

TIN

By James F. Carlin, Jr.

In 1996, there was no domestic mine production of tin. Of the primary tin used domestically, 25 firms consumed about 84%. The major uses were as follows: cans and containers, 25%; electrical, 20%; transportation, 12%; construction, 10%; and other, 33%. The estimated value of primary metal consumed domestically was about \$330 million.

About 11,000 metric tons of tin in purchased old and new tin scrap, including tin alloys, was recycled. Of this, about 7,600 tons was old scrap. About one-fifth of the tin consumed in the United States was produced from scrap at 7 detinning plants and 110 secondary nonferrous metal-processing plants. There was continued interest in the recycling of used tin cans, largely owing to the rising costs and limited space of landfills. The recycling rate for steel cans was 58% in 1996, having risen from 56% in 1995, 53% in 1994, 40% in 1993, and 15% in 1988. By yearend, 11,765 tons of pig tin had been sold from the National Defense Stockpile (NDS), leaving 112,954 tons in inventory, all of which was considered to be in excess.

World tin mine output increased only slightly. Industry observers believed that after 14 consecutive years of an excess of tin in world markets, supply and demand moved into an approximate equilibrium. The average Platt's Metals Week composite price of tin declined very slightly.

Tin was mined in 23 countries, the top 5 of which accounted for about 82% of the world total of 196,000 tons. China was the largest producer (31% of the world total), and was followed by Indonesia (20%), Peru (14%), Brazil (10%), and Bolivia (8%).

World tin reserves were estimated to be 7 million tons and were considered to be adequate to meet the world's future tin requirements. Assuming that the world primary tin consumption will be 200,000 tons annually, these reserves would last 35 years. Most tin reserves were in Asia and South America.

Legislation and Government Programs

The NDS continued in its seventh year of being managed by the U.S. Department of Defense, with day-to-day operations being guided by the Defense Logistics Agency (DLA). In 1996, the DLA sold 11,765 tons of pig tin from the stockpile. Of this total, 5,000 tons represented a long-term sales contract to Considar Corp. (New York, NY). From January to September, the DLA continued its daily tin sales program under the same format as in the prior year—sales held each day, with orders for lots of 5 tons or more being accepted daily between 1:30 p.m. and 3:30 p.m. at the price set by the DLA for that day. Then, at the beginning of fiscal year 1997 (starting October 1, 1996),

the daily tin sales program was changed to a monthly spot sales program for which 2,000 tons of tin was allocated. Another 10,000 tons of material was to be sold under two long-term contracts—one in February 1997 and one in August 1997.

The following depots held the largest inventories of tin, in descending order: Hammond, IN, Point Pleasant, WV, Anniston, AL, and Stockton, CA. At yearend, 112,954 tons of tin was in the NDS.

Production

Mine Production.—There was no domestic tin mine production in 1996. This was the third consecutive year there had been no domestic tin mine production, after many years of having one or two small tin mines operating.

Secondary Production.—The United States is believed by industry observers to be the world's largest producer of secondary tin. Tin metal recovered from new tinplate scrap and used tin cans was the only type of secondary tin available in the marketplace as free tin; most secondary tin was produced from the various scrapped alloys of tin and recycled in those same alloy industries. Secondary tin from recycled fabricated parts was used in many kinds of products and was a major source of material, particularly for the solder and the brass and bronze industries.

The former Steel Can Recycling Institute, which had been started in 1988 and funded by five domestic tinplate producers to advance the collection, preparation, and transportation of steel can scrap, was in its third full year of expanded activities under its new name, the Steel Recycling Institute (SRI). The SRI fostered the collection of all steel scrap (ranging from appliances to cars), not just steel cans. The SRI continued to maintain a program of having representatives in various regions of the United States work with municipalities, scrap dealers, and detinners to promote the recycling of tin cans. The SRI announced that the recycling rate for steel cans reached a new high of 58% in 1996. In the 8 years of SRI's existence, the recycling rate for steel cans has nearly quadrupled—from 15% in 1988 to 58% in 1996. The SRI continued to be an active sponsor of the recycling of aerosol steel cans.

One of the major domestic detinners, Proler International Corp. (Houston, TX) was purchased by Schnitzer Steel Industries Corp. (Portland, OR). Proler had detinning operations in Coolidge, AZ, and Seattle, WA. Schnitzer, long a major operator of various West Coast scrap operations, announced that it planned to keep Proler's detinning plants intact (Metal Bulletin, 1996e).

Consumption

Domestic consumption of primary tin increased by about 3.7% in 1996, whereas consumption of secondary tin fell by 24%, owing principally to less use in solder.

Tinplated steel and tin-free steel accounted for 24% of the 135 billion metal cans shipped domestically; aluminum accounted for 76%. These percentages were the same as those of 1995, when 134 billion cans were shipped domestically. Aluminum held virtually 100% of the beverage can market, while steel dominated in the food can and the "general-line" can markets (Can Manufacturers Institute, 1996). One of the domestic tinplate producers, Wheeling-Pittsburgh Steel Corp. (Wheeling, WV), announced the completion of construction of its new joint-venture tinplate mill in Belmont County, OH. The tin mill, known as Ohio Coatings Co., is a joint-venture with Dong Yang Tinplate Industries Co. Ltd. (Republic of Korea) and Nittetsu Shoji Inc. (Los Angeles, CA). The mill, which reportedly cost \$80 million, is the first tinplating facility constructed in the United States since the early 1960's and replaces Wheeling's existing 50-year-old tin mill in Yorkville, OH. The State of Ohio assisted in the venture by obtaining a 10-year tax abatement for the mill and working with the county in seeking government grants for equipment and employee training. Capacity of the new facility is rated at 230,000 tons per year, which is slightly higher than that of the Yorkville plant. The mill was expected to use about 500 tons of tin per year. The plant will initially produce tinplate, and then later, tin-free steel. Wheeling-Pittsburgh is expected to supply from 75% to 80% of the light-gauge cold-rolled coil feedstock. Trial runs were initiated near yearend. The United Steelworkers Union struck Wheeling-Pittsburgh on October 1; the strike continued through the end of the year (CRU Tin Monitor, 1996b).

Prices

The Platt's Metals Week composite price for tin metal reached its peak for the year in April and ended the year somewhat lower than at the beginning of the year. The 1996 average annual composite price was slightly lower than that for 1995.

The London Metal Exchange (LME) remained the primary trading arena for tin. Tin was one of only six metals (along with aluminum, copper, lead, nickel, and zinc) to be traded on the LME. The Kuala Lumpur Commodities Exchange in Malaysia continued as an active tin trading forum.

Foreign Trade

Imports, which supply most domestic requirements, declined about 9% in 1996. Imports of tin in all forms (ore and concentrate, metal, waste, and scrap) remained free of U.S. duty. (See tables 7, 8, and 9.) In the United States, trading firms marketed most of the tin metal, which they imported from a variety of countries and warehoused in this country until they sold it to customers. Foreign-owned trading firms tended to

dominate the field. Most tin dealers were based in the New York, NY, area. Some tin also was marketed directly in the United States by large foreign producers that maintained sales offices here and sold their tin metal, usually on a 1-year contract basis, only to the largest users. Perhaps foremost among these direct-sale operations was Indo-Metal Corp., which served as the exclusive North American sales outlet for tin metal produced by Indonesia's large tin producer, P.T. Tambang Timah.

For the fifth consecutive year, Brazil was the largest source of U.S. tin metal imports. Indonesia ranked second and was followed by Bolivia and China.

World Review

At the Association of Tin Producing Countries' (ATPC) 14th minister's conference in Singapore in September, it was announced that Australia and Thailand would be leaving the organization by yearend and that Brazil had decided to join in 1997. The Australian Government declared that its decision to leave the ATPC reflected its commitment to end mineral export controls. Thailand's decision to exit was reportedly a result of its declining tin output, which has caused the country to become a net tin importer (Platt's Metals Week, 1996).

Argentina.—U.S.-based Sunshine Mining and Refining Co. reported that it would be broadening its efforts to prove the viability of its Pirquitas silver-tin property in Argentina. The firm indicated that it would double its exploration expenditures to \$2.8 million during 1996 and expected to make a development decision by early 1997. Pirquitas, only recently acquired by Sunshine, reportedly has a resource estimated to be 312 million ounces of silver and 463 million pounds of tin (Metal Bulletin, 1996c).

Brazil.—Three domestic metals companies—Paranapanema, its largest tin producer; Caraiba Metais, a copper producer; and Companhia Paraibuna Metais, a zinc producer—merged their operations into a new organization called Companhia Brasileira de Metais Nao Ferrosas. A number of pension funds also participated in the venture. The new combination reportedly had plans to invest \$600 million, but the amount that could be directed to tin was unspecified. Paranapanema's tin production has declined in recent years, owing mostly to lower investment at the large Pitinga Mine in Amazonas State, where output could theoretically be as high as 30,000 tons per year of tin-in-concentrate; instead, Pitinga's actual 1996 production was estimated to be 15,000 tons. Paranapanema's other mines, including Massangana in Rondônia State, reportedly have only modest reserves. The company has a majority holding in Ebesa, which controls the garimpo activity in Rondônia. Production by the garimpo was estimated to be less than 15,000 tons per year in recent years (CRU Tin Monitor, 1996a).

Estanho do Rondônia, a joint venture formed in 1995 by two tin producers, reportedly was successfully merging the two operations. Cesbra, Brazil's second largest tin producer, and Best Metais e Soldas formed Estanho to move their smelting operations closer to the source of their tin ore, the Bom Futuro

Mine, in western Rondônia State. Until the merger, Best had been producing about 850 tons of tin metal annually at its São Paulo smelter and exporting almost none. Cesbra had been producing about 1,600 tons of tin metal at two smelters in the States of Rio de Janeiro and Rondônia, and exporting about 600 tons per year. The two firms are now using their São Paulo and Rio de Janeiro smelters to make tin solders and fluxes. By consolidating all their tin smelting operations at Estanho do Rondônia's new smelter and at Cesbra's existing smelter in Rondônia, the two companies have brought extraction and smelting operations closer, thus reducing production costs. Estanho officials planned to export from 1,000 to 2,000 tons of tin per year, with most earmarked for the United States (American Metal Market, 1996c).

Arqueana de Minerios e Metais announced that it was conducting a feasibility study into the possible reopening of its tin-tantalum mine at Arqueana in Minas Gerais State. The firm had suspended production there in 1992 (Tin International, 1996b).

Parapanema, the largest tin miner, announced plans to increase tin production, now 14,000 tons per year, to 20,000 tons per year. Reportedly, Parapanema has developed a new tin processing method that cuts costs by 10%. One step involves agglomerating the cassiterite concentrate. Smelting would change from a three-stage fusion process to a two-stage process and eventually to a one-stage process. The company also considered moving its tin smelter to Pitinga, their largest mine site, 320 kilometers north of Manaus.

Canada.—Toronto-based Adex Mining Corp., announced the signing of an agreement with Malaysia Smelting Corp. (MSC) which enables MSC to control about 51% of Adex for an investment of \$18 million. Under the agreement, Adex will use \$1.5 million to complete a full-feasibility study of its 100%-owned Mount Pleasant property in New Brunswick. This could be completed by early 1997. After delivery of the feasibility study, the remaining money could be used to fund the reestablishment of mining operations at the Mount Pleasant property. MSC is interested in Adex's Mount Pleasant deposit as a long-term, stable source of tin concentrates. Plans called for operations to start possibly in late 1997. Mount Pleasant is a polymetallic deposit that is also the world's largest reserve of indium. At full production, product values as a percentage of cash flow are estimated to be 55% for tin, 30% for indium, 6% each for copper and zinc, and 3% for bismuth.

China.—Government officials complained that they could not control mining of tin by thousands of jobless farmers; consequently, China would likely exceed its export quota set by the ATPC. In 1994, China exported 44,000 tons of tin and unwrought alloys, more than double the 20,000 tons of annual exports it agreed to as a condition of joining the ATPC. In addition to accountable exports, a significant quantity of tin is smuggled out of China, according to Asian tin traders. Government officials claimed that as many as 300 million farmers no longer had work on the land because of the reforms that increased agricultural efficiency. Mining or construction work tends to be the first alternative choice for many of these

displaced farmers. The Government found it difficult to organize and control these former farmers during this period of transition, while officials tried to develop alternative jobs in factories and elsewhere. The farmers searched for gold, tin, tungsten, and other minerals. Mining tin in China does not require a license and is done by farmers and local firms, as well as the two major companies based in Yunan Province and Guangxi Region that operate under the aegis of the Non-ferrous Metals Corp. The two firms together produce about 20,000 tons of tin per year. (Tin International, 1996c).

Two major European tinplate producers—Hoogovens (Holland) and Usinor (France)—announced that they would join forces to cooperate in a joint venture to construct and operate the first tin can manufacturing plant in China. The joint venture, to be based near Shanghai, will be formed by the Chinese steel company Baosteel (45%), the Shanghai-based distribution group Beiyi (30%), and the Belgian company Maison F. Mathieu (25%); a Usinor subsidiary is already present in China. The new plant, which will bear the name Shanghai Bao Yi Beverage Can Making Co. Ltd., was designed to produce 500 million cans per year. The project was to start in 1996, with production expected in early 1997. The Chinese market for two-piece beverage cans, which are now 100% aluminum, is estimated to be 5 billion units annually. Because the market is reportedly growing at an annual rate of 30% to 40% per year, it could quickly double to 10 billion cans per year. Hoogovens and Usinor will initially supply 20,000 tons of tinplate per year from their European tin mills (Metal Bulletin, 1996b).

Because of the strong increase in demand for domestic tinplate, three separate tinplate lines were under construction. At Yi Chang Steel, a 120,000- to 150,000-ton-per-year electrolytic tinning line was due to be commissioned late in 1996; Haikou Tinplate Co. was due to start up a new 100,000-ton-per-year plant on Hainan Island in mid-1997; and another line was being constructed in Fujian Province by a consortium that included Kawasaki Steel (Japan).

France.—Two large European packaging firms agreed to merge their metal packaging operations and sell 60% of the merged operation to a British investment firm. French-based Pechiney agreed to merge its food can, general line, and steel aerosol can businesses with Schmalbach Lubeca AG/Continental Can Europe, a subsidiary of Viag AG of Germany. By combining Pechiney's 19 production plants and Schmalbach's 16 production plants, a major European producer with annual sales of \$1.4 billion was created. The second part of the merger was for British-based Doughty Hanson and Co. to acquire a 60% stake in the new organization, with Pechiney and Schmalbach each retaining a 20% interest. At the time of the merger, Schmalbach's metal packaging division had a work force of 4,700 people, and Pechiney's can operations employed 3,200 people (American Metal Market, 1996a).

Germany.—Rasselstein Hoesch GmbH, one of the world's major tinplate producers, announced a new investment program that would focus on the pickling mill and the continuous annealing line at its Andernach tin mill. The resultant capacity increase of 100,000 tons of tinplate would be primarily in the

beverage can field. Rasselstein also planned to proceed with further down-gauging (thinner tinplate) as a means to compete with aluminum in the beverage can market. Tinplate accounted for 90% of the German beverage can market. Rasselstein planned to sell about 1.1 million tons of tinplate in 1996.

Industry reports indicated that Germany continues to lead Europe in the recycling of steel cans. According to figures from the Duales System Deutschland, 64% of tinplate packaging was recycled in Germany during the year. This compared favorably with a target of 49% and an aluminum recycling rate of 70%. The German target rate for tinplate for 1997 is 72%. The rest of Europe was not nearly so comprehensive in its recycling activities. The overall European Union recycling rate was reported to be 40%.

Indonesia.—P.T. Tambang Timah announced its intention to build an extra furnace at its Bangka Island tin smelter as part of a continuing expansion of the firm's production capacity. The new furnace would be the seventh at the smelter and would increase total production from about 43,000 tons to about 48,000 tons per year by yearend 1997. The Bangka Island tin smelter is a two-stage direct-reduction reverberatory furnace smelter fed with tin concentrates. Concentrating facilities are at Mentok. A Timah official stated that only about 5% of its tin metal production was for domestic use and that it now exports 47% of its output to Asia, 27% to Europe, and 21% to the North American market (Metal Bulletin, 1996g).

P.T. Koba Tin, 75%-owned by Renison Goldfields (Australia), announced the completion of construction of its 15,000-ton-annual-capacity tin smelter on Bangka Island. The first tin ingots from it were cast and shipped to customers early in 1996. This new smelter allows Koba Tin to smelt its own concentrates for the first time. Previously, Koba's tin mine output was smelted at the Mentok smelter of P.T. Tambang Timah, which owns 25% of Koba Tin. The new Koba Tin smelter will, therefore, free about 10,000 tons of annual capacity at the Mentok smelter for treatment of Timah's own concentrates.

Koba Tin announced that it had completed one of its major capital projects—the new Bemban dredge, in the western half of Koba's contract of work area. The dredge was operational by midyear and had increased the firm's annual production rate by 33%, to more than 10,000 tons of tin. The dredge reportedly was completed within its \$16 million budget (Metal Bulletin, 1996d).

Korea, Republic of.—Nippon Steel Corp. (Japan) announced that it won a contract to construct a dual tinplate and tin-free plating line for Dongbu Steel Corp. at its new Asan Bay works, southwest of Seoul. Startup was expected by mid-1998. The new line would give Dongbu a combined tinplate and tin-free steel capacity of 380,000 tons per year when combined with the existing facilities at its Inchon works. The contract is Nippon Steel's first for a tinplate plant in South Korea, although Nippon has constructed similar facilities for Siam Tinplate in Thailand and Guangzhou Pacific Tinplate in China (Metal Bulletin, 1996a).

Kyrgyzstan.—The Kara Balta Mining Complex formed a

joint venture with the Russian investment group Onyx to expand the Sary Dzhaz tin-tungsten project, where tin was being produced at the rate of 330 tons per year and tungsten at 220 tons per year. Onyx planned to invest \$8 million in the project, and expected that by early 1997, the tin production rate would have been increased to 1,100 tons per year and the tungsten rate to 660 tons per year (Tin International, 1996d).

Malaysia.—In 1996, the bulk of tin production continued to come from gravel pump operations; only three dredges were operating. Although Malaysia's tin resources were believed to be still substantial, the Government discouraged tin mining until the price of tin shows a marked increase. The long-established tin producer, Petaling Tin Bhd, sought approval from the Selangor State Government to convert its core business of tin mining into property development. The firm has considerable tin holdings at Dengkil, and once approval is received, these would be converted into a mixed development of factories and housing. Malaysia's two large tin smelters continued to obtain most of their feedstock from foreign sources; the intake of tin concentrate increased by 6% to 67,000 tons. One of the smelters, Datuk Keramat Smelting, indicated that it may cease operations in Malaysia and operate solely through a newly acquired smelter, Thaisarco in Thailand. Tin consumption has been increasing in Malaysia, especially for use in solder, tinplate, and pewter. With domestic consumption at 6,000 tons per year, Malaysia is on the verge of becoming a net tin importer (Mining Journal, 1996).

Malaysia Smelting Corp. (MSC) completed a tripling of its annual capacity to produce high-purity 99.99% tin from about 120 to 360 tons per year. This was in response to current and future expected demand for high-purity tin, often from Asian electronics firms and especially from the Japanese transplants that have been set up in the "tiger" economies of Asia, such as Malaysia, the Republic of Korea, Taiwan and Thailand. MSC reportedly invested about \$200,000 in the electrolytic treatment plant.

Peru.—Minsur's new \$24 million tin smelter began production in the fall and was reportedly on target to produce tin metal at less than one-half of the industry's average cost. The smelter has a capacity of 15,000 tons per year of refined tin. Although some concerns were initially expressed in the industry regarding the viability of the Ausmelt Technology used in the smelter, refined tin production reached the 2,400-ton-per-year level by yearend, despite some startup problems. Commercial shipments of Grade A tin began, and the company expected to gain LME certification eventually for its tin brand. Minsur hoped that 1997 output would approach the full refined production capacity of 15,000 tons per year. Officials projected that capacity could reach 20,000 tons per year after oxygen enrichment equipment is installed. Once it reached near capacity, the new smelter was expected to smelt and refine tin concentrates at a cost of \$300 per ton or less. This would be one-half of the \$600 per ton that Minsur paid to have 12,000 tons of its own tin concentrate toll refined at the Vinto tin smelter in Bolivia in 1996. The world industry average smelting and refining cost is reported to be as much as \$800 per ton of

metal. Minsur officials expected that its total depreciation plus mine-through-refinery costs, already the world's lowest at \$1,850 per ton, could decline to \$1,180 per ton in 1998; this contrasts with an industry average of about \$3,000 per ton. With the start of its own smelter, Minsur was in a position to reduce its tolling contracts. In 1995, all Minsur's mine output of 22,000 tons was toll refined at smelters in Asia and South America.

Portugal.—Early in the year, officials at the Neves Corvo copper/tin mine estimated that about 7,800 tons of tin concentrates, grading about 53% tin, equivalent to 4,100 tons of tin metal, would be produced at the mine in 1996. The Neves Corvo Mine is primarily a copper operation with a tin byproduct. The mine sells its tin concentrates to the three major Southeast Asian tin smelters—Malaysia Smelting Corp., Escoc Smelting Corp., and Thaisarco. Somincor owns 51% of the Neves Corvo Mine, and RTZ controls the rest (Tin International, 1996e).

Thailand.—Amalgamated Metal Corp. announced that it purchased the large Thaisarco tin smelter. Because Thaisarco had suffered declining tin concentrate supplies for several years, its tin production declined from 20,000 tons in 1989 to 8,000 tons in 1994. Its peak production had been 35,000 tons in 1980 (Tin International, 1996a).

United Kingdom.—South Crofty Holdings Ltd. announced that it had completed a major operational review of its South Crofty tin mine in Cornwall and now expected the mine to return to profitability in the near future. South Crofty Holdings, which acquired England's last remaining tin mine in 1994, raised \$9 million in 1995 to fund an improvement program after a lack of capital prevented mine management from developing additional ore reserves. Late in 1995, an unexpected variability in ore grade had an adverse impact on the mine's production levels. Following an extensive diamond drilling program, production levels increased in 1996, with a resultant decrease in unit production costs. The tin grade at the mine currently averages 1.6%, compared with a grade of 1.2% in 1995, and mill recoveries have increased to 90% from 87% in 1995 (Metal Bulletin, 1996f).

AMG Resources Corp. Ltd. reported on developments in its British detinning operations. This British unit is a subsidiary of the American parent company of the same name. AMG reported that local government initiatives and roadside collection programs have resulted in an increasing number of used tin cans finding their way into the recycling chain. AMG officials projected that their Llanelli (Wales) detinning plant would treat about 25% more used tin cans in 1996 than in 1995. In 1995, this plant produced 80,000 tons of scrap steel from detinning new tinplate scrap and 20,000 tons from detinning used tin cans. AMG also operates a detinning plant in Hartlepool, United Kingdom. AMG reported that limited amounts of tin are recycled from tinplate at both plants and that at Llanelli, about 150 tons of tin are produced each year from used beverage cans. This tin generally takes the form of 99.99%-pure tin ingots. Although AMG's tin ingot is listed on the LME, the bulk of the material is sold directly to British tin

alloy, copper wire, or solder operations. AMG officials are optimistic about the future of its British detinning operations, but they doubt if the detinning business will reach the levels achieved before aluminum beverage cans began to eat into tinplate's market share during the 1970's. Despite this, business has increased since the early 1990's when used tin can recycling programs began to accelerate (Metal Bulletin, 1996i).

Current Research and Technology

The International Tin Research Institute (ITRI), based in Uxbridge, United Kingdom, the world's foremost laboratory for tin scientific research and new tin applications, completed its second full year under its new structure. The ITRI is now privatized, with funding supplied by several major tin producer and user firms rather than by the ATPC. Solo Industries Ltd., (Sharhah, United Arab Emirates) became the 12th full member of ITRI Ltd. and the first consumer member. About 60% of current world tin production is represented by ITRI Ltd. members.

The Managing Director of ITRI Ltd. noted that it was actively searching for suitable lead-free solders for electronics, as a result of disposability problems. He noted the clear need for lead-free solders as consumers dispose of the ever-proliferating array of consumer electronics items, such as mobile phones and computers. ITRI completed its development of the Stanzec tin/zinc plating process. The resulting alloy could replace cadmium as a cheaper, less toxic anticorrosion coating on steel and was of interest to American automobile makers, according to the Managing Director. ITRI also is investigating alternatives to lead gun shot, which can pollute the environment; more than 60,000 tons of lead are fired from guns per year. ITRI has completed four ballistic trials by using tin gun shot; the results reportedly are promising. Another longer running ITRI project is an attempt to develop tin-based fire retardants. Zinc stannates and zinc hydroxystannate, developed by ITRI and manufactured by two British companies, contain about 46% tin and reportedly act as smoke retardants (Metal Bulletin, 1996h).

Aluminum Company of America (Alcoa) (Pittsburgh, PA) reported the development and patenting of a lead-free, cold-finished rod and bar aluminum alloy containing from 0.9% to 1.5% tin that allegedly provides good mechanical properties and the highest rating for machinability. Designated UltrAlloy 6020, the alloy also is said to have excellent corrosion resistance, anodizing response, and good brazability and weldability. Alcoa claims the alloy has finer chip formation than any other aluminum free-machining alloys and exhibits an enhanced surface finish after machining. These properties allow faster machining speeds and higher productivity. Typical applications include master cylinder brake pistons, connectors, transmission valves, and hydraulic components (Advanced Materials & Processes, 1996).

The Japan Research and Development Center for Materials, the Clean Japan Center, and Nikko Co. have jointly developed technology for efficiently sorting metal beverage cans. Their demonstration plant separates tinplate cans by a closed-type

magnetic separator and aluminum cans by a multistage separator (JOM, 1996).

Researchers at the University of Connecticut announced development of a new technique to deal with the problem that some recycling of tin cans used as food containers is inefficient because enamel on the can masks nearly 50% of the tin. Observing that tin cans of all types represent an abundant source of steel scrap, with some 100 million containers being used and discarded daily, the researchers noted that proper detinning was crucial because a tin content of 0.35% could make steel brittle and less ductile. The researchers believe that the tin coating should be reduced by proper detinning to a level of 0.06% by weight. Using relatively high temperatures and concentrations of potassium stannate in their alkaline electrochemical detinning process, optimum removal of enamel and selective removal of tin from the steel can body is achieved (American Metal Market, 1996b).

Outlook

Domestic demand for primary tin is expected to grow slowly in the next few years, at a rate of perhaps 1% per year. If, however, new applications, especially those in which tin is substituted for toxic materials, find acceptance in the marketplace, then that rate could double by 2000.

There appears to be some evidence of interest in exploration and investment to develop world tin reserves, perhaps motivated by somewhat higher prices of tin in recent years. It seems likely that U.S. requirements for primary tin will continue to be met by imports and Government stockpile sales.

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TABLE 1
SALIENT TIN STATISTICS 1/

(Metric tons of contained tin, unless otherwise specified)

	1992	1993	1994	1995	1996
United States:					
Production:					
Mine	(2/)	(2/)	--	--	--
Secondary e/	13,700	12,000	11,700	11,600 r/	11,000
Exports, refined tin	1,890	2,600	2,560	2,790	3,670
Imports for consumption, refined tin	27,300	33,700	32,400	33,200	30,200
Consumption:					
Primary	35,000	34,600	33,700	35,200 r/	36,500
Secondary	10,100	11,900	8,530	10,800 r/	8,180
Stocks, yearend, U.S. industry	10,700	10,800	10,400	11,700 r/	11,800
Prices, average cents per pound:					
New York market	282.58	239.17	254.93	294.54	288.10
Platt's Metals Week composite	402.40	349.80	369.14	415.61	412.43
London	277.00	233.00	248.00	282.00	279.00
Kuala Lumpur	271.85	231.58	244.76	277.50	275.19
World: Production:					
Mine	191,000 r/	191,000 r/	182,000 r/	195,000 r/	196,000 e/
Smelter:					
Primary	194,000	193,000 r/	198,000 r/	201,000 r/	191,000 e/
Secondary	22,600 r/	19,800 r/	19,100 r/	18,900 r/	16,300 e/
Undifferentiated	2,150	1,320	322 r/	322 r/	320 e/

e/ Estimated. r/ Revised.

1/ Data are rounded to three significant digits.

2/ Negligible.

TABLE 2
U.S. CONSUMPTION OF PRIMARY AND SECONDARY TIN 1/

(Metric tons of contained tin)

	1995	1996
Stocks, Jan. 1 2/	8,480	9,180
Net receipts during year:		
Primary	39,400 r/	39,200
Secondary	5,020 r/	2,730
Scrap	6,240 r/	6,340
Total receipts	50,600 r/	48,300
Total available	59,100 r/	574,000
Tin consumed in manufactured products:		
Primary	35,200 r/	36,500
Secondary	10,800 r/	8,180
Total	46,000 r/	44,700
Intercompany transactions in scrap	123	169
Total processed	46,100 r/	44,800
Stocks, Dec. 31 (total available less total processed)	13,000 r/	12,600

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes tin in transit in the United States.

TABLE 3
U.S. CONSUMPTION OF TIN, BY FINISHED PRODUCT 1/

(Metric tons of contained tin)

Product	1995			1996		
	Primary	Secondary	Total	Primary	Secondary	Total
Alloys (miscellaneous) 2/	W	W	W	W	W	W
Babbitt	589	282	871	617	234	851
Bar tin	1,200	W	1,200	1,150	W	1,150
Bronze and brass	1,080	1,750	2,830	1,100	1,660	2,760
Chemicals	7,060	W	7,060	7,520	W	7,520
Collapsible tubes and foil	W	W	W	240	W	240
Solder	10,800 r/	6,980 r/	17,700 r/	10,700	4,880	15,600
Tinning	1,110 r/	W	1,110 r/	2,030	W	2,030
Tinplate 3/	9,670	W	9,670	9,350	W	9,350
Tin powder	W	W	W	573	W	573
Type metal	W	W	W	W	W	W
White metal 4/	965	W	965	1,260	77	1,340
Other	2,770	1,780 r/	4,550 r/	1,900	1,320	3,230
Total	35,200 r/	10,800 r/	46,000 r/	36,500	8,180	44,700

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Other."

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes terne metal.

3/ Includes secondary pig tin and tin acquired in chemicals.

4/ Includes pewter, britannia metal, and jewelers' metal.

TABLE 4
U.S. INDUSTRY YEAREND TIN STOCKS 1/

(Metric tons)

	1995	1996
Plant raw materials:		
Pig tin:		
Virgin 2/	7,660 r/	8,060
Secondary	718 r/	696
In process 3/	1,010	1,360
Total	9,390 r/	10,100
Additional pig tin:		
Jobbers-importers	1,240	1,440
Afloat to United States	1,040	211
Total	2,270	1,650
Grand total	11,700 r/	11,800

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes tin in transit in the United States.

3/ Data represent scrap only, tin content.

TABLE 5
TIN RECOVERED FROM SCRAP PROCESSED IN
THE UNITED STATES, BY FORM OF RECOVERY 1/

(Metric tons, unless otherwise specified)

Form of recovery	1995	1996
Tin metal 2/	W	W
Bronze and brass e/ 3/	11,200 r/	10,800
Lead and tin alloys:		
Antimonial lead	335 r/	171
Babbitt	W	34
Type metal	39	37
Other alloys 4/	W	W
Total	374 r/	242
Tin content of chemical products	W	W
Grand total	11,600 r/	11,000
Value e/ 5/ thousands	\$106,000 r/	\$100,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes tin metal recovered at detinning and other plants.

3/ Includes tin recovered from copper-, lead-, and tin-base scrap.

4/ Includes foil, solder, terne metal, and cable lead.

5/ Based on Platt's Metals Week composite price.

TABLE 6
U.S. STOCKS, RECEIPTS, AND CONSUMPTION OF NEW AND OLD SCRAP AND TIN RECOVERED,
BY TYPE OF SCRAP 1/

(Metric tons)

Type of scrap	Gross weight of scrap					Stocks, Dec. 31	Tin recovered e/ 2/		
	Stocks, Jan. 1	Receipts	Consumption				New	Old	Total
			New	Old	Total				
1995:									
Copper-base scrap	6,570	127,000	27,200	100,000 r/	127,000 r/	6,350	1,170	3,680	4,850
Brass mills 3/	--	40,500	40,500	--	40,500	--	833	--	833
Foundries and other plants	2,730	26,800	W	W	W	3,100	W	703 r/	703 r/
Total tin from copper-base scrap	XX	XX	XX	XX	XX	XX	2,010	4,380 r/	6,390 r/
Lead-base scrap r/	93,200	1,100,000	71,500	1,090,000	1,170,000	27,400	1,880	3,280	5,160
Tin-base scrap 4/	W	55	W	54	W	W	W	52	52
Grand total	XX	XX	XX	XX	XX	XX	3,880 r/	7,720 r/	11,600 r/
1996:									
Copper-base scrap	6,350	122,000	27,400	94,400	122,000	6,010	1,190	3,430	4,610
Brass mills 3/	--	45,900	45,900	--	45,900	--	885	--	885
Foundries and other plants	3,100	12,600	W	W	W	1,730	W	523	523
Total tin from copper-base scrap	XX	XX	XX	XX	XX	XX	2,070	3,950	6,020
Lead-base scrap	25,600 r/	1,230,000	52,800	1,170,000	1,230,000	31,200	1,390	3,630	5,020
Tin-base scrap 4/	W	W	W	W	W	W	W	W	W
Grand total	XX	XX	XX	XX	XX	XX	3,460	7,580	11,000

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Tin recovered from new and old copper-base scrap, brass mills, and foundries.

3/ Brass-mill stocks include home scrap, and purchased-scrap consumption is assumed equal to receipts; therefore, line does not balance.

4/ Includes tinplate and other scrap recovered at detinning plants.

TABLE 7
U.S. EXPORTS OF TIN IN VARIOUS FORMS 1/

Year	Tinplate and terneplate		Ingots and pigs		Tin scrap and other tin bearing material except tinplate scrap 2/	
	Quantity		Quantity		Quantity	
	(metric tons, gross weight)	Value (thousands)	(metric tons)	Value (thousands)	(metric tons, gross weight)	Value (thousands)
1995	307,000	\$185,000	2,790	\$17,300	57,600	\$56,600
1996	338,000	210,000	3,670	21,000	56,800	61,300

1/ Data are rounded to three significant digits.

2/ Includes rods, profiles, wire, powders, flakes, tubes, and pipes.

Source: Bureau of the Census.

TABLE 8
U.S. IMPORTS FOR CONSUMPTION OF TIN IN VARIOUS FORMS 1/

Year	Miscellaneous 2/	Dross, skimmings, scrap, residues, tin alloys, n.s.p.f.		Tinplate and terneplate		Tin compounds		Tinplate scrap	
	Value	Quantity		Quantity		Quantity		Quantity	
	(thousands)	(metric tons, gross weight)	Value (thousands)	(metric tons, gross weight)	Value (thousands)	(metric tons, gross weight)	Value (thousands)	(metric tons, gross weight)	Value (thousands)
1995	\$5,050	24,800	\$58,900	272,000	\$180,000	986	\$7,270	16,000	\$2,390
1996	5,070	16,000	58,800	251,000	161,000	354	3,120	64,600	5,690

1/ Data are rounded to three significant digits.

2/ Includes tin foil, tin powder, flitters, metallics, manufactures, n.s.p.f.

Source: Bureau of the Census.

TABLE 9
U.S. IMPORTS FOR CONSUMPTION OF UNWROUGHT TIN METAL, BY COUNTRY 1/

Country	1995		1996	
	Quantity (metric tons)	Value (thousands)	Quantity (metric tons)	Value (thousands)
Australia	--	--	222	\$1,260
Bolivia	6,630	\$40,300	6,290	39,200
Brazil	8,070	50,500	9,460	58,500
Canada	185	1,270	270	1,720
Chile	469	2,840	407	2,440
China	5,610	34,200	2,760	16,000
Hong Kong	134	1,260	--	--
India	146	844	898	5,720
Indonesia	7,230	44,600	7,550	47,000
Korea, Republic of	219	1,090	10	--
Malaysia	3,810	23,200	965	6,760
Netherlands	60	411	--	--
Peru	--	--	481	2,850
Russia	149	926	435	2,760
Singapore	40	385	120	750
United Kingdom	97	632	243	1,550
Other	306	2,000	57	441
Total	33,200	204,000	30,200	187,000

1/ Data are rounded to three significant digits; may not add to totals shown.

Source: Bureau of the Census.

TABLE 10
TIN: WORLD MINE PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Australia 3/	6,609	8,057	7,100	8,656 r/	8,828 4/
Bolivia	16,516	18,634	16,169 r/	14,419	15,200
Brazil	27,000 r/	26,900 r/	20,400 r/	19,500 r/	19,500
Burma 5/	649	689	814	747	420
Burundi e/	110	10 r/	10 r/	-- r/	(6)
Cameroon e/	3	3	2	2	1
China e/	43,800	49,100	54,100	61,900 r/	60,000
Indonesia	29,400	29,000 e/	30,610	38,378	38,500
Kazakstan e/	75	50	24	15	15
Laos e/	300	300	200	200	200
Malaysia	14,339	10,384	6,458	6,402	5,174 4/
Mexico	1	3	3 e/	1	2
Mongolia e/	190	150	100	150	100
Namibia	11	4	1	2	-- 4/
Niger e/	20	20	20	20	20
Nigeria 7/	415	400 e/	185	185 e/	150
Peru	10,044	14,310	20,275 r/	22,331	27,004 4/
Portugal	6,560	5,334 r/	4,332 r/	4,627 r/	4,800
Russia	15,160	13,100	10,460	9,000 e/	8,000
Rwanda e/	500	400	50	--	--
South Africa	582	450 e/	--	--	--
Spain	7	2	4	2 e/	2
Tanzania e/	8	11	4 4/	--	--
Thailand	11,484	6,363	3,926	2,201 r/	1,450
Uganda e/	30 4/	30	30	30	30
United Kingdom	2,044	2,232	1,922	1,973 r/	2,103 4/
United States	W	W	--	--	--
Vietnam e/	3,400	3,500	4,000	4,500	4,500
Zaire	1,020	700 e/	1,000	-- r/	--
Zambia	2	2 e/	--	--	--
Zimbabwe e/	950	800	82 4/	--	--
Total	191,000 r/	191,000 r/	182,000	195,000 r/	196,000

e/ Estimated. r/ Revised. W Witheld to avoid disclosing company proprietary data; not included in "Total."

1/ World totals and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through June 25, 1997.

3/ Excludes tin content of copper tin and tin tungsten concentrates.

4/ Reported figure.

5// Includes content of tin tungsten concentrate.

6/ Less than 1/2 unit.

7/ Concentrate gross weight reported, estimated 62% Sn content.

TABLE 11
TIN: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Argentina: e/					
Primary	140	145	100	100	100
Secondary	100	100	100	100	100
Total	240	245	200	200	200
Australia:					
Primary	240	222	315	570	460 3/
Secondary e/	360	250	260	300	300
Total e/	600	472	575	870	760
Belgium: Secondary e/	5,260	5,000	5,000	5,000	3,000
Bolivia: Primary	14,393	14,541	15,285	17,709	16,000
Brazil:					
Primary	27,000	26,900	20,400	19,500 r/	19,500
Secondary e/	250	250	250	250	250
Total e/	27,300	27,200	20,700	19,800 r/	19,800
Bulgaria: Primary and secondary	23	23	22	22 e/	20

See footnotes at end of table.

TABLE 11--Continued
TIN: WORLD SMELTER PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country	1992	1993	1994	1995	1996 e/
Burma: Primary	189	170	200 e/	190 r/ e/	100
Canada: Secondary e/	200	200	--	--	--
China: Primary e/	39,600	52,000	67,800	62,100 r/	55,800
Czech Republic: Primary and secondary e/ 4/	XX	115	100	100	100
Czechoslovakia: 5/ Primary	115	XX	XX	XX	XX
Denmark: Secondary e/	100	100	100	100	100
Germany: Primary and secondary	127	179	100	100 e/	100
Greece: Secondary e/	200	200	150	150	100
India: Secondary e/	200	200	200	100	200
Indonesia: Primary	31,915	30,415	31,100 e/	38,628	39,000
Japan: Primary	821	804	706	630	524 3/
Korea, Republic of: Primary e/	400	400	300	300	300
Malaysia: Primary	45,598	40,079 r/	37,990 r/	39,433 r/	38,051 3/
Mexico: Primary	2,590	1,640	768	770	770
Netherlands: Secondary e/	200	--	--	--	--
Nigeria: Primary	370	350	179 r/	175 r/ e/	175
Norway: Secondary e/	90	90	90	70 r/	50
Portugal: Primary and secondary e/	2,000	1,000	100 r/	100 r/	100
Russia: e/					
Primary	15,200	13,400	11,500	9,500	9,000
Secondary	1,500	1,000	1,000	1,000	1,000
Total	16,700	14,400	12,500	10,500	10,000
South Africa: 6/					
Primary	592	452	43	-- r/	--
Secondary e/	60	45	--	--	--
Total e/	652	497	43	-- r/	--
Spain: e/					
Primary	600	500	500 r/	500 r/	150
Secondary	200	200	200	100 r/	50
Total	800	700	700 r/	600 r/	200
Thailand: Primary	10,679	8,099	7,759	8,243	8,000
United Kingdom: Secondary e/	100	100	100	100	100
United States: Secondary	13,700 r/	12,000 r/	11,700 r/	11,600 r/	11,000 3/
Vietnam: Primary e/	2,400	2,500	2,500	2,800	2,800
Zaire: Primary e/	50	20	20	15	15
Zimbabwe: Primary	716	657	82	--	--
Grand total	218,000 r/	214,000 r/	217,000 r/	220,000 r/	207,000
Of which:					
Total primary	194,000	193,000	198,000	201,000	191,000
Total secondary	22,600 r/	19,800 r/	19,100 r/	18,900 r/	16,300
Total undifferentiated	2,150	1,320	322 r/	322 r/	320

e/ Estimated. r/ Revised. XX Not applicable.

1/ World totals and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Wherever possible, total smelter output has been separated into primary (from ores and concentrates) and secondary (tin metal recovered from old scrap). This table reflects metal production at the first measurable stage of metal output. Table includes data available through June 25, 1997.

3/ Reported figure.

4/ Formerly part of Czechoslovakia; data were not reported separately until 1993.

5/ Dissolved Dec. 31, 1992. All production for Czechoslovakia in 1992 came from the Czech Republic.

6/ South Africa's only operating tin mine closed in early 1994.