

# **The Development of the Chinese Audio & Video Industry: The Development of CHPAVC (China Hualu Panasonic AVC Co., Ltd.)**

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## **Abstract**

This paper intends to present the development of the audio and video industry in China by illustrating the development of a specific company, CHPAVC (China Hualu Panasonic AVC Co., Ltd.). In 1994, China Hualu Group Co., Ltd. and Matsushita Electronic Industrial Co., Ltd. co-founded CHPAVC so as to address comprehensively the need for the development, production, and sale of digital video, audio, and information processing equipment. The development stages of CHPAVC are described in this paper: first the introduction of technologies, next, the export of products, then the independent research, and finally the exceptional design.

**Key Words:** R & D, Core Technology, Audio & Video Industry

## **1. The Technological Development of the Audio & Video Industry**

### **1.1 *The VCR Era***

The first VCRs were designed in the 1960s. A *VCR* (video cassette recorder) is an electromechanical device for recording and playing back full-motion audio-visual programming on cassettes containing magnetic tape.

VCRs became available to the public around 1970. There were two major types of VCR technology, known as *VHS* (Video Home System) and *Betamax*. Both types were developed in Japan, VHS by Japan Victor Company (JVC) and Betamax by Sony. VHS systems are far more popular among home TV viewers. In the late 1980s and early 1990s, the VHS and Betamax formats became competitive. For complex legal reasons, VHS captured the home video recording and reproduction market.

In recent years, the use of video tape has become less common because of the widespread availability and popularity of *DVD* technology.

### **1.2 *The DVD Era***

DVD, the Digital Versatile Disc, is a high capacity CD-size disc for video, multimedia, games and audio applications. Capacities range from 4.7 GB to 17.1 GB. The high quality of video and audio has helped DVD-Video to compete very effectively with VHS. With an

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increasing demand for storage capability, there was a quantitative increase in the data storing capacity from the initial CD to the current DVD, BD and HD DVD.

There are two rival formats currently competing to be the successor to the DVD. The HD DVD is backed by Toshiba and the HD DVD Promotion Group, and is the next logical advancement to the existing DVD technology. The other is the Sony-backed Blu-Ray disc, so-called because the technology of refined blue lasers was employed to maximize storage capability. Although the acronyms are different, there is a likelihood that we will see a rerun of the battle between Betamax and VHS thirty years ago.

### **1.3 *The Post-DVD Era***

HD DVD systems play the current generation of red laser DVD discs without problems, but part of the secret of their increased data capacity lies in the use of new blue-violet lasers, operating at the other extreme of the visible light spectrum. The blue lasers are used instead of the usual red lasers in that they have a shorter wavelength than red lasers. Consequently the beam can be focused on a smaller area, which means you can fit more data on an identically sized disc. The HD DVD sets a new standard for next-generation optical systems that deliver brilliant, high-definition performance. As the official successor to DVD, HD DVD is the next logical step in the format evolution for high capacity, high definition optical discs.

The shared disc structure of HD DVD and DVD allows full backward compatibility offering consumers the opportunity to enjoy their current DVD library and crystal-clear HD video on the same HD DVD player.

Blu-Ray is the alternative format to HD DVD. Although the technology of Blu-Ray is almost the same as that of CDs and DVDs, the fundamental difference rests on the laser that is used to read the discs. The new lasers adopted by Blu-Ray discs are not readable on standard CD and DVD players. However, many Blu-Ray disc drives will be backwards-compatible in the future, and enable playback of the older disc formats.

Each format has influential support behind them. The Blu-ray Association is comprised of over 160 member corporations, including Sony, Panasonic, Pioneer, Sharp, HP, Disney, Twentieth Century Fox, Lionsgate, Columbia Tristar, and MGM. The HD-DVD Promotion Group, with a 120 member corporations, doesn't have the same strength of studio support, but is supported by Microsoft, Toshiba, NEC, Warner Home Video, Paramount Pictures Home Entertainment, Universal Pictures, HBO Video, and New Line Home Entertainment. Many famous international companies are paying attention to the future digital discs technology, such as near-field optical storage, holographic optical storage and multilayer optical storage.

## **2. An Introduction to the Chinese Audio & Video Industry: The Development of the Chinese DVD Industry**

### **2.1 *The Market Status of the Chinese DVD Industry***

With the developments of the 1990s, China has been the country producing the most DVD equipment in the world based on the MPEG2 standard of 2001. Approximately 80% of the DVDs produced all over the world in 2005 were made in China. However, with increasing competition and less and less profit, the Chinese DVD market began to languish at the end of 2005. According to the 2005 Annual Report of the China Audio Industry Association, the export of Chinese DVDs fell 10% and the export price was cut to about 30 USD. As a result, many Chinese DVD enterprises began to change their investment plan, such as the

Shinco shifting to the color TV industry and the Nontaus Company beginning to produce Washing Machines, MP3 players, induction cookers, as well as other products.

## 2.2 The Technological Status of the Chinese DVD Industry

China is the biggest country for DVD production. However, the rights of constituting standards and key technology are controlled by foreign firms. From 1997 to 2005 there were 660 patents related to DVDs in the Chinese patent data-base. The top ten firms filing application were Sole Foreign-Invested Enterprises, except for the Shanghai LG Electronics Co., Ltd, which was a joint-stock ownership of Chinese and Korean firms. Chinese DVD firms are manufacturers in the world DVD industry chain, as both the producer of products and the purchaser of key technology.

The technology status of the Chinese DVD industry is shown in Figure 2.1.

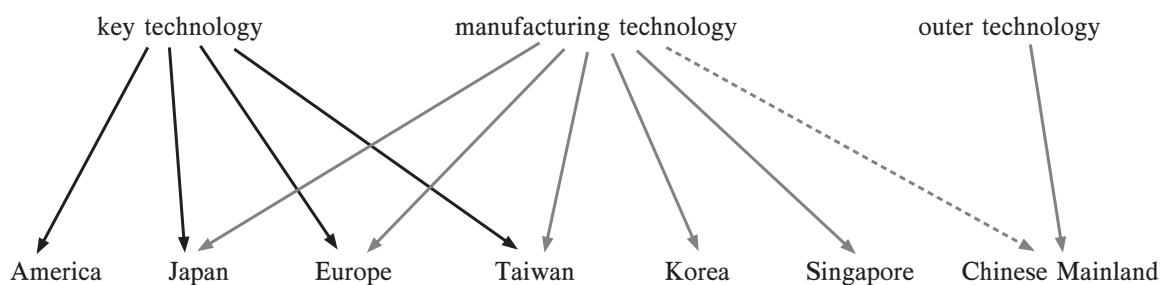


Figure 2.1 The technology status of the DVD industry

With the development of the Chinese DVD industry and the flourishing of the DVD market, some foreign holders of DVD patents formed an association and began charging Chinese DVD firms for patent fees, such as 6C, 3C, 1C and MPEG-LA. At present, the unit price of DVDs is under 40 USD in the international market, but Chinese DVD firms must pay more than 15 USD for patent fees. Consequently, with the companies' profit and competitiveness declining, Chinese DVD firms began to experience difficulties in the international market.

## 3. The Development of CHPAVC

### 3.1 Outline of the Company

Established by the China Hualu Group Co., LTD. and Matsushita Electronic Industrial Co., LTD. in 1994, China Hualu Panasonic AVC Co., LTD. (CHPAVC) has become a comprehensive company integrating development, production, and sales of key components for digital video, audio and information products. In the company's early stage, it mainly specialized in the production of key components for video recorders.

The production evolution of CHPAVC is shown in Figure 3.1:

CHPAVC has registered assets of 24 billion YEN and 5500 employees. From 1994, the operating performance of CHPAVC has made great improvement, based on the development of its technological capability and the market. CHPAVC offset its historical debt, distributed dividends in 2004, and had deposits of ¥17 hundred million in 2005. At present, CHPAVC has four production lines in four factories:

- (1) **Disc Factory.** The Disc industry has developed rapidly in the past years since it went into operation in 1997 with the following two total production systems

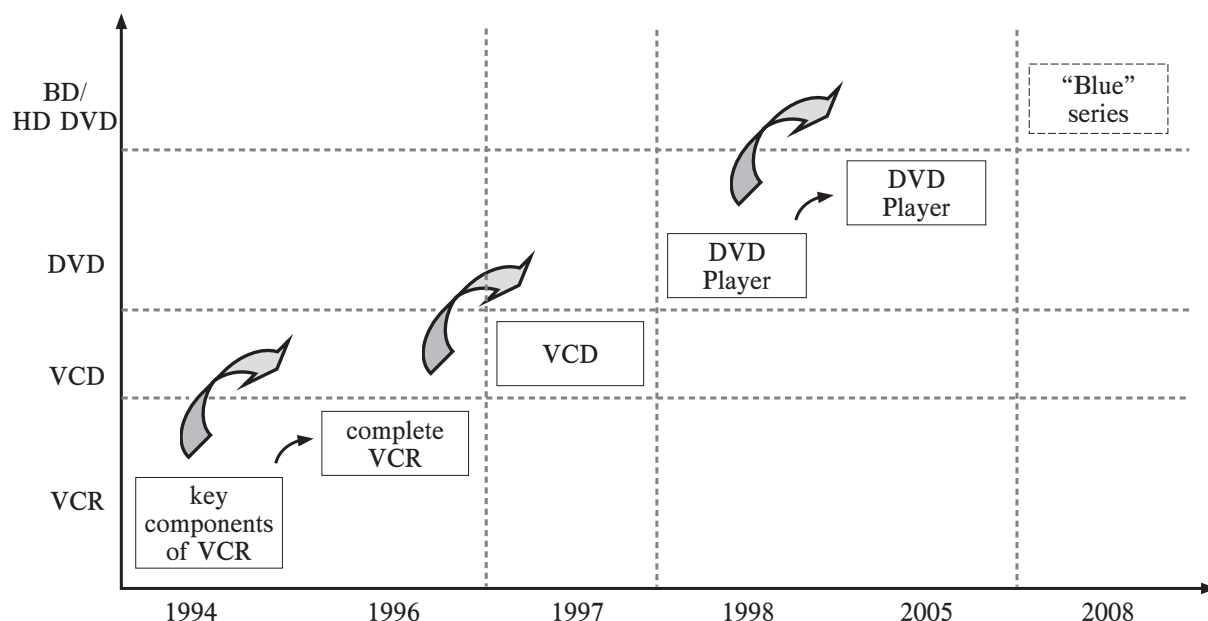


Figure 3.1 The production evolution of CHPAVC

formed: one from key components to complete VCDs and another from key components to complete DVDs. It is the first factory to produce complete DVDs in lots and to produce the DVD mechanism for clients at home and abroad. Manufacturing of computer optical pick-up, home theater systems, and other products of a digital AV network system have been increasing in scale.

- (2) **VCR Factory.** This factory upgrades production automation and adopts advanced technology in magnetic head and ferrite single crystal manufacture, and is Matsushita's overseas production base of key components for VCRs.
- (3) **Projector Factory.** This factory produces projectors for two market segments, one for business and the other for residential. Putting LCD projectors into production fills a void in this industry in China.
- (4) **Parts factory.** This factory manufactures parts and molds. Its design is based on the most advanced American software. CHPAVC has an extraordinarily accurate machine tool; its precision is  $\pm 0.005$  mm.

As a primary production base for key components for digital video, audio and information products in the world, CHPAVC has been introducing advanced Panasonic technologies and updating them since its establishment. It enjoys an overall advantage for complete development of sets and key components. At present, CHPAVC has established an R & D department, and its independent R & D capability is being enhanced gradually.

### 3.2 The Evolution and R & D Course of CHPAVC

#### 3.2.1 Adjustment of production and market

Just after its foundation, CHPAVC faced a tremendous market change. VCDs became fashionable in China in 1994, and it only took a short time to severely affect the market of VCRs. Because VCRs became unmarketable, the early nine VCR firms stopped production or shifted to the production of VCDs, one after another. And inevitably, the unmarketable goods caused problems for CHPAVC, since there were 300,000 sets of key components of VCRs lying helplessly in the storage depot.

Following self-reflection on the issue, CHPAVC carried out a series of adjustments to

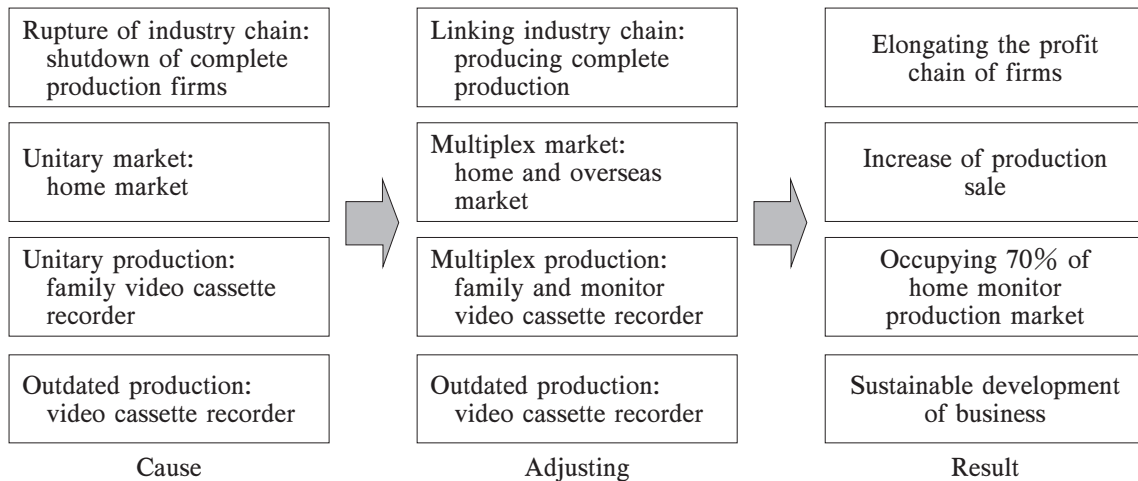


Figure 3.2 Adjustment of the production and market of CHPAVC

their production and their market as seen in Figure 3.2:

The adjustments which were made are as follows:

- (1) Linking industry chain. CHPAVC established a production line for the complete production of VCRs in 1996.
- (2) Multiplex market. CHPAVC adjusted the market structure and decisively implemented export tactics. In 2001, CHPAVC produced 2,500,000 memory drums for VCRs that could all be exported to other countries. At the same time, CHPAVC became the biggest firm producing VCR recorder heads in Asia, and had an output of 14,000,000 sets.
- (3) Multiplex production. CHPAVC began to conduct independent research on a VCR monitor that could be applied to banks, ward and fire protection in 1998, and initiated production in 2001.
- (4) Upgrading the production. CHPAVC started producing VCDs in 1997 and became aware that VCD would not be the world standard. So CHPAVC took the lead in producing a DVD in 1998 while other firms competed intensely in the production of VCDs and CVDs. Pursuing further achievement, CHPAVC spared no effort to enhance the production capabilities of DVD optical pick-up, DVD mechanisms, DVD drivers and complete DVDs based on its advantage of manufacturing key components for video recorders.

### 3.2.2 Constructing an R & D system

CHPAVC attempted to research and devise DVDs independently after producing DVDs in 1999. The strategy of its R & D was to establish a perfect R & D system of core technology and a systematic development network centered on key component development.

An integrated R & D system was founded by CHPAVC in 2001. The structure and function of the system is shown in Figure 3.3. After establishing the R & D center, CHPAVC carried out the R & D plan of complete production, core manufacture technology, and key component technology. Fortunately, Panasonic contributed important help to CHPAVC when there were technology and funding problems during the course of developing the R & D department. Moreover, Panasonic permitted CHPAVC to increase R & D expenditure continuously, and the R & D expenditure of CHPAVC added up to above ¥60 million, which represented 3% of sales income.

CHPAVC has 300 R & D personnel at present, and with the development of the R & D

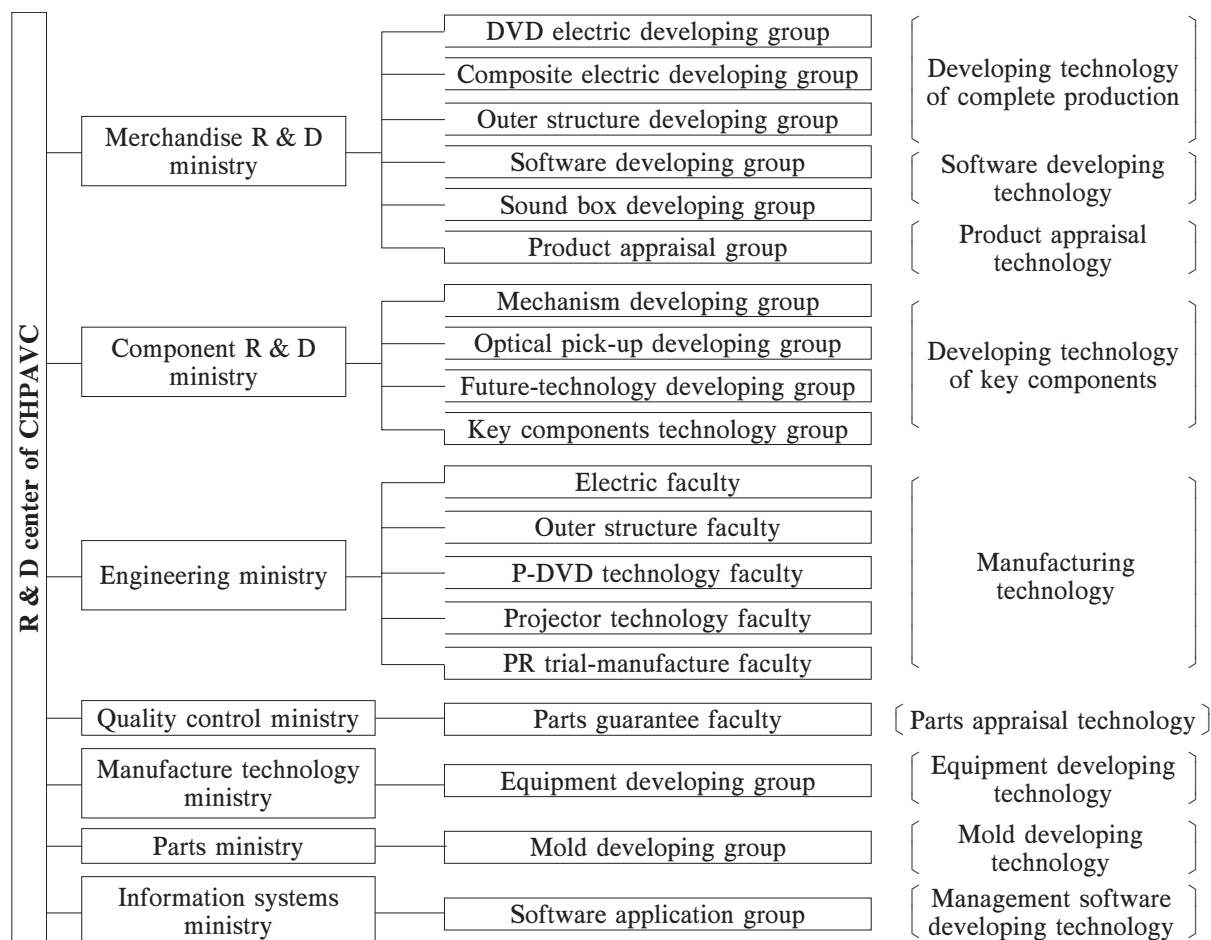


Figure 3.3 The R & D system of CHPAVC

Table 3.1 The amount and sale income of new products

	2002	2003	2004	2005	2006
The amount of new products	46	91	96	93	145
Sales income of new products/total income	45%	58%	62%	65%	80%

system and the enhancement of R & D competence, the unit volume and sales income from new products is increasing continually as shown in Table 3.1.

### 3.2.3 Complete production design

CHPAVC has now carried out an independent R & D plan, starting with complete production design. Differing from absolute dependence on Panasonic in the past, CHPAVC can now independently devise a complete production plan and establish an integrated R & D system including production figure design, core circuit design, exterior structure design and soft design. At present, CHPAVC realizes the complete production design for all requirements in the world and its products have spread to 50 countries or areas. The achievements of CHPAVC in complete production design are shown in Table 3.2.

By pursuing the R & D of ecological products in the cause of developing new products, CHPAVC can keep ahead in the field of reducing standby power, saving materials, and



**Table 3.2 The achievements of CHPAVC in complete production design**

Time	Main R & D products	Key achievements introduction
2000	DVD-RV32 series, DVD players	Cooperatively developed with Japan, put into production and entered into American and European markets in 2001.
2001	27 species of DVD players	Realized the complete production design for all requirements in the world and saw its products spread to 50 countries or areas.
2002	46 species of DVD productions, RP652	Achieved independent R & D of DVD player-RP652 and received praises in home market.
2003	91 species of DVD productions, K45 and HT860/600	Exported DVDs based on independent R & D for the first time (K45), to markets in China and Southeast Asia. First success in independent R & D of home theater sound system (HT860/600), which was distributed in China, Asian markets and Russian markets.
2004	96 species of DVD productions, PM6(micro-component system), advanced DVD with HDMI	Advanced DVD with HDMI is successfully developed in cooperation with Japan and takes the lead in markets in the world. PM6 is successfully developed by CHPAVC independently.
2005	93 species of DVD products	Achieved independent R & D of all DVD products. Began to develop acoustics. Began to cooperatively develop the DVD-Recorder, portable DVD and projectors with Japan.
2006	145 species of new DVD will be put into production	The DVD-Recorders and projectors cooperatively developed with Japan began to be widely exported.

substituting pernicious ingredients. The standby power of CHPAVC's DVD products was 2 W in 2000, less than 1 W in 2002, reduced to 0.5 W in 2004 and 0.1 W in 2006. This was much less than the request of the Chinese Energy Conservation Labeling Commission and was the most advanced in the world. In material saving, CHPAVC reduced the hammer at parts dots and miniaturized design through technological innovation. Accordingly, the weight of CHPAVC's complete DVD was 4 kg in 2000, reduced to 2.2 kg in 2004 and 1.8 kg in 2006. In addition, CHPAVC began to substitute other materials for pernicious material in 2004, fully accomplishing it in April 2005. The DVD products of CHPAVC applied with ROHs in European Countries one year ahead of schedule and met the related criterion of the Ministry of Information Industry of People's Republic of China one year earlier than other Chinese firms.

### 3.2.4 Core manufacturing technology

Early in the operation of CHPAVC's VCD and DVD manufacturing lines, core manufacture technology techniques were introduced according to the mode of VCRs. The equipment was purchased from Panasonic. However, CHPAVC achieved a moiety of manufacturing technology capability through the production process of the VCR, by which CHPAVC had accumulated experience. Thus CHPAVC developed its weak and requisite production technology early in the period of VCDs and DVDs.

The trained technical operators, pullulated by more than ten years of experience, became knowledgeable in the manufacturing technology of VCRs, VCDs and DVDs. CHPAVC's technicians were aware that core manufacturing technology is the foundation to the core key

components technology, thus, the first mission was to independently study and comprehend the core manufacturing technology.

As the mold is the foundation of the quality of DVD parts' and is vital to the manufacture of the key components, CHPAVC made many endeavors in the mold field. In 1994, CHPAVC carried out some simple maintenance activities of the prototype mold, and sent technicians to Japan at the same time. The technicians came back in 1996 and 1997. The designers of CHPAVC carried out practice on VCRs from 1997 to 1999, and started to devise the mold of DVD products in 2000. In 2002, the "one mold with two work-pieces" of the hot-runner front panel was designed, which was the first one in China and also the first in Panasonic's worldwide enterprises. CHPAVC started to develop a high-precision mold of the mechanism in 2005. CHPAVC has experienced all stages, from introducing the mold to independently producing the mold and finally exporting the mold. Accordingly, the mold technology of CHPAVC has now achieved an international advanced level.

The stamping and molding technologies of precise parts, an important part of core manufacturing technology, were the keys of products manufacturing. In 2003, the R & D center of CHPAVC succeeded in developing a "special four-series simultaneous-motion stamping technology" of the DVD soleplate, which enhanced manufacturing efficiency by 160%. The DVD optics objective lens project began to be carried out in the latter part of 2005. CHPAVC was the first to carry out this endeavor in China. CHPAVC grasped the injection molding technology and multilayer plating-film technology of an ultra-precise "one mold with eight work-pieces" for the aspherical objective lens. This project was successfully put into production, and filled the void at home and also at the international level.

In order to establish a solid foundation for the R & D of core key components technology, CHPAVC enhanced the development of specialized adjusting and testing equipment, which are vital to the manufacturing of key components. The important achievements are shown in Table 3.3.

So far, CHPAVC has developed various types of manufacturing and adjusting/testing

**Table 3.3 The important R & D achievements in specialized adjusting and testing equipment**

Time	Name	Remark
2002	4.16 DVD optics head adjusting machine	Listed as an Electronic Fund Project of the Ministry of Information Industry— "R & D of DVD Optics Head Adjusting Machine System". The project reached an international advanced level and was a domestic pioneer. It was selected into the Exhibition of the National Electronic Fund in August 2005, and was assessed as one of the 60 outstanding projects and received national awards.
2003	7.1 optics head adjusting machine	Saved 9.03 million RMB of equipment investment.
2004–2005	7.5 HB optics head adjusting machine; 7.5 HB mechanism adjusting machine	Effectively supported the mass production of the 7.5 HB optics head and created ¥10 million in benefits.
2004	Optics head mechanics matrix FO\Q tester; torquer dynamic angle tester	Apparatus for testing the parameters of optics heads for servo design; precision equipment for inspecting vertical degree of laser beam when the optics head works dynamically
2005	Recordable DVD online capability appraisal system	The project is listed as an Electronic Fund Project of the Ministry of Information Industry in 2005



equipment for the manufacture of complete production, mechanism, optics heads, and the key part of the optics heads — the torquer.

### 3.2.5 Core key components technology

With the aim to acquire the technology for devising the magnetic head, memory drum and mechanism, CHPAVC set up a special R & D group for key components design in the age of the video cassette recorder, and sent staff to Japan to study the mechanism design technology in 1994, 1995 and 1996. However, due to a shortage of training material for the related techniques and the lack of coordination of the Japanese training institution, CHPAVC did not achieve this goal.

Influenced by successive excellent design schemes and the desire for the R & D capability of CHPAVC, Panasonic eventually approved CHPAVC's R & D for core key components. With some successful attempts and Panasonic's support, CHPAVC set out to devise core key components based on its core manufacturing technology. CHPAVC began to introduce and produce DVD products in 1999 and to study the technology during the course of key components manufacturing. In 2003, CHPAVC began to design some correlative parts of driver and optics heads, and also analyze the DVD key components of SANYO and SHARP. CHPAVC began to research the design technology of DVD drivers and optics heads in January 2004. An R & D plan was started in 2004 addressing other important key component-DVD mechanisms. The important R & D achievements of core key components are listed in Table 3.4.

CHPAVC has developed a self-contained core technology R & D system centering on core key components. The Core technology R & D system of CHPAVC is shown in Figure 3.4.

In conclusion, CHPAVC has established an optics head R & D laboratory and a driver R & D laboratory for testing equipment and infrastructure. Correlative special equipment has

**Table 3.4 The important R & D achievements of core key components**

Time	Main R & D products	Key achievements introduction
2002	DVD mechanism: DL1S	R & D independently manufactured the first DVD mechanism of less than 50 mm in China, largely sold to primary Chinese DVD assembly factories
2003	DVD mechanism: DL2S	Cooperatively developed with Japan the first design of rotating open mechanism and transparent circle tray, with a height of only 38 mm, largely sold to primary DVD assemble factories, leading to the fashion of ultra-thin mechanisms and complete DVD production.
2004	DVD mechanism: DL3	Design of ultra-thin inhaling mechanism of only 15 mm height; ownership of two patents for it; Application to advanced game machine design by a Japanese company, with an output of 900 thousand per month and sales of \$200 million per year.
2005	Optics head of DVD player: 7.5 Hz	The first DVD key component created in China with independent intellectual property rights and 5 new type patents, breaking the technology monopoly of foreign companies. The capability exceeds that of Japanese products and the cost decreased by more than \$1.50, increasing the benefit of ¥30 million per year for the company.
2006	Optics head of DVD player-matching RAM	

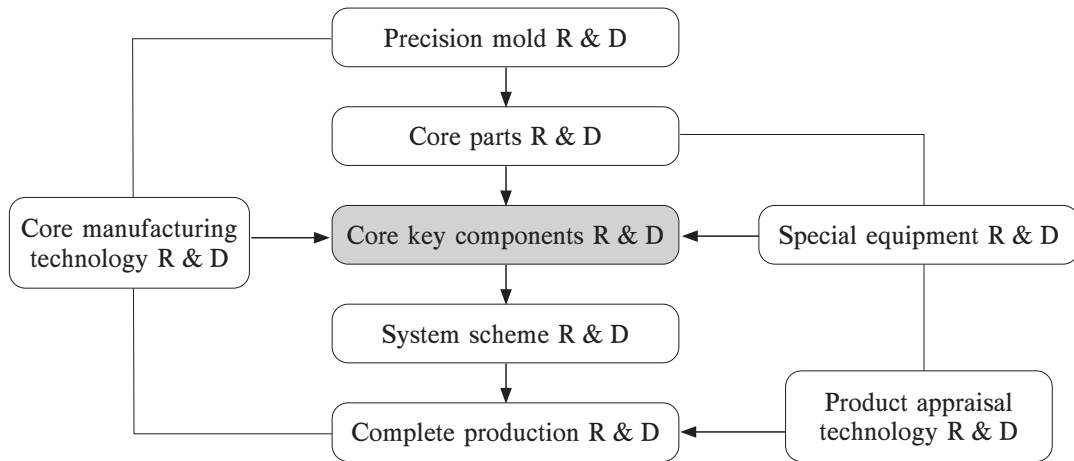


Figure 3.4 Core technology R & D system of CHPAVC

been obtained through independently designing and purchasing it. With uninterrupted advancement, CHPAVC has had the ability to design, trial-produce diversiform productions, and test the capability of productions.

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