

# Industry & Trade Summary

---

Television Picture  
Tubes and Other  
Cathode-Ray Tubes

---

USITC Publication 2877  
May 1995

OFFICE OF INDUSTRIES  
U.S. International Trade Commission  
Washington, DC 20436



**UNITED STATES INTERNATIONAL TRADE COMMISSION**

**COMMISSIONERS**

**Peter S. Watson, Chairman**  
**Janet A. Nuzum, Vice Chairman**  
**David B. Rohr**  
**Don E. Newquist**  
**Carol T. Crawford**  
**Lynn M. Bragg**

---

Robert A. Rogowsky  
Director of Operations

---

Vern Simpson  
Director of Industries

---

*This report was prepared principally by*

John Kitzmiller

Electronic Technology and Equipment Branch  
Services, Electronics, and Transportation Division

**Address all communications to  
Secretary to the Commission  
United States International Trade Commission  
Washington, DC 20436**

## 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.<sup>1</sup>

This report on television picture tubes and other cathode-ray tubes covers the period 1989 through 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 electronics and transportation sectors.

<i>USITC Publication number</i>	<i>Publication date</i>	<i>Title</i>
2430	November 1991 . . . . .	Aircraft, spacecraft, and related equipment
2445	January 1992 . . . . .	Television receivers and video monitors
2505	April 1991 . . . . .	Construction and mining equipment
2540	July 1992 . . . . .	Photographic supplies
2648	July 1993 . . . . .	Measuring, testing, controlling, and analyzing instruments
2674	September 1993 . . . . .	Medical goods
2708	December 1993 . . . . .	Semiconductors
2728	February 1994 . . . . .	Capacitors
2746	March 1994 . . . . .	Aircraft and reaction engines, other gas turbines, and parts
2751	March 1994 . . . . .	Certain motor-vehicle parts and accessories
2820	October 1994 . . . . .	Telecommunications equipment
2821	October 1994 . . . . .	Computers, peripherals, and computer components
2822	October 1994 . . . . .	Audio and video recording and reproducing equipment
2849	January 1995 . . . . .	Motorcycles and certain other vehicles
2850	January 1995 . . . . .	Computer software and other recorded media
2851	February 1995 . . . . .	Optical fiber, cable, and bundles
2877	May 1995 . . . . .	Television picture tubes and other cathode ray tubes
2879	May 1995 . . . . .	Unrecorded media

---

<sup>1</sup> 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.



# CONTENTS

	<i>Page</i>
<b>Preface</b> .....	i
<b>Introduction</b> .....	1
<b>U.S. industry profile</b> .....	3
Industry structure .....	3
Consumer characteristics and factors affecting demand .....	5
<b>Foreign industry profile</b> .....	6
<b>U.S. trade measures</b> .....	8
Tariff measures .....	8
U.S. Government trade-related investigations .....	8
<b>Foreign trade measures</b> .....	11
Tariff measures .....	11
<b>U.S. market</b> .....	11
Consumption .....	11
Production .....	11
Imports .....	11
<b>Foreign markets</b> .....	12
Foreign market profile .....	12
U.S. exports .....	13
<b>U.S. trade balance</b> .....	13
<b>Appendixes</b>	
A. Tariff and trade agreement terms .....	A-1
B. Reports of the U.S. International Trade Commission pertaining to television picture tubes and other cathode-ray tubes .....	B-1
<b>Figures</b>	
1. Basic elements of CRT .....	2
2. CRT electron gun, aperture mask, and matrix line screen .....	2
3. Picture tube and other cathode-ray tube distribution .....	3
<b>Tables</b>	
1. Television picture tubes and other cathode-ray tubes: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of June 30, 1994; U.S. exports, 1993; and U.S. imports, 1993 .....	9
2. Television picture tubes and other cathode-ray tubes: by U.S. shipments, exports of domestic merchandise, imports for consumption, and apparent U.S. consumption, 1989-93 .....	12
3. Television picture tubes and other cathode-ray tubes: U.S. imports for consumption by selected sources, 1989-93 .....	12
4. Television picture tubes and other cathode-ray tubes: U.S. exports to selected markets, 1989-1993 .....	13
5. Television picture tubes and other cathode-ray tubes: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1989-93 .....	14



## INTRODUCTION

This summary on television picture tubes and other cathode-ray tubes (CRTs) covers the period 1989-1993. The report is organized into three major sections: U.S. and foreign industry profiles; U.S. and foreign tariff and nontariff trade measures; and U.S. industry performance in domestic and foreign markets. In addition, appendices include definitions of tariff and trade agreement terms and information on reports of the U.S. International Trade Commission pertaining to television picture tubes and other cathode-ray tubes.

The products covered by this summary include television picture tubes for both direct-view and projection televisions; cathode-ray display tubes for computer and video monitors and for industrial and military displays; television camera tubes, image converters and intensifiers, and other photocathode tubes; and parts of the foregoing. The industry commonly is divided into four main sectors: television and entertainment tubes; data display tubes; instrument tubes; and industrial and military tubes.

In 1993, color television picture tubes accounted for 85 percent of total U.S. shipments of products covered by this summary. The products imported in the greatest volume were miscellaneous cathode-ray tubes, deflection coils, and parts of CRTs other than for television and video monitors. About 70 percent of the \$400 million in parts (exclusive of glass) used in the production of CRTs in 1993 were imported. Japan supplied \$156 million (39 percent) and Mexico supplied about \$96 million (24 percent).

A cathode-ray tube is an electron tube in which a beam of electrons can be focused to a small area and varied in position and intensity on a surface. CRTs are used to display text and/or video images. CRTs have the longest history and enjoy the most widespread use of all electronic displays.<sup>1</sup>

The most familiar and most common form of the cathode-ray tube is the television picture tube found in home television receivers. The picture tube is the most valuable component of a television receiver, constituting about 50 percent of the total value. Direct-view television receivers use one cathode-ray tube, either color or monochrome (black and white). Most projection television receivers use three monochrome tubes, one each projecting red, green, and blue images.

Cathode-ray tubes are used in large quantities in measuring instruments such as oscilloscopes, which are used in the maintenance and repair of automobiles,

---

<sup>1</sup> Other electronic displays include, but are not limited to, light-emitting diodes (LEDs), liquid crystal displays (LCDs), and plasma displays.

aircraft, and electronic equipment. CRTs are also output devices for radar systems used by civil agencies and military services to track the movement of aircraft or watercraft. The military services are major users of CRTs, employing these devices to display data to guide weapons systems. CRTs are also widely used in computer input/output terminals and electronic medical equipment.

The basic elements of a CRT are the envelope, electron gun, and phosphor screen (figure 1). The envelope, typically made of glass, serves as a vacuum enclosure, substrate<sup>2</sup> for the phosphor screen, and support for the electron gun. The envelope is typically funnel-shaped, with the small end blocked by a glass stem that supports the electron gun. The electron gun produces, controls, focuses, and deflects the electron beam that causes the phosphor screen to glow. The large end of the funnel is sealed by a glass panel or faceplate on the inside of which the phosphor screen is deposited.

The phosphor screen emits light when excited by electron bombardment, and thereby produces a viewable image. CRTs produced with one color phosphor are monochromatic, that is, the image is black-and-white, black-and-green, or any other color contrasted with black. Color CRTs use several colors of phosphor, generally red, green, and blue, and produce full-color images as additive combinations of these colors.

To produce a color television picture tube, the most commonly produced CRT in the United States, a thin screen of perforated metal—called an aperture mask—is welded to a frame mounted within the panel. This aperture mask must travel with the glass panel throughout the production process. Using the aperture mask as a pattern, multiple coatings and rinsings of the panel are performed, leaving a surface with thousands of narrow lines of red, green, blue, and black (figure 2).

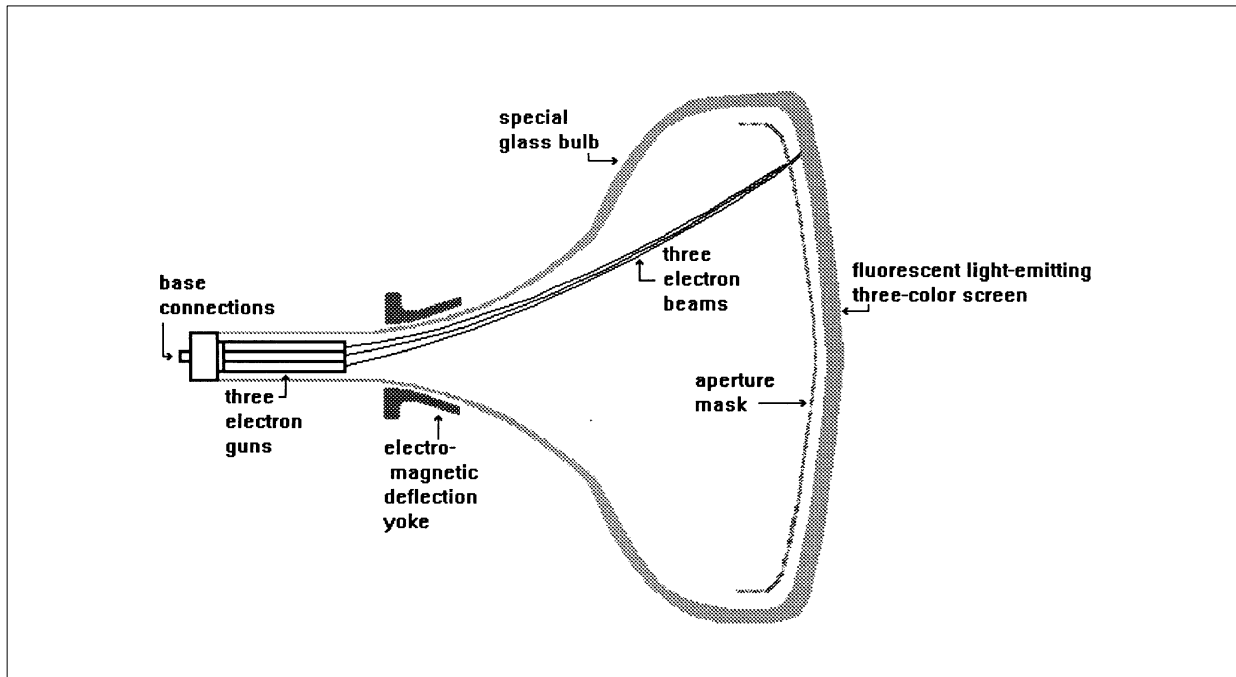
The panel, with aperture mask in place, is then sealed to the envelope. The assembly of electron guns and deflection yoke is fitted to the rear of the envelope, the air is evacuated from the envelope, and the envelope is sealed. The proper alignment of guns, aperture mask, and panel is of critical importance in the assembly of a tube and determines the not only the quality of the image but whether or not the tube will function.

Glass forms the outer shell of the CRT and functions as much more than a simple container. The composition of the glass in the tube is designed to

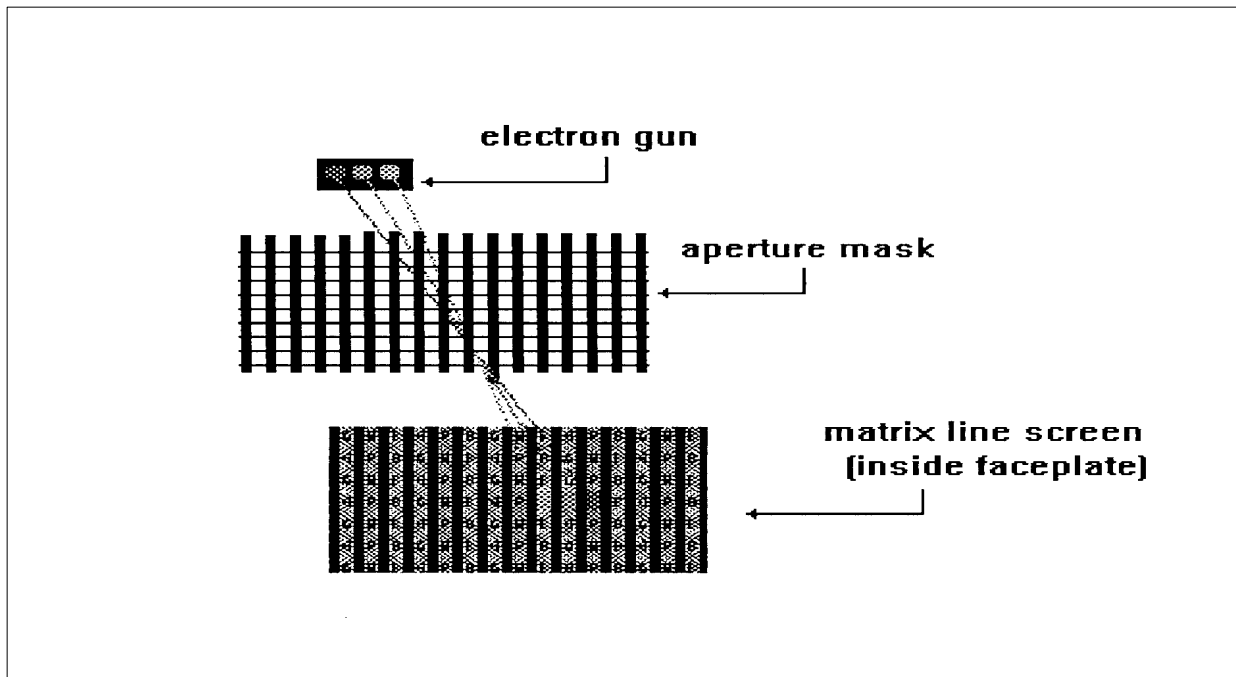
---

<sup>2</sup> The surface on which the phosphor screen is deposited.

**Figure 1**  
Basic elements of CRT



**Figure 2**  
CRT electron gun, aperture mask, and matrix line screen





minimize optical defects, provide electrical insulation for high voltages, and provide protection against X-radiation emissions. The thickness of the glass must be increased as tube size is increased, to withstand the atmospheric pressure exerted on the tube which contains a vacuum.

## U.S. INDUSTRY PROFILE

### Industry Structure

Cathode-ray tubes<sup>3</sup> are produced throughout the United States by both large and small companies; some are U.S.-owned and others are foreign-owned. There are now 7 producers of color television picture tubes in the United States, about 30 other producers of other types of CRTs, and 21 producers of electron tube parts except glass blanks. These firms are of all sizes and many are affiliated with large defense contractors or scientific equipment producers. Sony, active in the television tube sector, has announced plans to expand its facility in San Diego to produce color computer monitor tubes.<sup>4</sup> Major U.S. producers of CRTs for industrial and military uses are:

Company	Location
Burle	Lancaster, PA
CRT Scientific	Van Nuys, CA
Hughes Display Products	Lexington, KY
Image & Sensing Technology	Horseheads, NY
ITT	Roanoke, VA
Litton	San Carlos, CA
Magnavox/General Atronics	Philadelphia, PA
Philips Components	Slatersville, RI
Raytheon	Quincy, MA
Thomas Electronics	Wayne, NJ
Thomson	Lancaster, PA
Video Display	Stone Mountain, GA

The majority of CRTs are produced and used in-house or sold to affiliates. This is the case for both television picture tube manufacturers and for producers of other cathode-ray tubes; however, the percentage of captive production and affiliate sales is much higher for television tubes. The distribution system for CRTs is shown in figure 3.

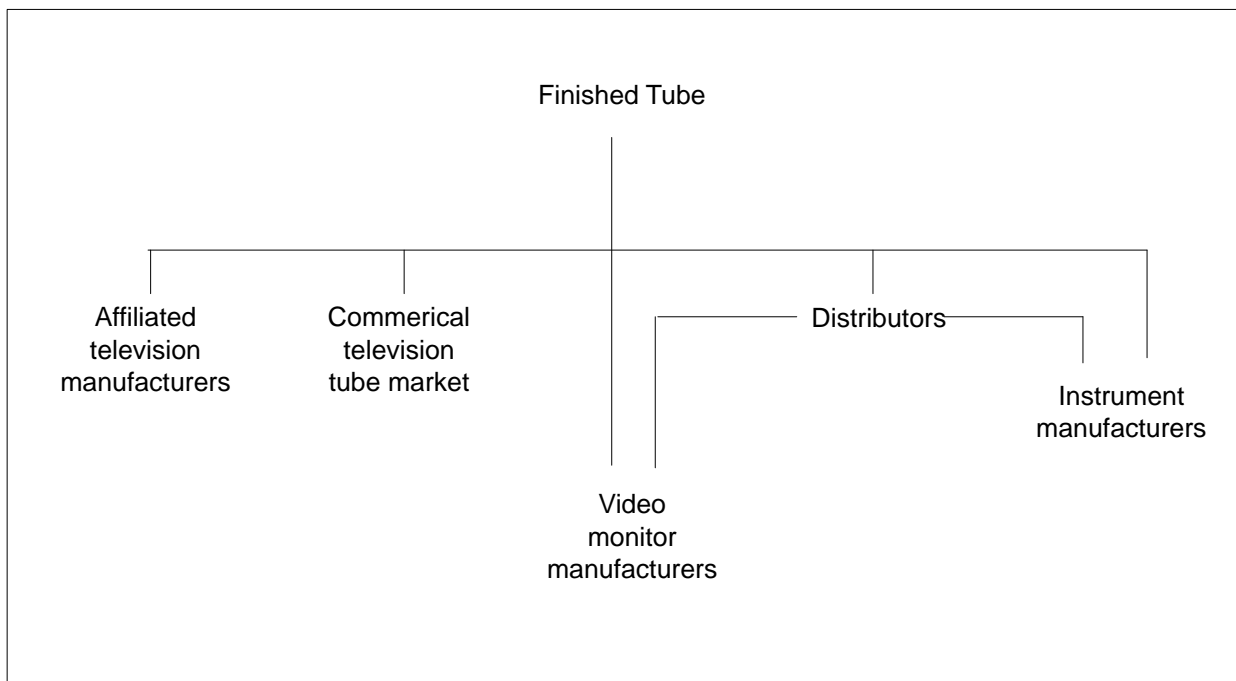
The majority of CRTs produced in the United States are color<sup>5</sup> picture tubes for television receivers. These products are produced by large, multiproduct, multinational, and, for the most part, foreign-owned companies. Currently there are seven color picture tube producers in the United States:

<sup>3</sup> Cathode-ray tubes, including television picture tubes, are reported under SIC 3671, Electron Tubes. Glass envelopes are reported under SIC 3229, Pressed and Blown Glass and Glassware, Not Elsewhere Classified.

<sup>4</sup> *Television Digest*, vol. 34, No. 29, p. 13.

<sup>5</sup> There is no monochrome (black and white) picture tube production in the United States.

**Figure 3**  
**Picture tube and other cathode-ray tube distribution**



Company	Headquarters	U.S. Location
Hitachi	Japan	Greenville, SC
Matsushita/Philips	Japan/ Netherlands	Troy, OH
Philips	Netherlands	Ottawa, OH; Emporium, PA
Sony	Japan	San Diego, CA
Thomson	France	Marion, IN; Scranton, PA
Toshiba/ Westinghouse	Japan/ United States	Horseheads, NY
Zenith	United States	Melrose Park, IL

Picture tube plants now producing for Philips, Thomson, and Toshiba were once owned by U.S. producers. Philips purchased the television receiver and picture tube business of Magnavox, a U.S. company, in the 1970s, and Thomson purchased the television receiver and tube business of RCA/GE in the 1980s. Toshiba went into partnership with Westinghouse in its picture tube business. The other Japanese picture tube producers built new factories in the United States.<sup>6</sup> Zenith is the only U.S.-owned color picture tube producer in the United States.

All seven tube producers are also color television receiver producers; however, there are receiver producers that are unaffiliated with tube producers. In times of limited supply, the affiliates have a much more secure supply of tubes than do non-affiliated receiver producers.

Given the tremendous capital investment in picture tube production, it is not economically feasible for every tube manufacturer to make every size of tube. This is especially true of the smaller tubes that have become the mainstay of low-cost Far Eastern companies. In fact, there are no color picture tubes and no color television receivers smaller than 19 inches in viewable diagonal measurement being produced in the United States. To meet the demand for tubes not produced by their U.S. affiliates, receiver manufacturers either import the tubes they need from affiliated plants in other countries or buy tubes from other U.S. tube builders. Sony is the only U.S. color television picture tube producer that produces solely for internal consumption.

The major upstream industry for color television picture tubes is glass for CRTs. With a trend toward larger picture tubes, glass represents a growing

<sup>6</sup> Mitsubishi, another Japanese company that produces color television receivers in the United States, operates a picture tube plant (formerly owned by RCA) in Canada.

percentage of the value of materials, currently around 60 percent, up from 30 percent just a few years ago. There are three glass producers in the United States—Corning-Asahi, Techneglas, and Thomson—and production is concentrated in Indiana, Ohio, and Pennsylvania.

In 1988, Corning entered a joint venture with Japanese glassmaker Asahi to produce glass for television picture tubes. At the time, Corning was facing tremendous costs of tooling for new picture tube sizes larger than 27-inch, which were the biggest made in the United States before the partnership was formed.<sup>7</sup>

Techneglas is the major supplier of glass for picture tubes in the United States, supplying an estimated 60 to 70 percent of U.S. demand.<sup>8</sup> Techneglas was a joint venture formed in 1988 between Owens-Illinois (O-I) and Nippon Electric Glass (NEG). Owens-Illinois sold 50 percent of its picture tube glass operation to NEG, in order to receive technical assistance from NEG for the development and production of picture tube glass for larger size screens with higher quality picture resolution.<sup>9</sup> Like Corning, O-I faced tremendous costs of tooling for new picture tube sizes larger than 27-inch.<sup>10</sup> In 1993, NEG bought O-I's share in this joint venture, which was renamed Techneglas.<sup>11</sup>

Thomson, formerly RCA Corp, is an affiliate of Thomson CSF and Thomson Consumer Electronics and the only U.S. producer integrated from the production of glass for picture tubes through television receiver production. Thomson produces glass for consumption by Thomson's U.S. picture tube plant only; however, it is not able to supply all Thomson's glass needs. In fact, none of the U.S. glass producers has sufficient capacity to meet demand<sup>12</sup>. Corning-Asahi (CA) gets most of its imported glass from Asahi facilities in Japan and Taiwan and from Samsung Corning in Korea. CA's plants in the United States are running at capacity with no scheduled maintenance shutdowns before 1996. Techneglas will be importing millions of glass funnels and faceplates from its own Far Eastern operation and from Schott Glass Works in Germany.<sup>13</sup>

<sup>7</sup> *Television Digest*, vol. 28, No. 29, p. 9.

<sup>8</sup> Telephone conversation with Ben Cellitti, O-I/NEG, Sept. 8, 1994.

<sup>9</sup> *Television Digest*, vol. 28, No. 12, p. 11.

<sup>10</sup> *Television Digest*, vol. 28, No. 29, p. 9.

<sup>11</sup> *Television Digest*, vol. 33, No. 20, p. 16.

<sup>12</sup> Staff interviews with representatives of Thomson Consumer Electronics and Techneglas, Dec. 1994.

<sup>13</sup> *Television Digest*, vol. 34, no. 5, p. 12.

The glass industry supplying picture tube manufacturers has been hard pressed in recent years to keep up with demand, which now exceeds capacity in the United States. Since larger screen tubes consume more glass than smaller tubes, the trend toward larger screens means fewer tubes can be produced from the same amount of glass. The North American Free-Trade Agreement (NAFTA) may increase the demand for U.S.-made tubes at Mexican border plants, further intensifying the glass shortage. Industry shortfalls continued through 1994, when five of the seven U.S. picture tube plants were forced to shut down due to a shortage of glass.<sup>14</sup> Only the two Thomson plants operated through the year. Glass producers are unable to supply a sufficient amount of funnels and faceplates—glass capacity in the United States is only 20 million units.<sup>15</sup> In 1993, maintenance on some production lines by glass producers also contributed to the glass shortages. Intensifying the shortfall in glass was the need for separate production of new, high-contrast “dark glass” tubes. In addition, a fire in the Thomson warehouse in Marion, Indiana, in July 1993 destroyed significant quantities of finished tubes.

The shortage has been compounded by the strength of the yen against dollar. Additional glass supplied by Japan has become “incredibly expensive” and Japan’s ability to act as a “safety valve...has been disappearing”.<sup>16</sup> No meaningful increases in U.S. tube plant capacity are expected before 1995.<sup>17</sup> As a result of the glass supply problems, Sony and Corning-Asahi have entered a joint venture to produce picture tube glass for Sony’s Pittsburgh facility. Samsung and Corning have also entered into an agreement to build a glass producing plant in Mexico to supply Samsung’s Mexican plant. However, it is estimated that it will be a minimum of 2 years before such a plant can be brought online and that the investment required is at least \$200 million.<sup>18</sup>

The number of total employees and production workers in the United States decreased significantly during the 1980s. After declines estimated to be as much as one-quarter of all workers, employment stabilized by the end of the decade and has grown 1 to 2 percent during 1989-1993.<sup>19</sup> There were about 20,600 workers employed in the cathode-ray tube

industry in 1992, of whom about 16,300 were production workers.<sup>20</sup> Average wages were \$28,500 per year for all workers and \$25,500 per year for production workers. Payroll accounted for almost 77 percent of total compensation and about 25 percent of the value of shipments, whereas materials accounted for about 57 percent of the value of shipments.<sup>21</sup> New capital expenditures declined between 1990 and 1991, the latest year for which information is available, from about \$170 million to about \$77 million.

### **Consumer Characteristics and Factors Affecting Demand**

The major consumers of these products are manufacturers of television receivers, computer terminals, avionics, and medical electronics. The major factor affecting demand for CRTs is consumer demand for color television receivers. Industrial and military CRTs are dependent upon technical specifications and government programs, especially those of the U.S. Department of Defense.

The most important factor in demand for picture tubes is the consumer’s preference in screen size. There is increasing demand worldwide for large-screen (25-inch and over) direct-view televisions, leading to a shortage of large-screen picture tubes. Of 23 million direct-view color television receivers units sold to in the United States in 1993, 19 percent were over 26 inches in diagonal measurement, up from 10 percent in 1989.<sup>22</sup> U.S. television set producers generally have reserved domestic production of larger screen size TV sets for U.S. plants.

The demand for television receivers is highly elastic, and a small difference in price produces a dramatic difference in quantity demanded. Because of the increasing cost of glass, the cost of tubes has risen during the period 1982-93. At the same time, the proliferation of integrated circuitry has reduced the cost of electronic television componentry other than picture tubes. Consequently, the share of television receiver cost attributable to the CRT has risen, and currently represents more than half the total unit cost of a finished color television.<sup>23</sup> Attempts by the glass and picture tube industries to raise prices to offset rising costs have been met with stiff resistance by television receiver producers.

Consumers demand higher quality images and increased resolution in CRTs. The pitch—the distance between the dots inside the faceplate—must be reduced in order to increase resolution and aligning the aperture mask and faceplate is more difficult as the pitch is

<sup>14</sup> Interview with Thomson Consumer Electronics official, Nov. 18, 1994.

<sup>15</sup> O-I/NEG Sales and Marketing Vice President Lawrence Weaver, interview in *Television Digest*, vol. 33, No. 39, p. 11.

<sup>16</sup> Corning Asahi business manager Willard Boyer, interview in *Television Digest*, vol. 33, No. 39, p. 11.

<sup>17</sup> *Television Digest*, vol. 33, No. 39, p. 11.

<sup>18</sup> *Television Digest*, vol. 34, No. 46, p. 11.

<sup>19</sup> Estimated by the staff of the U.S. International Trade Commission and U.S. Department of Commerce, *Annual Survey of Manufactures* (Washington, DC: GPO).

<sup>20</sup> Based on shipments per worker for SIC 36714.

<sup>21</sup> *Annual Survey of Manufactures*, 1991.

<sup>22</sup> *Color Television Activity Report*, Electronic Industries Association, various years.

<sup>23</sup> Staff interview with representatives of Sony, Thomson, and Zenith, Dec. 1994.

reduced. In addition to image quality and resolution, consumers of tubes look for other quality differences and specify a tube by deflection angle; whether the front panel is flat or curved; whether or not the front panel is glare-resistant; aspect ratio<sup>24</sup>; type of phosphors; type of electron gun; type of funnel coating; and type of mounting system.

Factors in military demand for CRTs are ruggedness, resolution, and weight. Weight is an especially important factor when CRTs are used in displays in military aircraft. A move toward head-up displays<sup>25</sup>, or HUDs, first used in military aircraft, then in commercial aviation, has increased the demand for smaller CRTs. For other industrial tubes, size, resolution, and price are the important considerations. Demand for industrial tubes is related to demand for the end equipment, such as oscilloscopes, of which tubes are integral components.

Demand in the United States is rising for 14-inch and larger color CRTs used in computer terminals because of the spreading adoption of operating systems using a graphical user interface (GUI).<sup>26</sup> There also is strong demand for 17- to 21-inch CRT monitors in areas where computerized graphics are an important consideration, such as for engineering workstations or desktop publishing.<sup>27</sup>

Currently there are no economically viable substitutes for color television picture tubes. There is increasing interest around the world in flat-panel displays (FPDs), including LCDs. LCDs are being used in small screen color and monochrome television receivers but are limited in size to 4 inches or less in diagonal measurement. The yield in production of large LCDs makes them prohibitively expensive for use in larger screen size television receivers at this time. Larger screen size LCDs are used as displays in portable computers in sizes up to 10 inches, where their compact size, light weight, and low power consumption makes them worth the cost. Prototype LCDs as large as 21 inches in diagonal measurement have been exhibited.<sup>28</sup> However, they are several

<sup>24</sup> Aspect ratio is the ratio of picture width to picture height. Normal TV aspect ratio is 4:3, HDTV aspect ratio is 16:9.

<sup>25</sup> Head-up displays project text and video information from a CRT onto a transparent screen in front of the pilot. With HUDs, the pilot need not take his eyes off the sky in front of him in order to read elevation, heading, airspeed, and other quantified characteristics of the aircraft.

<sup>26</sup> Operating systems make basic functions of the computer available to software. Common operating systems employing GUIs are Windows 3.1, OS/2 3.0, and MAC system 7.5.

<sup>27</sup> *Display Devices: Electronic Display Devices and Application Technologies*, Dempa Publications, 1993. Supplement to Journal of Electronics Engineering.

<sup>28</sup> *Electronics Weekly*, "Sharp Opens Way for Colour LCD Television," No. 1688, July 13, 1994, p. 10.

times as expensive as color CRTs would be for the same application.

The benefits of FPDs are that they are lighter in weight, more compact, and consume less power than CRTs. The drawbacks to FPDs are their limited size and high cost compared to CRTs. The demise of CRTs in favor of FPDs has been predicted for over a decade. Although FPDs have made inroads, they are far from becoming a viable substitute for CRTs.

## FOREIGN INDUSTRY PROFILE

Foreign producers of CRTs face many of the same problems as do U.S. producers—product differentiation, capacity constraints, need for investment capital, and supply shortages. Domestically produced CRTs tend to be similar to imported tubes in characteristics and uses. In general, cathode-ray tubes are made of the same materials, perform the same function, and have a similar production process. Because of increased demand worldwide, manufacturers are operating at or near full capacity for the production of larger screen tubes and the cost of adding more capacity for larger screen tubes is very high.<sup>29</sup> Furthermore, as in the United States, glass producers are finding it difficult to keep up with demand from CRT manufacturers.

The principal producers of CRTs are those that have sufficient capital to construct plants, access to technology (generally acquired as a result of a viable consumer electronics industry), and access to large domestic or export markets. Japan, Korea, and the European Union (EU) have traditionally been the largest foreign producers of CRTs. Firms in these countries were able to make the major capital investments required to construct CRT plants; were part of large consumer electronics industries; and, in most cases, especially the largest companies, were affiliated with television receiver producers, the largest consumers of CRTs.

The dominance of Japan, the EU, and Korea has lessened during 1989-93 as price competition, technology transfer, the emergence of trading blocks, and the growing economies of the developing nations have influenced the location of production expansion and new facilities. Although the general trend has shifted production to the developing nations of Asia, there was some expansion in the EU and Canada.

Japan was the world's major CRT producer in 1992, producing about 53 percent of world output. Other leading producers were Korea (20 percent), the United States (17 percent), Germany (8 percent), and

<sup>29</sup> Staff interviews with representatives of Thomson Consumer Electronics and Techneglas, Dec. 1994.

Italy (6 percent).<sup>30</sup> In Japan, CRTs for high-end television receivers generally were sourced domestically, while CRTs for mid-range items were primarily acquired from Korea.<sup>31</sup> Japan is the major source of large-screen tubes for the Far East.<sup>32</sup>

Korea was the second largest source of CRTs in the world in 1992. Korean manufacturers export color televisions with screen sizes of not more than 21 inches, with larger models reserved for domestic consumption. Larger screen models will be available for export after larger CRTs become available to manufacturers on the local market.<sup>33</sup>

Japanese companies, facing of stiff competition, trade barriers, and relatively slow growth in developed countries, are continuing their drive to relocate production to East Asia. Production facilities in the developing countries of Asia offer not only lower production costs but also facilitate entry into new markets. In late 1992, NEG (Malaysia) began investing in the production of glass bulbs for CRTs. Samsung of Korea has also established a picture tube plant in Malaysia.<sup>34</sup> By 1996, the Malaysian market is expected to have grown to 8.8 million bulbs for CRTs annually.<sup>35</sup> Toshiba has set up facilities in Thailand to produce color television tubes for its Far East plants.<sup>36</sup> Thailand, Vietnam, and China are also locations in Asia attractive to CRT producers.

A plant to build color picture tubes for export to the United States and the EU will be built in Hong Kong's New Territories by the joint venture of U.S.-owned Lotus Scientific Development and China Everbright Group. Lotus bought former U.S. tube maker GE's small tube production equipment (10- and 13-inch) when GE left the small tube market in 1985 and sold its machinery to a mainland China operation.<sup>37</sup> Chinese picture tube manufacturers expect demand to increase further after China joins the World Trade Organization, which will lower many countries' tariffs on Chinese exports.<sup>38</sup>

As in the United States, supply shortages are common in Asia. Demand for larger screen tubes in

Asia has increased since the EU imposed antidumping duties on imports of small-screen (less than 16 inches) televisions. The Asian countries that produced small-screen televisions are shifting production to larger screen sizes, leading to increased demand for larger tubes and more glass.<sup>39</sup>

More countries in Asia are trying to produce their own CRTs domestically.<sup>40</sup> China produced 7 million color televisions in 1988, but had the capacity to produce only 1 million color picture tubes. China plans to produce from 10 million to 12 million color televisions per year using Chinese-produced picture tubes before the end of the decade. While four picture tube plants are under construction, China is importing tubes from other countries.<sup>41</sup>

Most portable television manufacturers in Taiwan have suffered from insufficient supplies of CRTs, particularly color CRTs. The booming computer market encouraged CRT makers to concentrate on making more profitable units for computer monitors. Television makers, heavily reliant on overseas markets, claimed they were hurt by the abolition of state export subsidies in 1992.<sup>42</sup>

The major European-owned tube producers in Europe are Thomson, Philips, and Nokia, all of which are television receiver producers. Foreign-owned CRT producers are increasing their presence in Europe. Sony, one of the largest CRT producers in Europe, operates a plant in Wales that supplies television plants in Spain and Germany.<sup>43</sup> Samsung bought a CRT factory and a glass plant in the former East Germany and rebuilt and modernized both plants. The tube facility, which is supplied by the glass plant, is expected to produce nearly 2 million color television tubes in 1994 increasing to 5 million in 1997. These tubes will be shipped to Samsung television set plants in Turkey, the United Kingdom, and Portugal.<sup>44</sup>

While Far East CRT producers are moving production to Europe to take advantage of EU free trade, others are moving to Mexico to gain duty free access to the U.S. market under the NAFTA.<sup>45</sup> Samsung plans to include a television tube plant in an integrated television production facility in Mexico due to start up in October 1995. The tube plant will

<sup>30</sup> *Yearbook of World Electronics Data*, vols. 1-3 (Oxford: Elsevier Science Publishers, Ltd., 1994).

<sup>31</sup> *Asian Sources Electronics*, "Rising demand for big screens sharpens competition," November 1992, pp. 114-163.

<sup>32</sup> *Television Digest*, vol. 28, No. 41, p. 12.

<sup>33</sup> *Asian Sources Electronics*, "Rising demand for big screens sharpens competition," November 1992, pp. 114-163.

<sup>34</sup> *Television Digest*, vol. 34, No. 38, p. 11.

<sup>35</sup> *Asian Sources Electronics*, "Rising demand for big screens sharpens competition," November 1992, pp. 114-163.

<sup>36</sup> *Television Digest*, vol. 30, No. 20, p. 14.

<sup>37</sup> *Television Digest*, vol. 27, No. 14, p. 20.

<sup>38</sup> *Asian Sources Electronics*, "Product Survey: Color TVs," June 1993, p. 240.

<sup>39</sup> *Asian Sources Electronics*, "Rising demand for big screens sharpens competition," November 1992, pp. 114-163.

<sup>40</sup> *Television Digest*, vol. 30, No. 20, p. 14.

<sup>41</sup> *Television Digest*, vol. 28, No. 41, p. 9.

<sup>42</sup> *Asian Sources Electronics*, "Product Survey: Portable TVs," January 1992, p. 250.

<sup>43</sup> *Television Digest*, vol. 30, No. 20, p. 14.

<sup>44</sup> *Television Digest*, vol. 34, No. 40, p. 12.

<sup>45</sup> *Asian Sources Electronics*, "Product Survey: Color TVs," May 1993, p. 240.

produce approximately 3 million 19- and 20-inch tubes for use in the planned television production facility in Tijuana, Mexico.<sup>46</sup> Thomson produces television picture tubes in Mexico City.

## U.S. TRADE MEASURES

### Tariff Measures

In 1993, the trade-weighted rate of duty for all products in this summary was 6.8 percent ad valorem—6.2 percent when trade preferences were taken into account. The nominal rates of duty on imports of picture tubes and other CRTs ranged from a high of 15 percent ad valorem for color picture tubes to a low of 4.2 percent ad valorem for photocathode tubes. The nominal rate of duty on deflection coils was 3.7 percent and the rate of duty on other parts of CRTs was 6 percent (table 1). However, the effective trade-weighted average duty on U.S. imports of color picture tubes was 12.1 percent ad valorem;<sup>47</sup> on other cathode-ray tubes, 4.8 to 6.5 percent; on deflection coils, 2.8 percent; and on other parts of CRTs, 5.6 percent.

The NAFTA, as implemented by the North American Free Trade Agreement Implementation Act (Public Law 103-182, enacted Dec. 8, 1993), provided for the elimination of U.S. duties on picture tubes and other CRTs imported from Mexico effective January 1, 1994. Also, the NAFTA stipulated that color television receivers larger than 13 inches assembled in Mexico must have North American-made tubes to avoid import duties if the finished receiver is brought into the United States. Television receivers exported from Mexico to the United States that do not meet this requirement could be assessed a Mexican tariff of 15 percent on the tube and an additional 5 percent on the value of the completed television.

The first stage of tariff reductions resulting from the Uruguay Round Agreements (URA) became effective Jan. 1, 1995.<sup>48</sup> Under the URA, the United States agreed to reduce its tariffs on the products covered by this summary by as much as 50 percent.

<sup>46</sup> *Television Digest*, vol. 34, No. 39, p. 12.

<sup>47</sup> Picture tubes imported in combination with, or incorporated into, other articles are classified under the Harmonized Tariff Schedule of the United States (HTS) in subheadings 8540.11 through 8540.12, inclusive, unless they are incorporated into fully assembled units such as television receivers, word processors, or similar articles, or are included in kits containing all the parts necessary for assembly into finished units such as television receivers, word processors, or similar articles.

<sup>48</sup> For more information on the impact of this agreement, see U.S. International Trade Commission, *Potential Impact on the U.S. Economy and Industries of the GATT Uruguay Round Agreements* (inv. No. 332-353), vol. 1, USITC publication 2790, June 1994.

However, most duties on color television picture tubes will not be reduced. The resulting trade-weighted duty for this sector is expected to decline approximately one-third as a result of URA tariff reductions.

### U.S. Government Trade-Related Investigations

In late 1987, Commerce and the USITC determined that imports of color television picture tubes from Canada, Japan, Korea, and Singapore were being sold in the United States at less than fair value (LTFV) and that the U.S. color television picture tube industry was materially injured or threatened with material injury by reason of such LTFV sales.<sup>49</sup> As a result Commerce issued an antidumping order with respect to such imports.<sup>50</sup> The weighted-average dumping margins were as follows (in percent):

Country	LTFV margin
Canada:	
Mitsubishi Electronics Industries Canada, Inc . . . . .	0.65
All others . . . . .	0.65
Japan:	
Hitachi Ltd . . . . .	22.29
Matsushita Electronics Corp . . . . .	32.91
Mitsubishi Electric Corp . . . . .	1.34
Toshiba Corp . . . . .	33.50 <sup>51</sup>
All others . . . . .	30.02
Korea:	
Samsung Electron Devices Co., Ltd . . . . .	1.91
All others . . . . .	1.91
Singapore:	
Hitachi Electronic Devices (Singapore) Pte., Ltd . . . . .	5.33
All others . . . . .	5.33

Each year during the anniversary month of the publication of an antidumping order, an interested party may request that Commerce conduct an administrative review of the order. There has been only one significant change with respect to the antidumping orders on imports of CRTs. As a result of the first administrative review of imports from Japan, initiated by Commerce in March 1989, and covering Toshiba Corp., Commerce issued a final determination in September 1990, lowering the margin to 23.10 percent.

<sup>49</sup> See 52 F.R. 49209, Dec. 30, 1987. For the report on the investigation, see U.S. International Trade Commission, *Color Picture Tubes from Canada, Japan, the Republic of Korea, and Singapore*, (investigation Nos. 731-TA-367 through 370 (Final)), USITC Pub. 2046, Dec. 1987.

<sup>50</sup> 53 F.R. 430, Jan. 7, 1988.

<sup>51</sup> 23.10 following administrative review.

**Table 1**  
**Television picture tubes and other cathode-ray tubes: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of June 30, 1994; U.S. exports, 1993; and U.S. imports, 1993**

HTS subheading	Description	Col. 1 rate of duty as of June 30, 1994		U.S. exports, 1993	U.S. imports, 1993
		General	Special <sup>1</sup>		
<i>Million dollars</i>					
8540.11.00 <sup>2</sup>	Color cathode-ray television picture tubes, including video monitor cathode-ray tubes .....	15%	Free (B,E,IL,J) 7.5% (CA)	541.9	106.6
8540.11.10	Color picture tubes, non-high definition, non-projection, exceeding 35.56cm .....	15%	Free (B,CA,E,IL, J,MX)	( <sup>3</sup> )	( <sup>4</sup> )
8540.11.20	Color picture tubes, non-high definition, non-projection, not exceeding 35.56cm .....	15%	Free (B,CA,E,IL, J,MX)	( <sup>3</sup> )	( <sup>4</sup> )
8540.11.30	Color picture tubes, high definition, exceeding 35.56cm .....	15%	Free (B,CA,E,IL, J,MX)	( <sup>3</sup> )	( <sup>4</sup> )
8540.11.40	Color picture tubes, high definition, not exceeding 35.56cm .....	15%	Free (B,CA,E,IL, J,MX)	( <sup>3</sup> )	( <sup>4</sup> )
8540.11.50	Other color picture tubes .....	15%	Free (B,CA,E,IL, J,MX)	( <sup>3</sup> )	( <sup>4</sup> )
8540.12.00	Monochrome cathode-ray television picture tubes including video monitor cathode-ray tubes .....	( <sup>5</sup> )	( <sup>5</sup> )	2.4	( <sup>6</sup> )
8540.12.10	Monochrome picture tubes with a straight-line dimension across the faceplate greater than 29cm but not greater than 42cm, non-high definition .....	7.2%	Free (A,B,E,IL,J, MX) 2.8% (CA)	( <sup>3</sup> )	( <sup>4</sup> )
8540.12.20	Monochrome picture tubes with a straight-line dimension across the faceplate greater than 29cm but not greater than 42cm, high definition .....	7.2%	Free (A,B,E,IL,J, MX) 2.8% (CA)	( <sup>3</sup> )	( <sup>4</sup> )
8540.12.40 <sup>2</sup>	Monochrome picture tubes with a straight-line dimension across the faceplate greater than 29cm but not greater than 42cm .....	7.2%	Free (A,B,E,IL,J) 3.6% (CA)	( <sup>3</sup> )	1.1
8540.12.50	Other monochrome picture tubes, non-high definition .....	6.5%	Free (B,E,IL,J, MX) 2.6% (CA)	( <sup>3</sup> )	( <sup>4</sup> )
8540.12.70	Other monochrome picture tubes, high definition .....	6.5%	Free (B,E,IL,J, MX) 2.6% (CA)	( <sup>3</sup> )	( <sup>4</sup> )

See footnotes at end of table.

**Table 1—Continued**

**Television picture tubes and other cathode-ray tubes: Harmonized Tariff Schedule subheading; description; U.S. col. 1 rate of duty as of June 30, 1994; U.S. exports, 1993; and U.S. imports, 1993**

HTS subheading	Description	Col. 1 rate of duty as of June 30, 1994		U.S. exports, 1993	U.S. imports, 1993
		General	Special <sup>1</sup>		
<i>Million dollars</i>					
8540.12.80 <sup>2</sup>	Other monochrome cathode-ray television picture tubes, including video monitor cathode-ray tubes .....	6.5%	Free (B,E,IL,J) 3.2% (CA)	( <sup>3</sup> )	184.8
8540.20.20	Cathode-ray television camera tubes, image converters, and intensifiers .....	6%	Free (B,CA,E, IL, J,MX)	52.9	4.8
8540.20.40	Other photocathode tubes .....	4.2%	Free (B,CA,E, IL, J,MX)	54.9	13.0
8540.30.00	Other cathode-ray tubes .....	6%	Free (B,CA,E, IL, J,MX)	32.8	281.2
8540.91.15	Front panel assemblies .....	6%	Free (B,E,IL,J,MX) 2.4% (CA)	( <sup>3</sup> )	( <sup>4</sup> )
8540.91.20	Deflection coils .....	3.7%	Free (B,E,IL,J,MX) 1.4% (CA)	5.6	109.8
8540.91.40 <sup>2</sup>	Other parts of cathode-ray tubes, including front panel assemblies .....	6%	Free (B,E,IL,J) 3% (CA)	79.0	220.8
8540.91.50	Other parts of cathode-ray tubes .....	6%	Free (B,E,IL,J,MX) 2.4% (CA)	( <sup>3</sup> )	( <sup>4</sup> )

<sup>1</sup> 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); North American Free Trade Agreement: Goods of Canada (CA); Caribbean Basin Economic Recovery Act (E); United States-Israel Free Trade Area (IL); Andean Trade Preference Act (J); and North American Free Trade Agreement: Goods of Mexico (MX).

<sup>2</sup> This tariff classification was removed as of Jan. 1, 1994. However, imports during 1993 used this subheading.

<sup>3</sup> No export subheading exists for this HTS classification.

<sup>4</sup> This is a new tariff classification as of Jan. 1, 1994 and no trade occurred under this subheading in 1993.

<sup>5</sup> There is no Col. 1 rate of duty for this classification because it is an export number only.

<sup>6</sup> No HTS subheading exists for this export classification.

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



The unions that had filed the antidumping petition in 1986 filed a petition with Commerce in 1990 requesting an inquiry to determine whether Canada, Japan, Korea, and Singapore were circumventing the antidumping duty orders on color picture tubes. Commerce conducted the requested inquiry and made a final negative determination in March 1991.<sup>52</sup>

## FOREIGN TRADE MEASURES

### Tariff Measures

Major importers of CRTs include the United Kingdom, Germany, Korea, Hong Kong, and Singapore. Duty rates for these countries and other major producers are as follows:

Country	Picture tubes	Other CRTs
EU countries	15.0 percent	5.0 percent
Canada <sup>53</sup>	9.3 percent MFN free from U.S.	9.2 percent MFN free from U.S. (3.5 percent ASEAN)
China <sup>54</sup>	30-40 percent	9-17 percent
Hong Kong <sup>55</sup>	0 percent	0 percent
India <sup>56</sup>	65 percent	65 percent
Japan <sup>57</sup>	30 percent 4.2 percent GATT	30 percent 4.2 percent GATT
Korea <sup>58</sup>	20 percent	20 percent
Malaysia <sup>59</sup>	2 percent	5-35 percent
Singapore <sup>60</sup>	5 percent	5 percent

## U.S. MARKET

### Consumption

Apparent U.S. consumption of television picture tubes and other CRTs increased by 17 percent during 1989-93, from \$2.1 billion to \$2.4 billion. The import penetration level increased from 32 percent in 1989 to

34 percent in 1993 (table 2). Demand in the United States has been strong during 1991-3 because of the proliferation of machinery, such as automated teller devices, incorporating CRTs; increasing use of personal computers in the home and the workplace; and the consumer's desire to move up to larger screen television receivers.

### Production

U.S. production of television picture tubes and other CRTs increased by 33 percent during 1989-93, from \$1.8 billion to \$2.4 billion, due mainly to the increase in shipments of color picture tubes. Shipments of those tubes increased by 50 percent during the period, from \$1.3 billion to \$2.0 billion. Most of the increase came between 1990 and 1991, when shipments of picture tubes increased by 42 percent. However, during 1989-93, shipments of CRTs other than for military and industrial use decreased by 13 percent, from \$230 million to \$200 million and shipments of military and industrial CRTs fell 4 percent, from \$37 million to \$35 million. Additionally, shipments of parts decreased by 9 percent, from \$115 million to \$104 million.<sup>61</sup> In 1994, U.S. picture tube manufacturers were operating at full capacity for the production of larger screen tubes, limited only by the supply of glass.

### Imports

U.S. imports of television picture tubes and other CRTs increased by 24 percent during 1989-93, from \$664 million to \$822 million (table 3). The major sources of imports were Japan, accounting for \$530 million (64 percent) of 1993 imports, and Mexico, accounting for \$115 million (14 percent). The major imports from Japan were CRTs other than picture tubes (\$237 million) and parts of CRTs (\$159 million), which together accounted for 75 percent of imports of this product type from Japan. Virtually all imports of this product type from Mexico—\$110 million out of a total of \$115 million—were of parts of CRTs.

Deflection coils and parts of CRTs accounted for 40 percent of 1993 imports. Imports of these parts increased from \$252 million to \$331 million (or 31 percent). The major importers of CRT parts were picture tube producers. Display CRTs other than for television receivers and video monitors accounted for 34 percent of 1991 imports and increased by 7 percent, from \$263 million to \$281 million during 1989-93. The major importers of display CRTs other than for television and video monitors were producers of display monitors such as for automatic teller machines (ATMs).

<sup>61</sup> U.S. Census Bureau, "Semiconductors, Printed Circuit boards, and Other Electronic Components." Current Industrial Report MA36Q, various editions.

<sup>52</sup> 56 F.R. 9667, Mar. 7, 1991.

<sup>53</sup> *Revenue Canada Customs & Excise*, 1993.

<sup>54</sup> International Customs Tariff Bureau 1989-90.

<sup>55</sup> As a free port, Hong Kong has no duties on imports of CRTs.

<sup>56</sup> *Cen-Cus New Method 2-Step Tariff 1992-1993*, Cen-Cus Publications, New Delhi.

<sup>57</sup> *Customs Tariff Schedules of Japan 1992*, Japan Tariff Association.

<sup>58</sup> *Tariff Schedules of Korea-1988*, Korea Customs Research Institute.

<sup>59</sup> International Customs Tariff Bureau 1987-88.

<sup>60</sup> International Customs Tariff Bureau 1989-90.

**Table 2**  
**Television picture tubes and other cathode-ray tubes: U.S. shipments, exports of domestic merchandise, imports for consumption, and apparent U.S. consumption, 1989-93**

Year	U.S. shipments <sup>1</sup>	U.S. Exports	U.S. Imports	Apparent U.S. consumption	Ratio of imports to consumption
	<i>Million dollars</i>				<i>Percent</i>
1989 .....	1,767	352	664	2,079	31.9
1990 .....	1,761	430	648	1,979	32.7
1991 .....	2,276	565	679	2,390	28.4
1992 .....	2,321	602	758	2,477	30.6
1993 .....	2,376	769	822	2,429	33.8

<sup>1</sup> Estimated by the staff of the U.S. International Trade Commission.

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

**Table 3**  
**Television picture tubes and other cathode-ray tubes: U.S. imports for consumption by selected sources, 1989-93**

Source	1989	1990	1991	1992	1993
	<i>Value (1,000 dollars)</i>				
Japan .....	412,335	401,539	446,445	522,117	529,980
Mexico .....	74,255	98,021	105,079	101,409	115,467
Canada .....	16,152	9,824	9,057	5,766	4,144
Korea .....	8,010	10,373	6,989	9,829	11,455
Taiwan .....	94,005	73,150	47,927	46,520	38,308
United Kingdom .....	6,878	5,947	9,439	7,137	13,801
Italy .....	233	7,871	2,022	2,777	39,871
Brazil .....	19,463	11,289	9,009	12,219	11,865
Germany .....	3,980	4,176	16,009	8,255	18,289
France .....	9,327	9,725	12,619	18,638	17,577
All Other .....	19,843	16,528	14,878	23,194	21,241
Total Imports .....	664,481	648,443	679,473	757,861	821,998

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

Picture tubes and video monitor tubes accounted for 20 percent of total 1993 imports of CRTs. Imports of color picture tubes and video monitor tubes increased 45 percent from 1989 to 1993, from \$74 million to \$107 million. The average value of an imported color picture tube in 1993 ranged from \$45 to \$314, with larger screen sizes more expensive. Most of the increase was due to higher demand for large-screen picture tubes, most notably color picture tubes larger than 67cm (26 inches) which could not be satisfied by domestic producers. A major reason for the inability of domestic producers to supply increased demand in 1993 was a fire at Thomson's Indiana warehouse in that year, which destroyed most of the inventory. That lost inventory was replaced with imports from Thomson's picture tube plants in Agnani, Italy and Mexico City.<sup>62</sup>

## FOREIGN MARKETS

### Foreign Market Profile

The world market for CRTs in 1993 was about \$12 billion, of which Japan accounted for about

36 percent; Europe, about 22 percent; the United States, about 18 percent; and Korea, about 14 percent.<sup>63</sup> World demand has grown significantly in the 1990s, especially in developing countries, as per capita incomes have risen. Asian and Latin American markets have some of the highest growth rates in unit sales in the world. In the developed countries, demand has focused on larger screens and new applications.

The U.S. industry does not have a large share in foreign CRT markets for a number of reasons. CRTs are both fragile and heavy and consequently shipping costs are high per unit value. The most economical CRTs to ship overseas are the small tubes—those that are 15 inches or less in diagonal measurement. However, U.S. manufacturers produce relatively few of these products. Smaller cathode-ray tubes are produced primarily in Asia. The bulk of the midsize and larger tubes are produced in relative proximity to the plant where the tube will be incorporated into a finished product. That is one of the principal reasons that U.S. exports to Mexico account for such a high percentage of total exports. The remainder of the trade in CRTs is

<sup>62</sup> Ibid.

<sup>63</sup> *Yearbook of World Electronics Data*, vols. 1-3 (Oxford: Elsevier Science Publishers, Ltd., 1994).

primarily specialty tubes that are produced in small volume or that require such large investments in plant and equipment that it is not feasible to set up multiple locations.

Tube plants in major world markets improve access to local markets, particularly in countries with local content requirements. Picture tube producers in the EU have been consolidating their facilities in order to better compete with Japanese producers, while Japanese producers have purchased former European-owned plants in the EU so that they will have access to the European market.

### U.S. Exports

U.S. exports of television picture tubes and other CRTs increased from \$352 million in 1989 to \$769 million in 1993, or by an annual rate of almost 22 percent. U.S. exports of color television picture tubes increased from \$164 million in 1989 to \$542 million in 1993. As a share of total CRT exports, color television picture tubes increased from 46 percent to 70 percent during this period. The major exporters were U.S. color television receiver manufacturers, exporting color picture tubes to related television assembly operations in Mexico. The major markets for the United States in 1993 were Mexico (55 percent of exports), Canada (9 percent), Japan (7 percent), and Korea (7 percent) (table 4).

Exports of color picture tubes to Mexico more than tripled from 1989 to 1993, from \$102 million to \$360 million, as a result of the movement of television assembly operations from the United States to the maquiladora<sup>64</sup> plants in Mexico. Seventy percent of

<sup>64</sup> Maquiladoras are factories close to the U.S.-Mexican border, where parts and subassemblies from the United States are incorporated into assemblies or

1993 U.S. exports to Mexico were of color picture tubes not larger than 20 inches. Exports of color picture tubes over 20 inches increased at a rate of 43 percent per year during the period 1989-93, from \$90 million to \$540 million.

Exports to Korea, Canada, Japan, and the United Kingdom also increased dramatically from 1989-93. For the first three of these countries, picture tubes, mainly over 26 inches (67cm), accounted for most of the increase in U.S. exports. Of U.S. exports to Japan in 1993, almost 60 percent were of these large picture tubes; Korea, over 40 percent; and Canada, 35 percent. Increased exports to the United Kingdom were of small (less than 20 inch) picture tubes.

### U.S. TRADE BALANCE

The U.S. trade deficit in this industry fell from \$312 million in 1989 to \$53 million in 1993 (table 5). The deficit with Japan has been consistently the largest, increasing from \$384 million in 1989 to \$475 million in 1993. The balance of trade with Mexico has consistently been in surplus, rising from \$66 million in 1989 to \$310 million in 1993.

The reduction in the overall trade deficit was due mainly to picture tubes exported to Mexico, consumed in maquiladora plants in the assembly of television receivers to be exported to the United States. As U.S. television producers increased assembly operations in Mexico during 1988-93, U.S. exports of picture tubes to Mexico increased.

<sup>64</sup>—Continued

complete products for re-export to the United States. The assemblies or complete products are imported by the U.S. producer using the provisions of HTS subheading 9802.00.80. There are no duties on imports of the parts or subassemblies into maquiladoras, but maquiladora production may not enter the Mexican market.

**Table 4**  
**Television picture tubes and other cathode-ray tubes: U.S. exports to selected markets, 1989-1993**

Source	1989	1990	1991	1992	1993
	Value (1,000 dollars)				
Japan .....	27,944	34,808	49,774	43,020	54,699
Mexico .....	139,888	162,803	224,613	296,682	425,292
Canada .....	34,722	42,651	55,875	62,904	65,862
Korea .....	7,056	13,273	22,190	38,843	50,299
Taiwan .....	29,682	28,822	20,813	25,608	21,790
United Kingdom .....	17,283	16,891	20,130	17,308	37,878
Italy .....	3,293	8,799	5,746	4,976	8,905
Brazil .....	39,521	39,870	38,097	25,453	33,179
Germany .....	7,953	11,848	20,802	11,668	9,572
France .....	7,303	10,762	6,301	6,568	5,975
All Other .....	137,818	59,193	100,873	68,635	55,933
Total Exports .....	352,463	429,720	565,214	601,665	769,384

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

**Table 5**  
**Television picture tubes and other cathode-ray tubes: U.S. exports of domestic merchandise, imports for consumption, and merchandise trade balance, by selected countries and country groups, 1989-93<sup>1</sup>**

(Million dollars)

Item	1989	1990	1991	1992	1993
U.S. exports of domestic merchandise:					
Japan .....	28	35	50	43	55
Mexico .....	140	163	225	297	425
Canada .....	35	43	56	63	66
Korea .....	7	13	22	39	50
Taiwan .....	30	29	21	26	22
United Kingdom .....	17	17	20	17	38
Italy .....	3	9	6	5	9
Brazil .....	40	40	38	25	33
Germany .....	8	12	21	12	10
France .....	7	11	6	7	6
All other .....	38	59	101	69	56
Total .....	352	430	565	602	769
ASEAN .....	3	5	28	11	5
Central Europe .....	1	2	2	2	2
EU-12 .....	43	62	66	53	74
U.S. imports for consumption:					
Japan .....	412	402	446	522	530
Mexico .....	74	98	105	101	115
Canada .....	16	10	9	6	4
Korea .....	8	10	7	10	11
Taiwan .....	94	73	48	47	38
United Kingdom .....	7	6	9	7	14
Italy .....	( <sup>2</sup> )	8	2	3	40
Brazil .....	19	11	9	12	12
Germany .....	4	4	16	8	18
France .....	9	10	13	19	18
All other .....	20	8	15	23	21
Total .....	664	648	679	758	822
ASEAN .....	6	6	3	5	5
Central Europe .....	( <sup>2</sup> )	( <sup>2</sup> )	( <sup>2</sup> )	0	( <sup>2</sup> )
EU-12 .....	33	37	50	51	103
U.S. merchandise trade balance:					
Japan .....	-384	-367	-397	-479	-475
Mexico .....	66	65	120	195	310
Canada .....	19	33	47	57	62
Korea .....	-1	3	15	29	39
Taiwan .....	-64	-44	-27	-21	-17
United Kingdom .....	10	11	11	10	24
Italy .....	3	1	4	2	-31
Brazil .....	20	29	29	13	21
Germany .....	4	8	5	3	-9
France .....	-2	1	-6	-12	-12
All other .....	18	43	86	45	35
Total .....	-312	-219	-114	-156	-53
ASEAN .....	-3	-1	25	6	( <sup>3</sup> )
Central Europe .....	( <sup>2</sup> )	1	2	2	2
EU-12 .....	10	25	16	1	-29

<sup>1</sup> 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 "Central Europe".

<sup>2</sup> Less than \$500,000.

<sup>3</sup> Less than (\$500,000).

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

**APPENDIX A**  
**EXPLANATION OF 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 nonembargoed countries except those enumerated in general note 3(b) to the HTS—Afghanistan, Azerbaijan, Cuba, Kampuchea, Laos, North Korea, and Vietnam— whose goods are dutiable at the rates set forth in *column 2*. Goods from Albania, Armenia, Belarus, Bosnia, Bulgaria, the People’s Republic of China, Croatia, the Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Poland, Romania, Russia, Slovakia, Slovenia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan are now eligible for MFN treatment. Among goods 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 September 30, 1994. 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 4 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 7 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 8 to 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 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 11 to the HTS.

Preferential rates of duty in the special subcolumn of column 1 followed by the symbol “CA” are applicable to eligible goods of Canada, and those followed by the symbol “MX” are applicable to eligible goods of Mexico, under the *North American Free Trade Agreement*, as provided in general note 12 to the HTS, effective January 1, 1994.

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 5) and the *Agreement on Trade in Civil Aircraft* (ATCA) (general note 6), and *articles imported from freely associated states* (general note 10).

The *General Agreement on Tariffs and Trade* (GATT) (61 Stat. (pt. 5) A58; 8 UST (pt. 2) 1786) is a multilateral agreement setting forth basic principles governing international trade among its

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**  
**REPORTS OF THE U.S. INTERNATIONAL TRADE COMMISSION**  
**PERTAINING TO TELEVISION PICTURE TUBES AND OTHER**  
**CATHODE-RAY TUBES**

**U.S. International Trade Commission investigations related to trade in television picture tubes and other cathode-ray tubes, 1971-87**

<b>Date</b>	<b>Type of investigation</b>	<b>Product</b>	<b>Petitioner</b>	<b>Respondent/ source country</b>	<b>Final outcome</b>
1971	Eligibility for assistance as a result of adverse impact of imports (TEA-W-80)	deflection yokes and horizontal output transformers	workers at Advance Ross Electronics	all importers	negative
1971	Eligibility for assistance as a result of adverse impact of imports (TEA-I-21)	television receivers and certain parts thereof	International Association of Machinists and Aerospace Workers (IAM); International Brotherhood of Electrical Workers (IBEW); International Union of Electrical, Radio, and Machine Workers (IUE)	all importers	no finding <sup>1</sup>
1977	Volume of imports such as to harm, or likely to harm, domestic industry (TA-201-19)	television receivers, color and monochrome, assembled or not assembled, finished or not finished, and subassemblies thereof	Industrial Union Dept., AFL-CIO (IUD); American Flint Glass Workers Union; Allied Industrial Workers Union of America; Communications Workers of America; Glass Bottle Blowers Association of the United States and Canada; Independent Radionic Workers of America; IAM; IBEW; IUE; United Furniture Workers of America; United Steel Workers (USW); Corning Glass Works; GTE Sylvania; Owens-Illinois, Inc.; Sprague Electric Co.; Wells-Gardner Electronics Corp.	Japan	affirmative <sup>2</sup>
1980	Termination of import relief (TA-203-6)	color television receivers and subassemblies thereof	see above	Japan	affirmative (no relief granted) <sup>3</sup>
1987	To modify/ revoke antidumping order (751-TA-14)	LCD televisions	Casio Computer Ltd.; Casio, Inc.; Citizen Watch Co.; Hitachi Ltd.; Hitachi Sales Corp. of America; Hitachi Sales Corp. of Hawaii; Matsushita Electrical Industrial Co. Ltd.; Matsushita Electrical Co. of America; NEC Corp.; NEC Home Electronics (USA) Inc.; Seiko Epson Corp.; Sharp Corp.; Sharp Electronics Corp.; Toshiba Corp.; Toshiba America, Inc.	Japan	negative (no revokation) <sup>4</sup>

<sup>1</sup> Although the USITC was evenly divided with regard to the question of whether a domestic industry was being harmed by imports of deflection yokes and horizontal output transformers, the President accepted an affirmative finding, making the petitioner eligible for adjustment assistance. *Television Receivers and Certain Parts Thereof*, investigation No. TEA-I-21, TC Pub. 436, Nov. 1971.

<sup>2</sup> *Television Receivers, Color and Monochrome, Assembled or Not Assembled, Finished or Not Finished, and Subassemblies Thereof*, investigation No. TA-201-19, USITC Pub. 808, Mar. 1977.

<sup>3</sup> *Color Television Receivers and Subassemblies Thereof*, investigation No. TA-203-6, USITC Pub. 1068, May 1980.

<sup>4</sup> *Liquid Crystal Display Television from Japan*, investigation No. 751-TA-14 (Final), USITC Pub. 2042, Dec. 1987.

**U.S. International Trade Commission investigations related to trade in television picture tubes and other cathode-ray tubes, 1971-87—Continued**

<b>Date</b>	<b>Type of investigation</b>	<b>Product</b>	<b>Petitioner</b>	<b>Respondent/ source country</b>	<b>Final outcome</b>
1987	Antidumping (731-TA-367 through 370)	color television picture tubes	IAM; IBEW; International Union of Electronic, Electrical, Technical, Salaried, and Machine Machine Workers; USW; IUD	Canada Japan Republic of Korea Singapore	affirmative <sup>5</sup> ; antidumping order imposed on imports of color television picture tubes imported from subject countries

<sup>5</sup> Color Picture Tubes from Canada, Japan, the Republic of Korea, and Singapore, investigations Nos. 731-TA-367 through 370 (Final), USITC Pub. 2046, Dec. 1987.