized the Bethlehem mine of El Romeral, cutting off shipments to the United States. Instead, Chile has contracted to send one million long tons of this ore annually to Japan. Present levels of shipping to the East Coast of the United States from the Marcona mine in Peru are expected to remain steady, however, shipments from the Chilean mines of Compania de Acero del Pacifico (CAP) and Santa Barbara-Santa Fe, may fluctuate rather wildly due to political considerations and are not expected to be significant through 1985.

Thus, Table 30 illustrates the projection of iron ore shipped through the Panama Canal from the West Coast of South America to the East Coast of the United States from 1975 through 1985. This volume is estimated to decline from its 1971 level of 2,700,000 tons to 1,500,000 tons by 1985.

The trade from the West Coast of South America to Europe has declined from 2.8 million tons in 1963 to 764,000 tons in 1971. Africa, Brazil, Peru, and Chile are expected to be the major areas from which Europe imports iron ore. In addition, Europe is expected to emphasize its program of self-sufficiency in this commodity. Marcona in Peru accounted for 500,000 long tons of the 1971 tonnage traversing the Canal on this route to Europe; Marcona executives feel this level will remain through 1985. Thus, tonnage on the South America-to-Europe trade route is projected to remain at 750,000 long tons through 1985. Oceania to the U.S. is expected to be a new route established by 1975. Of the new deposits being mined in Australia, a small amount is projected to traverse the Canal and most is forecast to bypass the Canal in large ships. Thus, traffic is projected at 300,000 long tons in 1975, increasing to 375,000 long tons in 1985.

Other Pacific to Atlantic routes not previously discussed are projected under the heading Miscellaneous Pacific to Atlantic. This category has declined from 468,000 long tons in 1961 to only 28,000 long tons in 1971. In the main, these are spot shipments and it is anticipated that such shipments on miscellaneous Pacific-to-Atlantic routes will account for approximately 50,000 long tons of iron ore annually between 1975 and 1985.

Table 30

PROJECTED IRON ORE TRAFFIC
THROUGH THE CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Pacific to Atlantic				
West Coast South America to East Coast United States	2,709	1,500	1,500	1,500
West Coast South America to Europe	764	750	750	750
Miscellaneous Pacific to Atlantic	28	50	50	50
Oceania to United States	--	300	375	375
Subtotal	3,501	2,600	2,675	2,675
Atlantic to Pacific				
Canada to Asia	283	450	500	550
Other	283	200	250	250
Subtotal	566	650	750	800
Total Traffic	4,067	3,250	3,425	3,475

Source: Economics Research Associates.

Until 1969, shipments of iron ore from the Atlantic to Pacific were small, with no major trade route established. In 1969, when the Iron Ore Co. of Canada enlarged its facilities in Labrador in the Province of East Quebec and made contractual arrangements with Japanese steel companies, the following tonnages were sent on small ships that traversed the Canal:

	1970	1971	1972 (nine months)
Iron Ore - Canada to Japan	220,000	283,000	314,000

As mentioned before, this ore will be traveling on large ships by 1975 and tonnage traversing the Canal is expected to be limited to backhaul cargos for combo-bulkers to Japan. A summary of projected iron ore traffic is presented in Table 30.

Section XIII

OTHER ORES AND METALS: SCRAP METAL, MISCELLANEOUS METALS, MISCELLANEOUS ORES

ANALYSIS OF 1969 FORECAST

ERA's projection for scrap metal traffic in 1971 through the Canal was low by about 17 percent as traffic in the Atlantic to Pacific direction did not drop as much as expected. Figure 13 presents actual and ERA's original projected tonnages of scrap metal traversing the Panama Canal from 1960 to 1985. Table 31 presents summary figures of this traffic broken down by trade route. In 1970, 3.9 million long tons of scrap crossed the Canal in Atlantic to Pacific direction and dropped to 2.6 million long tons in 1971. ERA had predicted a downward trend along this route, whose trade is comprised principally of U.S. exports to Japan. Scrap in Japan is used principally for steel production, and Table 32 presents Japanese steel production figures for the period 1965 to 1971. As shown, production had been growing rapidly, but fell in 1971. The source of scrap to fill Japanese steel production needs depends on two factors of which the first is the amount of domestic production of scrap. ERA expects a rapid growth in the supply of domestically generated scrap due to the maturation of Japan's post war economy. The second factor is the fact that scrap is extremely price sensitive on the world market and if foreign sources are cheaper than domestic sources, Japan will import her large scrap metal needs. This is probably what happened in 1970, when U.S. scrap was cheaper on the world market than Japan's other foreign suppliers

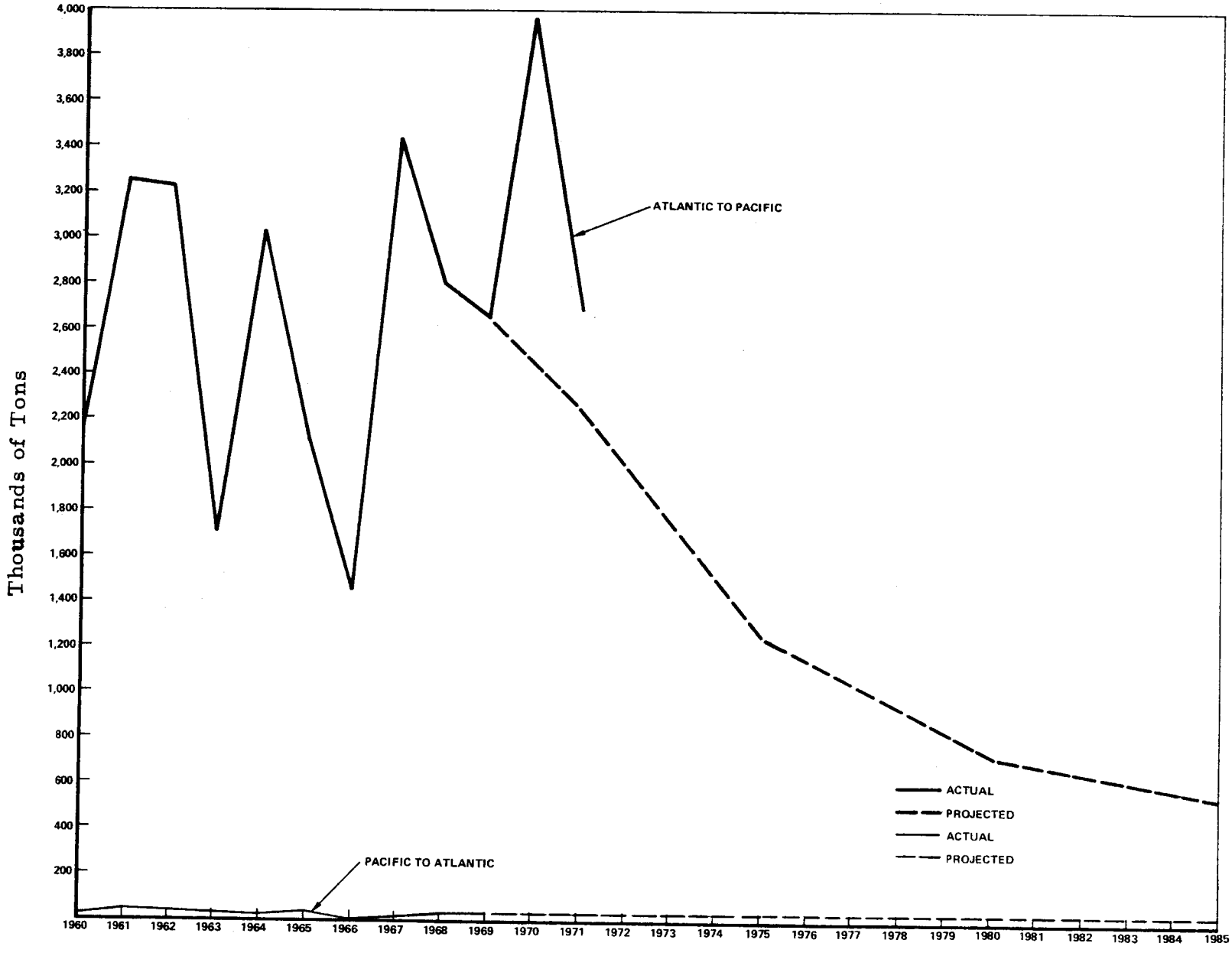


Figure 13

VOLUME OF SCRAP METAL TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 31

SUMMARY OF SCRAP METAL SHIPMENTS
THROUGH THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to Japan	2,545	3,742	2,473	1,960
Other	96	170	174	300
Subtotal	2,641	3,912	2,647	2,260
Pacific to Atlantic	32	33	18	23
Total Traffic	2,673	3,945	2,665	2,283

Source: Panama Canal Company and Economics Research Associates.

Table 32

JAPANESE STEEL PRODUCTION
1965-1971
(Metric Tons)

Year	Total
1965	41,161,000
1966	47,784,000
1967	62,154,000
1968	66,892,000
1969	82,166,200
1970	93,023,000
1971	87,700,000

Source: Japan Economic Journal, January 11, 1972.

and cheaper than Japanese produced scrap. In 1971, prices probably returned to more normal levels and imports of U.S. scrap metal to Japan declined.

PROJECTED CANAL TRAFFIC IN SCRAP METAL

Atlantic to Pacific

ERA projects that Japan will increasingly continue to fill her own scrap metal needs and therefore, will import less U.S. scrap. Table 33 presents projected traffic in scrap metal. Scrap tonnage traversing the Canal in the Atlantic to Pacific direction from the United States to Japan is projected to decrease from 1,900,000 long tons in 1975 to 300,000 long tons in 1985. However, while ERA has projected a definite downward trend in any one year, tonnage on this route can fluctuate tremendously, as witnessed by the upswings in 1961, 1964, 1967, and 1970, and the tremendous downswing in 1966. The other routes comprising the Atlantic to Pacific trade in scrap metal are expected to increase slightly to 200,000 long tons in 1975, and reach 300,000 long tons by 1985. The introduction of oxygen furnaces in Asia will tend to inhibit increases in the movement of scrap to other Asian countries.

Pacific to Atlantic

Historically, the trade in scrap metal moving from the Pacific to the Atlantic has been very small, consistently averaging approximately 23,000 long tons between 1960 and 1971. This is not expected to change significantly and 25,000 long tons is anticipated annually between 1972 and 1985.

Table 33

PROJECTED CANAL TRAFFIC
IN SCRAP METAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
United States to Japan	2,473	1,900	900	300
Other	174	200	250	300
Subtotal	2,647	2,100	1,150	600
Pacific to Atlantic	18	25	25	25
Total Traffic	2,665	2,125	1,175	625

Source: Economics Research Associates.

Because the volume of this commodity will become relatively insignificant, it is anticipated that the size distribution of ships transiting the Panama Canal with scrap iron and steel will not increase in the future. Thus, no bypasses of the Panama Canal are anticipated during the next 15 years.

MISCELLANEOUS METALS

Analysis of 1969 Projection

ERA's productions of miscellaneous metals traversing the Canal in 1971 were nearly accurate, off by only 6 percent. ERA predicted 2.0 million long tons of miscellaneous metals would traverse the Canal in 1971 and actually, 2.1 million long tons passed through, 567,000 long tons in the Atlantic to Pacific direction and 1.54 million in the Pacific to Atlantic direction. Table 34 presents these figures. ERA had predicted that 600,000 long tons would traverse the Canal in the Atlantic to Pacific and 1.4 million in the Pacific to Atlantic direction.

CANAL MISCELLANEOUS METALS TRAFFIC

The volume of miscellaneous metals[1/] shipped through the Panama Canal during the period 1960 through 1971 increased significantly from 1.4 million long tons to 3.6 million in 1968, but declined to 2.1 million long tons in 1971. The factors which resulted in the increase are not expected to be repeated in the future. Beginning in 1967 European steel mills found that in the following two years they were going to produce

1/ Includes aluminum, copper, pig iron, lead, tin and zinc, and unclassified metals.

Table 34

SUMMARY OF MISCELLANEOUS METALS
TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific	1,556	1,559	567	600
Pacific to Atlantic	1,265	1,390	1,543	1,400
Total Traffic	2,821	2,949	2,110	2,000

Source: Panama Canal Company and Economics Research Associates.

considerably more pig iron than they needed. This was sold to the Japanese, whose steel industry was in the midst of a period of rapid growth. This unusual volume of pig iron reached its peak in 1968 and decreased to a near-zero level by the beginning of 1970.

In establishing a trend as a basis for projection, it is best to disregard the abnormal shipments of pig iron from Europe to Asia. When these are excluded, a steady growth rate of 3.5 percent per year is derived for the period 1960 to 1971, in which long tons carried increased from 1.4 million to 2.0 million. During this time the Pacific-to-Atlantic traffic increased from 982,600 long tons to 1.5 million (an annual growth rate of 3.0 percent), while Atlantic to Pacific flow increased from 419,000 to 567,000 long tons (an average annual growth of 2.8 percent).

PROJECTED CANAL TRAFFIC IN MISCELLANEOUS METALS

Using the historical trends since 1960, minus the abnormal number of shipments of pig iron from Europe to Asia, projections for the volume of miscellaneous metals transiting the Panama Canal between 1975 and 1985 can be made. This is illustrated in Table 35. It is estimated that 600,000 long tons will move the Atlantic to Pacific route in 1975, increasing to 860,000 in 1985 for an annual growth rate of 2.6 percent. For Pacific to Atlantic traffic, most of which is copper from the West Coast of South America going either to the East Coast of the United States or to Europe, it is anticipated that total trade in miscellaneous metals will grow from 1.525 million in 1975, and reach 1.8 million in 1985. While this annual growth rate of 1.8 percent is low, it reflects both a very steady historical trend evidenced since 1960

Table 35

PROJECTED CANAL TRAFFIC
IN MISCELLANEOUS METALS
1971-1985
(Thousands of Long Tons)

Year	Total for Panama Canal	Atlantic to Pacific	Pacific to Atlantic
1971 (actual)	2,110	567	1,543
1975	2,125	600	1,525
1980	2,470	780	1,690
1985	2,660	860	1,800

Source: Economics Research Associates.

and the unstable politics of the South American countries exporting extensive amounts of copper. Consequently, total Panama Canal traffic in miscellaneous metals is expected to grow at an annual rate of 2.1 percent between 1975 and 1985. In volume, this represents an increase of from 2.1 million long tons in 1975, to nearly 2.7 million in 1985.

The distribution of the size of ships transiting the Panama Canal with miscellaneous metals is not anticipated to change significantly in the near future. If unusual factors, like shifts in the policies of South American countries, markedly increase the flow of such metals as copper to the East Coast of the United States or to Europe, geographical considerations could influence the use of large ships that bypass the Canal or the construction of new ships with configurations very near its maximum limits. However, indications of such shifts in the distribution of ship size cannot be adequately forecast at this time.

MISCELLANEOUS ORES

Analysis of 1969 Forecast

ERA's projection for miscellaneous ores is low by 20 percent for 1971. Traffic in the Atlantic to Pacific direction is nearly accurate, overstating actual tonnage crossed by only 23,000 long tons. Traffic in the Pacific to Atlantic direction, however, is understated, due principally to an increase in "other and unclassified ores" traveling the Oceania to East Coast U.S. and Oceania to Europe routes. Figure 14 presents actual and projected tonnage of miscellaneous ores traversing the Panama Canal from 1964 to 1971. Table 36 presents actual Canal traffic from 1969 to 1971 as

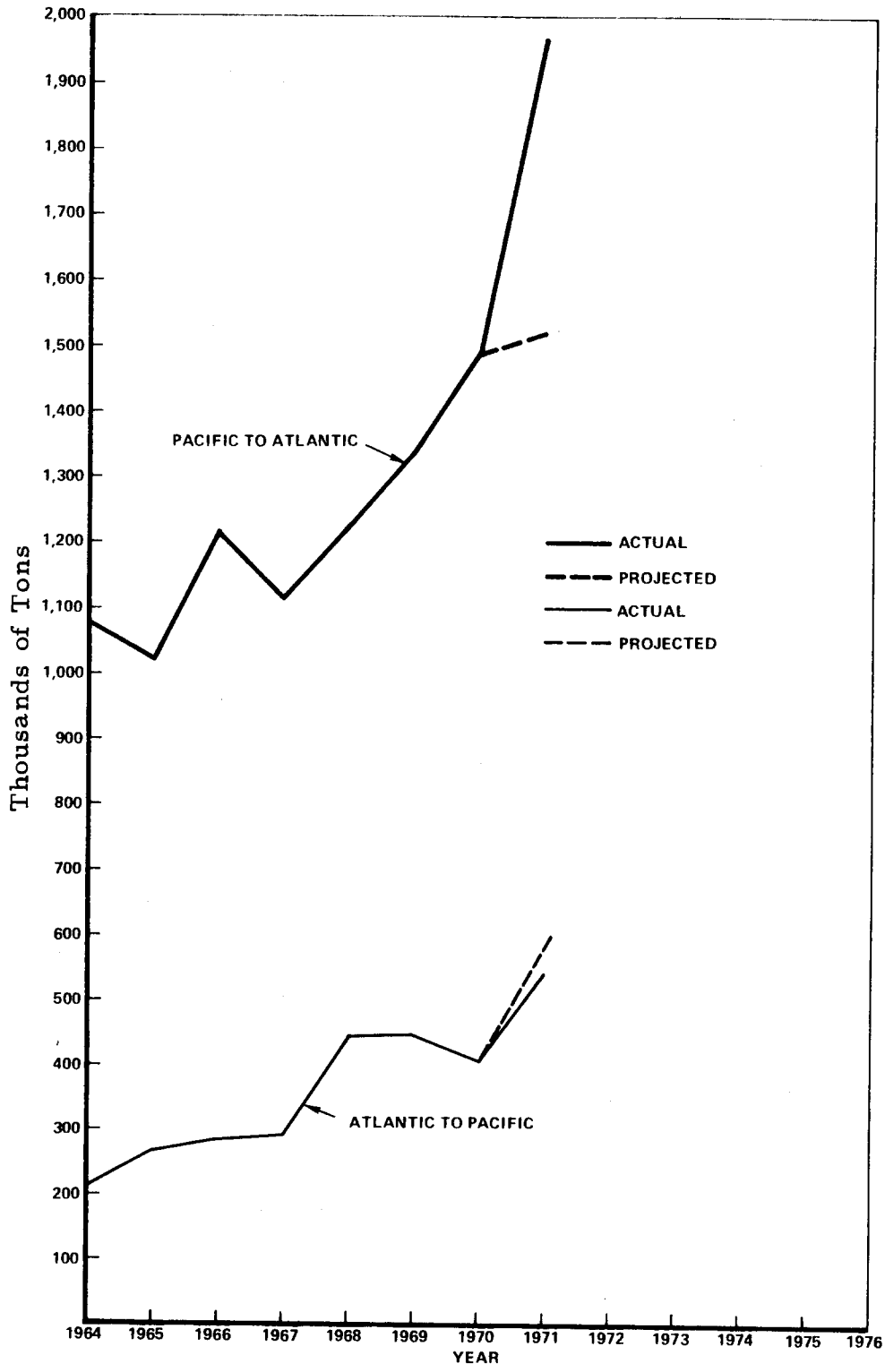


Figure 14

VOLUME OF MISCELLANEOUS ORES TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 36

SUMMARY OF MISCELLANEOUS ORES
TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific	446	403	547	570
Pacific to Atlantic	1,341	1,487	1,965	1,520
Total Traffic	1,787	1,890	2,512	2,090

Source: Panama Canal Company and Economics Research Associates.

well as the 1971 ERA projections. ERA had projected a total increase of 179,000 long tons in the Pacific to Atlantic direction from 1969 to 1971 for all ores included in the miscellaneous classification. Traffic of "unclassified ore" on the two aforementioned trade routes increased 164,000 long tons alone in the period 1969 to 1971. ERA expects this increased traffic from Oceania to the United States and Europe to continue through 1985, although at a slower rate than its 1969 to 1971 rate of increase.

CANAL MISCELLANEOUS ORES TRAFFIC

Traffic in miscellaneous ores[1/] transiting the Panama Canal during the period 1960 through 1971 has grown at an annual rate of 6.05 percent. The total movement of miscellaneous ores through the Canal has grown from 1.2 million long tons in 1960 to nearly 2.5 million in 1971. The Pacific-to-Atlantic portion rose from 1.1 million long tons to 1.9 million long tons during the same period. The category of unclassified ores accounts for 40 percent of this trade. Miscellaneous ores transiting the Canal from the Atlantic to the Pacific grew 13.3 percent annually. However, in actual volume the overall trade is small, ranging from a 1960 figure of 139,000 long tons to 547,000 in 1971.

PROJECTED CANAL TRAFFIC IN MISCELLANEOUS ORES

ERA projects that total traffic on the Pacific to Atlantic route will increase from 2.1 million long tons in 1975 to 2.94 million long tons in 1985.

1/ Includes copper, chrome, tin, manganese, zinc, and lead.

Table 37 presents these projections. Traffic along the Atlantic to Pacific route is expected to increase from a level of 640,000 long tons in 1972 to 1,020,000 long tons in 1975, to 1,560,000 long tons in 1985.

Because of the number of categories included in miscellaneous ores and the resulting small yearly shipments of each, it is not anticipated that the bulkers carrying these commodities will significantly change in size between now and 1985. Only when significant increases occur unexpectedly in trade in one of these ores will ship economics dictate a general shift in the size distribution of transiting ships.

Table 37

PROJECTED CANAL TRAFFIC
IN MISCELLANEOUS ORES
1971-1985
(Thousand of Long Tons)

Year	Total for Panama Canal	Pacific to Atlantic	Atlantic to Pacific
1971 (actual)	2,512	1,965	547
1975	3,120	2,100	1,020
1980	3,850	2,440	1,410
1985	4,500	2,940	1,560

Source: Economics Research Associates.

Section XIV

BAUXITE-ALUMINA

ANALYSIS OF 1969 PROJECTION

ERA's projections of 1971 bauxite-alumina traffic through the Panama Canal were understated by 6.5 percent or approximately 110,000 tons. Figure 15 presents actual and projected tonnage of bauxite-alumina traversing the Panama Canal from 1960 to 1985, from the Atlantic to Pacific and Pacific to Atlantic.

Table 38 presents the component trade routes of the traffic traveling in both directions from 1969 to 1971 and ERA's projections for 1971 traffic. ERA's understatement in the Atlantic to Pacific direction involved two main trade routes, the East Coast South America to the West Coast of the United States route and the West Indies to the West Coast-United States route. ERA projected that 300,000 long tons of alumina would traverse the Canal on the South American route in 1971. Actual tonnage crossed was only 125,000 long tons. This decrease is a reflection of lower production and a general recession in South American economies.

Traffic on the West Indies to West Coast United States trade routes accounted for the increase in bauxite-alumina tonnage traversing the Canal from 1969 to 1971. ERA projected that 150,000 long tons would cross the Canal on this route in 1971; in actuality, 644,000 long tons were shipped through the Canal in this year. Projections for the decreased tonnage were based on new trade patterns being established by aluminum plants under

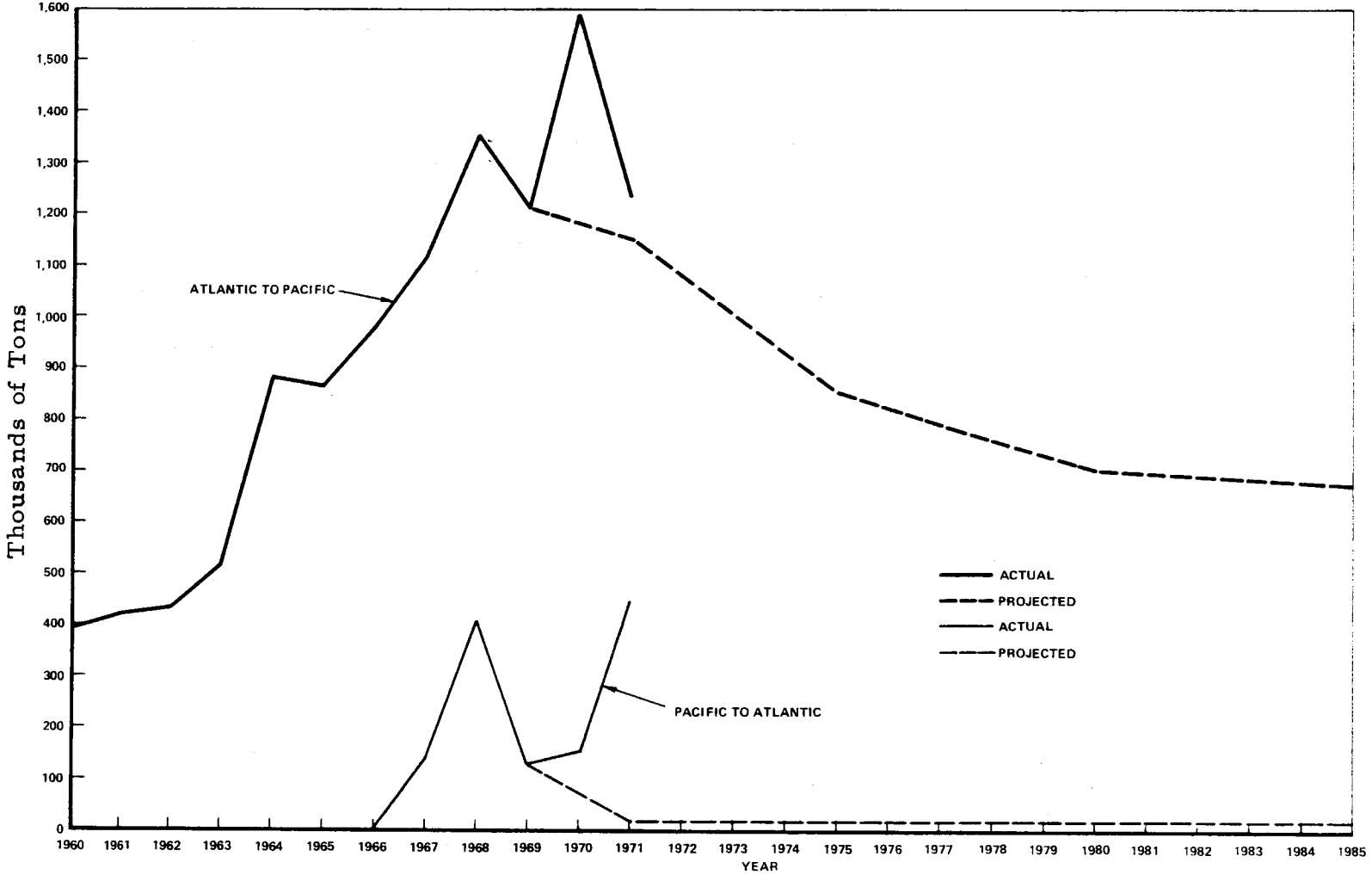


Figure 15

VOLUME OF BAUXITE-ALUMINA TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 38

SUMMARY OF BAUXITE-ALUMINA SHIPMENTS
THROUGH THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to West Coast United States	217	330	220	250
East Coast South America to West Coast United States	286	267	128	300
West Indies to West Coast United States	178	499	644	150
West Indies to West Coast Canada	342	311	125	300
Other	200	182	119	550
Subtotal	1,223	1,589	1,236	1,550
Pacific to Atlantic				
Oceania to West Indies	106	131	330	20
Other	24	24	113	--
Subtotal	130	155	443	20
Total Traffic	1,353	1,744	1,679	1,570

Source: Panama Canal Company.

construction in Central and Eastern United States. These new plants were projected to divert the bauxite shipments from the West Indies to the West Coast of the United States where the hydroelectric power plants are located. Kaiser, Reynolds, and Anaconda built a new bauxite processing plant in Jamaica in early 1971. Anaconda has a new smelter under construction in Kentucky to which this Jamaican alumina will eventually be shipped. By 1973-1974, approximately 250,000 long tons of alumina which now travels to Washington from Jamaica will be shipped to this new smelter in Kentucky via the Ohio and Mississippi rivers. ERA had miscalculated the completion date of this new smelter. However, even with some traffic being diverted away from the Canal with the construction of new plants, traffic along the West Indies to West Coast United States route will be considerable. ERA projects that 370,000 long tons of bauxite-alumina will cross the Canal in 1975, decreasing to 250,000 in 1980 and 200,000 in 1985.

In terms of Pacific to Atlantic traffic, ERA predicted 20,000 long tons would traverse the Canal in this direction, while actually 443,000 long tons passed through the Canal in this direction in 1971. As can be seen from the table, the only major trade route in this direction is the Australia to West Indies route. ERA projected that new processing plants under construction in Australia would divert bauxite traffic traveling to the West Indies to be processed. However, postponements and delays in plant expansion have forced shipments to the West Indies for processing. In addition, an unexpected increase in bauxite shipments by Harvey Aluminum from Australia to St. Croix and Corpus Christi, Texas occurred in 1971

and is expected to continue to increase until 1975 when African bauxite will be mined exclusively. ERA feels that for these reasons, traffic traveling the Australia to West Indies route has been unusual, and will decrease to 30,000 long tons when the new plants and sources are developed.

CANAL BAUXITE-ALUMINA TRAFFIC

Transits of bauxite and alumina through the Panama Canal increased significantly from 1960 through 1971. Table 39 presents these figures. The total volume of this commodity's transits rose from 390,000 long tons to 1.68 million long tons during this period. Such dramatic growth was in response to a rapidly growing aluminum industry, with plants located near the major sources of hydroelectric power in the northwestern United States and in southwestern Canada. Shipments to the West Coast of the United States and Canada accounted for about 75 percent of the bauxite-alumina trade through the Canal.

The great majority of Panama Canal shipments of alumina resulted from the industry's established transportation pattern. The large deposits of bauxite in the West Indies and on the northeast coast of South America dictate that the aluminum companies locate plants there to produce alumina from the ore. While the major markets for aluminum are in the eastern United States and Canada, the primary sources of power via hydroelectric plants lie in the northwest United States and the southwest of Canada. The natural transportation pattern, therefore, indicates the shipments of necessary alumina from the Caribbean area through the Panama Canal to the aluminum plants. The growth in this transportation pattern parallels expansion in the aluminum industry as a whole.

Table 39

VOLUME OF BAUXITE-ALUMINA TRAVERSING
THE PANAMA CANAL BY MAJOR TRADE ROUTES
Fiscal Years 1960-1971
(Thousands of Long Tons)

	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
Atlantic to Pacific												
East Coast United States to West Coast United States	--	--	--	42	230	217	285	263	287	217	330	220
East Coast South America to West Coast United States	31	20	44	42	41	34	167	238	330	286	267	128
West Indies to West Coast United States	4	38	12	--	13	40	29	32	272	178	499	644
West Indies to West Coast Canada	303	277	220	252	301	337	360	346	275	342	311	125
Other	54	85	153	179	294	233	138	241	186	200	182	119
Subtotal	392	420	429	515	879	861	979	1,120	1,350	1,223	1,589	1,236
Pacific to Atlantic												
Oceania to West Indies	--	--	--	--	--	--	--	127	397	106	131	330
Other	1	--	1	1	1	1	2	9	12	24	24	113
Subtotal	1	--	1	1	1	1	2	136	409	130	155	443
Total Traffic	393	420	430	516	880	862	981	1,256	1,759	1,373	1,744	1,679

Source: Panama Canal Company.

BAUXITE-ALUMINA PRODUCTION AND TRADE

When projecting the volume of bauxite and alumina transiting the Panama Canal, certain factors adversely affecting the Canal's present trade patterns are significant. First, the large bauxite deposits used by aluminum companies in the United States and Canada are in Australia, the West Indies, on the northeast coast of South America, and in Africa. Until recently, the only large concentration of bauxite-processing plants were in the Caribbean area. Now, extremely large alumina plants are being constructed in Australia which will eventually be large enough to satisfy both the needs of the West Coast of the United States and the West Coast of Canada together with the anticipated rapid growth of the Japanese aluminum industry.

The second major factor involves the availability of large blocks of electricity and the location of primary markets for aluminum. Only recently, the last major block of electricity generated by the hydroelectric power plants of the northwestern United States and southwestern Canada was distributed. It takes, of course, massive amounts of electricity to form aluminum from the alumina. Large-scale construction of additional hydroelectric power plants in that area is not expected because of the economics of the production of electricity. Consequently, the expansion in the production of aluminum by the United States and Canada would have to depend on electricity from other new power plants. These plants would be steam-generating units using either coal or oil as their fuel source.

It is at this point that the location of the primary market for aluminum becomes important. That market has always been in the eastern

portions of both the United States and Canada; the availability of hydroelectric power was the only reason that aluminum plants were built in the West. Economics of the industry dictate that the aluminum plants be as close as possible to the primary market while still taking into consideration the availability of large blocks of electricity. Since the new electric power plants are not dependent on the flowing waters of the Northwest, logically new production capacity will locate in the East.

Therefore, the aluminum plants of the northwestern United States and southwestern Canada can be more cheaply served with alumina from the new plants in Australia. Also, the alumina plants of the Caribbean, processing both local bauxite as well as ore from new deposits in Africa will be well able to serve the aluminum plants in the East and in Europe.

PROJECTED BAUXITE-ALUMINA TRAFFIC THROUGH THE CANAL

Future Ship Size

Because of the changing transit patterns and the expected decrease in tonnage flow through the Panama Canal, the present ship size (almost 50 percent of the tonnage is carried by bulk carriers in the 20,000 to 40,000 DWT range) is expected to remain relatively constant in the future. It is anticipated that bulk carriers will handle more than 90 percent of the trade during the next 15 years.

Projected Traffic

Although a significant modification in transit patterns is anticipated, it by no means indicates that the bauxite and alumina traffic through the Canal will decrease rapidly. Such significant changes realistically

take place over long periods, and even when they have been completed, some flows of the commodity continue to resist the new patterns. Table 40 projects bauxite and alumina shipments through the Panama Canal between 1975 and 1985. Total Panama Canal traffic is expected to decrease from an actual 1,700,000 long tons in 1971 to 1,600,000 long tons in 1975 and to 720,000 long tons in 1985. On the Atlantic-to-Pacific routes shipments from the East Coast to the West Coast of the United States are estimated to continue at approximately their present flow of 250,000 long tons. This trade serves the aluminum industry internally. The route from the East Coast of South America to the West Coast of the United States is expected to decline from an actual 128,000 long tons in 1971 to 100,000 in 1975 and to 50,000 long tons in 1985. Both this route and that from the West Indies to the West Coast of the United States and the West Coast of Canada illustrate this commodity's changing transit patterns. On the shipping lane from the West Indies to the West Coast of the United States, it is anticipated that current shipments of 644,000 long tons will decline to an annual figure of 370,000 long tons for 1975 and decrease to 200,000 long tons by 1985. On the route from the West Indies to the West Coast of Canada, 125,000 long tons moved in 1971; this tonnage is projected to increase slightly to 150,000 long tons in 1975 and then decrease to 100,000 long tons in 1985.

Bauxite-alumina's Pacific-to-Atlantic flow has historically been extremely small. As discussed previously, the increased 1971 traffic is expected to remain at about the 500,000 to 700,000 ton level until 1975 and then decrease to its lower level of 20,000 long tons by 1980.

Table 40

PROJECTED BAUXITE-ALUMINA TRAFFIC
THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
To West Coast United States from:				
United States	220	250	250	250
South America	128	100	50	50
West Indies	644	370	250	200
West Indies to Canada	125	150	100	100
Other	119	150	100	100
Subtotal	1,236	1,020	750	700
Pacific to Atlantic	443	600	20	20
Total Traffic	1,679	1,620	770	720

Source: Economics Research Associates.

Section XV

COAL AND COKE

ANALYSIS OF 1969 FORECAST

ERA's projection for coal traversing the Panama Canal in 1971 was overstated by 16 percent, with actual tonnage at 22.2 million long tons and projected tonnage at 25.7 million long tons. Figure 16 presents a summary of actual traffic and the ERA projection and Table 41 presents a summary comparison of these figures. The overstatement of total traffic was due mainly to a decrease in the traffic on the major trade route in the Atlantic to Pacific direction, U.S. to Japan. Actual 1971 U.S. to Japan coal traffic traversing the canal was 20.9 million long tons and ERA projected 25.0 million long tons. The recent devaluation of the dollar which worked against the U.S.-Japanese terms of trade and Japan's declining 1971 steel production which fell from 94.5 million long tons in 1970 to 89.1 long tons in 1971 are the major factors causing this increase.

Traffic traveling the Pacific-to-Atlantic direction was understated with actual tonnage at 376,000 long tons. ERA had projected coal traffic at 150,000 long tons. This increase was on the West Coast Canada-to-Europe trade route. Kaiser has recently begun mining coal in Ferney and Sparwood in the Canadian Rockies. This is principally coking coal which has been shipped to Europe at a rate of 200,000 to 300,000 long tons annually since 1970.

CANAL COAL AND COKE TRAFFIC

Coal and coke, moving primarily from the Atlantic to the Pacific, make up one of the largest commodity tonnages traversing the Panama

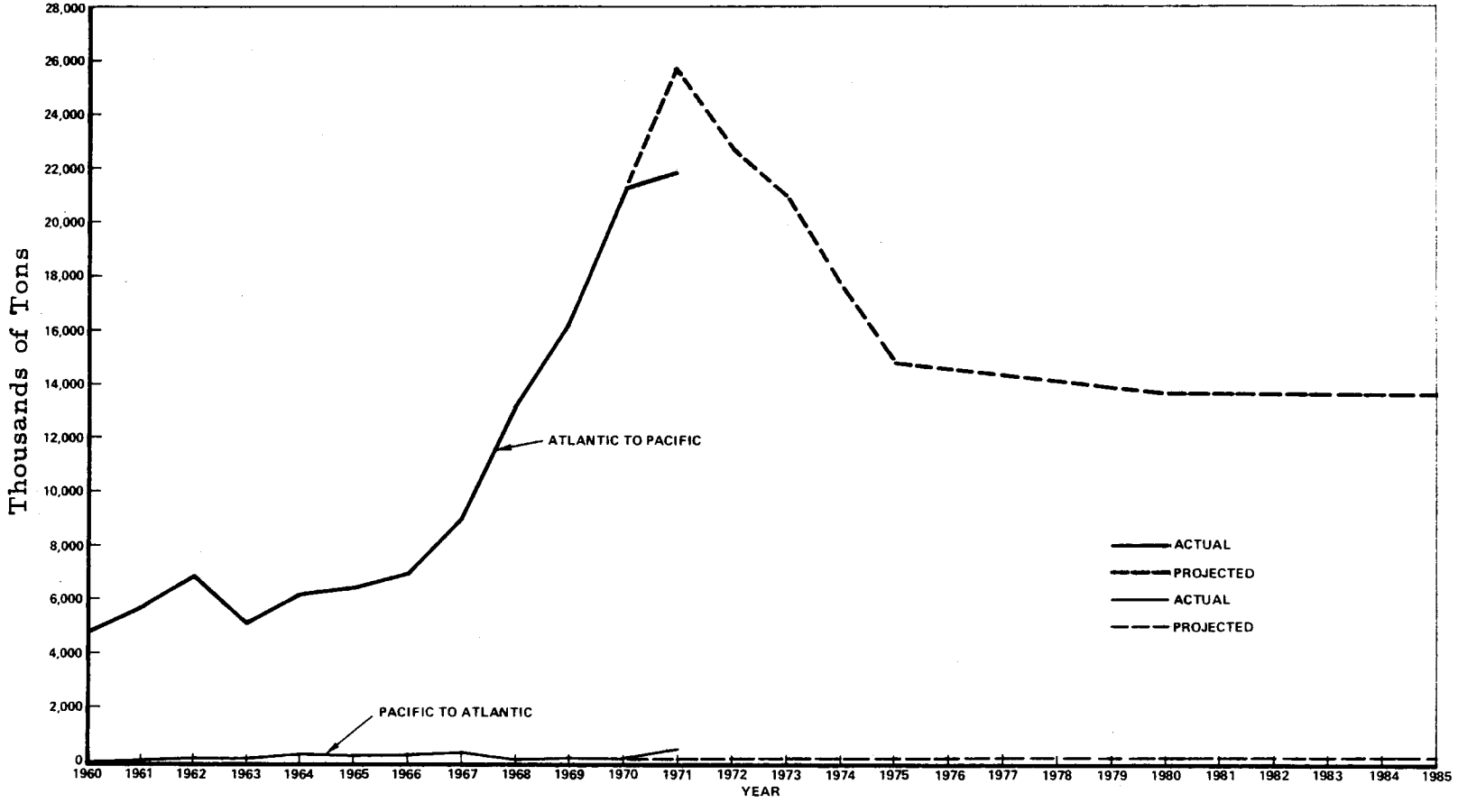


Figure 16

VOLUME OF COAL AND COKE TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 41

SUMMARY OF COAL AND COKE
TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to Japan	15,146	20,407	20,962	25,000
Other	1,115	899	869	600
Subtotal	16,261	21,306	21,831	25,600
Pacific to Atlantic	30	26	376	150
Total Traffic	16,291	21,332	22,207	25,750

Source: Panama Canal Company and Economics Research Associates.

Canal. They accounted for more than 22 million long tons in 1971 or approximately 18 percent of the total Canal traffic. Coal moving from the East Coast of the United States to Japan has historically accounted for approximately 95 percent of the total Panama Canal traffic in this important commodity.

JAPAN'S COAL CONSUMPTION AND TRADE

In view of the overpowering role played by one trade route in the volume of coal and coke transiting the Canal, it is imperative that factors affecting the trade route from the United States to Japan be thoroughly analyzed. Therefore, Japan's steel industry and its continued growth in the next 15 years are of paramount importance. Based on discussions with leading Japanese trading concerns and steel companies, Table 42 projects the future of the Japanese steel industry through 1985. Crude steel production is expected to rise from more than 89.1 million long tons in 1971 to more than 167.2 million long tons in 1985. This represents an annual growth rate of 6.2 percent until 1977, then dropping to 4 percent annually thereafter. The output of pig iron, which comprises approximately 70 to 80 percent of crude steel production, will grow from more than 71.3 million long tons in 1971 to nearly 134 million long tons by 1985. Coal needs are approximately 80 percent of pig iron production, so that the resulting coal requirement for the entire Japanese steel industry will rise from slightly more than 57 million long tons in 1971 to nearly 72 million long tons by 1975, and almost 107 million long tons by 1985.

Table 42

PROJECTION FOR JAPANESE STEEL INDUSTRY
1971-1985
(Millions of Long Tons)

Year	Crude Steel Production	Pig Iron Production	Coal Required
1971 (actual)	89.1	71.3	57.0
1972	95.0	76.0	61.0
1973	101.0	81.0	65.0
1974	107.0	86.0	69.0
1975	113.0	90.0	72.0
1977	127.0	101.6	81.3
1985	167.2	133.7	107.0

Source: Various Japanese trading and steel companies and Economics Research Associates.

The Japanese have made significant breakthroughs in blending high quality United States coal shipped from Hampton Roads, Virginia with lower quality, but significantly cheaper, types of coal from Australia and Canada. Present technology requires a minimum of 20 percent United States coal. However, because of the present and expected future inability of Australia to fill contracts, and the political factors involving Japan's balance of payments and foreign exchange with the United States, Japan is expected to import more than 25 percent of her coal needs during the next 15 years from the United States. This projected 25 percent represents a large drop from current 41 percent U. S. proportion of imported coal in Japan. The coal industries in Australia and on Canada's West Coast are in their infancy and will probably find delivery of projected volumes difficult until they develop more fully. The current inability of Australia to deliver all of the coal that Japan is willing to purchase is an example. Canada is expected to ship 10 million to 13 million long tons of coal to Japan by 1973, a difficult task considering that the mines are just now being developed.

PROJECTED COAL TRAFFIC THROUGH THE PANAMA CANAL

Future Ship Size

Coal is currently carried in bulk and ore carriers which approach the physical limitations of the Canal. It is expected that considerable coal will bypass the Canal during the next 15 years because of the introduction of the ore-bulk-oil (O. B. O.) ships that will be in the range of 100,000 to 150,000 DWT.

The Japanese have recently constructed deepwater channels right next to their steel mills, facilitating the unloading of O. B. O. ships and encouraging their future use to lower the cost of raw materials delivered at the factory.

During the past year, some coal from Hampton Roads has bypassed the Canal because of the O. B. O., about 5 percent of the total tonnage shipped to Japan in 1969. The O. B. O. s have loaded with coal to the 39-foot draft limits of Hampton Roads, and then completed their load in South America with iron ore for their trip around Africa. They then sail from Japan to the Persian Gulf, where oil is loaded for either Europe or the United States. In July 1970, the draft at Hampton Roads was deepened to 45 feet. This port's ultimate draft limitations of 55 feet and its limited storing capability dictate that through 1985 the O. B. O. s will probably not exceed 150,000 DWT.

In 1971, 90 percent of the coal traveling from Hampton Roads to Japan transited the Canal. However, it is projected that only 50 percent will transit the Canal by 1975, and only 40 percent by 1985.

Atlantic to Pacific

Table 43 indicates the Japanese coal requirements that are estimated to be fulfilled by the United States. It is projected that between 1972 and 1975, the percentage of Japanese coal requirements supplied by the United States will decrease from 41 percent to 28 percent; and further decrease to 25 percent in 1980. The total volume of United States coal shipped to Japan is estimated to decline from 23.7 million tons in

Table 43

JAPANESE COAL REQUIREMENTS FROM UNITED STATES
AND SHARE TRAVERSING THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

Year	Coal Required by Japan	Percentage from United States	United States Total	Percentage from United States Through Canal	United States Tonnage to Japan Through Canal
1971	57,000	41%	23,333 actual	90%	20,962
1975	72,000	28	20,160	50	10,080
1980	90,100	25	22,525	45	10,136
1985	107,000	25	26,750	40	10,700

Source: Economics Research Associates.

1972 to 20.2 million tons by 1975, and then rise again to 26.7 million tons by 1985.

Coal and coke transiting the Panama Canal from the United States to Japan is estimated to decrease from 20.9 million long tons in 1971 to 10.1 million long tons in 1975, and 10.7 million long tons in 1985.

ERA predicts that Japan will continue looking more to other sources to fulfill her coal needs from 1972 to 1985. Coal traveling from Europe to Asia increased 4 percent from 1969 to 1970, and 7 percent from 1970 to 1971. ERA predicts that this trend will continue so that other Atlantic to Pacific traffic will grow slightly from 869,000 long tons in 1971 to 975,000 in 1975 to 1.1 million in 1985.

Pacific to Atlantic

Shipments from the West Coast of Canada to Europe are estimated to increase slightly from the 376,000 long tons in 1971 to 400,000 long tons in 1975, increasing further to 450,000 long tons in 1985. These shipments are primarily from the Kaiser Coal deposits.

Summary

As shown in Table 41, Canal coal trade is expected to decline substantially because of the large ships bypassing the Canal. This decrease from 22.2 million long tons in 1971 to 12.3 million long tons in 1985 is summarized below:

	Thousands of Long Tons			
	Actual 1971	1975	1980	1985
Total Coal Traffic	22,207	11,455	11,585	12,250

Table 44

PROJECTED COAL TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
United States to Japan	20,962	10,080	10,160	10,700
Other	869	975	1,000	1,100
Subtotal	21,831	11,055	11,160	11,800
Pacific to Atlantic	376	400	425	450
Total Traffic	22,207	11,455	11,585	12,250

Source: Economics Research Associates.

Section XVI

PETROLEUM AND PETROLEUM PRODUCTS

ANALYSIS OF 1969 FORECAST

ERA projections of 1971 petroleum and petroleum products traffic through the Panama Canal were slightly higher than actual traffic. Figure 17 presents a summary of actual traffic and the ERA projections. As shown, the Atlantic to Pacific traffic was overestimated by about 2.3 million tons (14.2 percent). This was due primarily to the sharp reduction in Japanese imports of diesel fuel which declined from about 1.9 million tons in 1968 to about 0.2 million tons in 1971. Excluding this factor, the Atlantic to Pacific projections were within 2.9 percent of actual 1971 figures.

The Pacific to Atlantic projections generally follow the projected trend line, although the 1971 projections are high by about 750,000 tons. This difference is due primarily to a slower than expected increase in exports of west Coast South America crude oil through the canal. These exports through the Canal increased from 312,000 tons in 1969 to 1.3 million tons in 1970. They dropped off to 1.04 million tons in 1971, however, as compared to ERA's 1969 projection for 1971 of 1.5 million tons. Summaries of Canal traffic statistics since 1969 and ERA's 1971 projections are provided in Tables 45 and 46 for crude petroleum and petroleum products respectively.

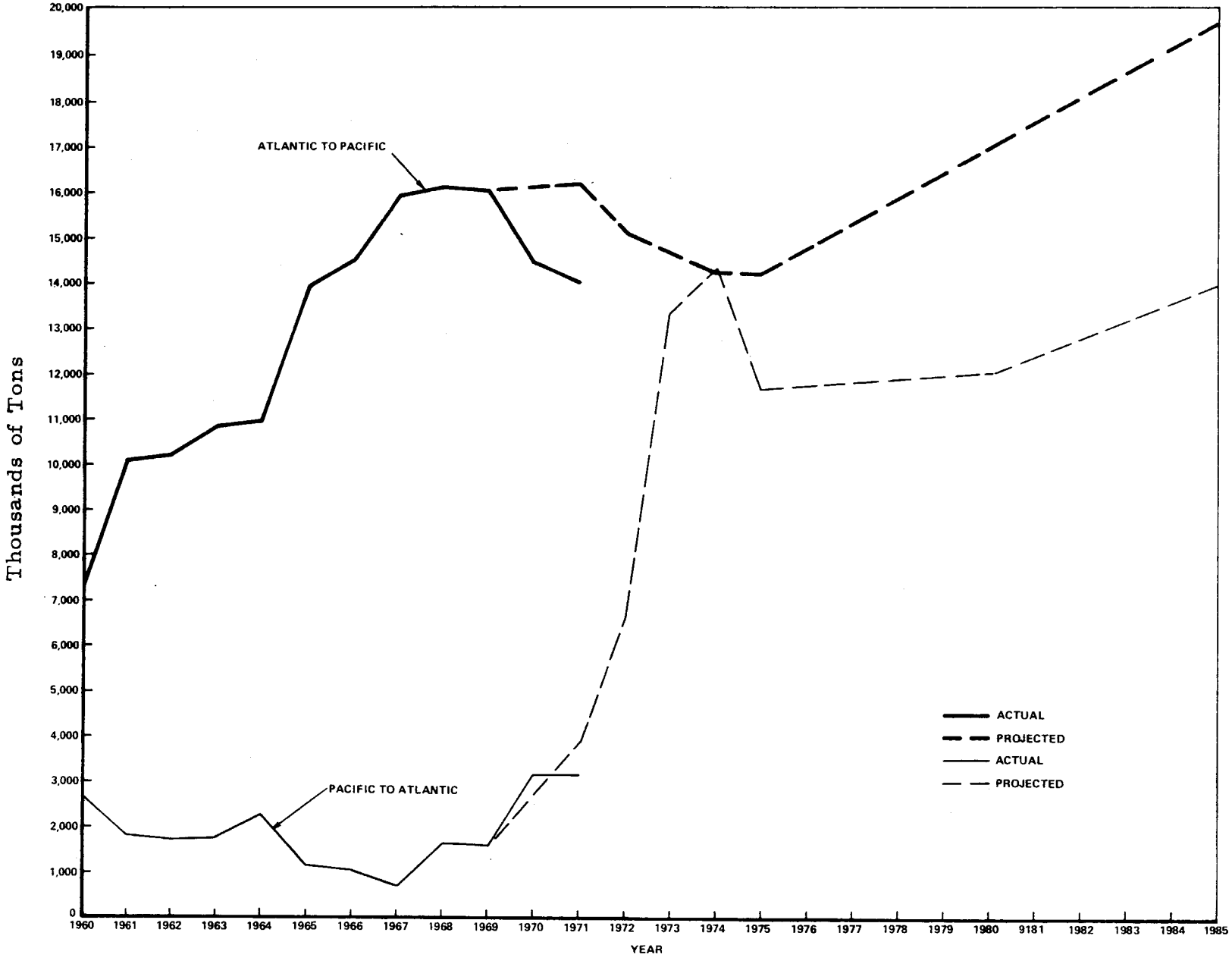


Figure 17

VOLUME OF PETROLEUM AND PETROLEUM PRODUCTS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 45

SUMMARY OF CRUDE PETROLEUM SHIPMENTS THROUGH THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
From South America to:				
United States	890	1,032	1,532	800
Central America	1,114	695	1,296	1,300
South America	3,295	1,594	1,274	2,800
Other	697	812	536	400
Subtotal	5,996	4,133	4,638	5,300
Pacific to Atlantic				
South America to United States	312	1,295	1,040	1,500
Other	260	343	269	400
Subtotal	572	1,638	1,309	1,900
Total Traffic	6,568	5,771	5,947	7,200

Source: Panama Canal Company and Economics Research Associates.

Table 46

SUMMARY OF PETROLEUM PRODUCTS SHIPMENTS
THROUGH THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to West Coast United States	1,015	522	453	1,100
East Coast United States to Asia	681	794	572	--
East Coast Central America to West Coast Central America	457	577	523	500
Central America to Balboa	419	428	493	300
East Coast South America to:				
United States	566	1,013	1,046	1,100
West Coast South America	560	647	695	800
Balboa	705	607	595	700
Hawaii	291	246	214	400
Asia	348	371	88	900
West Indies to:				
United States	1,655	1,278	1,594	1,800
South America	539	596	532	700
Hawaii	453	463	298	500
Asia	958	552	173	1,000
Central America	367	797	708	--
Other	1,393	1,467	1,380	1,100
Subtotal	10,007	10,360	9,364	10,900
Pacific to Atlantic				
United States to Europe	717	1,177	1,385	1,500
Other	331	312	445	500
Subtotal	1,048	1,489	1,830	2,000
Total Traffic	11,055	11,849	11,194	12,900

Source: Panama Canal Company and Economics Research Associates.

RECENT HISTORIC AND MARKET PATTERNS

Since 1968, there have been significant shifts in Canal traffic patterns. Historically, crude oil has traveled the Atlantic to Pacific trade routes, with southbound traffic in crude representing from 93 to 97 percent of the total. Since 1969, however, crude oil discoveries in the Pacific have tended to balance the flow such that in 1971 the southbound trade had declined to 78 percent of total crude oil traffic. Additionally, crude oil has become a larger portion of the total Canal petroleum traffic by increasing from around 30 percent of petroleum trade in the early 1960s to 32 percent in the middle 1960s, to a current penetration of about 35 percent in the past three years.

In petroleum products shipments, there has been an overall decline in shipments since 1968. Kerosene and jet fuel which had been the fastest growing product segment experienced a traffic decline of 600,000 tons in 1971 to total shipments of 1.85 million tons. This was due to a buildup in refinery capacity on the West Coast United States (the principal market) and a general market decline for the product due to reduced airline traffic in a sluggish U.S. economy. Gasoline shipments have also declined over the past five years from over 2.7 million tons in 1968 to 1.85 million tons in 1971. This decline was also primarily due to a decline in shipments to the West Coast United States.

Diesel fuel shipments continue to represent the largest petroleum product category. Shipments of the product, however, have been steadily declining since 1964 and are now just under 4 million tons. Traffic in diesel fuel is currently distributed over a wide variety of trade routes, the largest

destination being the Canal Zone which accounts for about 1.3 million tons. Other major trade destinations are the west coasts of South America, Central America, and the U.S. in that order. The trade route distribution has changed significantly since 1968. At that time, shipments to Japan accounted for about 2 million tons or 40 percent of all traffic. Currently, shipments to Japan are at the 200,000 tons level for a total decline of nearly 1.8 million tons. Shipments in the final major product category, lubricating oil, have remained relatively constant over the past ten years at about 1.1 million tons.

RECENT DISCOVERIES OF CRUDE OIL AND TRENDS IN PETROLEUM DISTRIBUTION

As described in ERA's 1969 report, important crude oil discoveries in the West Coast South America and on Alaska's North Slope were projected to increase the flow of crude oil from the Pacific to Atlantic basins over the next fifteen years. Recent developments regarding exploitation of these deposits are discussed below.

West Coast South America

The first-phase of the Ecuador pipeline to the Pacific port of Esmeraldas is expected to be completed in late 1972. This pipeline will have an initial capacity of 250,000 barrels/day and an eventual capacity of 400,000 barrels/day. The port facilities at Esmeraldas are being expanded to handle tankers up to the 100,000 DWT range for distribution of this crude. Market factors effecting this distribution are described on the following page.

1. Demand on the West Coast of South America is insufficient to absorb such a volume of production. Demand in this region is presently estimated at 170,000 b/d and is expected to increase at about a 6 percent compound rate to approximately 290,000 b/d in 1980.
2. The West Coast of the United States will not absorb the excess production from the West Coast of South America. North Slope crude, whose initial flow is expected to follow within four years of large shipments from the new South American wells, will more than adequately serve this market.
3. Japan is not particularly interested in these deposits since Indonesian crude is much more accessible. Secondly, early reports indicate that the crude coming from South America's West Coast is relatively high in sulfur and would require extensive desulfurization to meet Japan's strict air pollution regulations. One of the area's producers, however, feels that this crude can compete with oil from the Middle East in Japan and that a substantial traffic to this market will result.
4. On the East Coast of the United States, it is unlikely that crudes from South America's West Coast can compete economically with those from Venezuela and Nigeria. Some traffice to this market is expected, however, because of hemispheric import quotas (or preferential tariffs) and/or company microeconomics (i.e., controlled shipments by producers on the West Coast of

South America to their own refineries on the East Coast of the United States or in the West Indies).

5. Because of the preferential political considerations affecting trading among the members of the South American common market, the West Coast of South America is expected to begin shipping crude to that continent's highly populated southern areas (Brazil and Argentina). Such shipments are expected to travel on supertanker around Cape Horn.

In addition to the Ecuador discoveries, recent activity in Peru indicates that substantial crude deposits may be available in that country. Such deposits probably would not be developed until at least 1976.

North Slope of Alaska

In 1970, development of the large oil deposits on Alaska's North Slope were delayed due to an injunction against the construction of the trans-Alaska pipeline. This injunction called for compliance with a 1969 law which required an environmental impact study on projects of this type. The nine-volume impact study was published by the Interior Department in March 1972. Current feelings are that all legal obstacles to construction will be removed by the end of 1972, however, this process has caused a delay of nearly three years in pipeline construction. Consequently, North Slope oil will probable reach the West Coast in 1975 or 1976 as compared to earlier projections of 1973 or 1974. Production projections indicate that 2 million barrels per day will be flowing through the pipeline by 1980.

Initially, the West Coast of the United States will probably be the primary market for North Slope crude. Any supply beyond this demand will go to the Midwest and the East Coast of the United States; depending on the status of the United States import controls, some will possibly reach Japan and northern Europe. Since shipments to the East Coast of the United States are the most relevant for the Canal, the alternate methods of transporting North Slope oil to the East Coast are discussed below:

1. Northwest Passage

   If the recent experiment using the ice-breaking "S.S. Manhattan" proves successful, it is expected that tanker shipments via the Northwest Passage will amount to one million barrels per day by 1980. This would require approximately 30 ice-breaking tankers of 200,000 DWT. At present, data from the first "voyage of the Manhattan" are still being analyzed to determine the economic feasibility and operating characteristics of this passage.

2. Trans-Canada and Trans-United States Pipelines

   Pipeline alternatives for transporting North Slope crude include one trans-Canada pipeline from Prudhoe Bay to Chicago and two trans-United States pipelines from Seattle to Chicago and from Los Angeles to Houston. At this time, there have been no final decisions among these alternatives, although one or more of the pipelines may eventually be constructed. The volumes of oil which would be transported in this way will

range between .5 million and one million barrels per day for each pipeline.

3. Shipments via the Straits of Magellan

Direct shipments around the southern tip of South America to ports on the East Coast of the United States do not appear to be economically feasible because of the Jones Act, which requires that shipments between United States coastal points must be made in United States Flagships. Shipping costs for United States Flagships are approximately twice those for vessels flying foreign flags.

4. Trans-Panama Pipeline

In a joint venture, the government of Panama and an Anglo-German-Italian combine have announced a "heads of agreement" letter calling for the construction of an $80 million pipeline across the Isthmus of Panama. The pipeline, to be built for and operated by the Panamanian Government, is expected to have a capacity of 500,000 to 750,000 barrels per day and to be completed in 1975 or 1976. The announced capacity and the timing coincide with the expected development of crude reserves on the North Slope. Although the consultant for the project has indicated there is sufficient industry demand, ERA has yet to discover any large North Slope producer who is firmly committed to using the pipeline on other than a temporary basis when alternate facilities are not available. Similarly, the producers on the West Coast of South America have made no commitment to using this pipeline, and do not consider it as the

major means of moving their crude. Until the tariff rates are announced for the proposed pipeline, ERA cannot reach a definite conclusion regarding its ultimate use.

5. Backhual Shipments Through the Panama Canal

Another method of transporting North Slope crude likely to develop, is carrying it as a backhaul cargo on United States tankers whose primary load is shipments of petroleum products going to the Far East. Upon delivering their principal cargoes, these ships would pick up North Slope crude at the Valdez terminal and transport it to the East Coast of the United States.

All of the above alternatives are estimated to offer cheaper long-run transportation of North Slope crude than direct shipment through the Panama Canal. Additionally, the delay in construction of the Valdez pipeline, has revised industry thinking as to the timing and amount of crude that will go to the East Coast. Sources now feel that the West Coast will absorb all the early production through 1978 (2 million barrels per day) and, as such, the pressure for delivery systems to the East Coast has been reduced. Table 47 presents projections of the delivery costs per barrel for these various methods along with the expected delivery cost via the Canal. Based on these forecasts, it is unreasonable to assume that the Panama Canal will serve as a major channel of distribution for North Slope crude. It is expected, however, that the Canal will handle the backhaul movements discussed and also serve as an interim shipping route until the facilities required for one or more of the alternate methods are developed.

Table 47

RELATIVE TRANSPORTATION COSTS PER BARREL FOR NORTH SLOPE CRUDE TO EAST COAST OF THE UNITED STATES

Method	Estimated Cost per Barrel
Northwest Passage	$1.10
Trans-Canada Pipeline	1.31
Trans-United States Pipeline (Seattle to Chicago)	1.15
Straits of Magellan	1.25
Panama Pipeline	1.55[1]/ 1.25[2]/
Via Panama Canal	1.85

1/ Using 110,000 DWT tankers.
2/ Using 250,000 DWT tankers.

Source: Economics Research Associates.

Venezuela and West Indies

Venezuela's exports of crude oil to the Pacific area will decline as the new sources of crude in the Pacific are developed. Such shipments will not cease altogether, however; individual oil companies who control their own wells, may ship crude to their own refineries along trade patterns that seem uneconomical from an industrywide viewpoint. For this reason, shipments from Venezuela to Chile are expected to continue, although at reduced tonnages. The increased costs, through government taxes, of Venezuelan oil are also expected to reduce potential traffic.

Movements of oil products through the Canal from Venezuela and the West Indies are also expected to decline. The buildup of refinery capacity on the West Coast of the United States will probably shrink the volume of petroleum products sent there. Additionally, exports to Japan, consisting primarily of marine diesel fuel, have dropped off markedly in the last two years.

United States

In addition to the impact of the crude oil discoveries on the North Slope, several other factors in the United States market deserve attention:

1. Decline in Intercoastal Petroleum Traffic

   Intercoastal United States traffic in petroleum has declined over the past several years because of the better balancing of demand with production by the American oil companies and the

greater development of pipeline transportation within the country. This downward trend has been quite consistent, see Figure 18, but appears to be leveling off at aboat 600,000 tons.

2. Changes in United States Import Controls and Quotas

Several changes in United States oil import policy will probably be implemented in the 1970s. The exact nature of these changes has yet to be fully defined; however, a liberalization allowing greater imports is likely. Such a liberalization will probably include incentives intended to encourage imports from "secure" areas. These would consist of the noncommunist Western Hemisphere and the altered import policy would aid the relative positions of Venezuela, Canada, and producers along the West Coast of South America. Legislation and quota changes in this area bear close watching for their possible impact on the Canal.

PROJECTED TRAFFIC IN PETROLEUM AND PETROLEUM PRODUCTS THROUGH THE PANAMA CANAL

Future Ship Sizes

The size distributions of tankers transiting the Canal are not expected to change markedly over the forecast period. The current trend in tankers, i.e., toward using supertankers of 250,000 DWT or more, will not affect the Canal except insofar as the larger ships make certain bypasses around Cape Horn more economical. The trade routes from the Alaskan North Slope to the Virgin Islands and from the West Coast of South American to its East Coast are cases in point. It should be noted

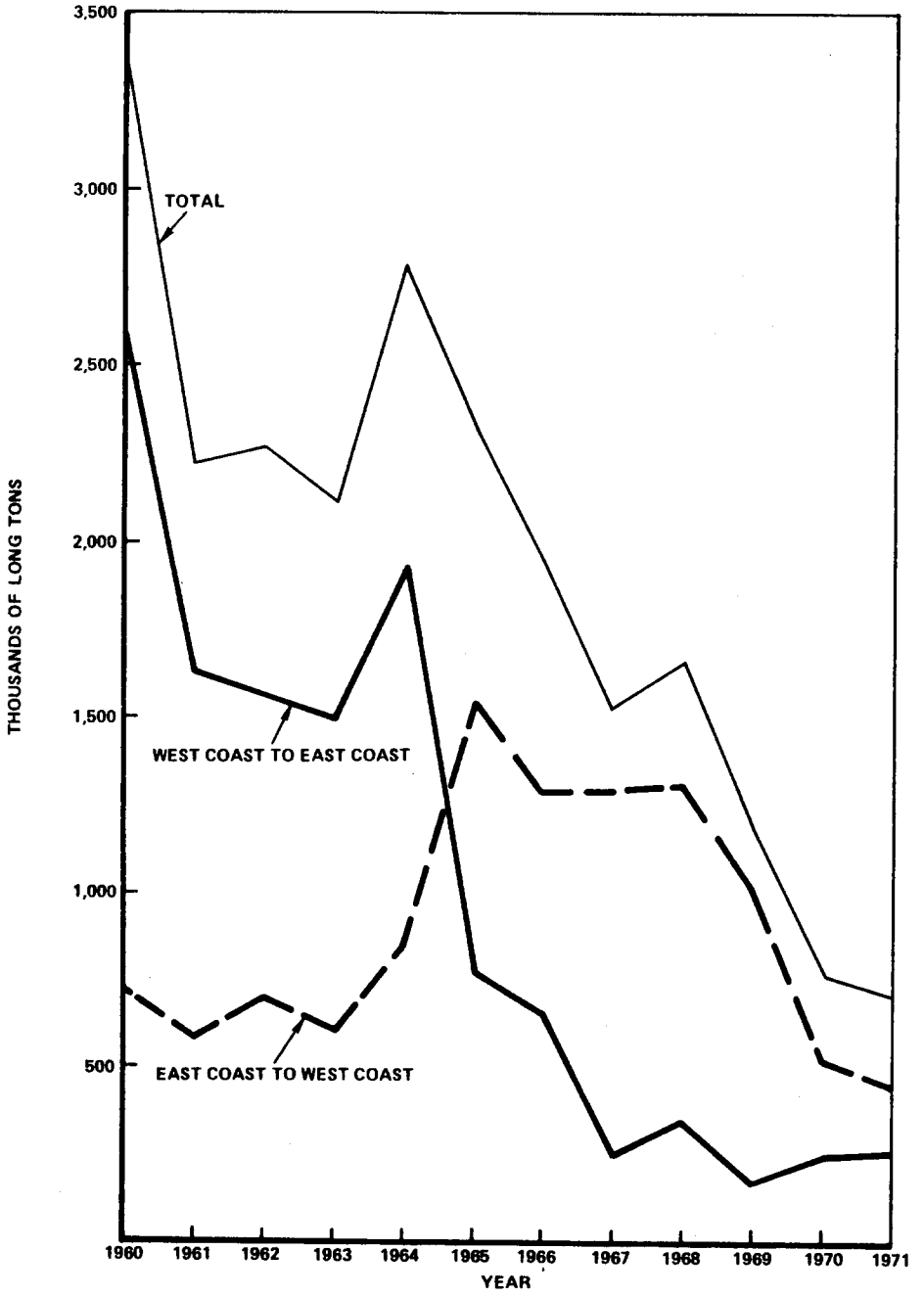


Figure 18

VOLUME OF U. S. INTERCOASTAL PETROLEUM TRAFFIC
TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

that the availability of supertankers makes trade along these routes economically feasible and does not represent a rerouting of traffic that would otherwise have traversed the Canal. The major increase in traffic, due to crude oil shipments from South America, will be in ships of the 45, 000 DWT to 50, 000 DWT class.

Atlantic to Pacific

As the new Pacific crude sources are developed, shipments of unprocessed petroleum through the Canal from Venezuela to the United States and Latin America are expected to experience a modest decrease over the next 15 years. Total southbound traffic in crude is projected to decline from 4.7 million long tons in 1971 to 2.7 million by 1975 and to 2.1 million long tons in 1985.

Traffic in petroleum products is projected to increase from 9.4 million to 9.8 million long tons from 1971 to 1975. After 1975, traffic in petroleum products is projected to increase to 12.9 million long tons by 1985. Shipments to the West Coast of the United States from its East Coast as well as from the West Indies and Venezuela are expected to grow from 2.9 million long tons in 1975 to 3.9 million longs tons by 1985 as a result of the growth in worldwide petroleum trade.

Pacific to Atlantic

Substantial growth is forecast for northbound petroleum trade as a result of the oil discoveries on the Alaskan North Slope and in South America. It is believed that a significant percentage of the projected crude petroleum from the West Coast of South America will go to markets in

areas other than the Pacific, specifically the Gulf and East coasts of the United States, the East Coast of South America and possibly Europe. This expectation is strengthened by the fact that each of the major developers of this crude has most of its refinery capacity on the East and Gulf coasts of the United States or in the West Indies. ERA estimates that 12 million long tons will transit northbound through the Canal by 1985. This Canal traffic is projected to increase from 1.1 million in 1971 to 10 million long tons by 1975.

North Slope crude could benefit the Panama Canal in late 1975 when oil is being pumped and spot or backhaul shipments to the East Coast United States may commence. For large volumes of crude, however, an alternate to transporting through the Canal will be developed. ERA projects that 1.0 million long tons will transit the Canal in 1975 with possibly higher volumes in 1976 and 1977. In 1980, this volume will probably level at 3.0 million long tons and remain constant through 1985 due to sporadic shipments and United States tankers returning from the Far East via Valdez with a backhaul cargo. The only major northbound trade in petroleum products is from the West Coast of the United States to Europe, where the trade is due primarily to a long range petroleum coke contract and is transported on auto-bulkers as a backhaul cargo. ERA forecasts a gradual increase from 1.4 million long tons in 1971 to 2.0 million by 1980. Other shipments of petroleum products are expected to increase from about 445,000 long tons to 1.5 million long tons in 1985. Miscellaneous crude shipments primarily from South America are expected to grow from 269,000 long tons in 1971 to 2.5 million long tons by 1985.

Summary

Tables 48 and 49 present the projected Canal traffic by major trade routes for crude petroleum and petroleum products, respectively. A growth in Canal traffic from 17.2 million long tons in 1971 to 35.0 million long tons for both commodities by 1985 is projected, as summarized below:

	Long Tons (millions)			
	1971 (actual)	1975	1980	1985
Total Traffic	17.2	27.9	30.4	35.0

The projected Atlantic-to-Pacific trade is summarized in the following text table:

	Long Tons (millions)			
	1971 (actual)	1975	1980	1985
Crude Petroleum	4.6	2.7	2.1	2.1
Petroleum Products	9.4	9.8	11.3	12.9
Subtotal	14.0	12.5	13.4	15.0

A summary of the estimated Pacific-to-Atlantic trade is as follows:

	Long Tons (millions)			
	1971 (actual)	1975	1980	1985
Crude Petroleum	1.3	12.7	15.0	16.5
Petroleum Products	1.9	2.7	3.0	3.5
Subtotal	3.2	15.4	18.0	20.0

Table 48

PROJECTED TRAFFIC IN CRUDE PETROLEUM THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1972	1973	1974	1975	1980	1985
Atlantic to Pacific							
From South America to:							
United States	1,532	1,100	1,000	1,000	900	600	600
Central America	1,296	1,200	1,100	1,000	700	500	500
South America	1,274	1,500	1,000	800	600	500	500
Other	536	500	500	500	500	500	500
Subtotal	4,638	4,300	3,600	3,300	2,700	2,100	2,100
Pacific to Atlantic							
Alaska to United States					1,000	3,000	3,000
South America to United States and Europe	1,040	1,100	5,350	10,000	10,000	10,000	11,000
Other	269	875	1,150	1,425	1,700	2,000	2,500
Subtotal	1,309	1,975	6,500	11,425	12,700	15,000	16,500
Total Traffic	5,947	6,275	9,750	14,725	15,400	17,100	18,600

Source: Economics Research Associates.

Table 49

PROJECTED TRAFFIC IN PETROLEUM PRODUCTS
THROUGH THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
East Coast United States to West Coast United States	453	700	800	1,000
East Coast United States to Asia	572	600	600	700
East Coast Central America to West Coast Central America	523	500	600	700
Central America to Balboa	493	500	600	700
South America to United States	1,046	700	800	1,000
East Coast South America to West Coast South America	695	700	800	1,000
South America to Balboa	595	800	1,000	1,000
South America to Hawaii	214	200	300	400
South America to Asia	88	100	100	100
West Indies to United States	1,594	1,500	1,700	1,900
West Indies to Central America	708	700	700	700
West Indies to South America	532	800	1,000	1,100
West Indies to Hawaii	298	300	400	400
West Indies to Asia	173	300	300	300
Other	1,380	1,500	1,700	1,900
Subtotal	9,364	9,800	11,300	12,900
Pacific to Atlantic				
United States to Europe	1,385	2,000	2,000	2,000
Other	445	700	1,000	1,500
Subtotal	1,830	2,700	3,000	3,500
Total Traffic	11,194	12,500	14,300	16,400

Source: Economics Research Associates.

Section XVII

CHEMICALS

ANALYSIS OF 1969 FORECAST

ERA projections of the total tonnages of chemicals expected to transit the Canal were about 9 percent low for 1971. Figure 19 presents a summary of the actual traffic and the ERA projections. As shown, the Atlantic to Pacific traffic was overestimated by 100,000 tons (6 percent). This was due primarily to lower than expected exports from the U.S. to Asia.

The Pacific to Atlantic traffic was underestimated by 315,000 tons. This was due primarily to the sharp rise in Asian exports of petrochemicals to Europe and the East Coast of the United States. This traffic increased 235 percent from 124,000 tons in 1969 to 416,000 tons in 1971. A summary of chemicals traffic by trade route for the last three years is presented in Table 50 along with ERA's projection for 1971.

CHEMICAL PRODUCTION, CONSUMPTION, AND TRADE

Since 1950 one of the fastest growing industries of the developed countries has been the production of chemicals. It has shown a far greater rate of increase than either the developed countries' heavy manufacturing or their gross national product. This rapid expansion is the result of progress in scientific and technological research, which has created a rising number of new products and new users. In the developed countries, the chemical industry's growth rate has been 1.5 to 2.0 times that of the GNP. Between 1958 and 1966, chemical manufacturing in the United States

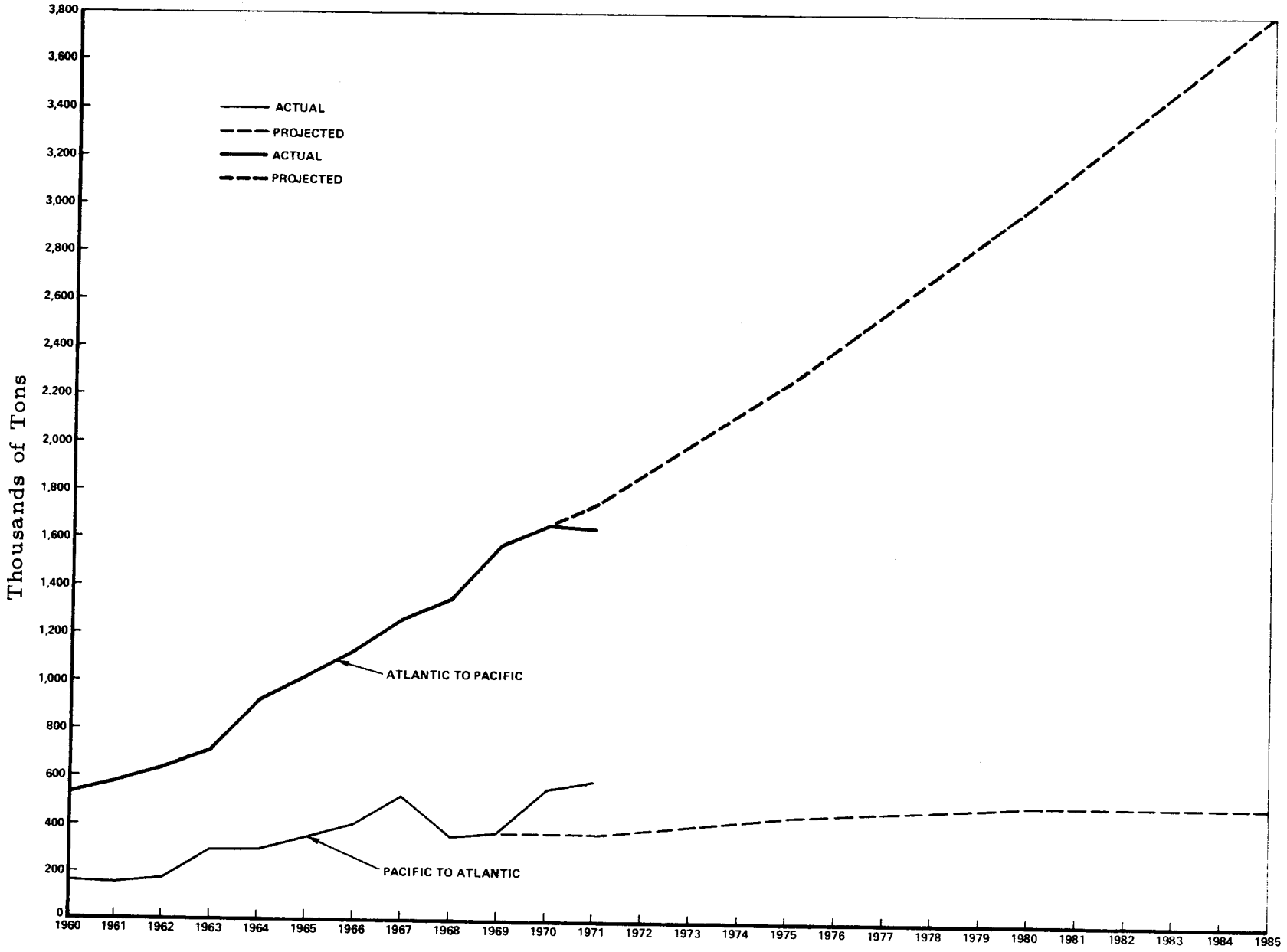


Figure 19

VOLUME OF CHEMICALS TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands Long Tons)

Table 50

SUMMARY OF CHEMICALS SHIPMENTS THROUGH
THE PANAMA CANAL SINCE 1969
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
East Coast United States to:				
United States	458	452	473	500
Asia	491	520	435	580
Oceania	170	191	260	200
Other	452	499	474	465
Subtotal	1,571	1,662	1,642	1,745
Pacific to Atlantic				
West Coast United States to East Coast United States	153	163	126	175
Asia to East Coast United States	81	160	230	1/
Asia to Europe	43	101	186	1/
Other	112	119	148	200
Subtotal	385	543	690	375
Total Traffic	1,956	2,205	2,332	2,120

1/ Included in other.

Source: Panama Canal Company and Economics Research Associates.

grew 8.0 percent annually, in western Europe more than 10 percent a year, and in Japan 17 percent a year.

The diversification of chemical production achieved in all the industrialized countries has increased the range of products offered on the international market. This has led to a substantial increase in chemical trade within the industrialized countries as well as to the developing areas.

The United States, Europe, and Japan are the world's three major exporting regions. The United States exports almost three times as much as it imports. Oceania imports three times as much as it exports while Latin America imports five times as much as it exports. But, for all areas, the tendency is to increase imports at a rate comparable with the increase in exports. It is expected that growth during the next five to 10 years in the chemical trade will continue to rise at a rapid, although slightly declining rate.

U.S. chemical imports are expected to increase over the next several years, particularly in certain petrochemicals. In particular, ethylene demand in 1974 is estimated at 12.2 million tons, which exceeds domestic production capabilities.

There has been considerable speculation recently about the rising demand for liquified natural gas (LNG) as a clean energy source. Recently, import plans for LNG have been announced or approved. Distrigas announced an import program of 190,000 tons in 1973 rising to 1.5 million

tons by 1976. Amoco has plans to import about 1.4 million tons from Trinidad in 1976 rising to 2.8 million tons by 1978. El Paso Natural Gas has announced plans for eventually importing 10.5 million tons per year from Algeria, and Jersey Standard is to buy 150 million barrels of LNG over the next 5 years from the same source.

Worldwide deposits of natural gas are widespread in both the Pacific and Atlantic basins such that major traffic through the Panama Canal is unlikely. In this sense, natural gas traffic may be expected to follow a supply-demand balance relationship as is currently experienced in petroleum flow.

The current production of LNG is estimated at 85 million tons and demand has been projected to increase to 455 million tons by 1980. U.S. imports are projected to rise to around 13.3 million tons in 1980.

Atlantic to Pacific

Southbound trade is expected to continue as the major source of Canal traffic in chemicals although to a lesser degree. United States intercoastal trade grew at about 10 percent per year for the 1960s, but has remained relatively constant in recent years. ERA expects growth to return to about the 6 percent level through 1975, declining to 3 percent by 1980. U.S. exports to Asia have declined as Japan has continued to build up its petrochemical production capability. In addition, Taiwan has announced petrochemical expansion plans. On this basis, exports to Asia are expected to show a relatively slow growth rate at 2 percent per year. In addition, the rate of growth in exports to Oceania is expected to decline. In summary, U.S. exports are projected as follows.

Destination	Long Tons (thousands) 1971	1975	1980	1985
United States West Coast	473	525	625	750
Asia	435	475	525	600
Oceania	260	325	400	450

Other southbound exports accounted for 474,000 tons in 1971. These are expected to increase at a basic 5 percent rate. In addition, total Canal traffic in LNG is expected to approach 1.4 million tons by 1980, the trade routes of which are uncertain. Assuming current patterns of energy imports continue, approximately 2/3 should travel in the southbound direction.

Pacific to Atlantic

The most significant change in northbound chemical traffic over the past few years has been the rise of Asian exports to the U.S. and Europe. This trend is expected to continue as Japan maintains a high growth rate in petrochemical exports and U.S. demand is surpassing domestic production of certain chemicals. Northbound traffic from Asia therefore should increase dramatically over the next few years and then level off at a 10-15 percent growth rate. These projections are shown below:

Destination	Long Tons (thousands) 1971	1975	1980	1985
East Coast United States	230	420	630	950
Europe	186	330	500	750

Traffic from the West Coast of the United States to the East Coast is expected to increase only slightly from 126,000 tons in 1971 to 200,000 tons by 1985. Other trade routes will probably account for another 300,000 to 350,000 tons as smaller nations develop petrochemical production capabilities and export programs. In terms of potential LNG traffic, approximately 500,000 tons is projected to travel northbound annually by 1980.

SUMMARY

Traffic in chemicals is expected to increase substantially over the next 15 years (see Table 51). Excluding LNG, total chemical traffic is expected to nearly double from 2.3 million tons in 1971 to 4.9 million tons in 1985. Including LNG, traffic is projected to increase to nearly 12.4 million tons by 1985.

Table 51

PROJECTED CHEMICALS TRAFFIC THROUGH
THE PANAMA CANAL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
East Coast United States to:				
United States	473	525	625	750
Asia	435	475	525	600
Oceania	260	325	400	450
Other	474	550	645	840
Other (LNG)	n.a.	150	900	5,000
Subtotal	1,642	2,025	3,095	7,640
Pacific to Atlantic				
West Coast United States to East Coast	126	150	175	200
Asia to:				
East Coast United States	230	420	630	950
Europe	186	330	500	750
Other	148	200	275	350
Other (LNG)	n.a.	100	500	2,500
Subtotal	690	1,200	2,080	4,750
Total Traffic	2,332	3,225	5,175	12,390

n.a. means not available.

Source: Panama Canal Company and Economics Research Associates.

Section XVIII

MANUFACTURES OF IRON AND STEEL

ANALYSIS OF 1969 FORECAST

ERA's projection for 1971 Canal traffic in manufactures of iron and steel were within 5 percent of actual traffic traversing the Canal. Figure 20 presents a comparison of projected and actual traffic. For the Atlantic to Pacific trade route, projected tonnage was understated by 8 percent, with actual tonnage at 1.9 million and projected tonnage at 1.7 million. In the Pacific to Atlantic direction, ERA's forecast was low by 4 percent with actual long tons at 6.4 million and projected tonnage at 6.1 million. These figures are summarized on Table 52 which presents actual as well as projected Canal traffic from 1969 to 1971.

CANAL MANUFACTURES OF IRON AND STEEL TRAFFIC

At a current level of more than 8.2 million long tons, manufactures of iron and steel play a significant role in the Panama Canal's transit volume. Especially important is the dramatic rise from 1965 to the present in this commodity's flow from the Pacific to the Atlantic. This increase has its source primarily in Japanese exports in iron and steel products to the East Coast of the United States, the East Coast of South America, and to Europe.

The quantity of manufactures of iron and steel moving from the Atlantic to the Pacific has remained relatively constant between 1960 and 1971, at an average of slightly more than 1.7 million long tons per year. In a like manner, the various trade routes which make up the total Atlantic-to-Pacific tonnage have not significantly changed in the past 11 years.

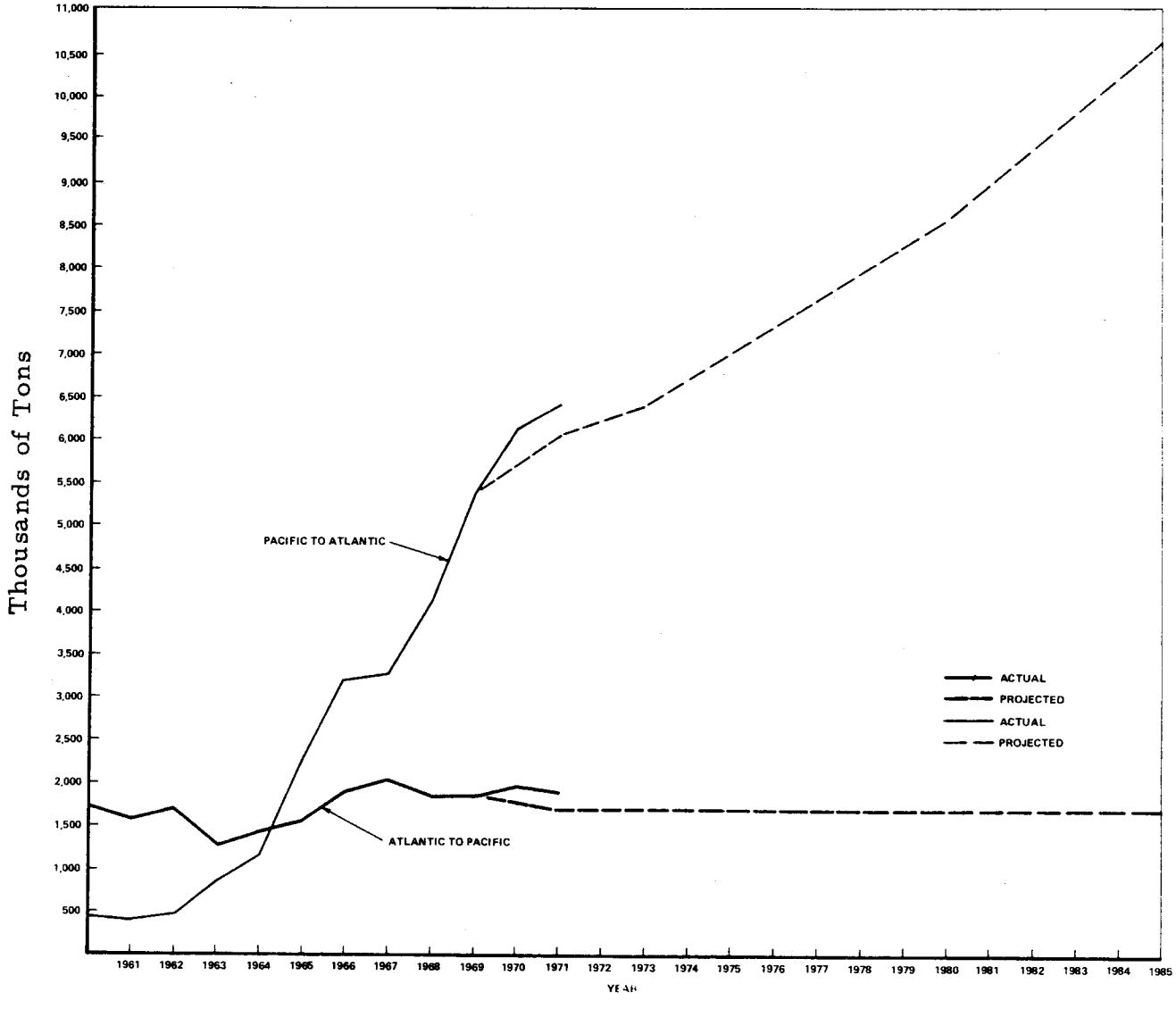


Figure 20

VOLUME OF MANUFACTURES OF IRON AND STEEL TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 52

SUMMARY OF MANUFACTURES
OF IRON AND STEEL TRAFFIC
TRAVERSING THE CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projected 1971
Pacific to Atlantic				
Asia to East Coast United States	4,391	3,511	4,134	4,850
Asia to East Coast South America	336	499	455	450
Asia to Europe	449	1,355	1,303	600
Other	247	779	499	250
Subtotal	5,423	6,144	6,391	6,150
Atlantic to Pacific				
East Coast United States to West Coast United States	629	687	605	650
East Coast United States to Asia	210	275	253	160
Europe to West Coast United States	283	220	305	205
Europe to West Coast South America	208	190	149	200
Other	521	598	548	500
Subtotal	1,851	1,970	1,860	1,715
Total Traffic	7,274	8,114	8,251	7,865

Source: Panama Canal Company and Economics Research Associates.

MANUFACTURES OF IRON AND STEEL CONSUMPTION AND TRADE

When projecting the future flow of manufactures of iron and steel transiting the Panama Canal between 1975 and 1985, there are several key factors. The most significant of these are the duration and characteristics of the "voluntary quota" imposed on Japanese and European exports of steel to the United States. These first went into effect in 1969 and recently have been revised for tighter Japanese and European export control. Under the old agreements, foreign steel makers were allowed to increase their exports here at the rate of 5 percent annually. The new 1972-1974 restrictions on shipments will limit annual increases to 2.5 percent or roughly the rate at which the American market grows.

As a potential market for manufactures of iron and steel, the East Coast of South America is not a large consumer of iron and steel because of its economy's level of development. Also, extreme nationalism of these countries is moving their economy toward near self-sufficiency in manufactures of iron and steel.

Analysis of the iron and steel market in Europe leads to similar conclusions. Economic conditions dictate that the European countries become self-sufficient as soon as possible and they are exerting great effort to achieve this. However, price fluctuations will influence the amount of iron and steel Europe imports from Japan.

PROJECTED CANAL TRAFFIC IN MANUFACTURES OF IRON AND STEEL

Future Ship Size

About 75 percent of the Canal volume in iron and steel products is handled by general-cargo ships, primarily in the 10,000 to 20,000 DWT range. Small bulkers of 20,000 to 30,000 DWT carry the other shipments. No appreciable change in either the size or type of ships transporting this commodity is expected.

Future Traffic

Due to the accuracy shown in the ERA 1969 forecast, few changes are necessary for an update. Only two modifications are required. First is a consideration of the large growth of manufactures of iron and steel traveling from Japan to Europe in the Pacific to Atlantic direction. ERA had predicted 600,000 long tons of traffic on this route, while actual traffic amounted to 1,300,000 long tons. This increased traffic is a result of increased European demand for steel accompanied by less than equal increases in production capacity. ERA projects traffic along this route will increase to 2,000,000 long tons by 1975 and remain at this level through 1985. Second is a consideration of the new voluntary quotas imposed by the U.S. on Japan and seven European nations. Because of these stricter controls, ERA projects that traffic from Asia to the U.S. will increase more slowly than before, growing to 4.7 million long tons in 1975 and 6.5 million long tons in 1985.

Summary

As shown in Table 53, traffic from Asia to the United States and Europe is expected to dominate trade in manufactures of iron and steel during the next 15 years. Pacific to Atlantic trade is projected to total almost 82 percent of the trade in this commodity as shown below:

	Long Tons (thousands)		
	1975	1980	1985
Atlantic to Pacific	1,900	1,900	1,900
Pacific to Atlantic	7,700	8,500	9,500
Total	9,600	10,400	11,400

Table 53

PROJECTED CANAL TRAFFIC
IN MANUFACTURES OF IRON AND STEEL
1971-1985
(Thousands of Long Tons)

	Actual 1971	1975	1980	1985
Pacific to Atlantic				
Asia to East Coast United States	4,134	4,700	5,500	6,500
Asia to East Coast South America	455	500	500	500
Asia to Europe	1,303	2,000	2,000	2,000
Miscellaneous Pacific to Atlantic	499	500	500	500
Subtotal	6,391	7,700	8,500	9,500
Atlantic to Pacific				
East Coast United States to West Coast United States	605	650	650	650
East Coast United States to Asia	253	250	250	250
Europe to West Coast United States	305	300	300	300
Europe to West Coast South America	149	200	200	200
Miscellaneous Atlantic to Pacific	548	500	500	500
Subtotal	1,860	1,900	1,900	1,900
Total Traffic	8,251	9,600	10,400	11,400

Source: Economics Research Associates.

Section XIX

ROAD VEHICLES AND ACCESSORIES

ANALYSIS OF 1969 ROAD VEHICLE AND ACCESSORIES FORECAST

ERA's 1969 forecast for road vehicles and accessories was low with actual tonnage at 1.2 million and projected tonnage at .9 million Figure 21 presents a summary comparison of the projections to actual traffic. Tonnage in the southbound Atlantic to Pacific direction was understated by 18 percent, with actual tons at 658,000 long tons and projected tonnage at 560,000 long tons. Table 54 breaks out the actual and projected traffic by trade route from 1969-1971. Traffic traveling the U.S. and Europe to Oceania routes was understated in the 1969 projections; actual traffic on these two routes was 142,000 long tons while ERA projected 100,000 long tons. "Other" traffic, which is mostly to Canada, was also understated with actual at 127,000 long tons and projected at 50,000 long tons. Road vehicles and accessories shipped from the Pacific to Atlantic were understated in the ERA's 1969 forecast. Projected tonnage was 310,000 long tons while actual tonnage was 567,000 long tons. The phenomenal growth of Japanese auto exports to the U.S. and Europe since 1969 is the main cause of this increase. There are now 10 Japanese manufacturers of passenger cars, 12 Japanese manufacturers of trucks, and eight of buses. The four largest exporters are Toyota, Nissan, Honda, and Toyo Kogyo. Included among the other manufacturers of cars, trucks and buses are Dayhatsu-Kogyo, Fuji Heavy industries, Hino-Motor, Isuzu Motor, Mitsubishi, Aichi Machines, and Suzuki.

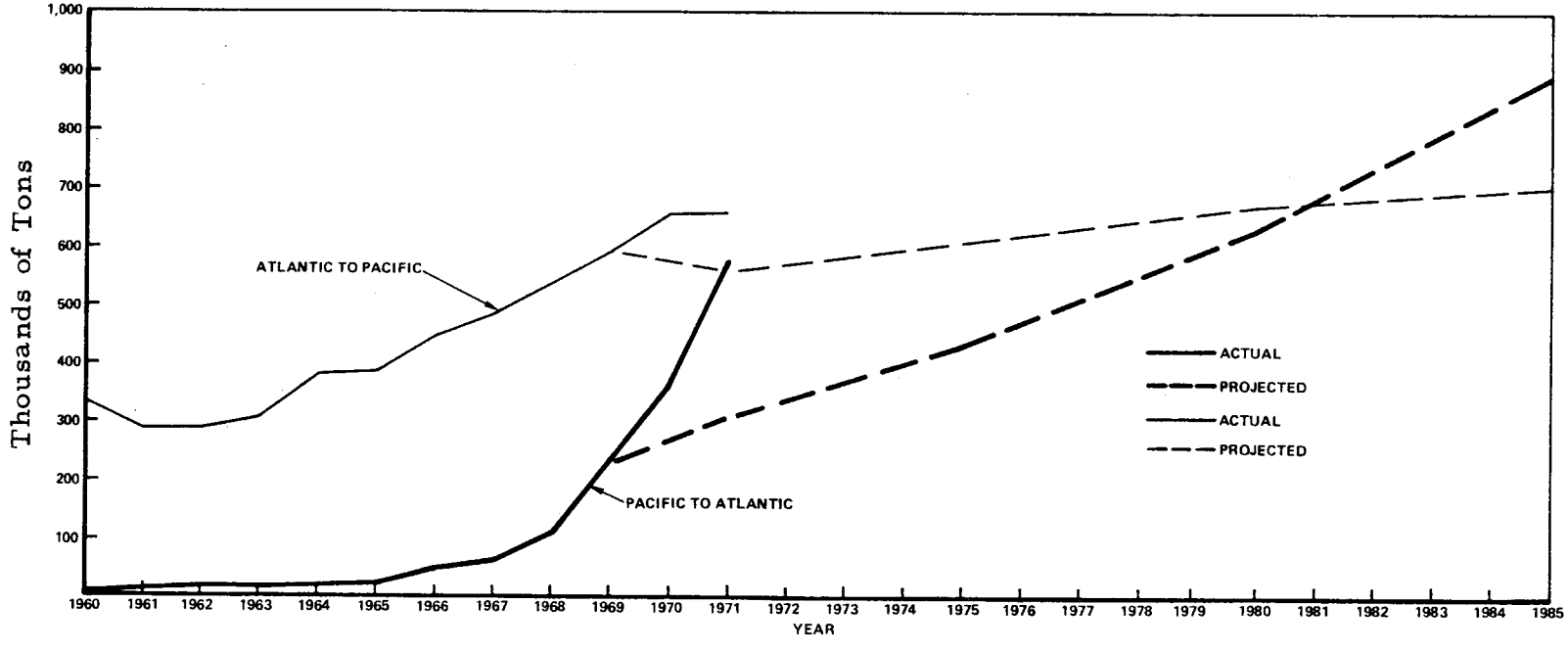


Figure 21

VOLUME OF ROAD VEHICLES AND ACCESSORIES TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 54

SUMMARY OF ROAD VEHICLES AND
ACCESSORIES TRAVERSING THE PANAMA CANAL
1969-1971
(Thousands of Long Tons)

	1969	1970	1971	Projection 1971
Atlantic to Pacific				
From East Coast of the United States to:				
South America	61	70	52	100
Oceania	35	45	32	
Asia	72	85	77	80
From Europe to:				
United States	240	230	260	230
Oceania	71	93	110	100
Other	116	137	127	50
Subtotal	595	660	658	560
Pacific to Atlantic				
From Asia to:				
United States	121	189	320	180
Europe	53	95	152	65
Other	54	79	95	65
Subtotal	228	363	567	310
Total Traffic	823	1,023	1,225	870

Source: Panama Canal Company and Economics Research Associates.

CANAL ROAD VEHICLES AND ACCESSORIES TRAFFIC

As can be seen in Table 54, the amount of tonnage in this commodity category, 1.2 million long tons in 1971, represents about 1 percent of total Canal traffic. However, automobiles and accessories have been isolated for special study because of the importance of road vehicles as producers of Canal revenue. In terms of total tolls generated, this commodity category ranks very high because of the low load factor[1/] of ships carrying road vehicles.

The United States has experienced slow but steady growth in its auto shipments to South America, Oceania, and Asia. However, the largest southbound traffic has been generated by trade from Europe to the West Coast of the United States, primarily shipments of Volkswagens from West Germany. The Pacific-to-Atlantic trade had been insignificant until the past few years, when the Japanese began to compete in the United States and European auto markets. In the past five years, shipments from Japan to these two markets have increased nearly eightfold from 42,000 long tons in 1967 to 472,000 long tons in 1971.

AUTOMOBILE PRODUCTION, TRADE, AND CONSUMPTION

United States auto imports in the past 15 years have varied considerably. In 1956, auto imports totaled only 100,000 units but by 1959

1/ Ratio of laden tonnage to DWT.

they had increased to 620,000, or 10 percent of total United States sales. However, with the introduction of the United States-produced compacts, imports declined to 340,000 cars by 1962. By 1968, foreign-made cars had again increased their market share to more than 11 percent, with 960,000 sales. In 1970, more than 2 million foreign cars were imported into the U.S. for a nearly 25 percent market share.

The United States auto manufacturers are again emphasizing the domestic compact, but its marketing is not expected to have the same effect on import sales as in the early 1960s. The imported cars are better equipped to meet the challenge of the United States compacts; they are well made and generally have a network of trained, well-supervised dealers. It is expected that imports will maintain their share of the auto market. Among auto exporters to the United States, the Japanese have experienced a substantial increase in automobile sales over the past decade as witnessed by the phenomenal annual growth of Japanese road vehicle imports from 1969 to 1971. Nissan Motors and Toyota Motors have projected annual growth rates of 8 to 10 percent in the United States for the next 10 to 15 years. However, 1972 Japanese auto imports to the U.S. are down from '71 due to the import surcharge and the docks strikes on the East, West, and Gulf coasts of the U.S. Since the surcharge has been lifted sales have increased slightly and are projected to return to normal levels by 1973. Volkswagen is expected to continue its growth, but at a reduced rate.

Lack of suitable roads and the low per capita income has limited growth in Latin America's demand for automobiles. Until 1957, automobile manufacturing there was almost nonexistent--cars were either imported

or assembled from parts produced elsewhere. However, since 1957 many Latin American countries have forced the development of local manufacturing by requiring a stated percentage of parts to be produced domestically. For example, Brazil and Argentina require that 95 percent of the parts be made locally. To a lesser degree, Mexico, Venezuela, Colombia, Chile, and Peru are doing the same thing. The increased demand for automobiles in Latin America is, therefore, being offset by domestic production and not imports.

Oceania imports few automobiles; production capability there is sufficient to handle domestic consumption. In addition, the Japanese automobiles are becoming increasingly popular in Australia.

Demand from Asia has increased significantly during the past 10 years. Although the Japanese are dominating this market, excess demand is expected to foster continued growth in United States auto exports. The Japanese are successfully competing in the European automobile market and substantial growth is expected in this trade route during the next decade.

PROJECTED ROAD VEHICLES AND ACCESSORIES TRAFFIC PASSING THROUGH THE PANAMA CANAL

Future Ship Size

Approximately 45 percent of the automobiles transiting the Canal are now transported on general cargo ships. Specialized automobile bulk carriers, with over 300 transits in 1971, are becoming increasingly popular, particularly for shipments of Volkswagens and Japanese autos. Since 1969, Japan has employed dual-cargo ships that carry autos to the Eastern United States and return to Japan with coal, corn, and the other bulk cargoes. The proportion of automobile transits on bulk carriers from these two

sources is expected to be 60 to 70 percent by 1985. The size of the automobile carriers will certainly not transcend Canal limitations during the next 15 years, as the largest ship will probably be less than 45,000 DWT.

Atlantic to Pacific

ERA's 1969 forecast for road vehicle and accessory traffic in the Atlantic to Pacific direction require minor modification. The principal trade route will continue to be from Europe to the West Coast of the United States. ERA projects that traffic on this route will grow moderately from 275,000 long tons in 1975 to 325,000 long tons in 1985. The U.S. to Asia route is forecast to grow from 100,000 long tons in 1975 to 120,000 long tons in 1985. Traffic to Oceania from the U.S. and Europe is expected to increase slightly from 150,000 long tons in 1975 to 170,000 long tons in 1985. With the trend toward domestic automobile manufacture in Latin America import traffic is expected to remain at about 50,000 long tons through 1985. Other traffic is estimated at about 130,000 long tons in 1975, increasing to 140,000 long tons in 1985.

Pacific to Atlantic

Pacific to Atlantic traffic is dominated by exports from Japan. The annual growth of auto imports from 1969 to 1971 to the U.S. from Japan has been 65 percent; the annual growth from Japan to Europe has been 70 percent in the past few years. ERA forecasts that Japanese auto imports to the U.S. will almost double from their 1971 level by 1975, reaching 560,000 long tons and then slow in their growth rate until they reach 700,000 long tons in 1980, increasing slightly to 750,000 long tons in 1985. ERA feels that the pollution legislation planned for 1975 makes the U.S. market uncertain and that it is difficult to project how the Japanese will be able to respond to the

proposed anti-pollution regulations. Recently, the Toyo Kogyo Co., manufacturer of the Mazda, reported that three of its test vehicles with improved rotary engine designs have been showing emissions well below the 1975 ceiling. The durability of a thermal reactor and other control devices used on these cars has not been confirmed. Traffic of Japanese autos traveling to Europe is forecast to increase to 400, 000 long tons in 1975, to 500, 000 long tons in 1980, and increase slightly to 550, 000 long tons in 1985. Other tonnage from Japan to Latin America and West Coast Canada is projected to increase from 116,000 long tons in 1975 to 168,000 long tons in 1985.

SUMMARY

Thus, because of the emergence of Japan as a major auto exporter, auto traffic through the Canal is expected to grow significantly. This increase is illustrated in Table 55, and summarized below:

	Long Tons (thousands)			
	Actual 1971	1975	1980	1985
Atlantic to Pacific	658	705	770	805
Pacific to Atlantic	567	1,116	1,340	1,468
Total	1,225	1,821	2,110	2,273

Table 55

PROJECTED ROAD VEHICLE TRAFFIC
THROUGH THE CANAL
(Thousands of Long Tons)

	1971	1975	1980	1985
Atlantic to Pacific				
Europe to United States	260	275	300	325
United States to Asia	77	100	110	120
United States and Europe to Oceania	142	150	170	170
United States and Europe to Latin America	52	50	50	50
Other	127	130	140	140
Subtotal	658	705	770	805
Pacific to Atlantic				
Asia to United States	320	560	700	750
Asia to Europe	152	400	500	550
Other	95	116	140	168
Subtotal	567	1,116	1,340	1,468
Total Traffic	1,225	1,821	2,110	2,273

Source: Economics Research Associates.

Section XX

GENERAL CARGO

ANALYSIS OF 1969 FORECAST

ERA's forecast for general cargo passing through the Canal in 1971 was fairly accurate, with actual tonnage at 16.6 million long tons and the ERA forecast at 15.2 million long tons. The Altantic to Pacific projection was nearly exact with actual and projected tonnage at 6.3 million. Pacific to Atlantic traffic was slightly understated with projected tonnage at 9.0 million and actual at 10.3 million long tons. Table 56 presents a summary comparison of these actual and projected figures.

CANAL GENERAL-CARGO TRAFFIC

General cargo refers to those commodities not specifically analyzed in detail in the preceding chapters. This category includes: (1) canned and refrigerated foods exclusive of bananas, (2) machinery and equipment exclusive of automobiles and accessories, (3) minerals, and (4) various agricultural and miscellaneous commodities. None of these goods, which are currently shipped almost exclusively on general-cargo ships, is carried in sufficient tonnage to warrant detailed analysis.

Total traffic in general cargo has risen about 6.3 million long tons since 1960, increasing from 10.4 million to 16.7 million. Growth has taken place in both the northbound and southbound directions with the largest increase and volume occurring on the Pacific-to-Atlantic trade routes. From 1960 to 1971, Atlantic-to-Pacific traffic increased about 3.9 percent

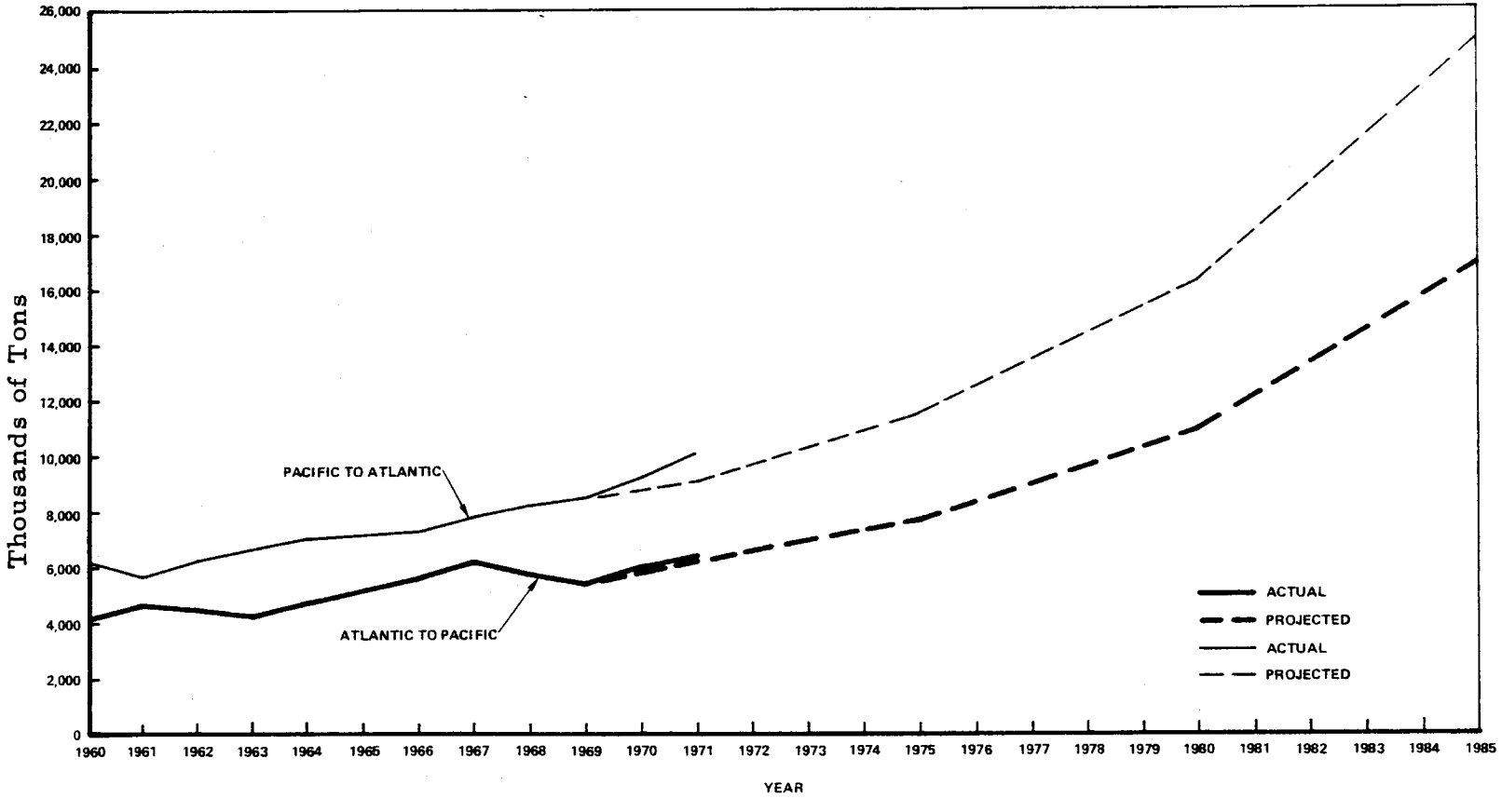


Figure 22

GENERAL CARGO TRAFFIC TRAVERSING THE PANAMA CANAL
1960-1985
(Thousands of Long Tons)

Table 56

SUMMARY OF GENERAL CARGO SHIPMENTS
THROUGH THE PANAMA CANAL
1969-1971
(Millions of Long Tons)

	1969	1970	1971	Projected 1971
Atlantic to Pacific				
From the United States to:				
Asia	1.9	1.7	1.8	2.4
Oceania	0.4	0.4	0.4	0.4
Latin America	0.5	0.4	0.5	0.5
From Europe to:				
United States	0.4	0.4	0.5	0.4
Oceania	0.4	0.5	0.6	0.5
Other	1.8	2.5	2.5	2.0
Subtotal	5.4	5.9	6.3	6.2
Pacific to Atlantic				
From Asia to:				
United States	1.8	1.9	2.2	2.1
Europe	0.5	0.7	0.9	0.5
From Oceania to:				
United States	0.6	0.6	0.5	0.6
Europe	1.3	1.2	1.1	1.3
United States to Europe	1.0	1.3	1.1	1.0
South America to Europe	0.6	0.5	0.5	0.6
Other	2.6	3.2	4.0	2.9
Subtotal	8.4	9.4	10.3	9.0
Total Traffic	13.8	15.3	16.6	15.2

Source: Panama Canal Company and Economics Research Associates.

annually, while Pacific-to-Atlantic traffic had a yearly rise of 4.7 percent. All commodities experienced substantial growth in tonnage, except canned and refrigerated foods which remained relatively constant.

PROJECTED CANAL TRAFFIC IN GENERAL CARGO

The most logical method of projecting general-cargo traffic is to use the aggregate commodity approach and a regional analysis. ERA has selected five major southbound trade routes, from the Atlantic to the Pacific, and six northbound trade routes, from the Pacific to the Atlantic, for specific growth forecasts. The other trade routes are analyzed collectively.

Atlantic to Pacific

Five major general-cargo routes carry the Atlantic-to-Pacific trade (refer to Table 57 for historical traffic). Shipments of approximately 1.8 million long tons from the East Coast of the United States to Asia accounted for about one-third the traffic in 1971. Trade has grown 50 percent since 1960, peaking in 1967 with 2.2 million long tons but declining slightly since 1969. While no one commodity has dominated the trade, increases have occurred in every category except canned and refrigerated food. Based on the historical trends and the expected future expansion of Asia's economy, and specifically Japan's, a future growth rate of over 6 percent per year through 1985 is forecast for the Canal traffic. Thus, a general-cargo total of 2.9 million long tons is projected for 1975, increasing to 5.2 million long tons by 1985.

Table 57

GENERAL-CARGO ATLANTIC-TO-PACIFIC TRAFFIC FOR SELECTED YEARS
BY MAJOR TRADE ROUTE
1960-1971
(Thousands of Long Tons)

	1960	1961	1967	1968	1969	1970	1971
From East Coast of United States to Asia							
Canned and refrigerated foods	70	78	69	58	62	52	54
Machinery and equipment	57	84	132	139	112	115	141
Minerals	24	33	124	82	29	12	29
Other agricultural commodities	518	564	525	622	474	432	484
Miscellaneous commodities	560	586	1,386	935	1,196	1,082	1,068
Total	1,229	1,344	2,236	1,836	1,873	1,693	1,776
From East Coast of United States to Latin America							
Canned and refrigerated foods	25	23	19	27	20	23	18
Machinery and equipment	65	76	136	109	107	106	93
Minerals	17	19	41	19	13	11	19
Agricultural and miscellaneous commodities	302	312	312	275	351	253	328
Total	409	430	508	430	491	393	458
From East Coast of United States to Oceania							
Machinery and equipment	32	45	84	79	56	67	65
Minerals	226	228	308	195	137	130	133
Agricultural and miscellaneous commodities	190	231	307	235	195	218	239
Total	448	504	699	509	388	415	437
From Europe to West Coast of United States							
Canned and refrigerated foods	13	17	27	31	38	41	51
Machinery and equipment	0	0	56	58	64	53	60
Minerals	4	6	4	8	6	4	2
Agricultural and miscellaneous commodities	331	256	265	262	315	334	359
Total	348	279	352	359	423	432	472
From Europe to Oceania							
Canned and refrigerated foods	3	9	10	12	15	19	21
Machinery and equipment	47	61	83	65	70	84	90
Minerals	40	43	42	53	48	56	51
Agricultural and miscellaneous commodities	279	434	299	303	300	361	441
Total	369	547	434	433	433	520	603

Source: Panama Canal Company.

General-cargo trade from the United States to Latin America has been rather inconsistent in the 1960s; tonnage reached a peak in 1966 with 559,000 long tons, an increase of 150,000 from 1960 but only about 70,000 long tons more than the 1969 total of 491,000. Based on the projected future development of Latin America, an annual growth rate of approximately 4 percent is projected for trade going there, yielding an estimated 600,000 long tons of general cargo for 1975 and 900,000 for 1985.

Shipments to Oceania have decreased since 1960, totaling only 437,000 long tons in 1971. The fall in sulfur trade since 1967 has caused this decline from the height of 700,000 long tons reached in 1967. Future trade in sulfur is expected to drop even further but growth in other commodities is projected to more than balance the loss. Therefore, general-cargo traffic of 500,000 long tons in 1975, increasing to 700,000 long tons by 1985 is projected.

Traffic from Europe to the West Coast of the United States and to Oceania is expected to experience moderate growth. Shipments to the United States remained at about 350,000 long tons per year until 1969 when tonnage began to increase significantly. Improved marketing techniques will probably swell the demand for European goods and raise their flow to the United States from 500,000 long tons in 1975 to about 700,000 long tons in 1985. New Zealand will continue to be almost the sole destination of general-cargo shipments to Oceania, which are estimated to increase at about 3 percent per year. The 700,000 long tons projected to transit the Canal in 1975 will probably expand to 900,000 by 1985.

The other general-cargo traffic, shipped along more than 50 trade routes, accounted for about one-third of the tonnage in the 1960s. Trade on these other routes is expected to grow more than that of any of the major shipping lanes. One or more of these routes will most likely emerge as a substantial contributor to future Canal traffic, either because of a country's accelerated economic growth or because of its development of new raw material sources. As to which trade routes, ERA is not prepared to forecast. In addition, this miscellaneous category has been used to reflect the potential of "new" commodities--those raw materials or finished goods not currently produced or shipped through the Canal. A certain amount of this unknown growth will probably be handled by bulk carriers, but for purposes of simplication, the uncertainty has been projected in the general-cargo category. To include an allowance for unknown factors, ERA has selected an initial growth rate of 6 percent, gradually increasing to 15 percent by 1985; the increasing traffic growth rate reflects the degree of uncertainty over time inherent in the disaggregate forecast approach. As a result, 3.5 million long tons are projected for 1975, 6.3 million for 1980, and 12.8 million by 1985. As described in Section XVII, Chemicals, traffic in liquefied natural gas (LNG) is expected to be a relatively important commodity which was not identified in ERA's original 1969 forecast. Since this "new" commodity may now be identified, the general cargo forecast should be adjusted to back out the projected tonnage in the "new" commodity. This leads to projections of 5.4 million tons and 7.8 million tons in 1980 and 1985, respectively. The proportion of general cargo "other" tonnage transitting in the Atlantic to Pacific direction was gradually increased from

38 percent in 1971 to 53 percent in 1985 to reflect a projected increase in ships in the Atlantic basin looking for a backhaul cargo.

Pacific to Atlantic

Six major trade routes exist for northbound traffic in general cargo, Table 58 presents the tonnage for selected past years on these routes. Shipments from Asia to the East Coast of the United States since 1960 have more than doubled to 2.3 million long tons, for an annual growth rate of about 8.2 percent. This trend is expected to endure for the next 14 years as Japan continues to expand its markets in the United States. ERA projects 2.9 million by 1975 and 6.3 million by 1985.

As long as the Suez Canal remains closed, general cargo moving from Japan to Europe will continue to transit the Panama Canal. Significant future growth is expected as Japan enlarges her markets in Europe. Trade, projected to be 1.2 million long tons in 1975, should rise to 1.6 million long tons by 1985.

Shipments from the West Coast of the United States to Europe from 1960 to 1971, have remained relatively constant at approximately 1.0 million long tons. The decline in volume of canned foods has been offset by the rise in minerals trade. Future growth is expected to be modest, increasing by about 100,000 long tons every five years from a 1975 level of 1.1 million long tons.

Canal trade from Australia and New Zealand to the United States has doubled to 548,000 long tons since 1960. This is primarily the result of the rising American demand for Australian and New Zealand meat products, whose continued growth is forecast. An annual increase of 5 percent is projected for the Oceania-to-United States trade route; the 800,000 long tons

Table 58

GENERAL-CARGO TRAFFIC FROM THE PACIFIC TO THE ATLANTIC
FOR SELECTED YEARS BY MAJOR TRADE ROUTE
1960-1971
(Thousands of Long Tons)

	1960	1961	1967	1968	1969	1970	1971
Asia to East Coast of United States							
Canned and refrigerated foods	97	103	158	178	174	172	198
Machinery and equipment	24	25	137	158	160	199	258
Minerals	--	--	--	12	--	1	1
Agricultural and miscellaneous commodities	821	730	1,317	1,455	1,512	1,577	1,797
Total	942	858	1,612	1,803	1,846	1,949	2,254
Asia to Europe							
Canned and refrigerated foods	17	11	16	86	69	87	116
Machinery and equipment	--	--	1	53	59	93	142
Agricultural and miscellaneous commodities	33	26	103	298	368	498	637
Total	50	37	120	437	496	678	895
Oceania to Europe							
Canned and refrigerated foods	616	606	650	746	739	640	691
Agricultural and miscellaneous commodities	403	341	329	561	513	558	520
Total	1,019	947	979	1,307	1,252	1,198	1,121
Oceania to East Coast of United States							
Canned and refrigerated foods	164	134	295	301	322	363	322
Agricultural and miscellaneous commodities	110	80	265	268	269	231	226
Total	274	214	560	569	591	594	548
West Coast of United States to Europe							
Canned and refrigerated foods	382	379	398	248	205	232	200
Machinery and equipment	6	10	10	10	19	23	20
Minerals	199	201	336	399	402	491	429
Agricultural and miscellaneous commodities	459	375	370	304	350	561	476
Total	1,046	965	1,114	961	976	1,307	1,125
West Coast of South America to Europe							
Canned and refrigerated foods	23	20	30	29	35	31	34
Agricultural and miscellaneous commodities	387	435	496	547	528	500	430
Total	410	455	524	576	563	531	464

Source: Panama Canal Company.

projected for 1975 will probably expand to 1.3 million long tons by 1985. Modest growth has characterized shipments from New Zealand to Europe during the past 10 years, with dairy and meat products bound for the United Kingdom dominating this trade route. Because of the uncertainty of New Zealand's future trade relations with the United Kingdom, a modest annual increase in tonnage of 3 percent has been projected for the Oceania-to-Europe trade route: 1.5 million long tons for 1975, increasing to 1.7 million long tons by 1980, and 1.9 million by 1985.

Shipments from the West Coast of South America to Europe have shown small growth from 410,000 long tons in 1960 to 464,000 in 1971. Growth in Canal trade of 5 percent per year is expected as the South American countries continue to increase their exports to Europe. ERA projects 600,000 long tons will pass along this route by 1975 and 900,000 long tons by 1985. As with the miscellaneous trade routes from the Atlantic to the Pacific, ERA has projected an initial growth rate of 6 percent, gradually increasing to 15 percent by 1985. Again, the justification for this high rate of expansion is the uncertainty of when undeveloped countries will reach their economic take-off point or when and where new sources of commodities will be discovered. An estimated 4.4 million long tons in 1975, 6.4 million in 1980 and 11.5 million by 1985 will be carried on northbound miscellaneous trade routes. Backing out projected figures for LNG traffic, the forecasts reduce to 5.9 million tons and 9.0 million tons in 1980 and 1985, respectively. The percentage of "other" transits which are in the Pacific to Atlantic direction was reduced from the 1971 figure of 61.5 percent to 47 percent to reflect a projected shortage of shipping and higher freight rates for northbound traffic.

SUMMARY

The commodity category of general cargo is projected to generate a significant portion of growth in Canal traffic. Total tonnage will probably increase from 16.6 million long tons in 1971 to 38.5 million long tons by 1985, as shown below and presented in Table 59.

	Millions of Long Tons		
	1975	1980	1985
Atlantic to Pacific	8.6	12.0	16.2
Pacific to Atlantic	12.4	16.2	22.3
Total	21.0	28.2	38.5

It should be noted that if a normal growth rate (about 5 percent) had been applied to the miscellaneous trade routes, total estimated tonnage in 1985 would be approximately 11.5 million long tons less. Therefore, the uncertainty factor has been projected to be about 6.5 percent of the total Canal tonnage estimated for 1985.

Future Ship Size

General-cargo ships transiting the Canal are projected to increase in size over the next 15 years. By 1985, it is estimated that very few liners of less than 5,000 DWTs will be passing through the Canal while a substantial number, approximately 15 to 20 percent, will be in the range of 15,000 and over DWT.

The significant trend, however, will be the replacement of liners traveling the major trade routes by container ships. It is estimated that by 1975, about 8 million long tons of general cargo will transit the Canal

Table 59

PROJECTED GENERAL-CARGO TRAFFIC
THROUGH THE PANAMA CANAL
1971-1985
(Millions of Long Tons)

	Actual 1971	1975	1980	1985
Atlantic to Pacific				
From United States to:				
Asia	1.8	2.9	3.9	5.2
Oceania	0.4	0.5	0.6	0.7
Latin America	0.5	0.6	0.7	0.9
From Europe to:				
United States	0.5	0.5	0.6	0.7
Oceania	0.6	0.7	0.8	0.9
Other	2.5	3.4	5.4	7.8
Subtotal	6.3	8.6	12.0	16.2
Pacific to Atlantic				
From Asia to:				
United States	2.2	2.9	4.3	6.3
Europe	0.9	1.2	1.4	1.6
From Oceania to:				
United States	0.5	0.8	1.0	1.3
Europe	1.1	1.5	1.7	1.9
United States to Europe	1.1	1.1	1.2	1.3
South America to Europe	0.5	0.6	0.7	0.9
Other	4.0	4.3	5.9	9.0
Subtotal	10.3	12.4	16.2	22.3
Total Traffic	16.6	21.0	28.2	38.5

Source: Economics Research Associates.

in containers. By 1985, this is anticipated to be about 23.0 million long tons, or approximately 60 percent of the Canal's traffic in general cargo. By 1975, about 70 percent of the tonnage on the major Canal general-cargo trade routes is projected to be containerized, other trade routes are expected to containerize about 20 percent of their general-cargo traffic by 1980 and 30 percent by 1985. The slow development of container ports in the underdeveloped countries will hinder their use of container ships.

The container ships are not expected to exceed Canal limitations although a substantial number will have the maximum beam of 106 feet; these ships will be able to carry about 2,000, 20-foot container boxes and be in the 30,000 to 35,000 DWT range.