

# Pursuing the realization of a "Crystal AV World"

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## Abstract

A CRT display, which has been playing a major role among information display devices for this half a century, is one of the most important inventions of this century.

Now that the 21st century near at hand, the momentum of 'analog to digital' has become irresistible in the contents and infrastructures surrounding the audio-visual field such as the broadcast and package media. In these circumstances, LCDs, featuring a high resolution, digital compatibility, human/environment friendliness and space/energy saving nature, start to play a leading part among the displays. Sharp is now pursuing to realize "Crystal AV World", where LCDs are used for all the displaying products in a typical diagonal size range from 3" to 500".

## Introduction

It is true that the electronics industry has been developing along with the appearance of key devices. They are, at first, vacuum tubes followed by transistors and then ICs and LSIs while various electronic devices such as radios, portable electronic calculators and PCs have been developed. Especially in the AV fields such as the video, audio and broadcasting industries, the momentum of "analogue to digital" is becoming stronger. That is, digital and multi-channel systems are spreading across the world. Examples are the CS broadcasting, BS digital broadcasting slated for in 2000, DVDs, video cameras, electronic still cameras and electronic game machines. This movement toward the diversification of AV media is accompanying an increasing need for making these media more handy and convenient. People are beginning to want to view, listen or use their desired TV or radio programs or application software (e.g. music, movies and games) anytime or anywhere they like.

LC technologies can satisfy this requirement, are going to do it. Digital-philic, environment-friendly, less energy consuming, light, space-saving, high-resolution and eye-friendly LCD devices are beginning to take the place of CRTs that have been keeping their leading position for this fifty years. LCDs are a right fit for the current trend of favoring the integration between information devices and home electric appliances.

This report describes the current movement of LCD-applied products for AV fields, and introduces our research & development activities toward the realization of a Crystal AV World that is exploring various applications of our LCD product lineups.

## 1. Our R&D activities for LCDs for AV fields

Our "Crystal AV World" is a strategy to realize the replacement of most of CRT TVs in Japan with LCD-employed AV products in the early 21st century.

This strategy covers various types of products including home electric appliances, mobile products, and information systems for shops, offices and public spaces. The target size of display ranges from 3 to 500 inches in nominal diagonal length for each of the following products.

3 to 30 inches: "Window" series LCD TVs

25 to 50 inches: Large, flat PALC display

40 to 70 inches: CGS-LCD rear projection TVs

50 to 500 inches: Front projection type LCD projectors  
 Our product lineups can achieve the replacement of CRT devices in every size-based category as mentioned above (Fig. 1).

## 2. Advantages of LCDs over CRTs

LCDs have the following advantages over CRTs.

- (1) Low reflection and good vision in the light  
 LCDs provide a clearer vision thanks to the lower reflection of external light in the light or even under the direct sunbeams. When the illumination around the display is 300 luxes, the contrast is about twice larger than that of CRT display (actual measurement: LCD/CRT = 65/33).
- (2) Distortion-free, luminance-uniform images  
 LCDs can provide a uniform luminance, resolution and linearity throughout the screen, thus do not cause images to distort or deteriorate at around the corners unlike CRT screens.
- (3) Higher resolution  
 LCDs use 1.7 times as many as pixels than conventional CRT screens. LCDs featuring a complete linearity and higher resolution are thus the best choice as multimedia display devices that are required to clearly display pictures and characters simultaneously.
- (4) Eye-friendly, noiseless vision  
 Our unique scanning method and displaying technologies making use of the LC's memory characteristics enable noise- and flicker-less images unlike CRT screens. Viewing the screen from near it is thus possible.

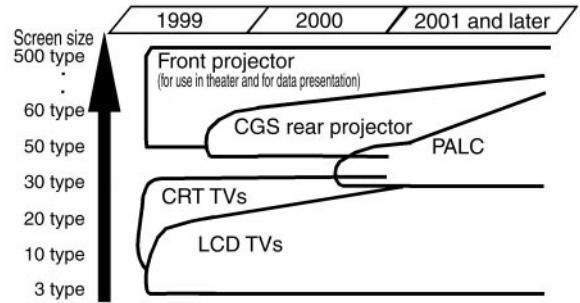


Fig. 1 LCD applied products from 3" to 500".

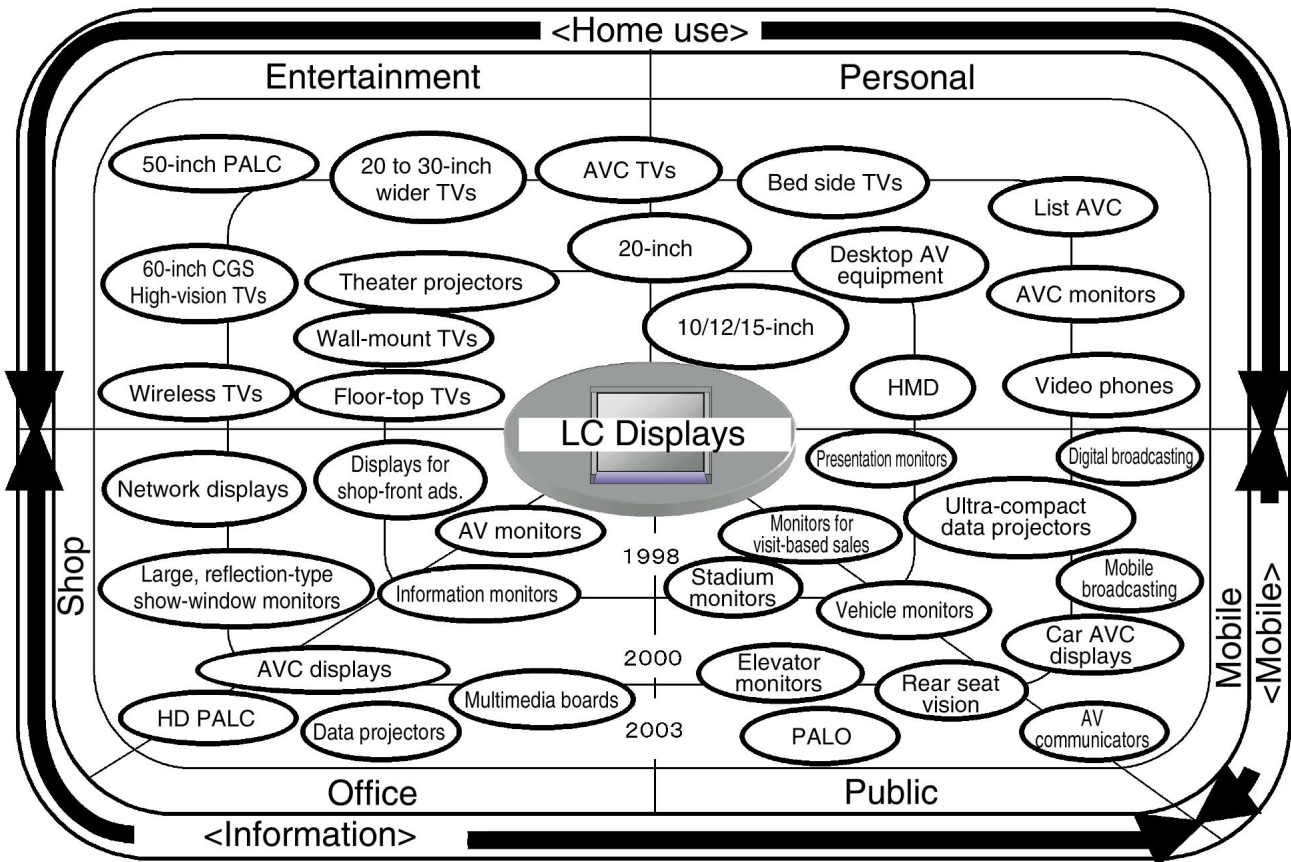


Fig. 2 Crystal AV world.

(5) Earth magnetism-free

CRTs emit electron beams. When moving the position of a CRT, color-displacement may occur as a result from the change in the earth magnetism environment. This is not the case for LCDs.

(6) Globe-friendly, energy and resource saving design

Our "Window" series 20-inch LCD TV can reduce power consumption by about 43% compared to a CRT TV of the same size, and weighs less than half of its weight. Our LCD devices needing less resources are products urgently needed to protect the environment of the globe.

(7) Space saving

The depth is significantly smaller than CRTs, so that wall-mounting is possible. Thanks to this feature, LCDs are available for wider applications (**Fig. 2**)

### 3. LCD TVs

Our Window-series LCD TVs have grown to the current 20-inch type fourth generation. Since the introduction of 12/15-inch types in March 1998, the market and users' styles in the use of LCD TVs have been significantly changing.

First, users' age groups have been changing. Users in the 20's and 30's age brackets are increasing while those in the upper age brackets are decreasing. In fact, users up to the 40's age bracket now account for about 60% of the total sales. Second, more users are beginning to use LCD TVs not only in the bedroom or personal rooms but also in the public rooms such as living, dining and kitchen. Third, more than half of our users are now using LCD TVs for two hours or longer a day, while those using for a shorter time are decreasing.

In March of this year, we started to sell a new version 20-inch "Window" LCD TV. This TV has a depth of as small as 5 cm, and weighs about 6 kg. The simple and flat-shaped TV with many options in the color of housing, installation method and peripheral components allows users to select their most desired appearance and installation according to their lifestyle or the atmosphere of the room, unlike conventional CRT TVs that may have been preventing the users from coordinating the interior of the room according to their taste. The optional components and accessories number as many as 20 so that users can create their "customized" system and its appearance according to their taste.

For example, the optional floor stand with casters allows the user to move the TV freely to his (her) desired place, e.g. the dining room when watching during eating, and near the sofa in the living room after dinner. Mounting the TV on a wall like a picture will allow the user to feel as if he (she) were in a theater or feel calm when playing an environmental (calming-purposed or feel-at-home) audiovisual software. Placing the TV on a desk, table or bow window will create an atmosphere of a personal theater. Our LCD TVs help users create their own style with respect to the use of TV and aesthetic view of the room.

### 4. Advantages of our 20-inch "Window" LCD TV

This product has the following advantages.

(1) The industry-largest 20-inch LCD color TV (the size corresponding to a CRT TV of 21-inch in nominal size) having a higher image quality as represented by a resolution of 920,000 dots (1.7 times more than that of 21-inch CRT TV) and luminance of 400 cd/m<sup>2</sup> (at least twice larger than that of an LC monitor for PC).

(2) The depth is as small as 49.5 mm (about one-tenth that of a 21-inch CRT TV) needing a smaller installation space and allowing any type of installation.



Fig. 3 The 20" LCD color TV with the floor stand.

(3) Global-friendly and energy saving: the annual power consumption is 67 kWh (smaller by about 43% than a 21-inch CRT TV), and a long-life back light for 40,000 hours use (1.6 times longer than our previous versions) is used.

(4) Fitted with a wireless AV receiver/transmitter that eliminates interface cables.

(5) Options: three types of the main unit and 20 accessories including wall-mount fittings and floor stands, allowing users to create their own watching/listening environment.

## 5. Acceptability of LCD TVs as the main home-use TV in near future

For our 20-inch LCD TVs, buyers in the 30's age bracket are further increasing. This is not the case for 15/12-inch LCD TVs. Reasons for buying 20-inch LCD TVs are (1) less space (90.9%), (2) larger screen (68.2%) and (3) wall-mountable (34.1%). This survey results suggest that the new possibilities of large-screen but thin and light LCD TVs such as the possibility of wall-mount and floor-top installation, which conventional CRT TVs cannot provide, are favored by the users.

The installation place of 20-inch LCD TV is (1) living room (54.5%), (2) bedroom (20.5%) and (3) dining room (9.1%). This suggests that many of them have been used as the main TV of the home. Watching hours are 2 hours or longer (70%) and 3 hours or longer (40%). This means that they have been used for longer hours than ever. When a married couple comes to a store to buy a TV, the wife selects an LCD TV in many cases. Unmarried women living apart from her family also favor LVD TVs. This suggests that LCD TVs are favored for reason that they can fit any atmosphere of the room. "Seeing this 20-inch LCD TV, they find how difficult it was to coordinate the existing CRT TV with the atmosphere of the room," said our marketing staff. Another reason for the popularity of our 20-inch LCD TV is the lineups of various options including aesthetic parts that allow users to create their custom-made interior of the room. We can conclude that our 20-inch LCD TVs will become the main home TV in place of conventional CRT TVs.

## 6. LCD projectors

It was in 1989 when our first LCD projector was developed with a view to realizing such a large screen that cannot be obtained by direct-view screens. Since then, we have been developing various technologies for LCD projectors. Major progresses obtained so far are summarized below.

### (1) No.1 Theater Projector (1989)

At the birth of LCD video projectors, no classification by use had existed. However, LCD projectors are now classified by use into "theater use" and "data presentation". The background for this classification is our industry-first portable LCD projector XV-100Z. While this product has been popular in Japan as a projector for home videos, it has been widely accepted in many countries as a portable projector intended for commercial presentation, which resulted in the creation of new category "data presentation".

### (2) Entry into the data projector market in 1993

It was 1993, four years after the commercialization of the No.1 Machine, when we first participated in the data projector market. Our first product on the market was a VGA model using the cross dichroic mirror system. This LCD product was completely different from the then mainstream devices based on the CRT three-tube technologies that needed a time-consuming work for installation and adjustment. The debut of the LCD product in the market was quite sensational. Since then, our company has been leading the market as a producer of LCD projectors.

### (3) Desktop presentation

In 1995 when notebook PCs were spreading, a new category of projectors called "desktop presentation" that

Table 1 Comparison of new/conventional LCD projector.

	XG-E800 (our No.1 data projector)	XG-NV6X	
Release	March 1993	July 1999	
Luminance	80 ANSI Lumen	2200 ANSI Lumen	27.5-fold
Resolution	VGA(640x480)	XGA(1024x768)	2.5-fold
Volume	48.4 liters	12.0 liters	1/4
Weight	15.1kg	7.2kg	1/2

is a combination between a portable projector and notebook computer appeared in the USA and other countries. This movement raised the need for small data projectors. Our company developed a new, industry-thinnest desktop projector "Notevision" intended for small-scale - 10 attendants or so - presentations using a notebook PC. The first product of this series was introduced in 1996. Table 1 shows a comparison between the first Notevision data projector and the latest model. As can be seen from this table, the size and weight of the latest model have been significantly reduced, the resolution is two ranks higher than the original model, and the luminance is 27.5 times higher.

#### (4) Recent status

The current data projector market is handling three different products: "ultra-compact" of 5 kg or lighter, "portable" of 5 to 10 kg and "conference" of larger size for use in a meeting room. The worldwide market size in the total of these three types is 310 thousand units in 1997, 387 thousand units in 1998, 475 thousand units in 1999 (forecast) and 700 thousand units in 2001 (forecast). "Theater" projectors have been sold worldwide about 100 thousand units per year, being expected to increase gradually.

Important design parameters of projectors are resolution and luminance. For data projectors, resolution requirements are now different between XGA and SVGA specifications. Along with the spread of higher-grade OSs and applications, resolution requirements have been changing. Some "ultra-compact" projectors have obtained a luminance of 1000 ANSI lumens. Some "portable" projectors have obtained a luminance of 2000 ANSI lumens.

#### (5) Outlook of LCD projectors

LCD projectors for commercial use are promising, as the market of "home theater" projectors are expected to grow. However, the key to the substantial growth is a digital high-vision broadcasting system slated for in both Japan and the USA. Seeing the clearer pictures obtained by the digital high-vision system, people may think of buying a larger screen. The digital broadcasting system will bear a new need for our technical know how gathered through the development of data projectors. This means that our company being good at theater and data projectors will therefore be able to have a favorable position in the projector market.

There are now over 40 manufacturers fiercely competing each other in the projector market. Under this circumstance, our company will keep the current leading position through pioneering new technologies for miniaturizing and reducing the weight of the present products and through developing new systems and networks and their software.

## **Afterword**

New LCD-applied technologies such as CGS LCD and PALC devices are at hand.

LCD devices are further spreading over various fields as "paper for industrial use". Our responsibilities and pleasure are to make continuing, lavishing efforts to produce such products than can move the people and contribute to the development of the society.

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