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Aluminum

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PREFACE

In 1991 the United States International Trade Commission initiated its current *Industry and Trade Summary* series of informational reports on the thousands of products imported into and exported from the United States. Each summary addresses a different commodity/industry area and contains information on product uses, U.S. and foreign producers, and customs treatment. Also included is an analysis of the basic factors affecting trends in consumption, production, and trade of the commodity, as well as those bearing on the competitiveness of U.S. industries in domestic and foreign markets.[1]

This report on aluminum covers the period 1988 through June 1993 and represents one of approximately 250 to 300 individual reports to be produced in this series during the first half of the 1990s. Listed below are the individual summary reports published to date on the minerals, metals, and miscellaneous manufactures sector.

USITC publication number	*Publication date*	*Title*
2426	November 1991	Toys and models
2475	July 1992	Fluorspar and certain other mineral substances
2476	January 1992	Lamps and lighting fittings
2504	November 1992	Ceramic floor and wall tiles
2523	June 1992	Prefabricated buildings
2587	January 1993	Heavy structural steel shapes
2623	April 1993	Copper
2653	June 1993	Glass containers
2692	November 1993	Refractory ceramic products
2694	November 1993	Flat glass and certain flat glass products
2706	April 1994	Aluminum
2738	February 1994	Structual ceramic products
2742	March 1994	Fiberglass products
2748	March 1994	Brooms, brushes, and hair-grooming articles
2757	March 1994	Builders hardware

[1] The information and analysis provided in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar subject matter.

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INTRODUCTION

Aluminum metal is valued for its physical properties such as high electrical and thermal conductivity, resistance to corrosion, low density, and good malleability. Such characteristics help explain the increasing use of aluminum in such traditional end markets as packaging, transportation vehicles, and wire and cable. These markets require lightweight, recyclable materials that can help manufacturers respond to environmental requirements related to fuel efficiency and recyclability of materials.

The global aluminum industry is in a state of flux. Primary production continues to shift from established multinational producers in the United States, Europe, and Canada to countries with lower cost energy or raw material reserves such as Australia, Brazil, Venezuela and China, and capacity continues to increase. New aluminum supplies from Russia, coupled with recessionary economic conditions that have lessened demand in many of the large consuming markets, are contributing to supply/demand disequilibrium in the global market. Although the aluminum industry is characterized by regular and substantial cyclical variations, global aluminum inventories are at record high levels in 1993, while prices have declined by about 48 percent since 1988.

Because of this situation, U.S. producers of primary aluminum face challenging economic circumstances, despite their solid competitive position based on aggressive restructuring during the past decade. During the 1980s, U.S. firms invested in lower cost facilities overseas, reduced domestic capacity, lowered production costs in the United States by negotiating variable power rates tied to primary aluminum prices, and vertically integrated their operations to obtain reliable, lower cost sources of raw materials. However, in 1993, four of five primary U.S. producers posted losses, and several companies closed facilities; the secondary aluminum industry, which uses scrap as a primary feedstock, is also experiencing price pressure and financial difficulties.

The segment of the U.S. aluminum industry that produces mill and fabricated products has been less affected by the current state of disequilibrium, in that lower prices for aluminum ingot have bolstered their healthy competitive position. However, the volatility of aluminum prices and the global recession in aluminum consuming industries have slowed expansion into new markets. Nevertheless, this segment of the industry is aggressively pursuing larger market share in the automotive and packaging industries through joint partnerships and foreign investment.

This summary profiles the aluminum industry by separately examining its two major segments: (1) primary and secondary producers of aluminum metal, and (2) producers of mill products and downstream fabricated products. Both sections of the report analyze the competitive factors influencing these segments of the industry, the performance of the industry in foreign and domestic markets during 1988 through midyear 1993, and the prospects for demand and consumption.

ALUMINUM METAL

Production Process

The primary aluminum industry produces aluminum from raw materials (i.e., bauxite and its derivatives) that are smelted into primary aluminum (figure 1). Most producers in industrialized countries depend on imports of bauxite and alumina inputs to produce aluminum because of the absence of significant reserves of metallurgical-grade bauxite.

The Bayer process is used almost universally to refine bauxite into alumina; calcined alumina is converted into aluminum, with a 4:2:1 average ratio (by quantity) of bauxite-to-alumina-to-aluminum. Bayer plants are designed to process a particular kind of bauxite ore and cannot be easily or economically switched to other bauxite grades.[1] These plants may be located near bauxite resources[2] to facilitate and reduce the cost of processing and handling a particular ore. Bauxite undergoes beneficiation (crushing, washing, and drying) before refining into alumina. Bauxite is usually dried before shipment to reduce moisture content and minimize transportation costs.

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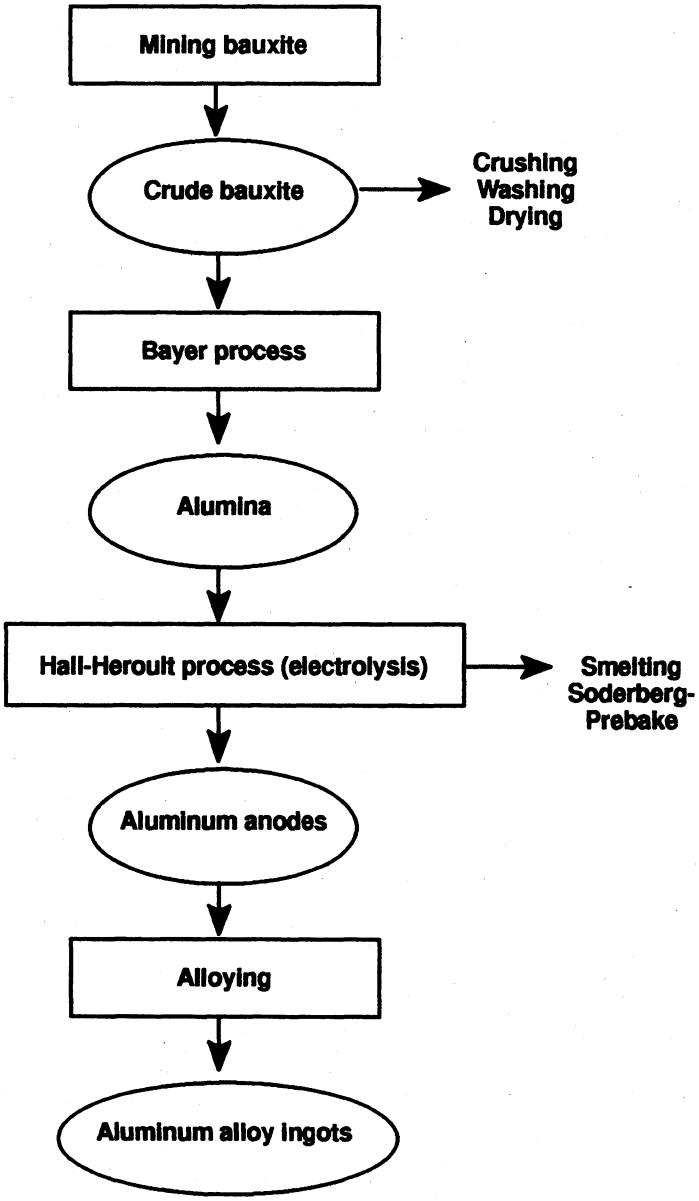
[1] The composition of bauxite varies by deposit. Those bauxite grades with low iron concentration are suitable for chemical and refractory uses whereas bauxite of higher iron content is used for metallurgical purposes.

[2] Bauxite is found in deposits that are mined from the surface (in Jamaica and Guinea) or underground (as in Hungary and Greece).

Figure 1
Primary aluminum production process



Source: Compiled from information of Carnegie Mellon University and the staff of the U.S. International Trade Commission.

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Two types of alumina are generally produced as a result of the Bayer alumina production process.[3] North American Bayer plants generally produce a sandy, coarse-grained alumina of a relatively large particle size that facilitates the absorption of fluorine emissions when alumina is used in scrubber units. The alumina produced at European plants is floury and finer grained, and less amenable to environmental safeguards such as fluorine emissions reductions. This has prompted conversion of much of the world's alumina-refining capacity to production of sandy alumina.

The smelting of alumina into aluminum is highly energy-intensive, with an average of one-third of primary aluminum production costs represented by energy. Hydroelectric power is the most widely used energy source because of its relatively low cost, but coal and natural gas, and other power sources such as nuclear energy are also used to generate electricity.

Smelting technologies to produce primary aluminum are widely distributed, often through technology licensing by major primary producers (e.g., Pechiney, Kaiser). Smelters currently average about 200,000-250,000 metric tons in size, with construction completed in roughly 3-5 years at a cost of about $4000 per ton. This figure would be higher in areas without developed infrastructure such as power generation stations or ports.

The Hall-Heroult electrolysis process is the basis for aluminum smelting operations. Smelting occurs in cells (pots) that are filled with a molten cryolite solution; cells can produce 800 to 3000 pounds of aluminum daily, depending on their construction. An electrical current passes through a carbon anode (which is consumed) and reduces the alumina. Aluminum collects at the bottom of the cells. It is removed with a vacuum siphon technique into cast-iron pots for immediate use in holding furnaces for blending or for casting into solid forms such as t-bars or ingots for transport to fabricating plants.

Soderberg and prebake technologies are the two major primary aluminum production methods. The Soderberg process requires less labor and is a continuous anode-feeding operation (i.e., the carbon descending through the steel shell in the pot is continuously replaced as it is consumed in the smelting process), but is generally not considered state-of-the-art technology. The prebake anode process is more energy-efficient because the anodes are already baked, but this technology requires an anode fabricating plant. Prebake is more environmentally suitable because the potline cells are covered to capture gas emissions that are then treated to remove fluorine. Some smelters have a combination of Soderberg and prebake technologies, although most smelters apply only one method.

Commercially pure aluminum is usually 99.7% aluminum,[4] with the remaining percentage composed of various metals, such as magnesium, that are added to improve specific aluminum characteristics. More than 100 commercial aluminum alloys have been developed for various purposes, as reflected in variations in alloy strength and electrical conductivity, for example (see "Alloys" in the glossary, appendix D). Aluminum of higher purity is available at higher costs than standard commercial aluminum. Superpurity aluminum of 99.99% aluminum is used for limited applications, such as electronic end uses. Molten metal, ingots, billets, and t-bars from primary production are used for the manufacture of fabricated aluminum products.

The secondary aluminum industry recovers aluminum metal from old or new scrap.[5] Reduced costs associated with lower energy consumption is the major advantage of secondary aluminum production, with reductions in energy costs of up to 95 percent. The scrap is sorted by alloy and material to ensure mix purity and to facilitate blending; the scrap mix can be altered with the addition of alloys or primary metal.

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[3] In the former Soviet Union, an estimated one-half of its domestic alumina supply is derived from nepheline syenite, which contains a relatively low concentration (about 30 percent) of alumina.

[4] Primary aluminum must meet this minimum specification to be traded on the London Metal Exchange. Lower-purity aluminum is considered off-grade (or off-specification) and is not deliverable on the LME, but can be upgraded by blending with higher purity metal.

[5] Aluminum waste and scrap are characterized as new (from the production of intermediate and fabricated products of aluminum) or old (from purchased, recycled consumer products). New scrap is further categorized as pure (unalloyed), segregated (one alloy), or mixed (more than one alloy). New scrap can also be runaround scrap (home scrap recycled by the same company that generated it) or purchased scrap (new scrap purchased, imported, or treated on toll).

Secondary smelters remelt the recovered scrap, usually in gas- or oil-fired furnaces; used beverage cans (UBCs) are a principal source of recycled scrap. Secondary metal is used mainly for cansheet, castings, and forgings, as well as an addition to primary metal for blending purposes.

U.S. Industry Profile

Industry Structure

Cyclical price swings and supply/demand disequilibrium have become increasingly characteristic of the world aluminum industry. During the mid-1980s, the global aluminum industry experienced a period of low metal prices during which the U.S. industry underwent substantial contraction and structural change. The U.S. primary aluminum industry improved its competitive position during this time with the closure of about 25 percent (1.1 million metric tons) of less-efficient capacity.[6] Many U.S. firms shifted their investment focus overseas to countries with lower power costs, and negotiated variable cost power contracts linked to metal prices. In addition, the transition of several higher cost smelters into toll operations[7] during the mid-1980s changed the composition of the U.S. industry. As long-term contract smelters, these so-called "Lazarus" smelters are not as responsive (e.g., idling capacity during periods of oversupply) to changing global supply/demand conditions.

The current global aluminum situation has characteristics similar to the mid-1980s downswing. As a globally traded commodity, primary aluminum is priced on the London Metal Exchange (LME) where aluminum ingot contracts are purchased. Domestic aluminum prices are pegged closely to the LME price. The adjusted average domestic price declined from an average of 97.3 cents per pound in 1988 to about 47.6 cents in 1992, and fell to 42.5 cents per pound during April-June 1993, as LME inventories rose to over 1.5 million metric tons (figure 2 and table 1). This is the lowest price level in more than 13 years. In response, the U.S. primary aluminum industry has temporarily reduced capacity[8] in 1993[9] in an effort to stabilize supply/demand and to strengthen the primary aluminum price.

The composition and ownership of the domestic primary aluminum industry has changed little since 1988 except for the spinoff of Ravenswood from Kaiser in 1989, and the purchase of 100 percent of the National-Southwire smelter by Southwire in 1990. About 23 domestic primary aluminum smelters were operated by 13 firms in 1992, which is unchanged from 1988. Employment has remained relatively stable, up 2 percent during the period to an estimated 19,800 employees. Production workers have average hourly earnings of $15.39 as of July 1993, compared to $14.04 for all primary metal industries and $12.33 for durable goods manufacturing during the same period.[10] Worker productivity remained essentially unchanged during 1988-92 as the industry operated at full capacity with minimal employment changes. Approximately 68 secondary aluminum plants operated in the United States in 1992. Employment at these plants is estimated at 3,600 workers for the period. These plants

[6] Primary capacity in 1986 was 3.8 million metric tons.

[7] The Columbia Falls (Montana), Northwest (Oregon), and Columbia (Washington) smelters, for example, were destined for closure but were instead purchased by independent operators or employee groups who contract with alumina suppliers to produce aluminum for a fee. The aluminum is then turned over to the alumina supplier for processing or sale. In addition, a small portion of aluminum output from other smelters is also tolled. Tolling operations accounted for a minimum of 10 percent of U.S. production capacity in 1992.

[8] Permanent closure is capacity that is written off and no longer available for production. Temporary closure is capacity that is maintained for production availability when market conditions or other factors warrant.

[9] As of May 1993, approximately 440,000 metric tons of capacity were temporarily cut back by U.S. primary aluminum producers located mainly in the Bonneville Power Administration (BPA) region, where drought and environmental considerations resulted in 25-percent reductions in electricity supply. In June 1993, Alcoa announced the temporary closure of 25 percent of its primary aluminum capacity in the United States; in addition to the closure of 42,000 metric tons at its Wenatchee, WA, smelter in January 1993, Alcoa indicated that 268,000 metric tons of capacity at five smelters would be closed by mid-July. Reynolds also announced the temporary closure of 88,000 metric tons of capacity for October 1993, which is in addition to the 121,000 metric tons temporarily closed during August-December 1991.

[10] U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings, Sept. 1993.

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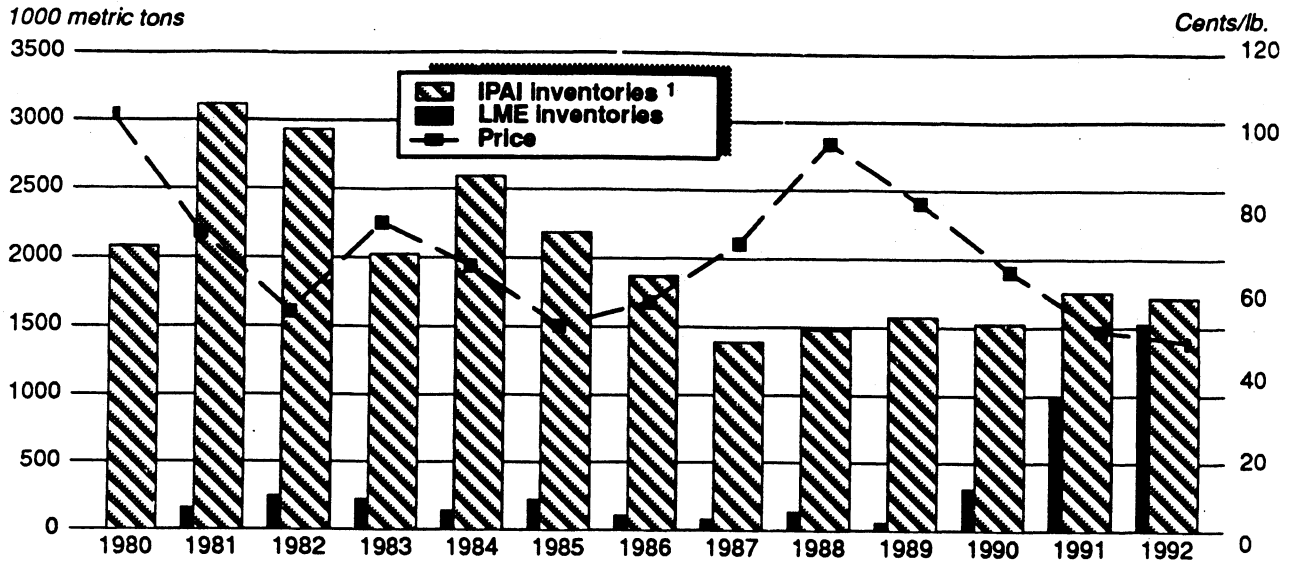
Figure 2
Primary aluminum: Inventories and price, 1980-1992



[1] International Primary Aluminum Institute. Inventories include unwrought aluminum held at smelters, integrated fabrication plants, and other premises at year end.
Note.—Prior to August 1991, IPAI included LME.
Source: Compiled from data of Kidder, Peabody and the U.S. Bureau of Mines.

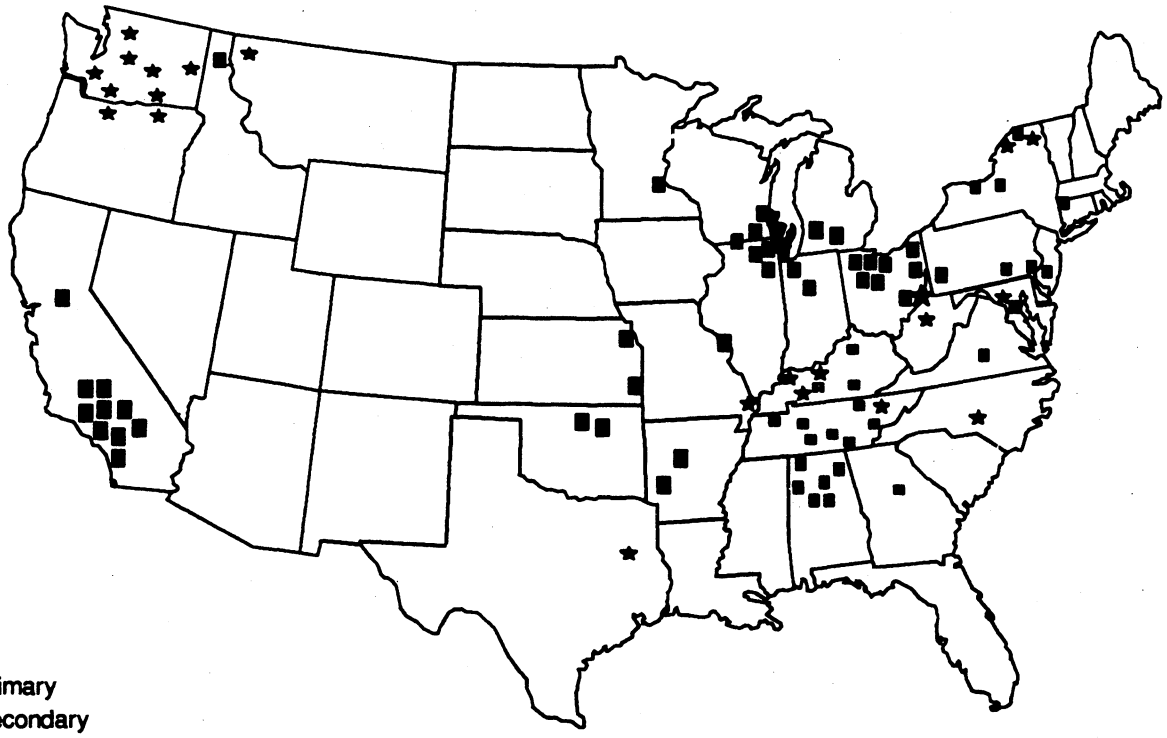
Table 1
Primary aluminum: London Metal Exchange and International Primary Aluminum Institute inventories, average annual U.S. market price, and price in constant 1987 dollars, 1980-92, January-March 1993, and April-June 1993

Year/period	Inventories LME	Inventories IPAI[1]	Average annual U.S. market price	Price in constant 1987 dollars
	----*1,000 metric tons*----		----------*Cents per pound*----------	
1980	([2])	2,078	76.1	104.3
1981	160	3,115	59.8	74.8
1982	249	2,936	45.8	55.2
1983	225	2,024	68.3	77.2
1984	142	2,594	61.1	66.6
1985	223	2,188	48.8	51.7
1986	111	1,869	55.9	57.6
1987	84	1,390	72.3	72.3
1988	137	1,482	110.1	97.3
1989	57	1,576	87.8	82.4
1990	311	1,527	74.0	65.4
1991	987	1,764	59.5	50.5
1992	1,527	1,717	57.5	47.6
1993:				
Jan.-Mar.	1,646	1,703	55.1	44.8
Apr.-June	1,888	1,855	52.6	42.5

[1] Unwrought aluminum held at smelters, integrated fabrication plants, and other premises at yearend.
[2] Not applicable.

Source: Compiled from data provided by the U.S. Bureau of Mines, and Kidder, Peabody.

Figure 3
Location of U.S. primary and secondary smelters



★ Primary
■ Secondary
Source: The Aluminum Association.

are mostly near major industrial and consumer centers (e.g., Southern California and the Great Lakes region), which generate significant waste and scrap[11] for recycling and recovery.

The major integrated domestic producers--Alcoa, Alumax, Reynolds, and Kaiser--accounted for over 63 percent of U.S. capacity in 1992, relatively unchanged from the 1988 percentage. Primary aluminum capacity is concentrated in the Northwest (42 percent) and in the Ohio River Valley (31 percent) to benefit from hydroelectric and coal-based electrical power (figure 3). Considering overall ability to compete, energy remains by far the most significant production factor because of marked price variability among countries and power suppliers. On average, energy accounts for about one-third of production costs.

U.S. primary capacity actually increased during 1988-92 by nearly 7 percent (table 2) to 4.2 million metric tons, primarily due to Alcoa's 130,000-metric-ton increase in capacity, which offset Kaiser's 110,100-metric-ton capacity reduction. Most of this capacity increase occurred during 1988-89, when prices for primary aluminum reached over $1.00 per pound. Investment cycles generally peak with aluminum prices. During periods of high prices, smelter capacity tends to expand, resulting in a period of metal oversupply with attendant lower prices. Relatively low prices then slow capacity expansion because all but ongoing projects are generally postponed. Since late 1991, substantial flows of aluminum metal into LME inventories have contributed to depressed prices for aluminum metal. The U.S. industry's average production cost of about 56 cents per pound in 1992, which is on the high end of major producing countries, contrasts with current spot LME prices of under 50 cents per pound (table 3). However, many smelters

[11] See glossary, appendix D for definition of scrap. Forty percent of purchased scrap is generally derived from new scrap, and the remaining 60 percent comes from old scrap. The most significant source of old scrap has been used beverage cans (UBCs), for which the recycling rate nearly reached 68 percent in 1992, up from nearly 55 percent in 1988.

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Table 2
Primary aluminum: U.S. capacity, by companies, 1988 and 1992

Company	Capacity 1988	1992	Change
	1,000 metric tons		*Percent*
Alcoa	1,155.0	1,285.0	11
Alumax	600.0	629.0	5
Reynolds	448.0	448.0	0
Kaiser	383.8	273.1	-29
Ormet	244.9	245.0	(1)
Noranda	204.1	215.0	5
Southwire[2]	79.6	186.0	(3)
Alcan	163.3	180.0	10
Columbia Falls	163.3	168.0	3
Ravenswood	(4)	168.0	(3)
Columbia	167.8	167.8	0
Vanalco	115.0	115.9	1
Northwest	81.6	82.0	(1)
National	95.4	(2)	(3)
Total	3,901.8	4,162.8	7

[1] Less than 0.5 percent.
[2] Southwire acquired 100-percent interest in the National-Southwire smelter in 1990.
[3] Not applicable.
[4] Prior to 1989, Ravenswood was a Kaiser facility.

Source: Compiled from data supplied by The Aluminum Association.

Table 3
Primary aluminum: Capacity, production, and average production cost, by major producing countries, 1992

Country	Capacity	Production	Average production cost
	1,000 metric tons		*Cents per pound*
Australia	1,240	1,216	45.3
Brazil	1,156	1,195	54.3
Canada	2,283	1,972	50.0
China	1,315	950	(1)
France	472	417	51.9
Germany	713	600	64.3
Norway	851	861	56.3
Russia	3,654	3,115	47.6
United States	4,163	4,042	56.1
Venezuela	610	566	45.3

[1] Not available.

Source: Compiled from data supplied by the U.S. Bureau of Mines, Resource Strategies, Inc., and World Bureau of Metal Statistics.

are likely to try and wait out periods of low prices rather than close capacity because the cost of major production inputs (i.e., electricity, alumina, labor) is often tied to the world price of primary aluminum.[12] Because of the linkage between production costs and metals prices, the U.S. industry capacity utilization rate has run near the maximum during the 1988-92 period, with a slight decline in 1992 (down to 96 percent from nearly 100 percent) as continuing price declines began to have an impact.

The U.S. industry is highly vertically integrated, from bauxite resources to downstream fabrication facilities. The absence of domestic metallurgical bauxite resources[13] led Alcoa, Reynolds, and Kaiser to invest in overseas bauxite and alumina operations in Jamaica and Guyana, for example, in order to guarantee raw material supplies and favorable prices. Bauxite is refined in the United States at five Bayer plants with an estimated capacity of 5.6 million tons. These plants are mostly in the Gulf region because of proximity to port facilities. The U.S. aluminum industry is highly dependent on bauxite/alumina imports, which account for about 85 percent of U.S. alumina supply.

Early foreign investments by the U.S. industry facilitated additional U.S. globalization when low energy prices became a more pivotal factor in determining aluminum smelter locations. As a result, U.S. investment in primary aluminum reaches into most parts of the world, including Latin America (e.g., Venezuela, Brazil), Australia, and Canada, all of which possess vast hydroelectric power at relatively inexpensive prices. Future U.S. investment in primary aluminum smelters will likely focus on these and other low-cost energy countries outside the United States. The level of investment activity will take into account factors such as aluminum company revenues/losses, perceived future demand levels, political/economic stability, and regulatory investment climate, as well as aluminum prices. For example, U.S. industry officials indicate domestic companies would likely assist certain plants in the former Soviet Union to upgrade environmental technologies and to improve the production efficiencies of existing smelters.[14] However, this type of long-term commitment will require better economic and political conditions in the countries of the former Soviet Union.

Of total U.S. primary aluminum capacity, about 1 million metric tons (roughly 25 percent) can be attributed to foreign investment. The United States is unlikely to receive significant future foreign investment in the primary sector because of its relatively high production costs. Foreign investment in the U.S. industry is outlined in the following tabulation:

Smelter	*Location*	*Investor*
Sebree	Kentucky	Canada[1]
Mt. Holly	South Carolina	Clarendon[2]
Ferndale	Washington	Japan[3]
Frederick	Maryland	Japan[4]
New Madrid . . .	Missouri	Canada[5]

[1] Alcan (100-percent ownership).
[2] A Swiss-based trading company holds a 25-percent interest.
[3] Mitsui, Toyo Sash, and Yoshida Kogya K.K. own 25 percent of Alumax, which operates both the Ferndale and Frederick smelters.
[4] Ibid.
[5] Noranda (100-percent ownership).

Consumer Characteristics and Factors Affecting Demand

The design and manufacturing benefits associated with aluminum and aluminum alloys make this metal the preferred material for a number of diverse industrial applications in the packaging (beverage cans and foil), electrical, automotive, and construction industries (see section on Aluminum Mill Products). Demand for primary and secondary metal is driven by the strength of demand in these end-use sectors and by the substitutability of other materials, based on cost and design considerations. The principal consumers of primary aluminum for fabrication of such products are the integrated primary aluminum producers. Other

[12] Those smelters with variable power rates, accounting for about 45 percent (1.8 million metric tons) of U.S. capacity, are located in the regions serviced by the Bonneville and Big River utilities.

[13] Three firms produced refractory grade bauxite (i.e., not suitable for metallurgical uses) in Alabama and Georgia. Estimated employment at these facilities totaled 35 workers in 1992. U.S. Department of the Interior, Bureau of Mines, Mineral Commodity Summaries, 1993.

[14] USITC staff discussions with U.S. Government officials, Sept. 1993.

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Table 4
Primary aluminum: Western World capacity, production, and consumption, 1988-92, and estimated 1993-95

(1,000 metric tons)

Year	Capacity	Production	Consumption
1988	13,611	13,501	13,775
1989	14,073	14,062	14,353
1990	14,504	14,186	14,385
1991	14,830	14,778	14,543
1992	15,348	14,763	14,952
1993[1]	15,908	14,975	15,094
1994[1]	16,019	14,750	15,650
1995[1]	16,047	15,000	16,200

[1] Projected capacity, production, and consumption figures.

Source: Kidder, Peabody, *Equity Research Industry Report*, Sept. 1, 1993.

purchasers include independent fabricators, distributors, and metal traders.

Because of the commodity nature of aluminum, international price-setting, and extensive industry globalization, the U.S. aluminum market is directly impacted by conditions in the global marketplace. There is currently disequilibrium in global supply and demand for primary aluminum, due in part to the emergence of Russian metal on the world market, coincident with recessions in consuming markets and expanding capacity in other countries.[15] Nevertheless, future global demand for primary aluminum is expected to exceed Western World supply (table 4). Those projects already under construction are expected to add a further 140,000 metric tons of capacity by 1995, representing less than 1 percent of 1992 Western World capacity. Other projects have been indefinitely delayed, pending a strengthening of metal prices.

Demand for secondary aluminum comes from many industrial sectors, primarily the automotive and packaging industries. Although recyclability of aluminum is a significant advantage to environmentally conscious consumers, the aluminum industry favors recycling also because of the significant energy-cost savings[16] in remelting waste and scrap.

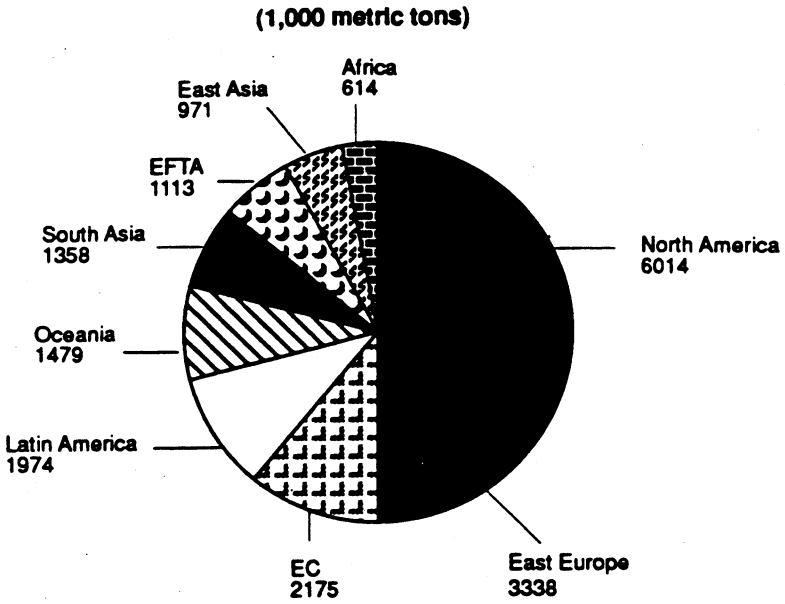
Foreign Industry Profile

The global bauxite and aluminum industries were dominated in the early to mid-1900s by five major producers in the United States, Canada, and Europe--Alcoa, Reynolds, and Kaiser (United States); Alcan (Canada); and Pechiney (France). These firms were highly integrated from bauxite through fabricated products, and accounted for the bulk of world bauxite and aluminum production and consumption. Following higher global energy prices in the late 1970s and a greater emphasis on cutting costs as aluminum prices fluctuated, these producers expanded offshore into

[15] The Governments of the United States, European Union, Russia, Canada, Australia, and Norway have held a series of discussions to address the current market disequilibrium. The first meeting was held in Moscow (October 20-21, 1993), with subsequent meetings in Washington, DC (November 1-2, 1993), Brussels (January 18-21, 1994), and Ottawa during the week of February 28, 1994. At the Ottawa meeting the six governments accepted a "Memorandum of Understanding Concerning the Aluminum Market" that is to remain in effect for no more than 24 months (see appendix E for the text of the Memorandum). In addition, government representatives agreed to establish a working party to improve market transparency. Another multilateral meeting of government representatives is tentatively scheduled for April 21, 1994 in Brussels. The purpose of the meeting is "to review further developments of the global market situation."

[16] Energy required for secondary aluminum production is only 5 percent of that required for primary aluminum.

Figure 4
World aluminum production, 1992



Source: Compiled from data of the U.S. Bureau of Mines, World Bureau of Metal Statistics, and The Aluminum Association.

many of the same resource-rich countries, as shown in the following tabulation:

U.S. firms	*Alcan*	*Pechiney*
Canada	United States	Canada
Brazil	Brazil	Greece
Venezuela	Netherlands	Netherlands
Norway	United Kingdom	Spain
Ghana	India	Cameroon
Australia	Japan	Australia
	Australia	

About the same time, many new producers entered the primary aluminum industry, taking advantage of low-cost power sources, abundant raw material resources, and developing consumer markets. In 1992, almost forty percent of world production was found outside North America and Europe (figure 4). Although the primary aluminum industry has experienced a shift in global production patterns, major sources remain unchanged for metallurgical-grade bauxite (Australia, Guinea, Jamaica, and Brazil) and for alumina (Australia, the United States, and Jamaica) (table 5).

Dispersion of the industry is expected to continue as production of primary aluminum declines in Western Europe and production in Asia, Canada, Latin America, and Australia is expected to grow. The result is projected to be an overall increase in global capacity of about 5 percent by 1995 (table 4). Like investment in the United States, however, the level and timing of foreign investment depends on a complex array of factors, such as projected aluminum prices, company earnings, future supply/demand levels, political/economic stability, and investment regulatory climate.

Western Europe

As a whole, Western Europe is the world's second-largest source of primary aluminum, with 3.4 million metric tons in 1992, despite relatively high production costs in most producing countries and high import reliance for raw materials. However, European production has declined by 9 percent since 1988, and is expected to decline by another 5 percent during 1993-94. The extent of government involvement in the European industry, reportedly in recognition of the political implications of major social disruptions associated with unemployment, is believed by industry sources to have contributed to sustained output levels despite relatively high production costs.

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Table 5
Primary aluminum: Bauxite reserves and production, by principal countries, 1988 and 1992

(1,000 metric tons)

Country	Reserves	Production 1988	Production 1992
Australia	5,620,000	36,370	39,964
Guinea	5,600,000	17,859	17,054
Jamaica	2,000,000	7,408	11,356
Brazil	2,800,000	7,728	10,800
India	1,000,000	3,961	5,549
Other	5,980,000	15,915	14,538
Total	23,000,000	89,241	99,261

Source: Compiled from data of the U.S. Bureau of Mines and World Bureau of Metal Statistics.

Norway

Two firms, Norsk-Hydro and the Elkem-Alcoa partnership, dominate this hydro-powered industry of seven smelters. Norway is Europe's largest aluminum producer, with 25 percent of output in 1992, and is the world's sixth-largest producer. Because of the availability of abundant energy sources, the Norwegian industry would likely be the only European industry to increase capacity in the future, despite a 7-percent (45,000 metric tons) temporary capacity cutback in 1991 by Norsk-Hydro at its four smelters because of falling prices and increased global inventories.[17] Because Norway lacks any domestic bauxite deposits or known refinery production, all alumina and bauxite are imported. Norway is currently believed to be the principal source of Russian metal for the European market because the Norwegian industry has played an integral role in the upgrading of off-specification Russian aluminum for sale in the global market.[18]

Germany[19]

The high production costs of the German industry and the downturn in the world aluminum market have driven capacity cutbacks since 1991, with announced temporary closures totalling 127,000 metric tons by three firms (Alusuisse, VAW, and Hoogovens).[20] Further cutbacks are expected during 1993-94. The German industry has extensive government ownership. Three refineries produce alumina; since Germany has no domestic bauxite deposits, refinery input materials are imported.

France

The French industry is dominated by Pechiney, one of the world's largest aluminum producers and also a state-owned corporation. France has no bauxite resources, but the French industry benefits from a relatively low power rate negotiated with Electricite de France, which supplies virtually all of Pechiney's needs. Pechiney owns and operates all primary aluminum production at seven smelters. The company is very globalized and is a major source of technology and financial assistance for new smelters. Only one alumina refinery--owned by Pechiney--currently operates in France.

Pacific Rim

The Russian Federation (Russia)

As the world's second-largest producer of primary aluminum, the recent export activity of Russian producers as players in the global market has had a

[17] U.S. Department of the Interior, U.S. Bureau of Mines, Aluminum, Bauxite, and Alumina 1991, January 1993, p. 13.

[18] The Russian metal is blended with higher grade aluminum to meet international standards.

[19] Discussion focuses on West Germany; East Germany had an estimated 20,000 metric tons of primary aluminum capacity in 1990 before reunification.

[20] Information compiled by the Aluminum Association from Morgan Stanley Group, Inc., Oct. 7, 1993.

Table 6
Primary aluminum: Former Soviet smelters and location, rated capacity, technology, and fuel source, 1992

Name	Location	Rated capacity	Technology	Fuel
		1,000 metric tons		
Volkov	Russia	20	Prebake	Nuclear/shale
Nadvoitsky	Russia	68	Soderberg	Nuclear/shale
Kandalaksha	Russia	60	Soderberg	Nuclear/shale
Volgograd	Russia	168	Soderberg	Nuclear/shale
Bogoslovsk	Russia	162	Soderberg	Coal
Kamensk-Uralsk	Russia	70	Soderberg	Coal
Novokuznetsk	Russia	284	Soderberg	Coal
Krasnoyarsk	Russia	755	Soderberg	Hydro
Bratsk	Russia	850	Soderberg	Hydro
Sayanogorsk	Russia	274	Prebake	Hydro
Irkutsk	Russia	262	Soderberg	Hydro
Zaporozhye	Ukraine	110	Soderberg	Coal
Sumgait	Azerbaijan	58	Soderberg	Gas
Tadjik	Tadjikistan	517	Prebake	Hydro

Source: Data compiled by the U.S. Bureau of Mines from VAMI, Planecon, and Resource Strategies, Inc.

significant impact on the global aluminum market. With the collapse of internal defense industry applications and the loss of the Eastern European market, Russia's domestic aluminum market contracted by an estimated 40 percent during 1988-92 to 1.7 million metric tons.[21] However, the Russian industry continues to produce at relatively high levels (ranging between an estimated 3.1 million metric tons and 3.3 million metric tons in 1992)[22] and to export aluminum to Western markets at record levels. This flow to world markets has contributed to excess inventories on the LME and to depressed prices.

Currently 11 smelters[23] (table 6) are operating in the successor countries to the former Soviet Union, with total capacity ranging between 3.6 million metric tons and 4.0 million metric tons.[24] The world's two largest smelters--Krasnoyarsk and Bratsk, with capacities in excess of 750,000 metric tons--are in Siberia. The smelters of the former Soviet Union generally operate independently of their respective state governments, and many are pursuing privatization. Because many of these smelters are located in remote areas, they are often the major regional source of employment, and are therefore considered essential to local social and economic health. With such importance, these smelters are viewed as unlikely to close in the near future despite health and environmental risks, or higher production costs.

The aluminum industry of the former Soviet Union reportedly benefits from inexpensive hydroelectric power[25] that contributes to comparatively low

[21] Estimates provided by Lloyd T. O'Carroll, corporate economist of Reynolds Metals Company.

[22] Although specific production data are unavailable, several industry sources (the Aluminum Association, U.S. Bureau of Mines, and the World Bureau of Metal Statistics) estimate production within this range.

[23] Ukraine, Tajikistan, and Azerbaijan each have one smelter; the remaining eight smelters are located in Russia.

[24] As compiled by the U.S. Bureau of Mines from estimates of Resource Strategies, Inc., Metal Bulletin, Vereingte Aluminium-Werke Ag (VAW), and materials from an aluminum conference held in St. Petersburg (September 1992).

[25] Although many former Soviet smelters use other power sources, such as nuclear/shale and coal, the largest smelters are located in Siberia where hydroelectric power is

(continued...)

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production costs (estimated at nearly 48 cents per pound), as well as a relatively low-wage-rate, well educated, and technically skilled workforce.[26] In addition, the large size of many former Soviet smelters contributes to cost savings associated with economies of scale. To complement these advantages, the Russian industry is also seeking Western financial assistance to upgrade smelter environmental technology, reduce power consumption, and, to a lesser extent, develop domestic consumer markets. Currently, however, internal economic and political conditions reportedly act as a deterrent to significant foreign assistance.

Most former Soviet smelters operate with the less technologically advanced Soderberg process.[27] Because these cells do not trap hazardous emissions, smelters have been a significant contributor to local environmental problems.[28] Remediation will require substantial Western funding and technical assistance. Another factor that will influence the future competitiveness of the Russian industry is the lack of indigenous high-grade bauxite reserves. Prior to its breakup, the Soviet Union sourced bauxite from Ukraine and Tajikistan, for example. This relationship has since deteriorated and the Russian industry is confronting bauxite/alumina supply difficulties. Russia currently imports over one-half of its bauxite/alumina needs from sources such as Australia and Guinea. In addition, a significant source of internal alumina supply for the industry comes from nepheline syenite, a relatively low-grade, uneconomical input material.

[25] (...continued)
the principal energy source; these smelters account for nearly 60 percent of rated capacity. Information compiled by the U.S. Bureau of Mines from VAMI, Planecon, and Resource Strategies, Inc.

[26] The Russian Aluminum Industry – Thoughts from a Recent Visit, Daniel A. Roling, First Vice President, Merrill Lynch & Co., Global Securities Research & Economic Group, Fundamental Equity Research Department, October 1992.

[27] Over 75 percent of former Soviet aluminum capacity is Soderberg technology. Information compiled by the U.S. Bureau of Mines from VAMI, Planecon, and Resource Strategies, Inc.

[28] For example, the average reported lifespan of a Russian aluminum smelter employee is 46 years.

Australia

The Australian industry also benefits from low-cost hydroelectric and coal-fired power, as well as an abundant supply of bauxite. Because of these inherent advantages, Australia is likely to be an area of future capacity expansions. Australia is already the world's fourth-largest primary aluminum producer with seven smelters, and is also the world's largest alumina producer with six refineries. As noted, there is currently a high degree of foreign investment in the Australian industry. The Point Henry and Portland smelters are majority-owned by Alcoa; Alcan has majority interest in Kurri Kurri; and the other four smelters are partnerships of a number of Australian and foreign firms.

China

China is a potentially significant producer of aluminum as well as other nonferrous metals. Although little information is available concerning expansion plans and market characteristics, the rapidly expanding Chinese market has spurred consumption of most base metals, including aluminum. China is currently a major aluminum importer seeking to become self-sufficient in aluminum and reduce its import dependence. The Chinese Government is looking more favorably on foreign investment to assist this development.[29] Chinese aluminum production capacity was estimated at 950,000 metric tons in 1992, up by 34 percent from 1988.[30] China also has significant bauxite resources and refinery capacity, and abundant hydroelectric power. Approximately 22 state-owned smelters are believed to be operating in China, more than one-half of which have relatively small capacities (under 50,000 metric tons). These smaller smelters are relatively inefficient from a cost perspective because of the considerable startup funds required and the smaller tonnage basis on which fixed costs are allocated.

[29] See, for example, "China Seeks Investments From Foreign Sources to Boost Nonferrous Output," American Metal Market, Aug. 4, 1987; "China Reported Slowing Buys of Overseas Nonferrous Metals," American Metal Market, Mar. 25, 1987; and "US Funds 'Great Wall' Complex Study; World Bank Wary, But China 'Committed'", Metals Week, May 22, 1989.

[30] U.S. Department of the Interior, U.S. Bureau of Mines, Aluminum, Bauxite, and Alumina 1991, January 1993, p. 37, and the Aluminum Association.

Canada

Canada's position as the world's third-largest primary aluminum producer is, in large part, based on its abundant low-cost hydroelectric power. The Canadian industry is comprised of 11 smelters, chiefly in Quebec and British Columbia near these power sources. The Canadian industry is dominated by Alcan, one of the world's major integrated producers. Alcan accounts for nearly one-half of Canadian primary aluminum capacity, and is also a major investor in smelter expansions abroad.

Canada's only alumina refinery--Arvida--has a capacity of 1.2 million tons, and is supplied by imports since Canada lacks significant bauxite deposits. Canadian primary aluminum expansions in the early 1990s totalled about 448,000 metric tons, principally as the result of smelter start-ups at Sept Isles (215,000 tons) and Deschambault (215,000 tons).[31] Capacity expansions accounted for about 20 percent of 1992 capacity of 2.3 million metric tons.[32] The Canadian and U.S. industries have significant linkages through Alcan's operations in both countries, Canadian Reynolds' investment in the Baie Comeau smelter, and other U.S. investment in the Becancour facility.

Latin America

Brazil

Brazil, the world's fifth-largest producer of primary aluminum, will also likely be a site of capacity expansions because of abundant energy sources and extensive bauxite reserves. However, Brazilian tax and pricing policies have raised energy prices to uncompetitive levels relative to those in other major aluminum-producing countries. The Brazilian industry currently consists of seven smelters, with capacity expansions of about 37 percent (326,000 metric tons) during 1988-92.[33] The Brazilian industry also has four alumina refineries, with additional plans for the Alunorte refinery to come onstream in 1997.

Venezuela

During the late 1980s Venezuela anticipated that by the year 2000 its primary aluminum industry would have a production capacity of 2 million metric tons[34] because of the country's considerable bauxite reserves and the world's lowest energy costs, which had sparked earlier interest by foreign investors. However, these prospects diminished in the face of low metal prices and political and economic instability that postponed any planned foreign investments. Despite these challenges, as one of the world's lower cost producers (about 45 cents per pound), Venezuela is still expected to be a major world producer. Currently there are only two primary aluminum producers--Venalum and Alcasa. The Venezuelan Government reportedly is currently seeking private investors for Venalum, a state-owned operation.

U.S. Market

Consumption

The United States is the world's largest market for aluminum and its raw materials. Aluminum consumption is estimated to have increased in terms of quantity by less than 1 percent during the 1988-92 period and declined during the first half of 1993 (table 7), reflecting slow growth in the domestic economy; the value of consumption declined over the entire period because of dramatic price reductions for primary aluminum. The share of consumption accounted for by imports in 1992 was about 25 percent, relatively unchanged from the 1988 level of 22 percent. During January-June 1993, U.S. consumption of primary aluminum was estimated at 2.6 million metric tons, of which nearly 35 percent (890,000 metric tons) was represented by imports.

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[31] Aluminum Market Update, Metal Bulletin Research, Sept. 1, 1993, p. 23.

[32] The Aluminum Association.

[33] Estimated by the U.S. Bureau of Mines.

[34] The Venezuelan aluminum industry's expansion plan and subsequent revisions were widely reported in the late 1980s. For example, see "Venalum, Fabricators in Joint Venture Talks," American Metal Market, Oct. 10, 1986; "Aluminum Expansions Still Venezuela's Target," American Metal Market, July 1, 1987; and "Venezuela Boosts Expansion Plans Again; 1.2-Million-mtpy Smelting Capacity by 1994," Metals Week, Aug. 31, 1987.

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Table 7
Primary aluminum: U.S. production, exports of domestic merchandise, imports for consumption, and apparent consumption, 1988-92 and January-June 1993

Year/period	U.S. production	U.S. exports	U.S. imports	Apparent U.S. consumption	Ratio of imports to consumption
	1,000 metric tons				*Percent*
1988	3,944	385	1,026	4,585	22.4
1989	4,030	593	925	4,362	21.2
1990	4,048	683	962	4,327	22.2
1991	4,121	793	1,028	4,356	23.6
1992	4,042	603	1,163	4,602	25.3
1993:					
Jan.-June	[1]1,893	231	890	2,552	34.9

[1] Production estimate for January-June 1993 based on annualized monthly data.

Source: Compiled from official statistics of the U.S. Department of Commerce, the U.S. Bureau of Mines, and the Aluminum Association, except as noted.

Production

The U.S. aluminum industry is the world's largest producer of primary and secondary aluminum. Primary aluminum production and domestic secondary recovery compose the total domestic output of aluminum. An increasing share of total output (41 percent in 1992 compared to 35 percent in 1988) is represented by secondary aluminum. During the 1988-92 period, recovery of old and new aluminum scrap increased by 30 percent to 2.8 million metric tons[35] and production at U.S. primary smelters reached capacity. New alloy developments and expanded applications in traditional end-use markets, such as packaging and automotive sectors, could reportedly expand U.S. production once aluminum prices improve.

U.S. primary production fluctuated in a narrow range around 4 million metric tons during 1988-92 despite the price decline. Because many smelters have negotiated variable price contracts for such inputs as electricity and alumina, as well as flexible labor agreements, production costs often decline with the price of primary aluminum, extending smelter longevity.

[35] Aluminum Statistical Review for 1992, the Aluminum Association, 1993, p. 31.

Imports

Canada accounts for nearly all U.S. aluminum metal imports (ingot and scrap, primarily UBCs) because of its nearness and extensive ties to U.S. operations (e.g., Alcan, Reynolds) (table 8). During the first six months of 1993, however, Russia emerged as a major import source, accounting for 22 percent (by quantity) of total U.S. imports. Venezuela is a secondary ingot source, and Mexico and Venezuela are secondary scrap sources.

Ingot imports increased by 13 percent during 1988-92 as some Canadian production from new capacity was earmarked for processing by facilities in the U.S. market. Over 80 percent of metal imports were accounted for by ingot, with the remaining portion being scrap.

U.S. Exports

Japan's reliance on imports of primary aluminum and waste/scrap to supply its fabricating sector contributed to its leading position as a U.S. export market, accounting for about 69 percent of U.S. aluminum exports in 1992 (table 9). Canada and Taiwan are secondary U.S. export markets. U.S. exports increased overall in quantity by about 57 percent during this period, but dropped off in 1992

Table 8
Primary aluminum:[1] U.S. imports for consumption, by principal sources, 1988-92, and January-June 1992-93

Source	1988	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (*1,000 metric tons*)						
Canada	([2])	790	825	959	1,057	532	633
Venezuela	([2])	61	77	50	58	30	27
Russia[3]	([2])	([4])	0	0	16	([4])	195
Brazil	([2])	30	39	6	10	5	7
United Kingdom	([2])	([4])	([4])	1	9	3	2
Argentina	([2])	13	3	4	5	1	0
United Arab Emirates	([2])	12	3	3	2	1	2
All other	([2])	18	15	3	5	1	23
Total	[5]1,026	925	962	1,028	1,163	574	890
	Value (*million dollars*)						
Canada	([2])	1,638	1,364	1,329	1,374	693	774
Venezuela	([2])	93	128	67	70	37	31
Russia[3]	([2])	([5])	0	0	16	([6])	209
Brazil	([2])	65	63	10	13	6	9
United Kingdom	([2])	2	2	2	13	3	3
Argentina	([2])	24	6	5	7	2	0
United Arab Emirates	([2])	27	5	4	3	2	2
All other	([2])	46	25	9	8	3	26
Total	2,196	1,903	1,601	1,432	1,509	749	1,057

[1] Excludes remelt scrap ingot.
[2] Country-level detail is provided only for years in which there are actual trade data under the Harmonized Tariff Schedule of the United States (HTS).
[3] Separate statistics for Russia were not collected until 1992. Data presented for Russia during 1988-91 represent those for the Soviet Union.
[4] Less than 500 metric tons.
[5] Includes imports of remelt scrap ingot.
[6] Less than $500,000.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 9
Primary aluminum:[1] U.S. exports of domestic merchandise, by principal markets, 1988-92, and January-June 1992-93

Market	1988	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (*1,000 metric tons*)						
Japan	([2])	445	454	613	416	164	139
Canada	([2])	28	75	60	79	41	40
Mexico	([2])	19	25	34	30	15	16
Taiwan	([2])	27	35	25	21	7	15
Korea	([2])	25	39	21	19	10	9
Thailand	([2])	5	14	8	11	6	4
Hong Kong	([2])	3	2	5	7	2	3
France	([2])	([3])	8	8	5	4	1
United Kingdom	([2])	2	1	2	4	2	([3])
Philippines	([2])	1	3	5	3	1	1
All other	([2])	38	27	12	8	4	3
Total	[4]385	593	683	793	603	256	231
	Value (*million dollars*)						
Japan	([2])	932	787	970	548	218	175
Canada	([2])	76	145	105	121	64	58
Mexico	([2])	44	50	62	60	30	27
Taiwan	([2])	51	46	37	30	12	16
Korea	([2])	51	42	32	26	14	12
Thailand	([2])	10	16	11	14	8	6
Hong Kong	([2])	7	4	8	10	2	4
France	([2])	2	15	13	8	5	1
United Kingdom	([2])	5	2	4	6	3	2
Philippines	([2])	3	5	7	4	2	2
All other	([2])	80	54	25	16	9	7
Total	[4]891	1,261	1,166	1,274	843	367	310

[1] Excludes remelt scrap ingot.
[2] Country-level detail is provided only for years in which there are actual trade data under the Harmonized Tariff Schedule of the United States (HTS).
[3] Less than 500 metric tons.
[4] Includes exports of remelt scrap.

Source: Compiled from official statistics of the U.S. Department of Commerce.

from peak 1991 levels. This decline, reflecting global economic activity, continued during the first six months of 1993 compared to the comparable 1992 period, with a further 10-percent drop in U.S. exports. Because of the significant aluminum price decline during the period, the value of U.S. exports in 1992 remained relatively unchanged from the 1988 level. Aluminum ingot accounted for two-thirds of U.S. exports, with the remainder represented by scrap metal.

U.S. Trade Measures

The rates of duty for column 1 countries and special rates of duty[36] appear in appendix B.[37] Under the U.S.-Canada Free-Trade Agreement, U.S. imports of primary aluminum from Canada enter duty-free. The North American Free Trade Agreement (NAFTA), as implemented by the North American Free Trade Agreement Implementation Act (Public Law 103-182, approved Dec. 8, 1993), provides for the phaseout of U.S. duties over a 10-year period on certain primary aluminum imported from Mexico. The NAFTA became effective for both the United States and Mexico on January 1, 1994. No U.S. nontariff measures are known that affect imports of primary/secondary aluminum and waste and scrap.

Foreign Markets

Foreign Market Profile

U.S. growth in many export markets, such as Canada, Australia, and the European Union (EU), formerly known as European Community, is generally constrained by the competitive strengths of local primary and secondary aluminum industries that tend to serve their respective fabricating sectors. The U.S. industry has made some inroads by investing in the Canadian and Australian primary aluminum sectors, but has generally been limited to joint ventures and/or subsidiaries in the fabricating sector of the European aluminum market.

High energy costs drove the Japanese primary aluminum industry out of business in the early 1980s. Consequently the Japanese industry has made considerable equity investments in smelters throughout the world (generally in the Pacific Basin area) that supply its primary aluminum needs. As a developed industrial nation, the Japanese fabricating sector relies on ingot imports or the local secondary industry to supply the metal needed to serve its customers in the automotive, packaging, construction, and electrical industries. The United States is a major source of waste and scrap for the Japanese secondary industry that produces castings/forgings for the automotive sector and cansheet from UBCs.

In Eastern Europe and Russia, a significant consumer market has yet to emerge in the ongoing economic/political transformation. In the long term, the region is viewed as having much growth potential. However, in terms of the primary/secondary sectors where Russia is a major world producer, the U.S. industry would most likely provide technological and financial assistance rather than export primary aluminum to the East European and former Soviet markets. The U.S. industry reportedly is more interested in developing the higher value-added products sector of these markets through investment.[38]

Foreign Trade Measures

Tariff and Nontariff Measures

The two Canadian rates of duty on imports of primary aluminum from the United States are duty-free and 6.5 percent ad valorem; waste and scrap enters duty-free. Unwrought aluminum and most waste and scrap imports from the United States are subject to a 10-percent rate of duty when entering Mexico. Mexico is obligated to phase out its duties on imports of such

[36] See appendix A for an explanation of tariff and trade agreement terms.

[37] The recently completed (December 1993) GATT Uruguay Round of trade negotiations may result in further reductions in U.S. and foreign duties on the articles covered by this summary. The Uruguay Round schedule of U.S. concessions was not available when this summary was prepared.

[38] USITC staff discussions with industry representatives. Also, see "Russia Extends Invite To Discuss Aluminum," Metals Week, Oct. 18, 1993, p. 1, for example.

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goods from the United States over a 10-year period under the NAFTA.[39]

In August 1993 the EU imposed a quota of 60,000 metric tons on imports of primary aluminum from Russia and from several other former Soviet states through the end of November 1993. The EU has since imposed a 45,000-metric-ton quota on imports from these countries, effective through February 1994.

U.S. Trade Balance

The U.S. trade picture in unwrought aluminum showed a declining deficit from $1.1 billion in 1988 to $179 million in 1991, followed by a significant increase in 1992 to $966 million. The trade deficit grew primarily because of the decline in U.S. shipments of waste and scrap to Japan. The United States generally maintains a deficit in primary aluminum and bauxite and alumina, but maintains a surplus in waste and scrap (table 10).

The U.S. trade deficit with Canada is mostly in the primary aluminum sector, and the deficit remained fairly constant at about $1.4 billion during 1990-92. The trade surplus with Japan declined by nearly 50 percent, to $692 million in 1992, with the slowdown of the Japanese economy and the Japanese purchases of scrap from other regional suppliers. The sustained trade deficit with the Caribbean Basin Economic Recovery Act (CBERA) countries (i.e., Jamaica, Guyana) signifies their continued importance as sources of bauxite and alumina for the U.S. primary aluminum industry.□

[39] The North American Free Trade Agreement was implemented by the North American Free Trade Implementation Act (Public Law 103-182, approved Dec. 8, 1993) and became effective for both the United States and Mexico on January 1, 1994.

Table 10
Unwrought aluminum: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country group, 1988-92[1]

(*Million dollars*)

Item	1988	1989	1990	1991	1992
U.S. exports of domestic merchandise:					
Canada	123	123	213	160	180
Japan	1,125	1,421	1,270	1,300	693
Mexico	71	85	76	91	90
Jamaica	(2)	(2)	(2)	1	(2)
Guinea	(2)	(2)	(2)	(2)	(2)
Venezuela	1	1	(2)	(2)	1
Brazil	1	6	10	10	1
Taiwan	97	129	103	96	54
Guyana	(2)	(2)	(2)	(2)	(2)
Korea	96	70	71	67	45
All other	199	210	155	115	91
Total	1,714	2,044	1,898	1,842	1,154
EU-12	137	130	95	46	25
OPEC	4	7	3	5	6
ASEAN	31	31	32	28	24
CBERA	3	7	6	8	5
Eastern Europe	2	(2)	(2)	(2)	(2)
U.S. imports for consumption:					
Canada	1,927	1,889	1,577	1,505	1,559
Japan	4	4	1	1	1
Mexico	37	26	29	23	38
Jamaica	96	108	111	108	124
Guinea	104	108	126	117	92
Venezuela	122	101	143	73	87
Brazil	113	108	123	71	62
Taiwan	1	(2)	1	(2)	(2)
Guyana	21	26	28	43	53
Korea	(2)	(2)	(2)	(2)	(2)
All other	377	192	114	79	104
Total	2,801	2,561	2,252	2,021	2,120
EU-12	35	17	17	21	35
OPEC	154	132	153	79	91
ASEAN	6	6	7	4	4
CBERA	124	142	144	157	180
Eastern Europe	2	(2)	(2)	(2)	(2)
U.S. merchandise trade balance:					
Canada	-1,804	-1,766	-1,364	-1,345	-1,379
Japan	1,121	1,417	1,269	1,299	692
Mexico	34	59	47	68	52
Jamaica	-96	-108	-111	-107	-124
Guinea	-104	-108	-126	-117	-92
Venezuela	-121	-100	-143	-73	-86
Brazil	-112	-102	-113	-61	-61
Taiwan	96	129	102	96	54
Guyana	-21	-26	-28	-43	-53
Korea	96	70	71	67	45
All other	-178	18	41	36	-13
Total	-1,087	-517	-354	-179	-966
EU-12	102	113	78	25	-10
OPEC	-150	-125	-150	-74	-85
ASEAN	25	25	25	24	20
CBERA	-121	-135	-138	-149	-175
Eastern Europe	(2)	(2)	(2)	(2)	(2)

[1] Import values are based on customs value; export values are based on f.a.s. value, U.S. port of export. U.S. trade with East Germany is included in "Germany" but not "Eastern Europe".
[2] Less than $500,000.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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ALUMINUM MILL PRODUCTS

Production of aluminum mill products[40] and downstream fabricated products[41] is concentrated in a handful of companies in the industrialized Northern Hemisphere. These companies have global operations through individual foreign investments, and through joint ventures and production sharing arrangements with one another and with emerging producers. Although comparative production cost-estimates are unavailable, the U.S. industry is believed to be highly competitive in production of aluminum mill products, as indicated by an increasing global market share of value-added, technologically-sophisticated aluminum mill products; worldwide diffusion of similar process technology, yielding comparable production cost structures; investments that increase capital intensity and labor productivity; and an increasing ratio of exports to net shipments.

Product Coverage and Manufacturing Processes

Aluminum mill products, both alloyed and nonalloyed, are broadly classified into two categories according to the manner in which the final product is formed: (1) wrought or fabricated (i.e., mechanically worked), and (2) castings.[42] There has occurred some blurring of the distinction between the two classifications of "mill" and "fabricated" products because of changes in technology, particularly the adoption of continuous casting.[43]

Two advantages that aluminum possesses over other metals are (1) that it may be fabricated by virtually any metalworking process and (2) that it may be alloyed[44] relatively easily. Aluminum mill products utilize hot metal to produce castings, continuous-cast sheet, rod, and bar. They may also be made by working semifinished forms of aluminum (ingot, tees, or billets) in one of four basic operations: casting, forging, machining, or the plastic deformation of hot or cold metal during rolling, drawing, or extruding operations (see figure 5 and "Manufacturing processes" subheading in the glossary, appendix D). From these operations, mill products are created that can then be shaped into numerous fabricated products (table 11); sheet and extruded products account for about 63 percent of all mill product shipments (figure 6). Table B-1 identifies the sixty-two 8-digit HTS subheadings that cover aluminum products (including primary aluminum and scrap) along with a short description of each.

U.S. Industry Profile

Industry Structure

The U.S. aluminum mill products industry is the largest in the world, as shown in the following tabulation, and its competitive position vis-a-vis foreign competitors is considered to be favorable.

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[40] Aluminum mill products are classified in chapter 76 of the Harmonized Tariff Schedule of the United States (HTS). Aluminum mill products are generally classified in Standard Industrial Classification product codes 3350 and 3355 (certain alloyed bar and rod, wire, strand and cable), 3353 (plate, sheet, and foil), 3354 (certain alloyed bar and rod), 3365 (aluminum and aluminum base alloy castings), 3399 (aluminum powder and paste), and 3463 (aluminum forgings and impacts).

[41] Fabricated aluminum products covered in this summary include aluminum and aluminum alloy pipe and tube fittings, household and kitchen articles of aluminum, structures (including door and window frames and door thresholds), and a residual category of other aluminum articles.

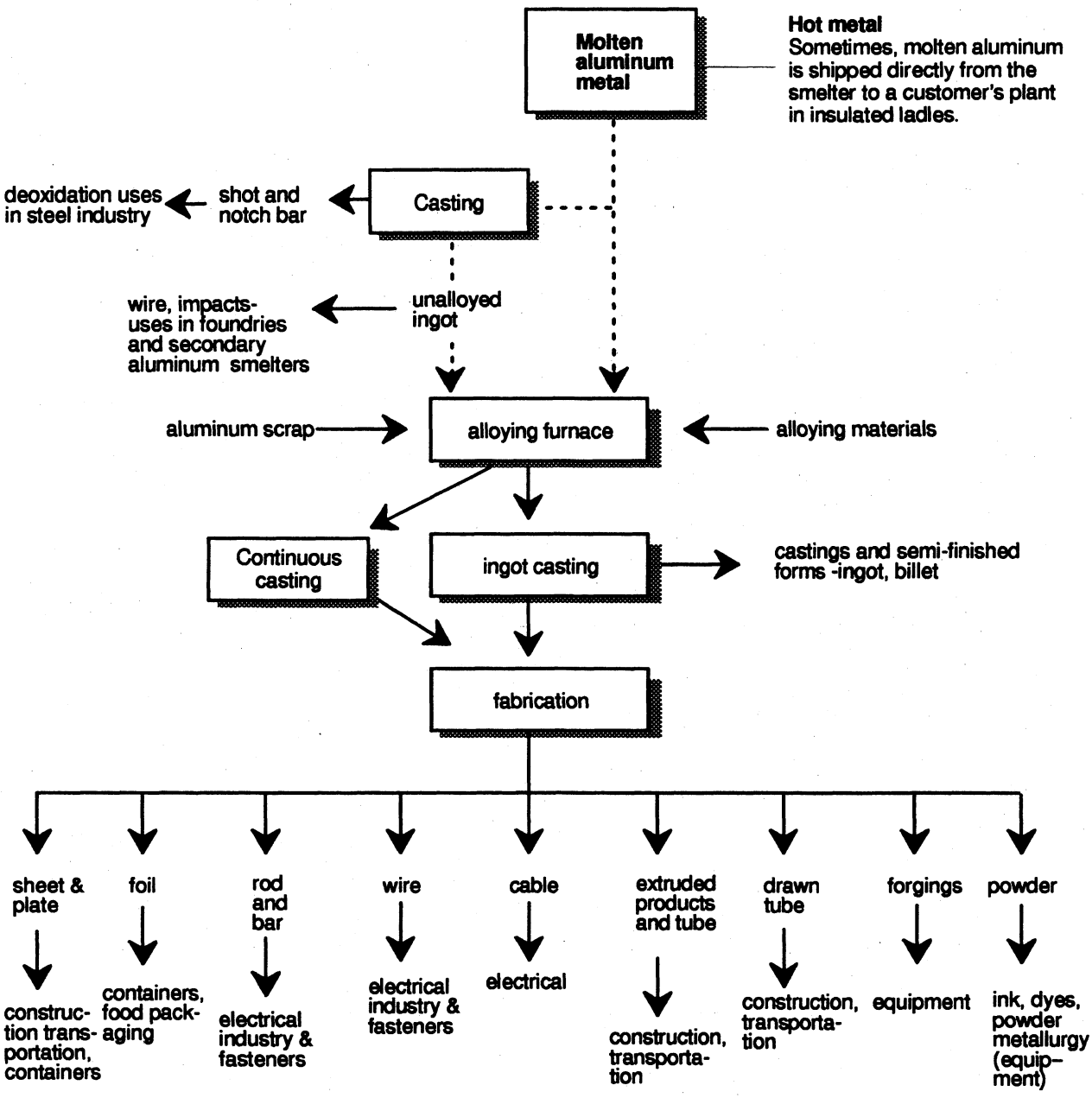
[42] Discussions of aluminum mill products are usually limited to wrought products. Castings are not considered to be mechanically worked, or "wrought" and are formed by pouring a molten metal mixture into a mold, die, or any other shape where the casting is the final form. Moreover, castings (continued...)

[42] (...continued)
are produced in facilities that typically do not produce aluminum mill products. However, for purposes of this discussion, castings are included within the discussion and data on aluminum mill products.

[43] See discussion under "Manufacturing processes" in glossary, appendix D.

[44] Alloying is performed by adding alloying agents (silicon, zinc, copper, manganese, iron, magnesium, titanium, and nickel, for example) to molten aluminum prior to casting. See "Aluminum alloys" subheading in the glossary, appendix D.

Figure 5
Simplified production flowchart for aluminum mill products and enduses



Source: Adapted from Rhea Berk et al., *Aluminum: Profile of the Industry*, p.11

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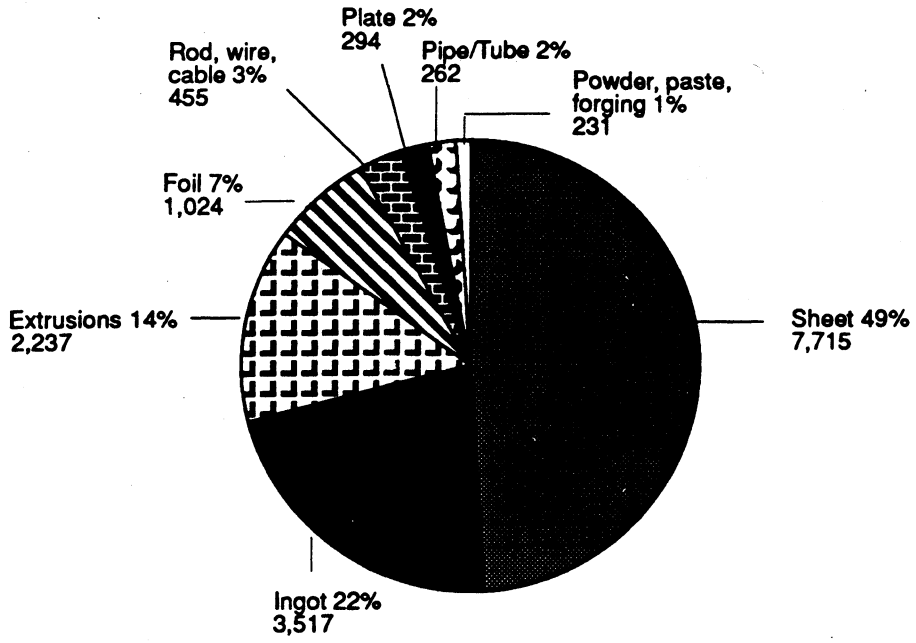
Table 11
Aluminum mill products: Selected enduse sectors and markets by major products

Sector/products primarily used	Markets
Building and construction (sheet/extrusions)	Doors, windows, and accessories Screen frames & screening Siding, roofing, awnings and canopies Buildings and structures Ductwork, gutters Builders' hardware
Transportation (sheet/plate/extrusions/ castings)	Aircraft, helicopters, missiles, and rockets Naval and commercial marine Rail, trailers, and semitrailers Cars, trucks, buses, trailers, and military and other vehicles
Containers and packaging (sheet/foil)	Flexible packaging and semirigid food containers Consumer and institutional foil Beverage cans, ends, lids Other containers
Machinery and equipment (sheet/extrusions/ pipe and tube)	Industrial, agricultural and mining equipment Lithographic stock Irrigation pipe Process industries stock Service equipment and supplies Ladders and scaffolds General components Fasteners and wire cloth Instruments and apparatus
Electrical (sheet/extrusions/ cable)	Electrical, electronics, and communications equipment Power transmission Lighting apparatus

Source: Compiled by USITC staff based on discussions with U.S. Aluminum Association officials.

Figure 6
U.S. domestic shipments of aluminum mill products, by type of product, 1992

(Million pounds and percent)



Source: Compiled from data supplied by the Aluminum Association.

1991 production[1]	*Semifinished aluminum and castings*
U.S. industry	6.1 million metric tons
EU industry	5.44 million metric tons
Japan	3.6 million metric tons
EFTA countries[2]	826,100 metric tons
All other	800,000 metric tons.

[1] World Bureau of Metal Statistics, *World Metal Statistics*, Aug. 1993, p. 13.

[2] EFTA countries include Austria, Denmark, Finland, Norway, Sweden, Switzerland and Yugoslavia.

There were 91 primary and secondary smelters in 1992, supplying primary forms of aluminum to approximately 440 facilities in the United States that produce aluminum mill products and to an additional 735 facilities that produce aluminum die-castings. Most companies, according to industry analysts, are considered forward-looking and are well-capitalized and managed. Integrated fabricators accounted for approximately 64 percent of U.S. production of aluminum mill products in 1992.[45] Integration varies by product line. For example, nearly 100 percent of drawing stock (used for the production of electrical conductor wire) is made by producers of primary aluminum metal. Within the sheet and plate product group, 39 facilities (out of a total of 48 such facilities) are operated by companies that also operate primary or secondary smelters. Thirteen foil facilities (out of 21) are operated by smelters. However, independent

[45] Most integrated fabricators (i.e., subsidiaries or divisions of companies also producing primary aluminum metal) purchase some ingot and other semifinished forms from other primary producers, and to take advantage of arbitrage opportunities in different currencies or geographical markets. USITC staff telephone conversations with industry analysts during Oct. 1993.

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fabricators account for a significant proportion of extruded products. These differences in the degree of integration reflect differences in corporate strategy, industry conditions, entry barriers, and historical development of the fabricating industry.[46] There has been limited industry consolidation. For example, most of the integrated companies withdrew from the electrical conductor segment, and many small aluminum castings producers closed during the 1980s.

Independent fabricators purchase primary forms of aluminum, and roll, extrude, cast, or forge them into finished products. Within the group of independent fabricators, some companies (known as "service centers" or "distributors") perform value-added services for their customers as well as performing a distribution function. Service centers assume price and inventory risk, assure just-in-time delivery for smaller quantities, and perform such services as cutting to length, slitting, drawing, and heat-treating.

According to the U.S. Aluminum Association, distributors and service centers accounted for approximately 36 percent of shipments of aluminum mill products, excluding castings, in 1992.[47] Distributors' market shares vary by product; they may not carry some products such as foil, forgings and powder, and their market share within the extrusions' segment is relatively low, because these products are typically produced to customized grades and specifications.[48] However, distributors and service centers have expanded their participation in basic and commodity grades of sheet, strip, rod and bar. Distributors' shipments accounted for nearly 65 percent of total U.S. shipments of plate; 53 percent of rod, bar, and wire; and 39 percent of sheet in 1992.

Although the industry segment that smelts and refines primary aluminum tends to be geographically concentrated in areas of relatively inexpensive electricity generation, the location decision is different for the industry segment producing aluminum mill products. Although many integrated and independent fabricators are close to refiners, others are close to end-markets or consumers. Reasons for this may include lower transportation costs and increased service to the customer (including technical service during the end-product design phase). Producers of aluminum mill products are in nearly every state, although generally concentrated in industrialized areas of the Northeast, Midwest, South, and Southern California (table 12).[49]

Research and Development

Producers of aluminum mill products focus on research and development (R&D) that tends to be product-related, in that they strive to develop new alloys and more technically-sophisticated aluminum mill products.[50] Such R&D, by exploiting aluminum's physical and mechanical properties, helps aluminum producers to retain and even expand markets for aluminum at the expense of other materials. These efforts also are part of a larger effort by several integrated producers to alter their product mix, by expanding the proportion of specialty grades and depending less on commodity-grade products.[51]

Integrated producers with rolling operations for sheet, foil, and plate account for the bulk of R&D expenditures. To some extent, technical requirements for more sophisticated products pose entry barriers for small producers. During the past decade, integrated producers have devoted most of their efforts toward higher value-added products for the automotive, packaging, and aerospace industries where profitability

[46] A review of corporate strategies and product mix is given in Office of Technology Assessment, Nonferrous Metals: Industry Structure Background Paper, Sept. 1990, p. 32.

[47] Aluminum Association, Aluminum Statistical Review for 1992, p. 8. A significant proportion of castings represents captive production by endusers in the automotive, aerospace, and machinery and equipment industries.

[48] USITC staff telephone conversations with industry officials during Sept. and Oct. 1993.

[49] Based on the Aluminum Association, U.S. Aluminum, Industry Plant Directory, March 1992, and Aluminum Statistical Review for 1992, April 1993.

[50] Pechiney (France) is reported to have significantly expanded its heat-treating, milling and machining, control and rolling capability and capacity, including introducing new alloys, in response to specific aircraft designs, for example. See, "Plate Investment Keeps Pechiney Flying High," Metal Bulletin Monthly, Apr. 1991, p. 33.

[51] Alcoa's expansion of its Davenport, IA, sheet and plate plant provides an example of several of these trends toward increasing the proportion of specialty grades, upgrading alloy-production capability, and focusing on automotive products. See, Melanie Lovatt, "Alcoa Aims at Markets in the Sky-and on the Road," Metal Bulletin Monthly, Dec. 1991, pp. 17-21.

Table 12
Aluminum and aluminum mill products: Facilities and geographic concentration by state in 1985 and 1992

Product	Number of facilities		1992	
	1985	1992	Geographic concentration	Number of facilities
Primary ingot	30	23	Washington	7
			Oregon	2
			Kentucky	2
			New York	2
Secondary ingot	69	68	California	11
			Ohio	8
			Tennessee	7
			Indiana	6
			Alabama	6
			Illinois	4
Sheet & plate	44	56	Illinois	9
			Kentucky	5
			Ohio	5
			North Carolina	4
			West Virginia	4
Foil	26	21	Kentucky	4
			Arkansas	2
			Illinois	2
			North Carolina	2
			Tennessee	2
Drawing stock	18	10	Missouri	2
			Washington	2
Bare wire	61	21	Alabama	2
			Connecticut	2
			Kentucky	2
			Massachusetts	2
			Pennsylvania	2
ACSR & bare cable	16	14	Illinois	3
			Kentucky	3
			Pennsylvania	3
Extrusions	217	190	California	24
			Ohio	18
			Indiana	12
			Michigan	12
			Texas	12
			Pennsylvania	11
Powder & paste	19	16	New Jersey	3
			Pennsylvania	3
			Indiana	2
			Texas	2
Forgings & impacts	61	60	California	18
			Ohio	6
			Pennsylvania	5
Castings	([1])	735	Ohio	90
			California	75
			Illinois	56
			Pennsylvania	48

[1] Not available.

Source: Compiled by USITC staff from various industry publications.

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and technical requirements are relatively high. A great deal of this product-related R&D is performed in strategic partnerships with equipment companies and consumers, or with other aluminum companies (see section on *"Globalization"*).

With respect to manufacturing process, R&D is focused on expanding production of higher quality products at lower cost. Areas of emphasis include (1) expanding utilization of continuous casting, and (2) improving process linkage, chiefly computer integrated manufacturing and statistical process control.[52] The magnitude of potential benefits associated with these efforts is reflected in Alcoa's reduced costs between 1990 and 1991 of over $400 million, including the reduction of inventory costs by 15 percent and of ingot conversion costs by 20 percent. Some of these savings were achieved by equipment improvements not specific to Alcoa. For example, the industry has generally improved reheating and tempering furnaces; installed better casthouses and expanded the use of electromagnetic stirring; accomplished faster roll changes on plate rolling mills; expanded width capability of sheet rolling mills; achieved better tempering of mill products; and increased the use of continuous casting.[53]

Environmental Considerations

Although environmental considerations associated with the manufacture of aluminum mill products are less significant than those in the primary aluminum segment, costs associated with safety and environmental regulations (primarily the disposal of salt slag generated by foundries)[54] have contributed to a decline in the number of small foundries. The fabricating industry recycles such discarded process solutions as waste water, greases, and oils, and it controls off-gases generated during reheating, casting, and rolling or extruding operations.

Pricing Practices

Most aluminum mill products generally are considered commodity products, competing primarily on the basis of price. The bulk of such products are sold in commonly accepted size, grade, and alloy designations. Mill products are usually sold on a pricing system that is based on the cost of primary or secondary aluminum[55] plus an added charge that reflects the fabrication value added by the transformation process. Such additional charges may increase the cost of aluminum mill products several cents to several dollars per pound depending on the alloy and product. This pricing system and the extensive participation of independent distributors, service centers, and trading firms suggests that buyers have numerous suppliers, tend to purchase standard sizes and alloys, and are interested primarily in minimizing their costs.

Although there is no terminal market contract for aluminum mill products, their prices are influenced indirectly by changes in the LME contract price for aluminum ingot. Moreover, primary producers reportedly transfer metal internally to aluminum mills at their cost of producing primary metal, which generally tracks the prevailing aluminum price. Because of this, some industry officials have argued that primary and secondary aluminum contracts establish the basis for premium/discount structures that apparently are used as the basis on which to price most aluminum mill products. Casters and distributors are more affected by changes in primary aluminum because of price transmission and their greater reliance on the spot market.

Some grades of aluminum mill products are not commodity-type products, and are not sold on a metal-based pricing system. With these products, specialty or customized alloy designations, or customized size and shape features require a closer customer-supplier relationship. In addition, long-term contracts tend to mitigate the short-term effects of price

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[52] For a description of how these aspects of quality control were implemented, see "Real-Time Process Windows Help Alcan Set New Rolling Standards," 33 Metal Producing, Jan. 1993, pp. NF-6-NF-8. For a description of improvements in extrusion technology, see Timothy M. Erdman, "Aluminum Extrusions: Not the Same Old Story," 33 Metal Producing, Apr. 1993, pp. NF-2-NF-4.

[53] Paul O'Neill, "True Innovation, True Values, True Leadership," Industry Week, Apr. 19, 1993, p. 25. Also see Lovatt, "Alcoa", p. 19.

[54] These environmental concerns affect foundries differently depending upon their process. For example, foundries in England use a salt-free process and are not affected by recycling or salt slag disposal.

[55] These include molten aluminum plus master alloys, or semifinished forms of aluminum or aluminum-based alloys of tees, slab, ingot, and billet.

changes in primary aluminum.[56] There is little substitution between these niche products and the more common standardized sizes and alloy grades. These products command a higher profit margin than do the bulk of aluminum mill products, although they account for a small percentage of overall production.

Consumer Characteristics and Factors Affecting Demand

Aluminum mill products are utilized in a multitude of industries and products, and demand is strongly affected by industrial output and consumer spending. Industry analysts forecast continued consumption growth of approximately 2 percent to 3 percent per year based on increased market share in historical lines and on an expanded share in certain new uses, primarily in the automotive industry.

Consumers of aluminum mill products range in size from small companies producing for market niches or regional markets to large multinationals (and in some cases, multimetal consumers). Consumer market power varies by market segment. In the aerospace, automotive, and beverage container industries, there are relatively few consumers. At the other end of the spectrum, producers of aluminum extrusions serve numerous geographic or product-segmented markets. Consumers of aluminum mill products produce aircraft, automobiles, trucks, and freight cars, and their parts in the transportation sector; wire and cable, and building components used in construction; containers and packaging used in the food and beverage industry; and parts used in machinery, equipment and consumer durables.

Aluminum's mechanical and physical properties (particularly its light weight, electrical and thermal conductivity, and corrosion resistance), recyclability, and ease of fabrication have allowed aluminum mill products to capture market share from other competing metals, such as steel and copper. Some recent substitution is cost-based; because of declining prices of primary aluminum, aluminum products are more cost-competitive with other metals. Producers, through product R&D and better production efficiencies, have also achieved cost savings. However, some potentially large consumers lack experience using aluminum or its use would necessitate reconfiguring these companies' production processes. Additionally, higher prices and greater price volatility have posed impediments to increasing consumption of aluminum metal.

The largest enduse segment for aluminum is the packaging industry, particularly beverage containers (figure 7). Aluminum sheet is the primary material in the container sector, accounting for approximately 97 percent of beverage containers produced in the United States. Consumption of sheet products used in beverage containers is expected to increase about 2 percent annually with increases in beverage consumption generally,[57] although less aluminum is being used per can now than in past years.[58]

The market share of aluminum sheet is also expanding within the cookware segment; foil consumption is increasing among producers of single-serving, disposable, consumer food items. For both uses, the impermeability, low cost (in relation to the overall cost of the item), ease of formability, and conductivity of aluminum are important in consumer purchasing decisions. Equally important among certain consumers is the perception that aluminum beverage cans possess an established recycling infrastructure and yield a payback on individual and municipal efforts.

In the transportation sector, the light weight of aluminum (yielding improved fuel efficiency), corrosion resistance, and lower tooling costs for extruded components have also contributed to gains in market share. However, its lower tensile strength when compared with steel, higher welding cost, and the potential costly requirements to reconfigure production processes by automakers are drawbacks to more

[56] USITC staff interviews with industry officials during Sept. 1993.

[57] "Beverage Cans Blow the Lid Off US Aluminum Exports," Journal of Commerce, Aug. 28, 1992, p. 1A.

[58] Trade press reports indicate that canmakers are switching to smaller lids in a continuing effort to light-weight metal beverage containers; average aluminum beverage can weights declined from nearly 45 pounds per 1000 containers in 1974 to less than 32 pounds per 1000 containers in 1992 due to thinner walls and smaller lids. Recent anecdotal accounts indicate that steel consumption in beverage cans continued to decline in 1992 and 1993. Although the U.S. market is nearly saturated (approximately 97 percent of beverage cans are made of aluminum), expansion of aluminum's market share is expected in Japan and Europe.

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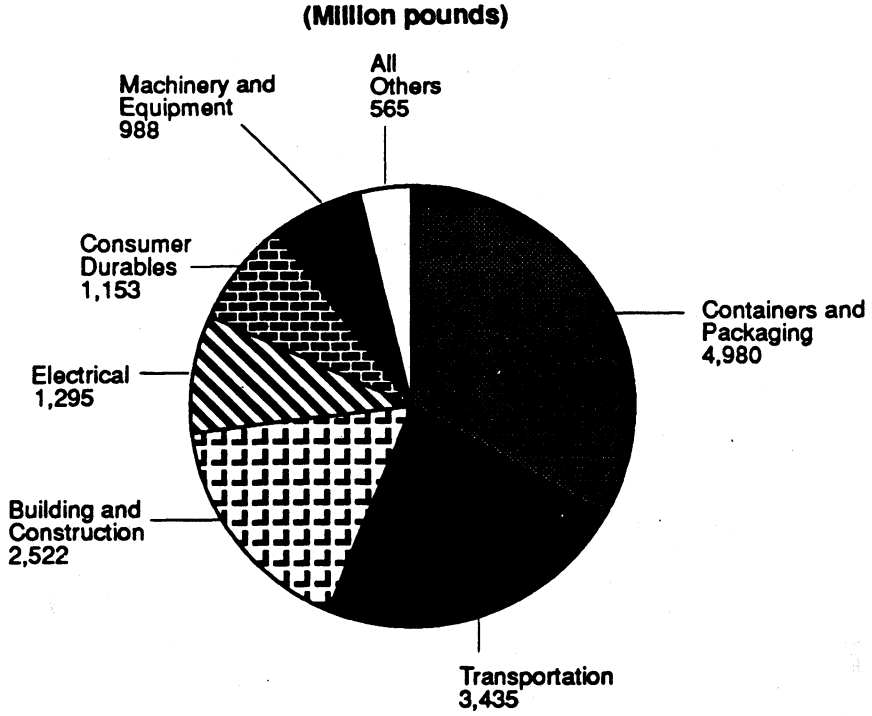
Figure 7
U.S. domestic shipments of aluminum mill products, by enduse markets, 1992



Source: Compiled from data suplied by the Aluminum Association.

widespread adoption.[59] Efforts to expand market share are the impetus for many joint ventures and strategic partnerships between the aluminum companies and automobile producers. Industry projections anticipate more uses of aluminum (heretofore limited to a few vehicle components) in exposed panels and frames, possibly doubling aluminum use in automobiles by the year 2000.[60] Also within the transportation sector, aluminum sheet and plate have won market share from steel in railroad car construction. Although the price per railcar is higher than for similar cars made of steel (reportedly by $3,000 to $5,000), railroads achieve fuel savings due to its lighter weight. In addition, the corrosion resistance of aluminum allows its use for the transportation of high sulfur coals.

Globalization

Globalization by U.S. and foreign fabricating firms is spurred by the desire to gain access to low-cost primary metal, technology, downstream consumers of aluminum mill products, and to gain market access by

[59] Reportedly the commodity nature and volatility of aluminum pricing also poses an impediment to development of the all-aluminum vehicle. See, "The Aluminum Question," Automotive Industries, Feb. 1993, p. 52. Also, "Ford Executive Counsels Aluminum Producers on Auto Industry," Journal of Materials and Metals, Sept. 1992, p. 42.

[60] Bob Regan, "US Vehicle Aluminum Reused," American Metal Market, Sept. 24, 1992, p. 6. Also, "Automakers Seen Doubling Aluminum Use Over 13 Years," Journal of Commerce, Feb. 17, 1993, p. 9A. Part of this growth is expected to come from increased usage of (continued...)

[60] (...continued)
aluminum alloys in heat exchangers and radiators, where aluminum competes with copper and brass.

avoiding tariff and nontariff barriers. For example, U.S. companies have formed alliances with Japanese companies to gain access to the Japanese market and technology; most U.S. and foreign producers of aluminum mill products have formed alliances with automakers seeking to expand aluminum use in the automotive sector; and several U.S. fabricators have made equity investments in Hungarian, Russian, and South American packaging and automotive parts plants. Similarly, foreign companies have formed strategic partnerships or have established manufacturing facilities in the United States to gain access to the U.S. market. A list below of selected joint ventures and strategic partnerships shows that R&D partnerships targeting the automotive industry are widespread, and that multinational aluminum companies are expanding into emerging capitalist and developing economies (table 13).

Foreign Industry Profile

Most of the world's production and consumption of aluminum mill products is concentrated in a handful of industrialized countries--the United States, Japan, Russia, Germany, Italy, France, and the United Kingdom. This concentration is largely explained by patterns of development in aluminum smelting and consuming industries, production scale economies, and vertical integration among the multinationals that produce aluminum.[61] Although certain developing countries have competitive aluminum mill products industries (Brazil, Venezuela, United Arab Emirates, for example), they are small in terms of output compared with the industries in the industrialized countries. Moreover, without a developed domestic market, producers of low-margin fabricated aluminum products must often export, facing stiff tariff barriers[62] in the industrialized world. Figure 8 shows the global distribution of consumption of aluminum mill products among regions in 1992.

[61] These companies include Alcoa (USA), Alcan (Canada), Kaiser (USA), Reynolds (USA), Pechiney (France), VAW (Germany), and Alusuisse (Switzerland).

[62] Tariffs on aluminum mill products are substantially higher than on primary or secondary aluminum, and tariffs on value-added (or technically more difficult or differentiated) aluminum mill products are higher than for commodity-grade products.

Canada

Alcan Aluminium dominates the Canadian aluminum mill products industry, and is considered a low-cost producer of ingot at several facilities, mainly in Quebec. Alcan is export-oriented; most ingot is shipped to Europe and to the United States. Alcan also has extensive foreign investments in refining and producing aluminum mill products outside of North America, targeting, for example, the production of sheet and extrusions in Europe and India. One other smaller producer of aluminum mill products is in Quebec, at Becancour, where Reynolds Metals (USA), one of the partners, produces rod and bar for export.[63]

Western Europe

Europe has several major producers of a wide range of aluminum mill products, including Pechiney (France), Alusuisse (Switzerland), Hoogovens (Netherlands), VAW (Germany), and British Alcan (United Kingdom). Downstream integration into the production of mill products and distribution are parts of overall business strategies for these companies and there is extensive cross-border investment in primary, secondary, and mill products production facilities. In addition, there are several smaller producers of aluminum mill products, including sheet and foil (the Spanish producer, Inespal, for example), as well as numerous companies that produce castings and extrusions.[64] Reportedly, Alusuisse's business strategy calls for a partial withdrawal, if not complete cessation, from primary metal production and a focus on specialized, high-value aluminum mill products. Hoogovens is one of few steel companies with aluminum involvement; the company produces primary

[63] The smelter is equally owned by Reynolds, Pechiney, Alumax, and Albecour (an arm of the provincial government). Reynolds operates a mill adjacent to the Becancour facility, producing approximately 60,000 metric tons per year of continuous cast bar and rod. USITC staff interview with company officials during Sept. 1993.

[64] Several of the extrusion companies are subsidiaries of U.S. multinationals, illustrating the substantial amount of cross-border investment in aluminum mill products production. For example, Reynolds' subsidiaries include Reynolds Aluminium Holland (two facilities); Alcoa and Alumax produce extrusions in the United Kingdom; and other European producers operate extrusion presses and foil rolling mills outside of their home countries.

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Table 13
Aluminum mill products: Selected joint ventures, strategic partnerships, and cooperative research and development in aluminum products by region and country, companies, and enduses

Region/country	Companies involved	Product or industry/enduse
North America		
	SsangYong U.S.A. Inc. (Korea) Innovation Group Ltd. (U.S.)	Nanam Now Innovation Group formed joint venture in March 1993 for aluminum cookware product development and marketing under the brand name Innova.
	Meyer Manufacturing (Hong Kong)	Hong Kong cookware manufacturer opened a new aluminum cookware plant in California in April 1993 to serve the professional cookware markets in California and Mexico.
	Kaimei Electronics Corp. (Taiwan) North American Capacitor Co. (U.S.)	Kaimei and North American (formerly Mallory Capacitor Co.) began to jointly market miniature aluminum electrolytic capacitors under the Mallory/Jamicon label in February 1993; targets OEMs in the United States, Canada, and Mexico.
	Nippon Chemi-Con (Japan)	Purchased Sprague Technologies' Lansing, MI, factory to form Chemi-Con Lansing; produces aluminum electrolytic capacitors.
	YKK AP America (Japan)	YKK opened a new plant in Dublin, GA during November 1992 that produces anodized aluminum extrusions for architectural applications.
	Ford Motor Co. Alcan (Canada)	Joint research, begun late 1992, to develop light-alloy fenders for new Taurus line and aluminum sheet for car body applications.
	Doehler-Jarvis (Germany) KS Aluminum Technologie	Two German companies formed a joint venture during 1992 to produce aluminum auto parts, including transmissions, for sale to Ford Motor.
	General Motors Alcan (Canada)	GM and Alcan formed a strategic partnership in 1992 to research weldable and bondable sheet for GM's electric car program; GM is reportedly working with other aluminum producers on extrusions for space frames and structural stampings.
	Altek Automotive Castings (Alcan Aluminum, Canada Italy) and Teksid, sub. of Fiat,	Two companies formed joint venture in 1993 to manufacture engineered aluminum castings for the automotive industry.
EC/CEE/CIS		
EC.....	Hayes Wheels International Nova Hut AS Ostrava (Czech Republic)	Joint venture to sell fabricated aluminum wheels to BMW AG (Germany).
	BMW (Germany) Hydro Aluminum Automotive (Norway)	Joint research on automotive applications for extruded aluminum structures.
Hungary.....	Alcoa (U.S.) Hungalu (Hungary)	Alcoa and Hungalu formed joint venture to produce semifinished, rolled, and extruded forms of aluminum and certain processed products in Hungary in December 1992. Alcoa's and Hungalu's European subsidiaries have joint marketing and sales responsibility.
Russia.....	Reynolds Metals (U.S.)	Aluminum company provides technical support to Russian producer for production and export sales of aluminum foil.
	Reynolds Metals (U.S.)	Aluminum company joint venture with castings producer in St. Petersburg.

Table 13--Continued
Aluminum mill products: Selected joint ventures, strategic partnerships, and cooperative research and development in aluminum products by region and country, companies, and enduses

Region/country	Companies involved	Product or industry/enduse
South America		
Argentina.....	Alcan (Canada) Aluar Aluminio (Argentina)	Joint venture formed in 1993 by merging aluminum fabricating subsidiaries; targets Argentina and surrounding countries; also to market products from Alcan's Brazilian and Uruguayan subsidiaries.
Pacific		
Japan.....	Hayes Wheels International	Partnership to jointly export fabricated aluminum wheels formed in Nissan Motors 1993.
	Reynolds Metals Co. (U.S.) Mitsubishi (Japan)	Global joint venture formed in 1992 for joint development of automotive extrusions.
	Reynolds Metals Co. (U.S.) Sumitomo Light Metal Industries Ltd. (Japan)	Partnership formalized in December 1992 for automotive sheet.
	Kaiser Aluminum (U.S.) Kawasaki Steel Furukawa Aluminum	Partnership formalized in October 1992 to develop automotive body and sheet, extrusions (space frames), castings and forgings.
	Alcoa (U.S.) Kobe Steel	Partnership formed to conduct joint research and development and market canstock; automotive sheet, extrusions, castings, forgings.
	Kawasaki Steel-Furukawa Aluminum Nippon Steel-Sky Aluminum NKK-Mitsubishi Aluminum Nippon Steel-Showa Aluminum-Nippon Light Metal; Sumitomo Metal Industries-Sumitomo Light Metal Industries.	Joint research and development, production and automotive sales between Japanese steel companies and Japanese aluminum companies.

Source: Compiled by the staff of the U.S. International Trade Commission from various articles appearing in American Metal Market, Metal Bulletin Monthly, Journal of Commerce, Light Metal Age, HFD, and others.

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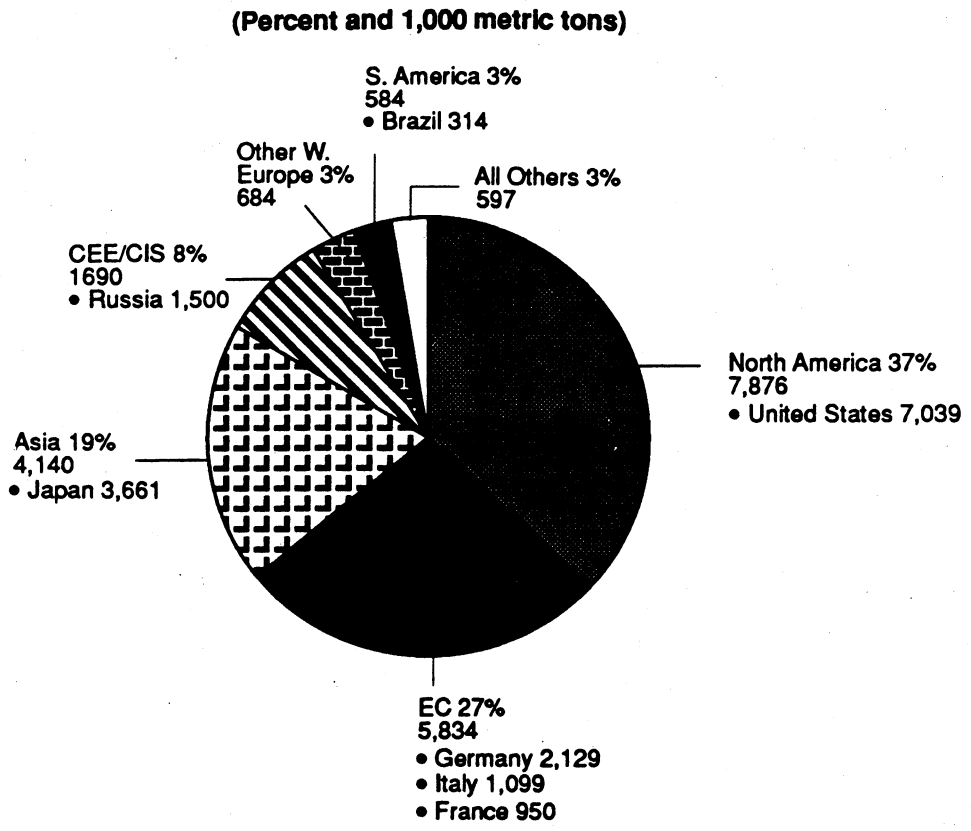
Figure 8
Apparent world consumption of aluminum, by regions and selected countries, 1992



Source: Compiled from data supplied by the Aluminum Association.

aluminum, flat-rolled products, and extrusions in Germany, Canada, Belgium, and the Netherlands.[65]

The Russian Federation (Russia)

Production of aluminum mill products in the territory of the former Soviet Union is concentrated in Russia where four large rolling mills specialize in the supply of certain flat-rolled products (mostly hard alloys). There are five other facilities that reroll sheet and plate into strip and foil, and produce extrusions, forgings, and other fabricated products. The Russian industry is said to have some new, modern equipment, and high capability. Although the industry was previously well-funded through the Air Defense Ministry of the former Soviet Union, it currently operates independently of the Russian government and government ministries.[66]

With the significant decline in both military and nonmilitary procurement, there has been a decline in domestic consumption of aluminum of over 40 percent.[67] Another problem is that the mill products and fabricated segments of the industry no longer have priority call on primary metal and have felt shortages of inputs as well as capital.

Several foreign companies have expressed some interest in working with the Russian industry. Reynolds

[65] "Hoogovens Aluminium Sorts Out Its Semis," Metal Bulletin Monthly, Apr. 1993, p. 55.

[66] Horst D. Peters, "An Overview of the CIS Aluminum Fabricating Sectors--Current and Future Potential," speech at Metal Bulletin's 8th International Aluminium Conference in Montreal, Sept. 14, 1993, and USITC staff conversations with industry officials.

[67] Ibid.

reportedly has formed a joint venture with an Italy-based financial institution to provide technical expertise and capital to the rolling mill at Sayansk and to participate in exporting sheet and foil. Reynolds also reportedly formed a joint venture with a St. Petersburg casting company to fabricate aluminum alloy wheels for autos.

Gulf Cooperation Council (Persian Gulf)

Aluminum mill product production in the six-nation Gulf Cooperation Council[68] is low, but rising. Because of inexpensive electricity and ample access to inexpensive primary metal, these producers are believed to be competitive in many product lines, although they may not be able to produce all types of aluminum mill products. Gulf producers apparently operate below capacity, mainly because of a lack of local consumption, which, however, is rising. Several facilities were damaged during the 1990-91 Persian Gulf conflict. There are eight extrusion plants with an annual capacity of approximately 50,000 metric tons, most of which is consumed locally by over 50 local fabricators. One aluminum rolling mill, Garmco, produces about 60,000 metric tons per year of sheet and cold-rolled coiled products, the bulk of which is exported to countries in the Far East (over 50 percent in 1991), the United States, and Europe; reportedly, canstock is the only significant growth market open to Garmco, but the rolling mill is limited to certain gages. There are five facilities that produce rod and cable in the Gulf (about 30,000 metric tons per year) to supply cable producers in Saudi Arabia, Dubai, and Kuwait.

Japan

The industry in Japan depends on imported ingot. However, Japanese fabricators have formed an extensive network of foreign joint ventures, cross-relationships, and production-sharing agreements that provide Japanese producers with aluminum feedstocks at competitive world prices. Additionally, Japanese producers have formed an extensive network of relationships and partnerships with equipment producers and consumers (including extensive steel/aluminum partnerships that target automotive sales) to ensure their competitiveness in terms of service.[69]

There are seven major producers of aluminum mill products, which are multimetal companies linked to Japanese trading companies that provide a source of ingot. These seven companies are, by quantity of production in 1992, Kobe Steel, Sumitomo Light Metal, Furukawa Aluminum,[70] Mitsubishi Aluminum, Sky Aluminum, Nippon Light Metal, and Showa Aluminum. These companies operated 18 plants in 1991, producing 95 percent of all domestic-origin flat-rolled products and extrusions. Three other companies produce aluminum mill products in Japan; in addition, a great many other companies produce castings. Production of flat-rolled products, extrusions, and castings was approximately equal in each fiscal year of 1990 and 1991, totaling 3.8 million metric tons.

U.S. Market

Consumption

Consumption levels during 1989-93 reflected changes in net shipments due to fluctuating end-use demand and increasing U.S. exports. U.S. consumption was initially lower because of reduced demand in transportation, packaging, and construction, and then recovered as demand in those sectors picked up; military spending added a boost to aluminum consumption during 1990-91, partly in response to Gulf-area military operations.

The competitiveness of the U.S. aluminum mill products segment is considered high. Import penetration fluctuated in a narrow range between January 1989 and June 1993 (table 14). Exports increased in response to higher foreign demand, particularly in Canada, Mexico, and Venezuela.

[68] This quasi-political group is composed of Saudi Arabia, Oman, Qatar, Bahrain, Kuwait, and the United Arab Emirates.

[69] Paul Millbank, "Japan--Producers Bask In Growth and Opportunity," Metal Bulletin Monthly, Dec. 1991, pp. 10-13.

[70] Furukawa Electric recently merged its two subsidiaries, Furukawa Aluminum and Fukui Atsuen (Rolling) Co. as a business strategy focusing more on automotive products and other transportation goods. "Three Japan Companies Merging," American Metal Market, Mar. 2, 1993, p. 7.

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Table 14
Certain aluminum products:[1] U.S. domestic shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1989-92 and Jan.-June 1992-93

Year/period	U.S. domestic shipments[2]	U.S. exports	U.S imports	Apparent U.S. consumption	Ratio of imports to consumption
	1,000 metric tons				Percent
1989	6,654	383	441	6,712	6.6
1990	6,377	488	465	6,354	7.3
1991	6,158	590	373	5,941	6.3
1992	6,608	615	414	6,407	6.5
Jan.-June					
1992	3,292	342	199	3,149	6.3
1993	3,392	344	224	3,272	6.8

[1] Aluminum mill products and aluminum castings. Castings' data are estimated by the staff of the U.S. International Trade Commission.
[2] Shipments data for castings include captive consumption.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Consumption in the United States is expected to rise in the automotive, beverage container, and construction sectors where demand elasticity is considered high and where consumption is expected to outpace GNP growth; also important will be government spending on infrastructure. However, in some aerospace and defense-related applications, consumption is stagnant or declining because of reductions in U.S. defense spending and reduced demand for mid- and large-sized commercial aircraft.[71]

Shipments

Fluctuations in consumption and production tend to occur in response to general economic conditions, although several industry analysts suggest that net shipments will continue to grow at approximately 2 percent to 3 percent per year during the 1990s, in line with growth in domestic consumption. Bar and rod, wire, cable, and castings shipments show the greatest variability, possibly because of their linkages to highly cyclical end-use industries such as automotive, construction, and electrical transmission. U.S. net shipments of flat-rolled aluminum mill products, bar, powder and paste increased slightly between 1989 and 1992, while shipments of other products decreased. Most product shipments declined between interim periods 1992-93 (table 15).

Imports

U.S. imports of aluminum mill products fell almost 20 percent by value, but only about 6 percent by quantity during 1989-92 because of reduced prices for primary forms of aluminum. This decline was led by lower imports of aluminum flat-rolled products (sheet, plate, strip, and foil) which fell 22 percent by value. Imports of flat-rolled mill products accounted for nearly 89 percent of total aluminum mill product imports. Changes in import levels varied among product groups, with some more adversely affected by the economic downturn than others; imports of aluminum wire and strand, used in electricity transmission, declined nearly 53 percent, for example (see trade tables in appendix C).

Canada, Japan, and Germany are primary sources of U.S. imports, particularly of flat-rolled products, and

[71] For example, aerospace use of aluminum sheet and plate (mostly heat-treatable and aluminum-lithium alloys) declined by 22 percent, to 288 million pounds during 1989-91, and is not expected to increase in the near term. "Aerospace: Aerospace Seems Stalled On The Runway," Metal Center News, Jan. 1993.

Table 15
Aluminum mill products: U.S. shipments of selected products, 1989-92 and January-June 1992-93

(1,000 metric tons)

Product	1989	1990	1991	1992	Jan.-June 1992	Jan.-June 1993
Sheet/plate	3,453	3,408	3,402	3,634	1,829	1,770
Foil	402	390	381	464	220	245
Bar/rod[1]	48	84	100	58	47	35
Wire/cable[2]	361	286	288	298	167	148
Extruded shapes	1,073	1,012	882	1,015	472	555
Powder/paste	42	44	44	43	20	24
Forgings/impacts	72	70	63	62	31	38
Castings[3]	995	968	866	918	504	433
Pipe and tube	130	132	132	119	74	70

[1] Includes electrical-conductor grades.
[2] Includes conductor, non-conductor, cable, and insulated wire and cable categories.
[3] Data for January-June 1992-93 are estimated by staff of the U.S. International Trade Commission.

Source: Compiled from data supplied by The Aluminum Association and U.S. Bureau of the Census, except as noted.

pipe and tube. In contrast to the general trend for flat-rolled products during the period, imports of such products from Canada, Germany, Sweden, and Spain increased slightly; some of these imports may have been channeled to joint venture and marketing partners in the United States. Important import sources with respect to bars, rods, and aluminum wire and cable, include Venezuela and Slovenia (a former republic of Yugoslavia). Most U.S. imports of aluminum mill products from Venezuela are of electrical conductor grades channeled to the producer's subsidiary facility in the United States. Imports from Slovenia of mechanical grades of rod, used for fasteners and parts, were first recorded in 1992. They increased significantly in January-June 1993, compared with the same period in 1992, reflecting the exporter's need for convertible currency and closure of other outlets during the Yugoslav civil war.

Several countries have established niche markets in the United States. Several European and Japanese firms export aluminum foil for lithography or decorative purposes. To some extent, this may explain why imports of aluminum foil, used in capacitors and lithographic printing, increased by 7 percent ($189 million) between 1989 and 1992. Some of Japan's exports of castings and sheet products are utilized by keiretsu auto transplants.

Imports under GSP duty-free provisions totaled about $36 million in 1992, about 3 percent of total imports of aluminum mill products. The main beneficiary countries were Mexico, Brazil, Venezuela, and Slovakia. Venezuela has been graduated from GSP treatment for certain bar, rod, and electrical conductor wire but remains eligible for benefits on other items. Imports of aluminum mill products other than foil under HTS provision 9802.00.60 had a total U.S. import value of $245.8 million in 1992 of which the duty-free portion (representing the value of the reimported goods that were produced in the United States) was $208.4 million, down slightly from 1991. Additionally, about $10.8 million (customs value) and $4.9 million (U.S. value) of imports of aluminum foil were entered under the provision 9802.00.60 in 1992.

U. S. Exports

U.S. producers' exports of aluminum mill products increased during the last 5 years. Many firms found their ability to compete in foreign markets improved, primarily because of the falling value of the U.S. dollar. The overall ratio of exports to U.S. net shipments increased by 4 percentage points to 9.3 percent during 1989-92, and remained at a high level, 10.1 percent, during the first 6 months of 1993. Exports of flat-rolled products (sheet, plate, and strip)

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and bars, rods, and profiles increased 77 percent to 485,749 metric tons (valued at $1.3 billion), and 14 percent to 48,156 metric tons (valued at $162 million) during 1989-92, respectively. These two categories accounted for over 75 percent of total aluminum mill products exported during the period. Exports of wire and bare cable tripled to 32,153 metric tons (valued at $104 million) during 1989-92.

Exports to Canada, Mexico, and Japan accounted for more than 60 percent by value and exceeded 65 percent by quantity of total aluminum mill product exports during 1989-92. Some exports to these countries are aluminum mill products exported for further processing and subsequently reimported under HTS provision 9802.00.60, for use in the automobile, container, and other manufacturing industries in the United States. The relative importance of foreign markets differs among aluminum mill products and between grade or size variations of the same product (see trade tables in appendix C.)

U.S. Trade Measures

Tariff and Nontariff Measures

In most cases U.S. tariffs for aluminum mill products are lower than their foreign counterparts. The U.S. column 1 tariff rates applicable to these products range from 1.5 percent to 6.5 percent *ad valorem* (table B-1). The trade-weighted average tariff rate in 1992 was 3.4 percent for these products.[72] Duties on eligible imports from Canada represent the fifth year of staged reductions under the United States-Canada Free-Trade Agreement, and will be reduced to zero by January 1, 1998. Most products are eligible for duty-free treatment under all preferential tariff programs. Also, some imports are U.S.-origin goods that are processed abroad and which reenter subject to duties only on the foreign processing-content (for example, under HTS provision 9802.00.60 covering wrought aluminum and aluminum foil); imports from Canada, Japan, and Mexico account for nearly all of such imports under this provision. Under the North American Free-Trade Agreement (NAFTA), most U.S. imports of aluminum mill products from Mexico would receive immediate duty-free status on January 1, 1994.[73]

There do not appear to be any U.S. nontariff measures that affect trade or investment in the aluminum mill products sector. There are many examples of foreign direct investment in the U.S. market.

U.S. Government Trade-Related Investigations

The U.S. International Trade Commission (Commission) conducted three investigations on aluminum or aluminum mill products during the 1980s: two under the antidumping (AD) law, and one during an annual review of the Generalized System of Preferences (GSP). One of the AD cases concerned unwrought secondary aluminum alloy from the United Kingdom. The investigation was instituted in April 1981; the Commission made a negative injury determination in the preliminary investigation, which terminated the proceeding.[74]

The second AD investigation concerned aluminum electrical conductor redraw rod from Venezuela. Pursuant to a petition filed by Southwire Co. of Carrolton, GA, the Commission and the Department of Commerce instituted an investigation in July and August 1987, respectively. Both the Commission and Commerce made preliminary and final affirmative determinations,[75] and import bonds were required for imports of the merchandise. This case is currently under review by the United States Court of Appeals for the Federal Circuit.[76]

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[72] Calculated by USITC staff from official statistics of the U.S. Department of Commerce.

[73] NAFTA was implemented by the North American Free Trade Agreement Implementation Act (Pub. Law 102-182, approved Dec. 8, 1993) and became effective for both the United States and Mexico on Jan. 1, 1994.

[74] USITC, 46 F.R. 27586, May 20, 1981.

[75] USITC Aluminum Conductor Redraw Rod from Venezuela, Investigation No. 731-TA-378, publication 2103 (Aug. 1988); Department of Commerce, 53 F.R. 31903, Aug. 22, 1988.

[76] The U.S. Court of International Trade (CIT) initially held that the petitioner did not have standing to file a petition since its petition was not supported by a majority of the domestic industry. Suramerica de Aleaciones v. United States, 746 F. Supp. 139 (CIT 1990). This ruling was reversed on appeal by the U.S. Court of Appeals for the

(continued...)

Concurrent with appeals of the AD investigation on aluminum electrical conductor redraw rod, Southwire and another domestic producer filed petitions with the Trade Policy Staff Committee during 1991 and 1992 to withdraw GSP-benefits from imports of the product from Venezuela. The petition was approved during the 1992 review on the basis that imports from Venezuela exceeded the competitive need limits. Accordingly, Venezuela was graduated from the GSP program, and imports of such rod are assessed the full column 1 rate of 2.6 percent *ad valorem*.

Foreign Markets

Competitiveness in aluminum mill products is dependent on low-cost inputs (such as ingot) and capability to produce high quality products. Because of the global diffusion of mill equipment, competitive advantage principally is derived from high labor and capital productivity, superior ancillary equipment, or strategic partnerships with endusers.

Most U.S. producers of aluminum mill products have foreign production subsidiaries; these sometimes take the form of joint ventures, production sharing agreements, joint marketing arrangements, or supply of technical expertise. Such facilities have affected U.S. exports by expanding foreign-based production but have positioned U.S. producers to take advantage of increasing consumption in foreign markets.

Foreign Trade Measures

Tariff Measures

Unlike domestic and foreign tariffs on primary aluminum, which tend to be low, higher tariffs on aluminum mill products may act as barriers to trade since these products are generally sold with low margins. Fairly high levels of tariff protection exist abroad (table 16), hampering exports from the United States. Under NAFTA, Mexico is obligated to phaseout its duties on imports of aluminum mill products from the United States over a 10-year period.[77]

The recently completed (December 1993) GATT Uruguay Round of trade negotiations may result in further reductions in U.S. and foreign duties on the articles covered by this summary. The U.S. Uruguay Round schedule of concessions was not available at the time that this summary was prepared.

Nontariff Measures

In addition, significant nontariff barriers to U.S. exports exist, including quantitative restrictions, import licensing, standards, testing, and certification, government procurement, and export subsidies. Some U.S. aluminum companies have invested abroad in manufacturing facilities to counteract foreign market access barriers or to benefit from emerging common markets abroad.[78] For example, Reynolds Metals (USA) reportedly will build plants for production of aluminum cans in Chile and Brazil, benefiting from a proposed South American common market.[79]

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[76] (...continued)
Federal Circuit (Federal Circuit), which then sent the case back to the CIT for further proceedings. Suramerica de Aleaciones v. United States, 966 F.2d 660 (Fed.Cir. 1992). Subsequently the CIT held, among other things, that there was no compelling evidence of threat of material injury, given the absence of support for the petition by a majority of the domestic industry. The CIT then remanded the case to the Commission and effectively directed the Commission to issue a negative determination. Suramerica de Aleaciones v. United States, Slip Op. 93-35 (Mar. 15, 1993). Pursuant to the CIT's order, the Commission issued a negative determination and, after the Court's acceptance of this determination, the Commission filed an appeal of the CIT's decision with the Federal Circuit.

[77] The North American Free Trade Agreement was implemented by the North American Free Trade Implementation Act (Public Law 103-182, approved Dec. 8, 1993) and became effective for both the United States and Mexico on January 1, 1994.

[78] USTR, National Trade Estimate Report on Foreign Trade Barriers, 1992 and 1993 issues.

[79] The Government of Brazil signed the Treaty of Asuncion on Mar. 26, 1991, which provides for the establishment of a common market of Argentina, Brazil, Paraguay, and Uruguay (Mercosur) by Dec. 31, 1994.

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Table 16
Tariff rates for selected aluminum mill products and comparative U.S. tariffs

(*Percent*)

Country	Primary	Bars/rods/ profiles	Flat products[1]	Tubes/pipes
Japan	1	11.5-12.8	0-3	5.8-12.8
Canada	0	2.1-10.3	2.1-10.3	8.1-10.3
EC countries	6	10	10	0-10
Mexico	10	10-15	10-15	20
South Korea	20	20	20	20
United States	0-2.6	2.6-5	2.7-6.5	5.7

[1] Includes plates, sheets, strip, and foil.

Note.--Except for Canada, tariffs are each country's most-favored-nation rate. Canadian tariff is the 1992 U.S.-Canada Free-Trade Agreement rate.

Source: Compiled by Commission staff from various sources.

The following excerpts from the *1993 National Trade Estimate Report on Foreign Trade Barriers* issued by the Office of the United States Trade Representative (USTR) describe the principal nontariff barriers to U.S. exports of aluminum mill products:[80]

- *China* employs a complex system of nontariff administrative controls over imports, including import licensing regulations. Chinese trading companies generally possess exclusive access to the domestic market. In February 1990, new import restrictions were approved on building materials such as aluminum alloy doors and windows. Foreign investment and operational control has been prohibited in several consumer appliance areas.

- Imports of aluminum mill products into the *European Union* are subject to high EU tariffs, and "buy national" or "buy European" policies. Such policies are particularly prevalent in the electricity-generating sector, telecommunications switching equipment, aircraft (Airbus), shipbuilding, and construction sectors, each of which utilizes aluminum mill products.

- The Government of *India* imposed a 110-percent ceiling on basic tariffs in March 1992, reduced subsequently to 85 percent ad valorem. Nonferrous metal imports are on a restricted import list and must be imported and distributed within India through the government trading monopoly.

- With respect to *Japan*, additional progress is seen as needed under the Structural Impediments Initiative in several areas. High import tariffs remain on certain aluminum products. Government subsidies and other forms of assistance to the shipbuilding and ship repair industry and aerospace industry present market entry barriers to U.S. aluminum exporters; keiretsu relationships in the Japanese auto parts and motor vehicle industries and the complexity and rigidity of Japan's distribution system also hinder U.S. exports by raising the cost of market entry and limiting access for fabricated aluminum mill products.

[80] Office of the United States Trade Representative, 1993 National Trade Estimate Report on Foreign Trade Barriers, Washington, DC: USGPO, 1993. See specific country sections.

U.S. Trade Balance

The U.S. trade balance in aluminum mill products dramatically improved between 1989 and 1992, from a deficit of 57,900 metric tons to a surplus of 201,400 metric tons (table 17). The trade balance remained positive during the first 6 months of 1993. In value terms, the United States increased its surplus from $177 million to $715 million during the period. Most of the improvement occurred as the result of increased exports of aluminum alloy plate, sheet, and strip to Mexico, Venezuela, and other destinations.□

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Table 17
Aluminum mill products: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1989-92 and January-June 1992-93

(*Thousand dollars*)

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
U.S. exports of domestic merchandise:						
Canada	783,253	891,030	791,595	800,546	442,735	401,522
Mexico	187,668	210,980	262,870	341,367	167,618	164,839
Japan	107,959	85,694	96,131	111,355	57,205	46,955
Korea	76,197	56,983	76,785	73,825	43,923	30,385
United Kingdom	54,806	83,484	74,075	71,174	37,267	33,234
Venezuela	17,669	22,061	58,971	66,752	27,983	24,939
Taiwan	45,906	48,963	83,694	63,725	43,303	21,834
Saudi Arabia	44,120	32,674	78,904	59,556	30,596	27,863
China	14,120	13,622	53,020	52,786	25,220	22,934
Germany	42,676	40,917	48,529	40,745	19,924	19,583
All other	320,725	311,619	396,728	354,426	179,535	196,766
Total	1,695,691	1,798,031	2,021,302	2,036,258	1,075,310	990,857
EU-12	210,106	241,112	250,166	219,458	114,424	103,924
OPEC	73,904	66,822	154,841	149,539	74,636	67,772
ASEAN	37,108	30,860	54,393	41,695	18,536	28,095
CBERA	31,739	27,414	27,672	37,814	19,675	27,451
Eastern Europe	154	308	425	571	67	763
U.S. imports for consumption:						
Canada	488,455	467,720	478,709	503,642	268,919	252,454
Japan	144,886	286,126	195,409	158,088	86,339	75,484
Germany	122,710	149,414	131,006	150,648	70,594	74,506
Mexico	57,601	69,593	72,609	74,936	36,969	37,361
France	99,374	83,360	64,786	64,329	25,817	35,523
United Kingdom	57,845	45,033	39,372	48,556	26,909	19,273
Venezuela	66,326	48,623	38,820	37,367	17,843	16,362
Taiwan	40,973	31,829	26,380	32,970	14,722	17,219
Sweden	12,180	14,842	18,746	24,538	11,400	14,655
Italy	29,872	22,522	21,490	23,018	11,265	10,121
All other	398,404	290,071	176,640	203,236	95,196	110,079
Total	1,518,626	1,509,132	1,263,966	1,321,327	665,972	663,037
EU-12	440,919	382,787	316,822	351,893	167,084	176,566
OPEC	67,900	48,650	39,538	37,379	17,856	16,419
ASEAN	1,736	1,566	1,858	2,543	1,369	1,830
CBERA	7,048	9,069	6,977	3,758	2,024	1,757
Eastern Europe	13,180	9,201	5,601	11,514	5,520	5,135
U.S. merchandise trade balance:						
Canada	290,476	423,310	312,886	296,904	173,816	149,068
Mexico	130,167	141,390	190,261	266,431	130,649	127,478
Japan	(36,927)	(200,432)	(99,278)	(46,733)	(29,134)	(28,529)
Korea	73,895	55,512	75,812	72,304	43,203	20,785
United Kingdom	(3,039)	38,451	34,703	22,618	10,358	13,961
Venezuela	(48,657)	(26,562)	20,151	29,385	10,140	8,577
Taiwan	4,933	17,134	57,314	30,755	28,581	4,616
Saudi Arabia	42,681	32,674	78,904	59,556	30,596	27,863
China	13,777	13,008	52,738	52,252	24,957	22,808
Germany	(80,034)	(108,497)	(82,477)	(109,903)	(50,670)	(54,923)
All other	(210,207)	(97,089)	116,322	41,362	36,842	36,116
Total	177,065	288,899	757,336	714,931	409,338	327,820
EU-12	(230,813)	(141,675)	(66,656)	(132,435)	(52,660)	(72,642)
OPEC	6,004	18,172	115,303	112,160	56,780	51,353
ASEAN	35,372	29,294	52,535	39,152	17,167	26,265
CBERA	24,691	18,345	20,695	34,056	17,651	25,694
Eastern Europe	(13,026)	(8,893)	(5,176)	(10,943)	(5,453)	(4,372)

[1] Import values are based on customs value; export values are based on f.a.s. value, U.S. port of export. U.S. trade with East Germany is included in "Germany" but not "Eastern Europe."

[2] Not available.

Source: Compiled from official statistics of the U.S. Department of Commerce.

APPENDIX A

EXPLANATION OF TARIFF AND TRADE AGREEMENT TERMS

A-1

TARIFF AND TRADE AGREEMENT TERMS

The ***Harmonized Tariff Schedule of the United States*** (HTS) replaced the *Tariff Schedules of the United States* (TSUS) effective January 1, 1989. Chapters 1 through 97 are based upon the internationally adopted Harmonized Commodity Description and Coding System through the 6-digit level of product description, with additional U.S. product subdivisions at the 8-digit level. Chapters 98 and 99 contain special U.S. classification provisions and temporary rate provisions, respectively.

Rates of duty in the ***general*** subcolumn of HTS column 1 are most-favored-nation (MFN) rates; for the most part, they represent the final concession rate from the Tokyo Round of Multilateral Trade Negotiations. Column 1-general duty rates are applicable to imported goods from all countries except those enumerated in general note 3(b) to the HTS, whose products are dutied at the rates set forth in ***column 2***. Goods from Albania, Armenia, Belarus, Bulgaria, the People's Republic of China, the Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Mongolia, Poland, Russia, Slovakia, Turkmenistan, and the Ukraine are currently eligible for MFN treatment. Among articles dutiable at column 1-general rates, particular products of enumerated countries may be eligible for reduced rates of duty or for duty-free entry under one or more preferential tariff programs. Such tariff treatment is set forth in the ***special*** subcolumn of HTS column 1. Where eligibility for special tariff treatment is not claimed or established, goods are dutiable at column 1-general rates.

The ***Generalized System of Preferences*** (GSP) affords nonreciprocal tariff preferences to developing countries to aid their economic development and to diversify and expand their production and exports. The U.S. GSP, enacted in title V of the Trade Act of 1974 and renewed in the Trade and Tariff Act of 1984, applies to merchandise imported on or after January 1, 1976 and before July 4, 1993. Indicated by the symbol "A" or "A*" in the special subcolumn of column 1, the GSP provides duty-free entry to eligible articles the product of and imported directly from designated beneficiary developing countries, as set forth in general note 3(c)(ii) to the HTS.

The ***Caribbean Basin Economic Recovery Act*** (CBERA) affords nonreciprocal tariff preferences to developing countries in the Caribbean Basin area to aid their economic development and to diversify and expand their production and exports. The CBERA, enacted in title II of Public Law 98-67, implemented by Presidential Proclamation 5133 of November 30, 1983, and amended by the Customs and Trade Act of 1990, applies to merchandise entered, or withdrawn from warehouse for consumption, on or after January 1, 1984; this tariff preference program has no expiration date. Indicated by the symbol "E" or "E*" in the special subcolumn of column 1, the CBERA provides duty-free entry to eligible articles, and reduced-duty treatment to certain other articles, which are the product of and imported directly from designated countries, as set forth in general note 3(c)(v) to the HTS.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol "IL" are applicable to products of Israel under the ***United States-Israel Free Trade Area Implementation Act*** of 1985 (IFTA), as provided in general note 3(c)(vi) of the HTS. Where no rate of duty is provided for products of Israel in the special subcolumn for a particular provision, the rate of duty in the general subcolumn of column 1 applies.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol "CA" are applicable to eligible goods originating in the territory of Canada under the ***United States-Canada Free-Trade Agreement*** (CFTA), as provided in general note 3(c)(vii) to the HTS.

Preferential nonreciprocal duty-free or reduced-duty treatment in the special subcolumn of column 1 followed by the symbol "J" or "J*" in parentheses is afforded to eligible articles the product of designated beneficiary countries under the ***Andean Trade Preference Act*** (ATPA), enacted in title II of Public Law 102-182 and implemented by Presidential Proclamation 6455 of July 2, 1992 (effective July 22, 1992), as set forth in general note 3(c)(ix) to the HTS.

Other special tariff treatment applies to particular ***products of insular possessions*** (general note 3(a)(iv)), goods covered by the ***Automotive Products Trade Act*** (APTA) (general note 3(c)(iii)) and the ***Agreement on Trade in Civil Aircraft*** (ATCA) (general note 3(c)(iv)), and

articles imported from freely associated states (general note 3(c)(viii)).

The **General Agreement on Tariffs and Trade** (GATT) (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) is the multilateral agreement setting forth basic principles governing international trade among its 111 signatories. The GATT's main obligations relate to most-favored-nation treatment, the maintenance of scheduled concession rates of duty, and national (nondiscriminatory) treatment for imported products; the GATT also provides the legal framework for customs valuation standards, "escape clause" (emergency) actions, antidumping and countervailing duties, and other measures. Results of GATT-sponsored multilateral tariff negotiations are set forth by way of separate schedules of concessions for each participating contracting party, with the U.S. schedule designated as Schedule XX.

Officially known as "The Arrangement Regarding International Trade in Textiles," the ***Multifiber Arrangement*** (MFA) provides a framework for the negotiation of bilateral agreements between importing and producing countries, or for unilateral action by importing countries in the absence of an agreement. These bilateral agreements establish quantitative limits on imports of textiles and apparel, of cotton and other vegetable fibers, wool, man-made fibers and silk blends, in order to prevent market disruption in the importing countries—restrictions that would otherwise be a departure from GATT provisions. The United States has bilateral agreements with many supplying countries, including the four largest suppliers: China, Hong Kong, the Republic of Korea, and Taiwan.

APPENDIX B

U.S. RATES OF DUTY

B-1

Table B-1
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty as of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
Primary (unwrought) aluminum					
7601.10.30	Unwrought aluminum, not alloyed, of uniform cross section throughout its length, of thickness not exceeding 9.5 mm, in coils	2.6%	Free (CA, E,IL,J)	(2)	1,154
7601.10.60	Other primary aluminum	Free		624,897	761,432
7601.20.30	Aluminum alloys, of uniform cross section throughout its length, of a thickness not exceeding 9.5 mm, in coils	2.6%	Free (CA,E,IL,J)	(3)	3,888
7601.20.60	Other aluminum alloys, containing 25% or more silicon	2.1%	Free (CA,E,IL,J)	(3)	328
7601.20.90	Aluminum alloys other than previously classified	Free		279,956[4]	756,107
Aluminum waste and scrap					
7602.00.00	Aluminum waste and scrap (used beverage container scrap and other waste and scrap)	Free		238,005	254,219
Aluminum powders and flakes					
7603.10.00	Aluminum powders of non-lamellar structure	5.7%	Free (A,CA,E, IL,J)	10,906	1,958
7603.20.00	Powders of lamellar structure; flakes	3.9%	Free (A,CA,E IL,J)	5,500	2,027
Aluminum mill products					
	Profiles, bars and rods				
7604.10.10	Profiles, unalloyed	5%	Free (A,CA,E, IL,J)	45,643	7,041
7604.10.30	Bars and rods, unalloyed, with a round cross-section	2.6%	Free (A[5],CA,E, IL,J)	6,662	3,775
7604.10.50	Other unalloyed bars and rods	3.0%	Free (A,CA,E, IL,J)	22,769	3,084
7604.21.00	Hollow profiles of aluminum alloys	1.5%	Free (CA,E,IL,J)	8,947	4,402
7604.29.10	Other profiles of aluminum alloys	5%	Free (A,CA,E IL,J)	46,211	7,809
7604.29.30	Bars and rods, of aluminum alloys, with a round cross-section	2.6%	Free (A[5],CA,E, IL,J)	11,039	10,360

See footnotes at end of table.

B-2

Table B-1--Continued
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
7604.29.50	Bars and rods, of aluminum alloys, not having a round cross-section	3%	Free (A,CA,E, IL,J)	20,943	3,904
	Wire				
7605.11.00	Aluminum wire, not alloyed, with a maximum cross-sectional diameter exceeding 7 mm	2.6%	Free (A[5],CA,E, IL,J)	16,526	5,922
7605.19.00	Aluminum wire, not alloyed, with a maximum cross-sectional diameter not exceeding 7 mm	2.6%	Free (A,CA,E, IL,J)	3,991	1,061
7605.21.00	Aluminum wire, alloyed, with a maximum cross-sectional diameter exceeding 7 mm	2.6%	Free (A[5],CA,E IL,J)	34,665	21,040
7605.29.00	Aluminum wire, alloyed, with a maximum cross-sectional diameter not exceeding 7 mm	4.2%	Free (A,CA,E IL,J)	31,213	4,209
	Plate, sheet, strip				
7606.11.30	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of rectangular shape (including square), not alloyed, and not clad	3%	Free (A,CA,E IL,J)	117,119	176,138
7606.11.60	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of rectangular shape (including square), not alloyed, clad	2.7%	Free (A,CA,E IL,J)	51,621	2,332
7606.12.30	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of rectangular shape (including square), alloyed, but not clad (including can and lid stock)	3%	Free (A,CA,E, IL,J)	696,365	416,723
7606.12.60	Aluminum plates, sheets and strip, of a thickness exceedin 0.2 mm, of rectangular shape (including square), alloyed, clad	6.5%	Free (A,CA,E, IL,J)	26,284	33,346
7606.91.30	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of other than rectangular shape (including square), not alloyed, and not clad	3%	Free (A,E,IL,J) 1.5% CA	([6])	38,673
7606.91.60	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of other than rectangular shape (including square), not alloyed, clad	2.7%	Free (A,E,IL,J) 1.3% CA	28,237	8,415

See footnotes at end of table.

B-3

Table B-1--Continued
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
7606.92.30	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of rectangular shape (including square), of aluminum alloys, but not clad	3%	Free (A,E,IL,J) 1.5% CA	([7])	40,629
7606.92.60	Aluminum plates, sheets and strip, of a thickness exceeding 0.2 mm, of rectangular shape (including square), of aluminum alloys, clad	6.5%	Free (A,E,IL,J) 3.2% CA	334,741	2,805
	Foil				
7607.11.30	Aluminum foil (whether or not printed, not backed with paper, paperboard, plastics or similar backing materials), rolled but not further worked, not backed, of a thickness not exceeding 0.01 mm	5.8%	Free (A,E,IL,J) 2.9% CA	22,888	39,136
7607.11.60	Aluminum foil (whether or not printed, not backed with paper, paperboard, plastics or similar backing materials), rolled but not further worked, not backed, of a thickness exceeding 0.01 mm but not exceeding 0.15 mm	5.3%	Free (A,E,IL,J) 2.6% CA	48,187	34,385
7607.11.90	Aluminum foil (whether or not printed, not backed with paper, paperboard, plastics or similar backing materials), rolled but not further worked, not backed, of a thickness exceeding 0.15 mm but not exceeding 0.2 mm	3%	Free (A,E,IL,J) 1.5% CA	31,800	15,912
7607.19.10	Etched capacitor foil	5.3%	Free (A,E,IL,J) 2.6% CA	([8])	24,147
7607.19.30	Other aluminum foil, whether or not printed, not backed, of a thickness not exceeding 0.15 mm, rolled, and cut to shape	5.7%	Free (A,E,IL,J) 2.8% CA	([8])	8,793
7607.19.60	Other aluminum foil, whether or not printed, not backed, of a thickness exceeding 0.15 mm but not 0.2 mm, rolled, but not cut to shape	Free		25,484	29,035
7607.20.10	Aluminum foil (whether or not printed), backed with paper, paperboard, plastics or similar backing materials) of a thickness not exceeding 0.2 mm, covered or decorated with a character, design, fancy effect or pattern	3.7%	Free (A,E,IL,J) 1.8% CA	([9])	19,201

See footnotes at end of table.

B-4

Table B-1--Continued
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
7607.20.50	Aluminum foil (whether or not printed), backed with paper, paperboard, plastics or similar backing materials) of a thickness not exceeding 0.2 mm, not covered or not decorated with a character, design, fancy effect or pattern	Free		47,300	18,402
	Tubes and pipes				
7608.10.00	Aluminum tubes and pipes, not alloyed	5.7%	Free (A,B,C[10],CA, E,IL,J)	23,532	10,516
7608.20.00	Aluminum tubes and pipes, alloyed	5.7%	Free (A,B,C[10],CA, E,IL,J)	23,100	11,842
7609.00.00	Aluminum tube or pipe fittings (couplings, elbows, sleeves)	5.7%	Free (A,B,CA,E IL,J)	19,646	8,325
	Structures and parts				
7610.10.00	Aluminum structures and parts of structures: doors, windows and their frames, and thresholds for doors	5.7%	Free (A,E,IL,J) 2.8% CA	37,033	15,700
7610.90.00	Aluminum structures and parts of structures, other than doors, windows and their frames, and door thresholds: sheet-metal roofing, siding, flooring, roof-guttering and drainage equipment, bridges and bridge sections, towers, lattice masts, roofs, pillars and columns, plates, rods, profiles, tubes, etc. prepared for use in structures	5.7%	Free (A,E,IL,J) 2.8% CA	12,366	44,145
	Containers				
7611.00.00	Aluminum reservoirs, tanks, vats and similar containers for any material other than compressed gas, of a capacity exceeding 300 liters, whether or not lines or heat insulated, but not fitted with mechanical or thermal equipment	2.6%	Free (A,E,IL,J) 1.3% CA	12,366	4,037
7612.10.00	Aluminum collapsible tubular containers	2.4%	Free (A,E,IL,J) 1.2% CA	4,742	19,133
7612.90.10	Aluminum containers, other than collapsible tubular containers, of a capacity not exceeding 20 liters	5.7%	Free (A,E,IL,J) 2.8% CA	64,322	47,431
7612.90.50	Aluminum containers, other than collapsible tubular containers, of a capacity exceeding 20 liters but not exceeding 300 liters	Free		38,301[11]	1,896
7613.00.00	Aluminum containers for compressed or liquefied gas	5%	Free (A,E,IL,J) 2.5% CA	29,534	3,719

See footnotes at end of table.

B-5

Table B-1--Continued
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
	Wire products				
7614.10.10	Stranded wire, cables, plaited bands and the like, including slings and similar articles, of aluminum, not electrically insulated, with a steel core, not equipped with fittings and not made up into articles	4.9%	Free (E,IL,J) 2.4% CA	(12)	914
7614.10.50	Stranded wire, cables, plaited bands and the like, including slings and similar articles, of aluminum, not electrically insulated, with a steel core, equipped with fittings or made up into articles	4.9%	Free (E,IL,J) 2.4% CA	10,554	1,271
7614.90.20	Stranded wire, cables, plaited bands and the like, including slings and similar articles, of aluminum, not electrically insulated, without a steel core, not equipped with fittings and not made up into articles, electrical conductors	4.9%	Free (A,E,IL,J) 2.4% CA[14]	(13)	8,256
7614.90.40	Stranded wire, cables, plaited bands and the like, including slings and similar articles, of aluminum, not electrically insulated, without a steel core, not equipped with fittings and not made up into articles, other than electrical conductors	4.9%	Free (A,E,IL,J) 2.4% CA[14]	1,975	880
7614.90.50	Stranded wire, cables, plaited bands and the like, including slings and similar articles, of aluminum, not electrically insulated, without a steel core, equipped with fittings or made up into articles	5.7%	Free (A,B,E,IL,J) 2.8% CA	4,670	158
	Household or kitchen articles				
7615.10.10	Table, kitchen, or other household articles and parts: cooking and kitchen ware that has been enameled or glazed or containing nonstick interior finsishes, cast	3.9%	Free (A,E,IL,J) 1.9% CA	3,610	6,352
7615.10.30	Table, kitchen, or other household articles and parts: cooking and kitchen ware that has been enameled or glazed or containing nonstick interior finsishes, other than cast	5.7%	Free (A,E,IL,J) 2.8% CA	15,368	106,533
7615.10.50	Table, kitchen, or other household articles and parts: cooking and kitchen ware that has not been enameled or glazed and does not containing nonstick interior finsishes, cast	3.9%	Free (A,E,IL,J) 1.9% CA	(15)	9,593

See footnotes at end of table.

B-6

Table B-1--Continued
Aluminum and aluminum mill products: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of Jan. 1, 1993; final MTN concession rate of duty; U.S. exports, 1992; and U.S. imports, 1992

HTS subheading	Description	Col. 1 rate of duty As of Jan. 1, 1993 General	Special[1]	U.S. exports, 1992	U.S. imports, 1992
				-Thousand dollars-	
7615.10.70	Table, kitchen, or other household articles and parts: cooking and kitchen ware that has not been enameled or glazed and does not contain nonstick interior finsishes, other than cast, and other than cooking ware (pot scourers and scouring or polishing pads, gloves and the like, of aluminum)	4%	Free (A,E,IL,J) 2% CA	([15])	39,184
7615.10.90	Table, kitchen, or other household articles and parts other than cooking and kitchen ware, of aluminum	3.8%	Free (A,E,IL,J)	33,212	20,595
7615.20.00	Sanitary ware and parts thereof, of aluminum	3.8%	Free (A,E,IL,J) 1.9% CA	4,412	1,504
	Other				
7616.10.10	Other articles of aluminum: nails, tacks, and staples	5.7%	Free (A,E,IL,J) 2.8% CA[14]	1,081	120
7616.10.30	Other articles of aluminum: rivets	4.7%	Free (A,B,CA,E,IL,J)	10,732	1,721
7616.10.50	Other articles of aluminum: cotters and cotter pins	5.7%	Free (A,B,E,IL,J) 2.8% CA[14]	715	18
7616.10.70	Other articles of aluminum: fasteners (including screws, bolts, nuts, screw hooks, and washers), whether threaded or not having shanks, threads, or holes over 6 mm in diameter	5.5%	Free (A,B,E,IL,J) 2.7% CA[14]	3,734	620
7616.10.90	Other articles of aluminum: fasteners (including screws, bolts, nuts, screw hooks, and washers), whether threaded or not having shanks, threads, or holes under 6 mm in diameter	6.3%	Free (A,B,E,IL,J) 3.1% CA[14]	11,438	1,472
7616.90.00	Other articles of aluminum not classified earlier, including ladders, venetian blinds and parts, hangers and supports for pipes and tubes, castings, forgings, and articles of wire	5.7%	Free (A,B,E,IL,J) 2.8% CA[14]	230,501	291,271

[1] Programs under which special tariff treatment may be provided, and the corresponding symbols for such programs as they are indicated in the "Special" subcolumn, are as follows: Generalized System of Preferences (A); Automotive Products Trade Act (B); Agreement on Trade in Civil Aircraft (C); United States-Canada Free-Trade Agreement (CA); Caribbean Basin Economic Recovery Act (E); and United States-Israel Free Trade Area (IL).
[2] Classification for exports does not exist at this level of detail. Exports under 7601.10.00 are shown opposite HTS 7601.10.60.
[3] No category for exports exists at this level of detail.
[4] Exports are classified under 7601.20.90 ($114,601,000) and 7601.20.95 ($165,355), and summed as shown.
[5] Venezuela has been proclaimed by the President as noneligible for GSP treatment for articles under this HTS subheading.
[6] Exports are classified under 7606.91.00 and shown opposite HTS 7606.91.60.
[7] Exports are classified under 7606.92.00 and shown opposite HTS 7606.92.60.
[8] No category for exports exists at this level of detail; total exports of aluminum foil, classified under 7607.19.00, are shown opposite HTS 7607.19.60.
[9] No category for exports exists at this level of detail; total exports of aluminum foil, classified under 7607.92.00, are shown opposite HTS 7607.20.50.

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Footnotes--Continued

[10] The rate of duty "Free (C)" appearing in the "Special" subcolumn applies only to tubes and pipes with attached fittings, suitable for conducting gases or liquids.
[11] Export and import categories do not correspond exactly. Exports shown here are classified under 7612.9090.
[12] Export and import categories do not correspond exactly. Exports classified under 7614.1000 are shown opposite HTS 7614.10.50.
[13] Export and import categories do not correspond exactly. Exports classified under 7614.9010 are shown opposite HTS 7614.90.40.
[14] Equipment originating in the territory of Canada, intended for use in the repair or maintenance of certain motor vehicles, is subject to accelerated staged tariff reductions.
[15] Export and import classifications do not correspond. Exports classified under 7615.10.20 are shown opposite HTS 7615.10.10 (cast aluminum cookware) and exports classified under 7615.10.40 (noncast cookware) are shown opposite HTS 7615.10.30.

Source: U.S. exports and imports compiled from data of the U.S. Department of Commerce.

B-8

APPENDIX C

TRADE TABLES

C-1

Table C-1
Aluminum plate, sheet and strip: U.S. imports for consumption, by principal sources, 1989-92, and January-June 1992-93

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada	155,325	164,318	175,838	200,931	105,313	97,043
Germany	10,134	14,205	11,842	15,870	6,863	9,156
Japan	23,380	67,816	29,341	16,963	10,011	8,179
France	24,996	24,416	17,137	14,808	5,399	8,206
United Kingdom	11,116	5,619	5,342	8,588	4,646	2,762
Venezuela	14,265	17,252	15,482	14,091	6,276	7,111
Netherlands	5,037	4,049	4,219	4,683	2,074	2,270
Belgium	30,659	18,806	10,525	5,800	3,967	2,944
Sweden	1,698	1,521	1,872	3,103	1,377	2,073
Spain	2,749	1,938	3,197	6,609	3,128	7,069
All other	61,061	66,704	26,587	37,424	18,713	19,043
Total	340,420	386,643	301,383	328,870	167,766	165,857
	Value (1,000 dollars)					
Canada	380,437	358,752	355,729	388,360	208,811	171,187
Germany	36,046	47,041	45,961	58,736	26,046	32,058
Japan	72,938	186,224	84,179	52,364	29,963	23,338
France	78,789	64,824	48,061	44,884	17,042	22,648
United Kingdom	37,579	22,912	19,947	27,654	14,655	8,990
Venezuela	29,960	30,200	27,282	22,048	9,848	11,537
Netherlands	24,243	16,561	16,616	13,976	6,260	6,644
Belgium	85,275	44,756	24,648	12,774	8,295	6,466
Sweden	8,010	6,918	8,514	12,139	5,495	7,720
Spain	7,389	4,862	6,674	11,886	5,543	11,628
All other	157,431	143,341	58,129	73,518	35,730	33,606
Total	918,097	926,391	695,741	718,339	367,688	335,822
	Unit value (dollars per kilogram)					
Canada	2.45	2.18	2.02	1.93	1.98	1.76
Germany	3.56	3.31	3.88	3.70	3.80	3.50
Japan	3.12	2.75	2.87	3.09	2.99	2.85
France	3.15	2.65	2.80	3.03	3.16	2.76
United Kingdom	3.38	4.08	3.73	3.22	3.15	3.25
Venezuela	2.10	1.75	1.76	1.56	1.57	1.62
Netherlands	4.81	4.09	3.94	2.98	3.02	2.93
Belgium	2.78	2.38	2.34	2.20	2.09	2.20
Sweden	4.72	4.55	4.55	3.91	3.99	3.72
Spain	2.69	2.51	2.09	1.80	1.77	1.64
All other	2.58	2.15	2.19	1.96	1.91	1.76
Average	2.70	2.40	2.31	2.18	2.19	2.02

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table C-2
Aluminum bars, rods, and profiles: U.S. imports for consumption, by principal sources, 1989-92 and January-June 1992-93

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada	2,901	1,656	2,018	6,187	2,119	19,248
Germany	227	396	392	944	404	280
Slovenia	(1)	(1)	(1)	1,416	110	1,486
Yugoslavia	2,652	3,250	2,949	1,204	1,204	(2)
Belgium	627	757	782	897	382	400
Japan	519	974	587	494	278	71
France	149	108	88	475	144	173
Venezuela	2,189	3,547	370	1,099	928	205
Brazil	4,384	1,738	337	466	231	331
Italy	230	182	145	367	119	748
All other	8,133	3,350	1,978	1,757	835	661
Total	22,012	15,958	9,647	15,305	6,754	23,105
	Value (1,000 dollars)					
Canada	8,872	5,000	5,938	14,075	5,554	31,381
Germany	1,966	2,610	3,105	7,089	3,094	1,870
Slovenia	(1)	(1)	(1)	3,475	254	3,753
Yugoslavia	7,823	8,514	7,547	2,863	2,863	(2)
Belgium	2,195	2,367	2,369	2,525	996	1,153
Japan	2,033	3,415	2,020	1,592	925	230
France	545	504	272	1,464	389	725
Venezuela	6,652	7,674	827	1,306	974	344
Brazil	10,977	3,361	809	882	423	651
Italy	799	598	421	827	299	409
All other	21,470	8,588	4,811	4,277	2,214	2,558
Total	63,331	42,631	28,118	40,375	17,985	43,075
	Unit value (dollars per kilogram)					
Canada	3.06	3.02	2.94	2.27	2.62	1.63
Germany	8.67	6.58	7.91	7.51	7.66	6.68
Slovenia	(1)	(1)	(1)	2.45	2.31	2.53
Yugoslavia	2.95	2.62	2.56	2.38	2.38	(2)
Belgium	3.50	3.13	3.03	2.82	2.61	2.88
Japan	3.91	3.51	3.44	3.22	3.32	3.22
France	3.65	4.67	3.07	3.08	2.71	4.18
Venezuela	3.04	2.16	2.23	1.19	1.05	1.68
Brazil	2.50	1.93	2.40	1.89	1.83	1.97
Italy	3.47	3.30	2.90	2.25	2.52	2.52
All other	2.64	2.56	2.43	2.43	2.65	3.42
Average	2.88	2.67	2.91	2.64	2.66	1.86

[1] Separate data for "Slovenia" were broken out from Yugoslavia beginning in June1992.

[2] Imports from the former Yugoslav republics were reported separately beginning in June 1992.

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-3

Table C-3
Aluminum pipe and tube: U.S. imports for consumption, by principal sources, 1989-92 and January-June 1992-93

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Japan	416	530	903	1,685	761	688
Canada	519	1,478	714	992	454	725
Germany	400	432	474	351	166	129
Mexico	80	400	446	518	222	225
Taiwan	405	338	317	396	202	293
France	54	93	175	153	71	92
United Kingdom	173	73	39	35	18	25
Israel	198	216	129	114	46	73
Denmark	2	0	0	148	16	125
Sweden	10	5	4	6	5	2
All other	551	213	143	140	47	239
Total	2,808	3,778	3,345	4,538	2,008	2,615
	Value (1,000 dollars)					
Japan	3,261	3,830	8,745	11,097	4,665	4,948
Canada	4,545	8,907	6,396	6,627	3,265	3,088
Germany	3,293	4,604	4,280	3,276	1,529	1,470
Mexico	281	1,240	1,678	2,152	876	768
Taiwan	2,031	1,952	1,591	1,943	824	1,230
France	679	1,033	1,729	1,419	767	805
United Kingdom	2,454	1,502	1,161	1,023	490	452
Israel	1,346	1,747	969	1,009	309	546
Denmark	9	0	0	815	139	657
Sweden	49	61	49	277	177	151
All other	2,416	1,263	1,052	1,044	499	814
Total	20,363	26,140	27,650	30,683	13,540	14,930
	Unit value (dollars per kilogram)					
Japan	7.84	7.23	9.69	6.58	6.13	7.19
Canada	8.76	6.02	8.96	6.68	7.19	4.26
Germany	8.24	10.66	9.03	9.33	9.20	11.41
Mexico	3.49	3.10	3.76	4.16	3.94	3.41
Taiwan	5.01	5.78	5.01	4.91	4.08	4.20
France	12.65	11.12	9.86	9.30	10.88	8.73
United Kingdom	14.18	20.72	29.49	29.25	27.02	18.29
Israel	6.80	8.10	7.52	8.87	6.74	7.50
Denmark	5.63	0	0	5.50	8.67	5.25
Sweden	4.76	12.20	11.30	45.23	35.23	96.09
All other	4.38	5.92	7.33	7.43	10.55	3.42
Average	7.25	6.92	8.27	6.76	6.74	5.71

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-4

Table C-4
Aluminum wire and cable: U.S. imports for consumption, by principal sources, 1989-92, and January-June 1992-93

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada	9,340	4,901	10,518	13,066	8,238	3,539
Venezuela	13,010	4,109	5,412	7,564	3,966	1,870
United Kingdom	1,806	1,805	1,463	1,265	737	649
Japan	822	566	477	592	307	255
Brazil	8,009	930	1,802	826	220	819
Germany	48	58	23	175	83	17
Argentina	175	121	102	168	80	101
Yugoslavia	97	248	181	271	271	(1)
France	128	363	92	53	32	4
Taiwan	16	4	27	35	26	31
All other	4,283	906	56	185	56	24
Total	37,733	14,012	20,154	24,199	14,016	7,309
	Value (1,000 dollars)					
Canada	21,975	11,312	18,876	20,591	13,071	5,313
Venezuela	28,972	8,618	9,097	12,046	6,219	2,912
United Kingdom	8,417	7,549	6,296	5,115	2,891	2,411
Japan	3,397	2,135	2,112	2,403	1,362	988
Brazil	19,256	1,875	2,802	1,197	339	1,146
Germany	393	490	426	513	82	188
Argentina	608	393	392	494	222	215
Yugoslavia	288	468	310	417	417	(1)
France	705	1,236	460	384	204	48
Taiwan	48	16	126	101	64	83
All other	10,258	1,503	292	451	149	277
Total	94,318	35,593	41,188	43,711	25,021	13,581
	Unit value (dollars per kilogram)					
Canada	2.35	2.31	1.79	1.58	1.59	1.50
Venezuela	2.23	2.10	1.68	1.59	1.57	1.56
United Kingdom	4.66	4.18	4.30	4.04	3.93	3.71
Japan	4.13	3.77	4.43	4.06	4.43	3.87
Brazil	2.40	2.02	1.56	1.45	1.54	1.40
Germany	8.23	8.41	18.42	2.92	0.98	10.83
Argentina	3.48	3.22	3.84	2.95	2.78	2.14
Yugoslavia	2.99	1.88	1.71	1.54	1.54	(1)
France	5.49	3.40	5.00	7.28	6.48	13.18
Taiwan	3.06	3.95	4.65	2.89	2.41	2.71
All other	2.39	1.66	5.19	2.44	2.65	11.68
Average	2.50	2.54	2.04	1.81	1.79	1.86

[1] Imports from the former Yugoslav republics were reported separately beginning in June 1992.

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-5

Table C-5
Aluminum powders and flakes: U.S. imports for consumption, by principal sources, 1989-92 and January-June 1992-93

Source	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Germany	326	354	262	225	110	115
Bahrain	1,040	495	553	681	288	323
Canada	138	272	147	586	191	158
Mexico	2	40	8	189	2	8
Brazil	127	46	18	120	59	36
Korea	0	0	32	27	0	48
France	113	110	0	12	0	0
Japan	77	39	4	1	1	2
United Kingdom	320	28	12	12	11	11
Taiwan	([1])	1	([1])	5	0	2
All other	117	100	21	28	6	38
Total	2,260	1,484	1,057	1,885	670	738
	Value (1,000 dollars)					
Germany	1,392	1,506	1,434	1,389	682	868
Bahrain	2,359	933	994	1,182	501	539
Canada	199	384	227	586	208	189
Mexico	10	125	31	242	13	40
Brazil	323	115	37	192	94	62
Korea	0	0	122	82	0	170
France	614	548	0	65	0	0
Japan	305	148	47	63	30	97
United Kingdom	1,251	146	91	57	54	32
Taiwan	3	6	3	52	0	10
All other	460	394	131	75	50	106
Total	6,916	4,305	3,116	3,985	1,632	2,114
	Unit value (dollars per kilogram)					
Germany	4.27	4.26	5.48	6.17	6.18	7.60
Bahrain	2.27	1.88	1.80	1.74	1.74	1.67
Canada	1.45	1.41	1.55	1.00	1.09	1.20
Mexico	5.76	3.13	3.90	1.28	5.61	5.25
Brazil	2.54	2.52	2.12	1.60	1.59	1.71
Korea	0	0	3.81	3.04	0	3.55
France	5.44	4.99	0	5.63	0	0
Japan	3.97	3.85	10.82	56.71	44.01	61.37
United Kingdom	3.91	5.22	7.50	4.86	4.80	3.00
Taiwan	8.20	9.11	10.80	11.03	0	6.61
All other	3.93	3.93	6.29	2.71	7.79	2.83
Average	3.06	2.90	2.95	2.11	2.44	2.86

[1] Less than 500 kilograms.

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce

C-6

Table C-6
Aluminum plate, sheet and strip: U.S. exports of domestic merchandise, by principal markets, 1989-92 and January-June 1992-93

Market	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada.....	230,986	245,970	230,817	268,305	152,846	136,239
Mexico.....	33,346	34,674	39,229	62,148	29,230	24,547
Japan.....	16,965	13,061	19,501	20,903	13,686	6,251
Venezuela.....	6,475	7,554	17,915	23,388	9,313	9,357
Saudi Arabia....	12,178	8,699	25,643	19,962	10,089	8,692
China.....	3,343	3,386	16,819	17,124	8,868	8,251
United Kingdom..	5,169	7,579	9,308	8,948	4,143	9,711
Korea.....	10,956	8,626	8,953	10,038	6,778	3,686
Taiwan.....	14,585	11,260	14,476	10,247	6,878	3,702
Germany.....	4,529	4,006	7,567	9,599	5,146	8,045
All other.....	35,617	31,836	46,933	35,085	17,963	33,530
Total.....	374,150	376,652	437,160	485,749	264,942	252,010
	Value (1,000 dollars)					
Canada.....	552,041	634,566	561,967	588,344	333,854	286,342
Mexico.....	107,383	110,672	119,419	188,374	89,650	70,909
Japan.....	58,898	48,311	59,115	68,639	38,723	23,964
Venezuela.....	15,961	20,261	53,266	59,922	23,646	21,247
Saudi Arabia....	32,312	21,723	61,123	44,895	22,696	19,286
China.....	10,973	10,339	43,232	44,681	21,067	17,706
United Kingdom..	20,352	38,180	41,121	36,784	17,745	18,499
Korea.....	32,800	30,869	32,412	33,032	20,729	12,474
Taiwan.....	34,240	31,773	46,948	31,606	19,943	11,390
Germany.....	17,907	19,470	22,600	25,973	13,264	10,243
All other.....	155,376	141,565	166,684	131,668	64,604	83,393
Total.....	1,038,243	1,107,729	1,207,885	1,253,917	665,921	575,455
	Unit value (dollars per kilogram)					
Canada.....	2.39	2.58	2.43	2.19	2.18	2.10
Mexico.....	3.22	3.19	3.04	3.03	3.07	2.89
Japan.....	3.47	3.70	3.03	3.28	2.83	3.83
Venezuela.....	2.47	2.68	2.97	2.56	2.54	2.27
Saudi Arabia....	2.65	2.50	2.38	2.25	2.25	2.22
China.....	3.28	3.05	2.57	2.61	2.38	2.15
United Kingdom..	3.94	5.04	4.42	4.11	4.28	1.91
Korea.....	2.99	3.58	3.62	3.29	3.06	3.38
Taiwan.....	2.35	2.82	3.24	3.08	2.90	3.08
Germany.....	3.95	4.86	2.99	2.71	2.58	1.27
All other.....	4.36	4.45	3.55	3.75	3.60	2.49
Average.....	2.77	2.94	2.76	2.58	2.51	2.28

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-7

Table C-7
Aluminum bars, rods, and profiles: U.S. exports of domestic merchandise, by principal markets, 1989-92 and January-June 1992-93

Market	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada	10,489	14,591	14,205	14,282	7,635	8,428
Mexico	4,959	5,604	5,479	6,385	4,147	3,493
Japan	6,855	2,224	1,919	2,788	1,112	2,946
Korea	7,528	3,477	8,789	6,002	4,453	1,913
Egypt	3	122	309	1,133	409	626
United Kingdom	1,859	2,107	1,499	1,395	675	545
Taiwan	486	1,576	1,555	1,962	581	902
Thailand	206	923	5,777	3,077	914	2,454
Italy	3,144	2,667	1,544	845	441	243
Germany	862	1,129	613	745	310	327
All other	5,700	8,196	10,057	9,532	4,470	4,449
Total	42,090	42,617	51,746	48,156	25,147	26,328
	Value (1,000 dollars)					
Canada	38,473	61,693	59,835	52,858	28,266	25,890
Mexico	15,405	16,722	13,561	16,602	10,024	8,035
Japan	19,129	10,810	10,924	11,707	5,304	10,335
Korea	24,817	10,957	17,502	11,368	7,860	3,854
Egypt	15	663	1,780	8,804	3,189	3,501
United Kingdom	9,708	11,375	7,552	7,028	3,378	2,492
Taiwan	1,668	4,922	8,109	6,252	3,190	2,464
Thailand	883	2,361	10,576	5,616	1,483	3,514
Italy	11,980	8,989	7,117	5,209	2,319	1,019
Germany	2,669	4,631	3,452	4,339	1,264	1,115
All other	32,026	36,861	35,567	32,431	15,348	21,343
Total	156,772	169,984	175,975	162,215	81,625	83,562
	Unit value (dollars per kilogram)					
Canada	3.67	4.23	4.21	3.70	3.70	3.07
Mexico	3.11	2.98	2.48	2.60	2.42	2.30
Japan	2.79	4.86	5.69	4.20	4.77	3.51
Korea	3.30	3.15	1.99	1.89	1.77	2.01
Egypt	5,61	5.43	5.76	7.77	7.80	5.59
United Kingdom	5.22	5.40	5.04	5.04	5.00	4.57
Taiwan	3.43	3.12	5.22	3.19	5.49	2.73
Thailand	4.29	2.56	1.83	1.83	1.62	1.43
Italy	3.81	3.37	4.61	6.16	5.26	4.19
Germany	3.10	4.10	5.63	5.75	4.08	3.41
All other	5.62	4.50	3.54	3.40	3.43	4.80
Average	3.72	3.99	3.40	3.37	3.25	3.17

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-8

Table C-8
Aluminum pipe and tube: U.S. exports of domestic merchandise, by principal markets, 1989-92 and January-June 1992-93

Market	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Canada	4,040	6,018	5,400	5,862	3,029	3,797
Mexico	1,974	1,561	1,677	3,328	1,451	2,390
United Kingdom	731	445	219	320	187	204
Brazil	78	177	309	350	137	175
Taiwan	183	344	398	288	248	83
Hong Kong	40	194	176	519	206	165
Japan	169	262	190	224	101	97
Korea	338	236	406	213	133	140
Australia	199	232	266	218	136	95
Italy	29	9	29	120	70	21
All other	1,587	1,905	3,317	2,942	1,798	1,008
Total	9,367	11,385	12,387	14,383	7,495	8,174
	Value (1,000 dollars)					
Canada	21,898	29,938	27,284	25,860	13,572	16,357
Mexico	9,317	7,379	7,418	10,866	5,790	7,960
United Kingdom	4,758	2,960	2,251	2,416	1,174	1,260
Brazil	1,235	1,435	2,712	2,360	1,050	973
Taiwan	1,034	1,968	2,463	2,232	1,818	785
Hong Kong	346	914	796	1,883	784	539
Japan	1,258	1,919	2,055	1,868	696	819
Korea	2,445	1,701	2,167	1,429	769	1,061
Australia	1,195	1,362	1,325	1,338	826	557
Italy	369	188	453	1,197	740	596
All other	11,221	10,955	16,938	14,830	8,589	6,286
Total	55,075	60,718	65,862	66,279	35,807	37,194
	Unit value (dollars per kilogram)					
Canada	5.42	4.97	5.05	4.40	4.48	4.30
Mexico	4.71	4.72	4.42	3.26	3.99	3.33
United Kingdom	6.50	6.65	10.27	7.55	6.27	6.17
Brazil	15.83	8.10	8.77	6.74	7.66	5.56
Taiwan	5.65	5.72	6.18	7.75	7.33	9.46
Hong Kong	8.65	4.71	4.52	3.63	3.80	3.27
Japan	7.44	7.32	10.82	8.33	6.89	8.44
Korea	7.23	7.20	5.34	6.70	5.79	7.58
Australia	6.00	5.87	4.98	6.13	6.07	5.86
Italy	12.72	20.88	15.62	9.98	10.57	29.80
All other	7.07	5.75	5.10	5.04	4.77	6.23
Average	5.87	5.33	5.31	4.60	4.77	4.55

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table C-9
Aluminum wire and cable: U.S. exports of domestic merchandise, by principal markets, 1989-92 and January-June 1992-93

Market	1989	1990	1991	1992	January-June 1992	January-June 1993
	Quantity (1,000 kilograms)					
Mexico	3,906	4,191	14,726	14,700	5,992	9,530
Taiwan	2,400	2,286	7,015	4,468	3,790	1,975
Korea	149	48	2,362	3,394	1,564	1,433
Canada	1,583	2,249	2,611	1,850	947	1,130
Hong Kong	805	77	3,803	943	942	326
Iran	0	0	0	156	151	15
China	2	1,097	316	1,736	710	1,894
Venezuela	42	28	78	877	564	805
Thailand	3	13	10	504	50	1,739
United Kingdom	74	102	157	274	133	85
All other	1,561	2,942	2,547	3,251	1,313	1,883
Total	10,524	13,034	33,625	32,153	16,155	20,816
	Value (1,000 dollars)					
Mexico	14,596	15,467	35,834	38,163	14,979	25,208
Taiwan	1,708	3,080	20,460	15,438	13,329	4,626
Korea	811	303	6,732	10,586	5,997	2,950
Canada	6,513	7,598	7,959	6,625	3,248	4,212
Hong Kong	1,107	433	10,640	5,203	5,152	760
Iran	0	0	0	5,084	5,033	53
China	54	776	1,861	5,012	2,025	3,772
Venezuela	216	170	407	2,962	1,785	1,946
Thailand	44	138	166	1,411	184	3,713
United Kingdom	456	667	1,535	1,190	488	471
All other	7,803	11,295	11,585	11,920	5,244	9,362
Total	33,307	39,927	97,180	103,593	57,465	57,074
	Unit value (dollars per kilogram)					
Mexico	3.73	3.69	2.43	2.59	2.49	2.64
Taiwan	.71	1.34	2.91	3.45	3.51	2.34
Korea	5.44	6.31	2.85	3.11	3.83	2.05
Canada	4.11	3.37	3.04	3.58	3.42	3.72
Hong Kong	1.38	5.62	2.80	5.52	5.47	2.33
Iran	0	0	0	32.59	33.33	3.53
China	27.00	0.71	5.88	2.88	2.85	1.99
Venezuela	5.14	6.07	5.21	3.38	3.16	2.42
Thailand	14.67	10.62	16.67	2.80	3.68	2.13
United Kingdom	6.10	6.53	9.77	4.34	3.67	5.54
All other	4.99	3.84	4.55	3.66	3.99	4.97
Average	3.16	3.06	2.89	3.22	3.55	2.74

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-10

Table C-10
Aluminum powders and flakes: U.S. exports of domestic merchandise, by principal markets, 1989-92 and January-June 1992-93

Market	1989	1990	1991	1992	January-June 1992	January-June 1993
	(Quantity (1,000 kilograms)					
Canada	980	1,744	1,499	1,268	618	593
Japan	392	419	665	632	254	497
United Kingdom	230	61	411	513	181	599
Mexico	444	440	478	576	211	238
France	405	536	503	318	142	476
Italy	163	244	72	72	50	61
South Africa	23	105	87	158	81	57
Hong Kong	8	9	12	30	13	27
Korea	13	16	68	41	33	55
Switzerland	16	22	17	28	19	17
All other	587	1,105	681	609	237	233
Total	3,261	4,701	4,494	4,246	1,839	2,855
	Value (1,000 dollars)					
Canada	4,301	5,385	4,472	3,589	1,944	1,755
Japan	2,813	3,249	4,309	3,485	1,481	2,539
United Kingdom	1,159	502	1,108	2,406	1,722	1,329
Mexico	1,516	1,733	1,578	1,616	671	609
France	1,524	2,080	2,007	813	324	1,683
Italy	811	800	547	489	326	229
South Africa	115	334	403	465	119	175
Hong Kong	72	81	179	375	196	301
Korea	145	156	411	277	239	107
Switzerland	262	177	111	265	93	143
All other	3,216	4,755	3,168	2,625	1,243	1,295
Total	15,934	19,253	18,291	16,406	8,359	10,164
	Unit value (dollars per kilogram)					
Canada	4.39	3.09	2.98	2.83	3.14	2.96
Japan	7.18	7.75	6.48	5.51	5.84	5.11
United Kingdom	5.05	8.20	2.69	4.69	9.51	2.22
Mexico	3.41	3.94	3.30	2.80	3.19	2.55
France	3.76	3.88	3.99	2.56	2.28	3.54
Italy	4.98	3.28	7.65	6.84	6.47	3.75
South Africa	4.97	3.19	4.64	2.95	1.46	3.04
Hong Kong	8.52	9.38	14.29	12.48	15.40	11.03
Korea	11.26	9.61	6.04	6.78	7.32	1.93
Switzerland	16.40	8.11	6.63	9.32	4.98	8.52
All other	5.48	4.30	4.65	4.31	5.24	5.56
Average	4.89	4.10	4.07	3.86	4.55	3.56

Note.--Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of Commerce.

C-11

APPENDIX D

GLOSSARY

D-1

GLOSSARY

Aging: A reaction of the alloying elements taking place in the heat-treatable alloys after solution heat-treatment. Aging increases hardness and strength although it decreases ductility. The reaction may occur at room temperature (natural aging), although it may be accelerated at elevated temperature (termed artificial aging), in the range of 250 degrees to 450 degrees F.

Aluminum alloys:

Each alloy is characterized by a series of numbers which distinguish it as wrought or cast and broadly describe its chemical composition and properties. Aluminum products also are classified as heat-treatable or non-heat-treatable depending upon whether such treatment is required to optimize alloy properties. Each wrought alloy is assigned a four-digit number. The first number denotes the alloy series or principal nonaluminum element. Each of the additives usually enhances one or more physical properties such as strength or corrosion-resistance. The second digit indicates any modifications to the original alloy, or impurity limits. The third and fourth digits identify the alloy composition in the series, although for the 1000 series which are at least 99 percent pure aluminum, the last two digits denote the minimum aluminum percentage. Alloys are further classified by denoting their metallurgical condition or the sequence of basic treatments used to produce various tempers. These are designated by single letters following the alloy designation. Temper designations include "F" (as fabricated), "O" (annealed), "H" (strain-hardened), "W" (solution heat-treated), and "T" (thermally treated to produce stable tempers other than F, O, or H).

1000 series consists of aluminum of minimum 99 percent purity, called unalloyed aluminum. Aluminum of this series possesses good corrosion resistance, high electrical and thermal conductivity, low mechanical properties, and excellent workability. Major applications are in the electrical and chemical industries as well as for decorative parts and foil.

2000 series contains copper as the major alloying agent and requires solution heat treatment to obtain mechanical properties equal to or better than low-carbon steel. These alloys possess good ductility (and good castability), machinability, and strength, but poor corrosion resistance; they are used for structural applications, screw machine products (bolts, nuts, and industrial fasteners). When combined with small amounts of silicon and zinc, aluminum alloys have excellent fluidity, allowing them to be used to make thin-section castings. Alloy 2024 is an aircraft alloy.

3000 series contains manganese, is generally non-heat-treatable, and is moderately stronger than alloys in the 1000 series while having the same corrosion resistance and workability. Alloy 3003 is considered a popular general-purpose alloy and is widely used in cooking utensils and chemical equipment.

4000 series contains silicon, which lowers the melting point. These alloys possess high corrosion resistance and have good castability. Some grades in the series are used in welding wire and as brazing alloys; others are used in meter and engine parts.

5000 series contains magnesium, and is non-heat-treatable with good welding characteristics, high tensile strength, and good corrosion resistance to sea water. Alloys in this series may be used for can stock and for wire, rod, bar, sheets, and tubing which are used in structural applications. When additionally alloyed with manganese, a moderate-to high-strength alloy results, suitable for use in welded structures.

6000 series contains both silicon and magnesium and is heat-treatable. Alloys possess good formability and corrosion-resistance with medium strength. Used widely.

7000 series contains zinc with smaller percentages of magnesium to create a high-strength, heat-treatable alloy. Small amounts of copper and chromium may be added as well. Alloy 7075 is used in air-frame structures and highly stressed parts.

Castings' alloys are designated by a two or three-digit alloy number followed by a decimal to denote their properties. The first digit signifies the alloy series or principal addition, the second and third digits identify the specific alloy; the decimal indicates whether the alloy composition is for the final casting, or for ingot. A capital letter prefix indicates a modification of the basic alloy. The elements most often found in casting alloys include silicon, magnesium, copper, and nickel.

Annealing: A thermal treatment used to soften the metal by removing stresses that build up during cold-working. When the metal is fully softened (fully annealed) it is more ductile but less strong than a metal that has been partially annealed.

Anodizing: The oxide film, naturally created when aluminum metals are exposed to the atmosphere and react with oxygen, is made thicker to enhance corrosion-resistance and wearability. To anodize, aluminum metal is transfered through a sulfuric acid bath through which an electric current is passed.

Billet: The raw material for an extrusion press. Billets are cylindrical lengths of cast aluminum which, after preheating to a specified temperature, will be loaded into the press container and forced through a steel die opening. The extrusion assumes the shape of the opening of the die.

Bloom: A semifinished, hot-rolled product, rectangular or square in solid cross-section, produced on a blooming mill. Blooms are often used for making rod, bar, and wire.

Cable: Usually comprised of one or more aluminum wires vertically wound around a central stranded core used for the transmission of electricity. Aluminum cable steel reinforced (ACSR) comprises most overhead high voltage transmission lines.

Cold finished: Rod or bar brought to a final diameter or thickness at room temperature.

Cold working: Material reduction or deformation carried on below recrystallization or annealing temperature of the aluminum metal. Cold working results in strain-hardening with an increase in strength and hardness. Annealing reduces hardness but results in less strength. Non-heat-treatable alloys are identified in the four-digit numbering system as having a "1", "3", "5", and sometimes an "8" as their first digit, indicating that these alloys have their strength increased by cold-working, but are not annealed.

Drawing stock ("redraw rod"): A solid round mill product in coils or straight lengths of 0.375 inches or greater in diameter, produced by continuous casting, followed by size-rolling or by rolling from cast ingot, suitable for drawing into wire. Most redraw rod is produced in the United States for drawing into electrical conductor.

Embossed/patterned sheet: A product produced by passing coiled sheet through a pair of steel rolls that have a repeating pattern machined or etched on their surface. The pressure of the rolls transmits the embossments to the sheet's surface.

Extrusions (or extruded shapes): Continuous lineal shapes produced by forcing a preheated billet through an orifice in a steel die under pressure, forcing the aluminum to assume the shape of the opening. Extrusions are commonly used in aircraft structural and frame members, chemical equipment, furniture, condensers, heat exchangers, pressure vessels, handrails and baggage racks, irrigation pipe and conduit, and automobile bumpers.

Finishing: Production operations performed on a material to alter its appearance, to improve its corrosion resistance, to enhance its esthetics, or to prepare it for further processing. The term includes: mechanical finishing (buffing, polishing, grinding, sanding, or shot blasting); chemical finishing (e.g., caustic etching or bright dipping--preparation for painting or anodizing); electrolytic finishing (anodizing processes); and, applied finishing (painting, laminating, or plating, for example).

Foil: A flat-rolled, flat-surfaced product, coiled or not, of solid rectangular (other than square) cross section with or without rounded corners, of a uniform thickness less than 0.0059 inches.[1] Foil may have patterns (grooves, ribs, checkers, tears, buttons, lozenges, for example) or have been perforated, corrugated, polished or coated. Foil comes in a limited range of alloys (most foil is produced in the United States in the 1000 series, although small amounts are rolled in the 2024, 3003, 5052, and 5056 alloy series) and tempers. Foil is produced from sheet and has been reduced on foil mills by further cold-rolling, annealing, and further cold-rolling; a few producers continuously cast foil. Foil can also be embossed, cut to shape, perforated, etched, coated, printed, colored, decorated, or backed. Containers and packaging, including flexible packaging, account for the bulk of foil uses.

Forging stock: A mill-produced rod, bar, or special shaped metal piece subjected to heat treatment to render it suitable for forging.

Heat-treatable alloys: Aluminum alloys in the 2000, 6000, and 7000 series that achieve their maximum strength through heat treating alone or through a combination of heat treatment and cold working.

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[1] This represents a definition commonly used within the U.S. industry. The tariff definition differs in terms of allowable thickness, up to 0.2 mm (0.00787 inches).

Impacts: A class of aluminum mill products also called impact extrusions produced by a forging process (see description under "Manufacturing process").

Ingot: A cast form of aluminum metal that is suitable for remelting or fabricating. It may take the form of a rolling ingot, extrusion ingot, forging ingot, or remelting ingot and its size and shape are designed to facilitate those processes.

Manufacturing process(es): Aluminum mill products, alloyed and unalloyed, are made by one of four basic operations: casting, forging, machining, and the plastic deformation of hot or cold metal during rolling, drawing, or extruding operations. From these operations numerous fabricated products can be created. In each operation, the raw materials are either primary or secondary aluminum in ingot form, tee, extrusion billet, or sheet.

Casting is the only fabricating process that requires aluminum to be in a liquid state. Casters purchase molten aluminum, master alloys in bar or ingot. In the casting process, molten aluminum is forced or poured into a mold, allowed to harden, and is then heat-treated and aged. This product is called a casting and distinguished from continuous cast products. Molds may be made of sand or metal; sand-castings are usually utilized to produce higher strength and rugged parts whereas metal or permanent mold castings are used for higher-volume parts' production. In die-casting, the molten metal is injected into a metal mold under high pressure. Cast products may be machined in downstream operations and become various builder's hardware, automobile and aerospace parts. Much of the industry that manufactures castings consumes its own production in-house; although there are numerous small casting shops, several large companies account for a significant proportion of captively-consumed production.

Continuously cast rod, bar, and sheet have gained market share in recent years. Production processes for these products utilize a molten metal flow onto a wheel (either the Hazlett caster, in the case of sheet, or the Properzi process in the case of bar and rod) whereupon the metal is continuously cast to near-final thickness, rapidly chilled and solidified, and is immediately channeled into the rolling process (described later). There is little or no overlap in uses between these products and castings; the industry performing continuous casting also differs from the castings' industry.

Forging may be done by several processes:

Hammer process--forging stock is heated to a hot-working temperature and then placed on a block which holds a die containing half the product to be forged. A second die, which is in the hammer end, strikes the stationary block. The process is repeated until the metal conforms to the shape of the two dies.

Impact products--are formed in a confining die from a cold metal slug by a rapid simple stroke application of force through a punch causing the metal to flow around the punch, and/or through an opening in the punch or die. In the punch method, pressure forces the slug to flow upwards around a punch to assume a cylindrical shape, such as a toothpaste tube, an aerosol can, or a fire extinguisher.

Forging-press process--aluminum metal heated to proper temperature is squeezed into the shape of the die under continuous pressure from a mechanical or hydraulic press. After the forging comes out of the die, it is heat-treated and aged.

Powder metallurgy process--mixed and blended aluminum metal powders are fed into a precision die and pressed, in most cases at ambient temperature, with pressures between 10 tons and 60 tons per square inch. The part, called a green compact, is ejected from the die and is heated in a controlled atmosphere sintering furnace to just under the melting point of the aluminum alloy which bonds the compressed powders into a strong structure. The advantages of powder metallurgy over other types of forging is in higher production rates of small intricate parts and lower tooling costs, and that certain unique products can be made with a great variety of combinations of metals and nonmetals. Powder metallurgy parts may be heat-treated, machined, plated, or impregnated with lubricants and other materials.

Machining: The process by which metal is removed from stock in order to produce a part or desired shape. Typical machining operations include turning, boring, cutting, and polishing. Machining typically is performed outside of aluminum mills by downstream processors.

Plastic deformation: Processes by which fabricators process aluminum metal in solid forms of ingot, billet, and slab by hot- and cold-metal rolling, drawing and extruding.

Rolling operations--common for the production of plate, sheet and strip, and foil that typically utilize sheet ingot as their input. The rolling ingot or sheet ingot is rectangular and is scalped to remove surface imperfections that might be rolled into the metal during subsequent processing. The ingot is heated and run through a reversing hot-rolling mill which reduces the thickness by compression while proportionately increasing the length.

Drawing process--used to produce rod, bar, wire, and drawn pipe and tube (although Properzi continuously-cast rod and bar have gained market share in recent years). Ingot is first reduced in size in a blooming mill, scalped to remove surface imperfections, and is reheated and rolled. From the rolling mill, the metal is moved to a draw bench where it is passed through a series of dies that further reduce its diameter and produce the desired shape while achieving a proportional elongation. It may then be heat-treated, straightened, and aged.

Extrusion process--used for making shapes, tubing, rod, and bar. A round form of ingot is heated and placed in an extrusion press where it is forced under pressure through a die. Heat treating, stretching, contour rolling, and aging follow extrusion. In the case of extruded tube, the billet used is often hollow and does not require further fabricating. This process may produce either seamless tube or porthole (a seamed product with a metallurgical weld). The extrusion process has potential for almost any application requiring a product with parallel lines and may be utilized to produce complex shapes.

Pipe and tube: Pipe is normally seamless and is sold to standard size schedules which designate standard dimensions for wall thicknesses, outside and inside diameters, and the weight per foot of each nominal size listed. Tube is a hollow section with a longer length than width and a uniformly thick wall; tube may be round (which predominates), hexagonal, octagonal, elliptical, square or rectangular with sharp or rounded corners.

Plate: A flat-rolled, flat-surfaced product, coiled or not, of solid rectangular (other than square) cross section with or without rounded corners, of a uniform thickness of 0.25 inch or greater (plate sizes range up to as much as 6 inches thick). According to industry product guides, plate is available in widths up to approximately 14 feet and lengths up to 105 feet. Plate is not typically rolled further on a cold-rolling mill, unlike sheet, strip, and foil. As the plate emerges from the hot-rolling mill shears or saws trim the edges to produce uniform rectangular or other desired shapes such as squares, circles, and blanks (irregular shapes). Tread plate has patterns (grooves, ribs, checkers, tears, buttons, lozenges, for example) of relief used to provide a non-skid surface on runways, flooring, or decking. Heat-treatable plate (which accounted for approximately 65 percent of shipments, by quantity in 1992) has undergone heat-treatments (commonly, aging or stabilizing). Plate is sold in nonstretcher-leveled ("as rolled"); stretcher-leveled to achieve commercial quality flatness; and stress-relieved in which internal compressive and tensile stresses are more nearly equalized.

Properties:[2]

Light weight: Aluminum has a specific gravity of 2.7 and its mass is only about 25 percent that of iron and 30 percent of copper, brass, or zinc.

Strength: 1000 series alloys possess a tensile strength of 13,000 pounds per square inch, which however, does not allow it to be used for structural applications. Cold-worked or alloyed, its tensile strength can be increased to over 100,000 p.s.i.

Durability: Aluminum possesses high atmospheric corrosion-resistance. This property is increased when alloyed.

Nontoxicity: Aluminum does not chemically interact with foods, allowing aluminum to be used in food packaging, cookware, and food-processing equipment.

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[2] Adapted from Rhea Berk et al., Aluminum: Profile of the Industry, p. 6.

Electrical conductivity: Electrical conductor grade aluminum possesses a conductivity equal to 61 percent that of copper; however, a pound of aluminum can conduct almost twice as much electricity as a pound of copper.

Terminal conductivity: Aluminum alloys are 1.8 times more efficient than copper and nine times more efficient than steel as a conductor of heat.

Reflectivity: Aluminum is an excellent reflector of radiant energy at all spectral wavelengths, with a light reflectivity in excess of 80 percent.

Ductility: Aluminum's crystalline structure allows it to be fabricated into any form, cast by any foundry method, rolled to any thickness, stamped, drawn, spun, roll-formed, hammered, or forged.

Emissivity: Although an excellent reflector, aluminum metal emits very little energy. After being heated, aluminum releases most of its heat through convection and conduction, rather than by emission.

Recyclability: Aluminum can be recovered and remelted repeatedly. Producing new molten metal by secondary processes requires only about 5 percent of the energy needed to produce aluminum from bauxite.

Nonporosity: Aluminum sheet and foil are moisture-proof, airtight, and light-proof; it is also nonsparking and nonmagnetic.

Powder and paste: This group of products includes flakes, powder, and paste, in sizes ranging from finer than 1,000 microns (that are produced by blowing or asperating molten metal through an orifice, termed atomized powder) to scale-like particles that are produced by milling aluminum metal products in the presence of a lubricant, thinner or plasticizer. Aluminum powders are used to make components for equipment using powder metallurgy techniques. Aluminum flakes and paste are used in inks, in paints, in the manufacture of stamping and embossing materials, and for decorative papers and plastics.

Profiles: Rolled, extruded, drawn, forged or formed products, coiled or not, of a uniform cross section along their whole length, which do not conform to any definitions of bars, rod, wire, plate, sheet, strip, foil, tubes or pipes.

Rod and bar (rolled, extruded, drawn, or forged): A solid, round, square, rectangular, hexagon, or octagonal-shaped product in straight lengths of 0.375 inches or greater in diameter, produced by continuous casting or rolling, or by extrusion, drawing, or forging processes. Bar and rod are used to produce fasteners and fine wire (used for mesh and screen) and for structural applications.

Scrap: Discarded metallic material that may be reclaimed through sorting and refining. Aluminum scrap is characterized according to its purity and origin. Old scrap is typically purchased by the refinery and is comprised of recycled consumer products whereas new scrap stems from the refinery's own production of intermediate and end products (new scrap is further characterized as pure, segregated, or mixed). Aluminum scrap is widely used by secondary refiners as a feed-stock for their production of ingot, used in the production of cansheet, castings, and forgings. Used beverage cans are a principal source of recycled scrap.

Sheet: A flat-rolled, flat-surfaced product, coiled or not, of solid rectangular (other than square) cross section with or without rounded corners, of a uniform thickness between 0.006 inches and 0.250 inches. Although sheet is initially produced on a hot-mill, it typically undergoes further processing on a cold-rolling mill, and may be subjected to an annealing process prior to a final cold-rolling step (termed a temper pass). After cold-rolling, heat-treatable sheet is heated and quenched; sheet may be further processed by stretching and aging. Sheet may be sold in straight or cut lengths, although it is more typically sold in coils with widths of up to 9 feet and in the nonstretcher- and stretcher leveled, and stress-relieved versions as plate. Sheet and strip (a narrow version of sheet) are mostly produced in the nonheat-treatable series (1000, 3000, and 5000 alloys), although a small amount is produced in the heat-treatable alloy series (2000, 6000, and 7000 series).

Soft alloys: Aluminum alloys in the 1000, 3000, 5000, and 6000 series because of their relatively lower strength. These alloys increase in hardness and strength through cold working and lose strength through thermal treatments. Also termed non-heat-treatable alloys.

Stabilizing: Aluminum-magnesium alloys tend to age soften during storage resulting in lower mechanical properties. These alloys are subjected to a low-temperature thermal treatment prior to shipment from the mill.

Wire: Rolled, extruded, or drawn products in coils which have a uniform solid cross section along their whole length in the shape of circles, ovals, rectangles (including squares), triangles, convex polygons. Usually under .375 inches in diameter. Cold-heading wire is a wire product of a quality suitable for the manufacture of rivets and bolts. Wire production follows a similar process as rod, although there are more dies and a smaller diameter is needed, and there may be an intermediate annealing process prior to the metal being drawn on wire drawing machines.

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APPENDIX E

CHAIRMAN'S PRESS STATEMENT AND MEMORANDUM OF UNDERSTANDING

E-1

CHAIRMAN'S PRESS STATEMENT

Multilateral Conference on Aluminum
Ottawa - March 1, 1994

1. As agreed in Brussels, representatives from the authorities of Australia, Canada, the European Union, Norway, the Russian Federation and the United States of America met again today in Ottawa to review developments in the global market situation since the Brussels meeting on the basis of the most recent information available.

2. The text of the Memorandum of Understanding agreed upon following the Brussels meeting was finalized and all participants have confirmed their acceptance of it. It is being made available.

3. In the review of the current market situation, the participants noted that following the Brussels meeting the reaction of the market has been positive. In this regard, the participants noted that there had been announcements of about one million tonnes of cuts in global aluminum production since November 1, 1993. The participants also noted that further adjustments would have to occur before normal market conditions are restored.

4. The participants decided to establish a working party to improve transparency and consider measures to exchange data on a more timely basis. The working party will begin work immediately and report back ~~to the next meeting~~.

5. Participants agreed to reconvene in Brussels on April 21, 1994 to review further developments of the global market situation on the basis of the most recent information available.

E-2

MEMORANDUM OF UNDERSTANDING
CONCERNING THE ALUMINIUM MARKET

Representatives of the authorities of Australia, Canada, the European Union, Norway, the Russian Federation and the United States of America, met at Brussels on 18 to 21 January 1994. Following governmental consultation these representatives on 28 January 1994 subscribed to the following Memorandum of Understanding:

1. They recognize that the world aluminum industry is facing a grave, exceptional and unforeseeable situation involving a considerable current excess global supply of primary aluminum, estimated by industry at the Washington Conference on 1/2 December 1993 at 1.5 to 2 million metric tonnes on an annual basis taking into account excess inventories.

2. In their assessment, these present structural problems are due to an unanticipated combination of political and economic developments which is unlikely to re-occur. They consider that the principal response to this situation should be by way of worldwide market oriented commercial decisions by companies on an individual basis.

3. The participants consider that on the basis of:

   - their objective analysis of conditions in the aluminum market relying on the best information available to government sources;

   - their assessment of possible adjustment by producers in other states;

   - the reduction of production of primary aluminium in the Russian Federation by 500,000 tonnes/year (to be composed of a first stage of 300,000 tonnes/year within three months of 1 February 1994, and 200,000 tonnes/year within the following three months) anticipated in accordance with its unilateral statement of 29 January 1994, regarding the steps to be taken concerning the aluminium market, as clarified*;

the situation in the world aluminium market now shows a likely reduction of worldwide production of an amount compatible with the higher end of industry assessments of excess supply noted in paragraph 1.

* Letter of the Russian Federation dated 1 March 1994.

4. They noted that commercial decisions by producers in other States could also be expected to facilitate the return to normal market conditions.

5. The participants consider that unilateral trade actions are not the preferred response to the current aluminum market problems. Any such actions would be inconsistent with this Memorandum of Understanding. Any existing measures will, however, be allowed to expire under their existing terms but in any event not later than 28 February 1994.

6. The participants consider that the IPAI offers the most effective mechanism to ensure transparency and the availability of full and comprehensive data concerning the evolution of the aluminum market. The Russian Federation confirmed that their producers have initiated the necessary steps to cooperate fully with the IPAI to incorporate Russian aluminum data into its reporting structure and with a view to becoming members of that body.

7. The participants consider that the aluminum industry should operate on the basis of fair competition and high environmental standards. With a view to furthering restructuring of the Russian aluminum industry, the outline of a programme for which was presented at the conference, participants consider that all means should be examined in order to provide technical and other assistance to the Russian Federation to facilitate modernization, the improvement of environmental standards and the development of internal aluminum consumption.

8. The participants noted the following statements made with a view to furthering cooperation and technical assistance in respect of the Russian Federation:

- Australia indicated that it foresaw significant opportunities for investment by Australian industry in the restructuring of the Russian aluminum industry, particularly in relation to the development of linkages on raw material supplies.

- Canada will assist Russia through its technical assistance programme providing specific expertise for policy and programme development in the metals sector and financial support to Canadian firms with respect to privatization, modernization and industrial development activity in the aluminum sector.

- The European Union pledged the full support of funds available under its TACIS programme (pursuant to its current procedures) and further assured the Russian Federation that it would use its best offices in respect of the financing of viable investment projects in the Russian Federation.

- Norway has established a general guarantee scheme in respect of exports to and investments in the CIS States and the Baltic States. In addition Norway indicated possible support of projects involving training and technical assistance.

- The United States of America, in furtherance of Russian restructuring of its aluminum industry, will sponsor the creation of a $250 million equity investment fund for capital intensive industries in the newly independent States, guaranteed by the Overseas Private Investment Corporation.

Participants further agreed to use their best offices with the EBRD and World Bank in respect of viable investment projects in the Russian aluminum industry.

9. The participants consider that this MOU will apply for 24 months at the maximum.

10. The participants agreed that they would meet again in Canada at the end of February when they would review the development of the global market situation on the basis of the most recent information available.

E-5

(Translation)

STATEMENT OF THE GOVERNMENT OF THE RUSSIAN FEDERATION OF JANUARY 29, 1994

The Government of the Russian Federation views with concern the crisis existing in the world market for primary aluminum.

A further intensification of this crisis [would be] fraught with serious negative economic and social consequences for all producers of aluminum, including Russia.

In this connection, Russia has come forward as the initiator of a multilateral process of consultations among the main aluminum producers, which began in Moscow in October 1993 and was continued in Washington in December 1993 and in Brussels in January 1994.

Sharing as it does the general understanding of the situation in the aluminum market reached during these consultations and the necessity of taking urgent measures to re-create an atmosphere of trust in the world trade in aluminum, the Russian side, as a good-will step and in expectation of an appropriate reaction on the part of other producers, confirms the intention of Russian industry to reduce its production of primary aluminum by 500,000 tonnes from the level as of November 1993, and is prepared to make use of the legal means at its disposal in order to induce the Russian aluminum producers to implement this reduction.

We have in mind that this reduction will be effected in two stages, lasting three months each, beginning on February 1, 1994, of 300,000 tonnes and 200,000 tonnes, respectively, of the annual rate in the course of each stage, and will remain [in effect] for no more than 24 months.

Thus, based on the agreed-upon estimates of the excess in world production over demand, Russia is prepared to make its contribution in the amount of one-fourth of the existing imbalance.

This intention will be implemented on the understanding that:

- the total reduction in world aluminum production, outside Russia, will amount to not less than 1.5 million tonnes, compared with the level as of November 1993;
- the time frames of this reduction will not lag behind the reduction of production in Russia;
- Russia's trading partners will refrain from maintaining existing protectionist measures or introducing new ones in the trade in aluminum.

The Government of the Russian Federation expresses its confidence that this step will be properly viewed by the other producers and will contribute to the success of the multilateral process.

E-6

Mr. ALLGEIER
ASSISTANT U.S. TRADE REPRESENTATIVE
EUROPE AND THE MEDITERRANEAN
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20506

МИНИСТЕРСТВО
ВНЕШНИХ ЭКОНОМИЧЕСКИХ СВЯЗЕЙ
РОССИЙСКОЙ ФЕДЕРАЦИИ

Dear Mr. Allgeier

The Ministry for External Economic Relations of the Russian Federation wishes to clarify the position of the Russian side regarding some provisions, contained in its Statement of January the 28th.

1. The Russian Federation confirms that the multilateral Memorandum of Understanding (MOU) reflects the general expectation that market forces are likely to lead to a world-wide reduction in annual aluminum production within the limits stated in paragraph 1 of the MOU.

In this respect the Russian side confirms the possibility of reviewing its intention to take measures related to the reduction of aluminum production in two steps by 300,000 and then 200,000 metric tons taking into account the extent to which the general reduction of world aluminum production is less than 2.0 million metric tons, and the rate at which such reductions occur.

2. The Government of the Russian Federation has at its disposal the necessary legal means to implement its intention (including those contained in the Customs Code of the Russian Federation), matching the requirements of the GATT, and intends to use them to meet the targets, indicated in paragraph 1 above.

Sincerely,

1 March 1994

Georgy Gabounia
Deputy Minister

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