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VIDEODISC STUDY

FINAL DRAFT

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A. D. Cameron
Arts and Culture Branch

Principal Investigator
Hugh H. Edmunds

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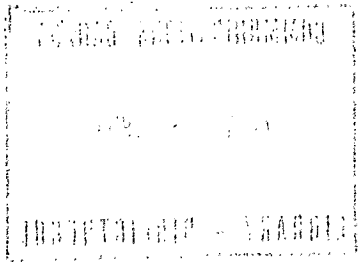
Note to Reader

The views expressed in this report are those of the author and do not necessarily represent the views of the Department of Communications or the other Agencies and Departments participating in this Study.



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PREFACE

When the Videodisc Study was in development in 1980 the initial objective was

> to provide that sufficient knowledge of the topic is available in time to assure that wise and orderly direction is given to the introduction of the new delivery services into Canada.

In researching the need and feasibility of the project it was soon apparent that most of the likely participants were well aware that videodisc technology had great impact and application to their concerns. While, in some cases, pilot studies were already in place, each expressed interest in acquiring greater operational knowledge. However, in the process of canvassing each of the parties to the project it became very obvious that one of the most beneficial aspects of this study would be in linking up the needs of some with the developments of others in relation to the requirements and capabilities of the federal government and of the country as a whole.

Much of the effort of the federal government in directly supporting Canadian content and culture through agencies such as

the CBC and the National Film Board and scientific development with examples like DOC's, Telidon, and NRC's development of NATAL 74 authoring language is constrainted in securing maximum national benefits through difficulties of distribution and general application. This is in part due to the restrictive mandates of the developers and producers, international competition and economies of scale, and to protective policies of other nations and the multi-national companies in furthering their proprietorial interests. In addition to extensive direct federal support in its own departments and agencies considerable subsidy through a variety of mechanisms has been given to the private sector -- the cultural industries, the software industries, and the electronic industries.

The videodisc industry embraces all these industries in various ways that employ content, software, and hardware in systematic applications. While initially the mass consumer market may consist largely of a visual phonograph this is not what much of the videodisc industry forsees. It is already looking well beyond mass entertainment to interactive in-home instruction, digital audio, in-home information storage and retrieval with or without advertising, etc. It would be advantageous if Canadian content and programming becomes a significant part of these systems, possibly in conjunction with other Canadian developments such as Telidon terminals.

In the areas of training and education, stand-alone or integrated with computer assited learning, the potential for integrated application of Canadian resources becomes more obvious -- content producers, software systems and expertise, and possibly Canadian hardware. For information storage and retrieval the videodisc is still in the field trial stage but may offer radical cost efficiencies in the near future. Canada may have capabilities for system design in the areas of data processing, statistics, libraries and archives, health and medical records where the size of the application makes it cost effective to develop the system internally with an eye to export potential.

The Videodisc Study began in September of 1980 when a number of federal government departments and agencies recognized a common need to study the impact and the implications of the development of videodisc in Canada. The Arts and Culture Branch of the Department of Secretary of State had been following videodisc development since 1975 and had reported on developments in this area in 1976. Similarly, the Education Technology Branch of the Department of Communications had studied the applications of the future technology to education. Interest in the videodisc technology as a consumer medium, a teaching tool and as a storage device grew in other quarters of the federal government. Most notably, the Public Archives instituted a demonstration project in September 1978 that culminated in production of the first videodisc for Canadian purposes.

In other departments and agencies, interest in videodisc developed. The National Museums of Man began to examine the technology as a potentially better way to store its vast quantities of audio material currently stored on degradable magnetic tape. The National Research Council began to look at videodisc as a good replacement for videotape in computer- aided instruction. The National Library wanted to investigate the potential applications of videodisc development to lending and public service operations, as well as for its storage, search and presentation potential. The Department of National Defense became interested in new training methodologies and videodisc provided potential efficiencies which warranted further study. The National Film Board and the Canadian Broadcasting Corporation became interested in disc technologies as a stable storage medium for their vast archives and as a potential delivery system to complement their film and broadcast activities. Consumer and Corporate Affairs was interested in issues such as potential obsolesence in the development of new communications technologies and the consequent disadvantaging of consumers. Industry Trade, and Commerce were interested in the size and scope of the potential industry and the opportunities it could provide for Canadian entrepreneurs. The Department of Communications with its expanded mandate in Cultural Industries and in light of the Minister's responsibilities for the Cultural Agencies reporting through him to Parliament saw the need for a study of the impact

of videodisc technologies on the Canadian communications and cultural industries.

The Arts and Culture Branch (of DOC) first organized a seminar on the technology in June of 1980 and subsequently with the support and involvement of the aforementioned departments and agencies set in motion this comprehensive study of videodisc technology with special reference to parallel technologies such as home videocassette recorders. The Arts and Culture Branch designed the study and managed the various separate research tasks to their completion and was responsible for the production of the final report. The various participating departments and agencies contributed in accordance with their varying levels of interest and financial resources to the study through transfers of funds to Arts and Culture. An ad hoc, steering committee, representative of the contributers, provided direction during the course of the study which required more than a year to complete.

All proposed research contracts and major decisions on the course of the study went before the committee for approval. The research program did not reflect solely the specific concerns of any one department or agency. Trying to find the right balance was a problem in that there were naturally separate departmental and agency priorities. Thus to the extent possible this report has attempted to strike a balance between these concerns, and to reflect truely the circumstances and potential developments in all areas of videodisc - the consumer market, the education and

training area and its applications for information storage and retrieval.

Participating Departments and Agencies

Department of Communications

Canadian Broadcasting Corporation

Department of Consumer and Corporate Affairs

The National Library of Canada

Department of Industry, Trade and Commerce

Department of National Defense

National Film Board

Public Archives of Canada

National Museums Corp.

National Research Council

The breath of interest of study participants is large, but this serves to reaffirm the range of implications of this technological development and the need to study them in relation to one another.

Methodology

In designing the study the committee stressed two things: firstly, the need to cover all applications of the technology, and secondly, to take an industrial analysis approach. There are three main markets for videodisc technology: the consumer market for the playback of pre-recorded content, the industrial

training/education market for interactive instructional programs, and the information storage and retrieval market for high-density/low-cost data or information memory and accessing. The first two markets are now in early development and the latter is about a year or two from significant exploitation. What is intriguing is the fact that for all three markets, it is estimated that industry, primarily large multi-national corporations, has spent in excess of a billion dollars in research and development. Hence a market or industrial analysis approach seemed the best way to find the reasons for such massive research and development.

Videodisc technology and other similar use technologies like videotape might have great social utility from some ideal viewpoint but from the corporate view, questions of standardization of equipment, the utility of stereo sound and recordability, various levels of computer integration etc, all have implications for costs and profits. The videodisc players, which reach the market, are the result not of the limits of technological capability but of crucial decisions based on corporate assumptions of the potential markets. For this reason the study commences with an analysis of the companies and their corporate strategies.

Then follows an assessment of the various present and near term technologies, an economic analysis, and discussion of the implications for Canadian industrial strategy and national development. The thrust of the report is to gain an insight into

what problems and opportunities may arise and what measures Canadians should be taking both to benefit from these developments to the greatest extent possible and to mitigate any adverse consequences.

The research has to compromise between what was ideal and what was practical. The first problem was that there are less than 150,000 videodisc players in the world; therefore it is difficult to get accurate user information on preferences for content, usage patterns, etc. Secondly, when the study started, only optical player models were in the market place. RCA just began selling consumer players and discs in March of 1981. There was, however, information available on home use of videotape cassette recorders (VCRs) and it was necessary to use this information, especially in respect of use of pre-recorded content, as a "proxy" to measure or project pre-recorded disc sales.

The Canadian data problem became compounded because accurate information on the number of disc players and VCR's in the market place was difficult to obtain. Various sources have estimated videocassette recorder (VCR) penetration at under 100,000 and videodisc players (VDPs) at a few thousand (primarily in GM and Ford dealerships) when the research phase got underway. Because the Committee decided from the outset not to survey Canadians on their potential use of scarcely available devices, research concentrated on economically available information

resources. Thus the report relies on combinations of U.S. and European consumer information and past experience like color TV sales patterns to project the Canadian market. As far as is known this "proxy" information was the best available, but naturally it would have been preferable (but too costly) to have actual statistics. Another problem is that this field is expanding rapidly and yesterday's data may be obsolete tomorrow. Therefore projections seemly valid in September may be very suspect in December.

Obviously, there will be a need to continue to monitor developments on a continuing basis to maintain the investment made in this study.

This report of the Videodisc Study Project cannot include or make available all the research and data collected in the last year and a half. Some of the purchased studies are protected by copyright. However, in a number of cases the report provides aggregate projections and summaries. Because one of the purposes of the study was to assist in informing industry and the public of opportunities arising from videodisc technology, a number of the studies are available upon request from the Department of Communications. In addition to those reports commissioned for the study as listed below, the research program included access to trade periodicals, industry newsletters, and bibliographical listings. Research staff or members of the study group also attended and reported on a number of significant conferences.

	Commissioned Reports	Contractor/Firm
1.	Canadian Participation in the Videodisc Industry (Report/ Appendices)	Socioscope Inc.
2.	Videodisc: The Potential for Education and Training	Ryerson Polytechnical Institute
3.	A Technical Assessment of Present and Near Term Videodisc Technologies	Michael J. Petro
4.	Videodisc and the Law	Claude Brunet (Grourd et Brunet)
5.	A Technical Assessment of the Information Storage and Retrieval Capabilities of Videodisc Optical Memory Systems	Robert G. Fannin
6.	A Report on New Programming Opportunities for the Independent Canadian Television Producer	Larry Shapiro and Associates
7.	Toward a Canadian Position on Videodisc	Nordicity Group Limited
8.	An Economic Analysis of the Videodisc Situation in Canada	J.C. Strick

CHAPTER I

CORPORATE ANALYSIS

A. INTRODUCTION

The primary concern of the Videodisc Study Project is to assess the impact in Canada of videodisc technology. This technology was first conceived over fifty years ago and was first marketed in England in 1936. For many reasons, at first technical, then in content and marketing, the "imminent" arrival of the videodisc has been delayed. However, in the last year or so the serious marketing of the technology has commenced. Results to date do not appear to match earlier industry expectations but for the first full year in the consumer marketplace videodisc sales have exceeded sales of such other consumer electronic products as; color TV, videocassette recorders and microwave ovens in their initial year.

Videodisc players and videodiscs are a part of the rapidly growing consumer electronics industry which is often integrated with the consumer entertainment industry. Major implications to Canada then lie in the development of a new entertainment and information delivery system through the mass distribution of

prerecorded content now referred to as Home Video. Since Home Video was evidenced first by the rapid proliferation of videocassette recorders and the use of prerecorded tapes these aspects of its development are fundamental to this study. Also, Home Video can not be addressed in isolation of its relationship to other content delivery systems such as broadcasting, cable and Pay-TV. Major implications to Canada also lie in the application of videodisc technologies in the areas of training and education and to devices for information storage and retrieval. There are three main target markets.

a) Mass consumer market. This is the immediate corporate target for the sales of videodisc players (VDPs), videocassette recorders (VCRs), pre-recorded content, digital audio and various add-ons, improvements or peripherals to the consumer-owned color TV set, e.g., large screens, portable VCRs, TV cameras, video games, etc. The videodisc device designed for this market may be characterized as being without elaborate micro-processor or mini-computer support.

b) The industrial and educational market. Videodisc machines with built-in micro-processor and/or readily adaptable to computer interfacing are directed toward this market. Sophisticated VCRs also will compete with videodiscs for this market to some extent. The industrial and business use of videodisc technology particularly in its interactive formats may predominate in the initial marketing efforts.

c) The information storage and retrieval market. With further development in the digital laser DRAW (direct-read-after-write) optical disc and in systems design, there are inherent advantages in speed, flexibility, cost and efficiency that point to a huge potential market for videodisc technology.

The impact (favourable and unfavourable) on Canadian industries concerned with content production, program delivery, educational and instructional systems, publishing, information storage and retrieval, hardware and software manufacturers could in time be very great. The cultural industries and those institutions with a mandate to promote Canadian social and cultural goals will see additional competition from another source of cheaply replicated foreign content in a manner not likely amenable to domestic regulation or control. This concern may apply equally to content for schools as for the home.

To date the underlying force for videodisc development arises from multi-national consortia headquartered in the U.S., Japan and Europe. This situation is in direct contrast to that of videotex development which has been fostered by governments and/or telecommunications common carriers. These multi-national companies see greater benefits from a more direct relationship with buyers and users in a relatively unregulated environment. Much of this activity is aimed at securing profit centers in the entertainment industries that have heretofore been the preserve

of the delivery system owner, e.g., the broadcaster, the Cable-TV company or the telecommunications common carrier.

Corporate investment over the last decade in videodisc for all applications is approaching one billion dollars.[1]

The first target market to be strongly promoted is the mass consumer one. While the fairly expensive Magnavox and LaserDisc machines have been sold for some time in the U.S., RCA's SelectaVision launched in March 1981 was supported by a concerted marketing campaign. The SelectaVision costs about $500.00 in the U.S., $700.00 in Canada, which is cheaper than a VCR, and produces a better picture. The VCR records off-air programs; the VDP does not. Whether this is a decisive factor is still not clear.

In 1982, at least 23 companies with three different incompatible systems will be competing to capture the multi-million dollar, worldwide consumer entertainment videodisc market. Projections for 1985 of annual sales of videodisc players in North America vary from 600,000 to 1 million units. Already some 12-15 million videocassette recorders have been sold worldwide with over 3 million of these in the U.S. Worldwide VDP sales are estimated at 200,000 as of the end of 1981.[2]

Exprapolating from Media Science Newsletter projections the Foster Advertising Study on New Video Technologies (September 1981) states that while there is no solid Canadian data it

projects 3% of Canadian homes equipped with VDPs in 1985 or about 240,000 units.[3]

Earlier industry and analyst projections assumed a cross-over year would occur in the near future when sales of videodisc players would exceed those of VCRs. More recent information suggests that the ascendancy of videodisc may be delayed or not occur. The relatively small differences in price and the recording capability of the VCR has led to significant consumer acceptance. Sales of 804,663 VCRs in the U.S. in 1980 were 70 percent above 1979. Strong sales performance continued through 1981 with some weakness in December. Total 1981 VCR sales were 1,360,998, up 69.1 percent over 1980.[4]

While VCRs and VDPs may appear to be stand alone competitive substitutes for broadcasting, Cable-TV, and Pay-TV (broadcasting/cable or a telecommunications network), there are indications that there is room for all, e.g. VCR sales are, as expected, highest in pay/cable homes and according to a recent survey, Pay-TV subscribers are the highest users of pre-recorded content.[5]

B. THE TARGET MARKET

VCR and VDP marketing plans seem to rest on the assumption that the consumer will re-apportion his disposable income toward more in-home entertainment and information services probably at the expense of theatres and cinemas, recreation, travel, and the automobile.

Although there has been a 5% drop in real personal income in the U.S. over the last 3 years the total sales of consumer electronics, notably color television, have never been better.

The potential corporate Home Video markets are by no means solely North American. Projections of growth in Europe and Japan are greater than for the U.S. and the so-called "fourth world" (the affluent parts of the third world) are other potentially large markets.

For example, while projections for VDPs in the consumer market are being revised downward, the rise in VCR sales is phenomenal. Mackintosh International of Great Britain which estimated in late spring 1981 a U.K. market of 600,000 to 650,000 units is now saying that Britain alone would import over one million machines in 1981. The boom is attributed in part to the unique hardware rental market system which offsets the bleak economic times. Mackintosh projections for VCRs are now:

Table I-1

Videocassette Recorder Sales

(Thousands of Units)

	Japan	United States	Western Europe
1980	900	800	1,350
1981*	1,500	1,500	2,200
1982*	2,000	2,300	2,800

*Estimated

The proportion of portable VCRs sold is rising from 10 percent to an estimated 25 percent which may be matched by Home Video camera sales.

The 1985 Mackintosh sales forecast of the principal types of Home Video products, including color television receivers, are as follows:

Table I-2

1985 Sales

	Europe		U.S.A.	
	Units 1000s	Value $M*	Units 1000s	Value $M
Home Video Recorders	2,065	1,545	1,470	900
Miniature Recorders	50	20	70	30
Non-recording Video Cameras	570	285	520	185
Recording Video Cameras	60	72	75	75
Blank Videocassettes		700		560
Videodisc Players	400	188	700	288
Colour TV Receiver		7,800		5,000
Projection TV Receivers	75	190	200	340
		10,800		7,378

*1980 Currency Values - U.S.

Mackintosh International of Great Britain forecasts VCR penetration in the U.S. to be more than 10% of households in 1985 and nearly 20% in 1990. The same forecast gives a figure of 3% VDP penetration in the USA for 1985 and 12% in 1990.

It would be unreasonable to expect a greater percentage of household penetration in Canada. Assuming over eight million Canadian households for 1985 would mean about 800,000 VCRs and about 240,000 VDPs in Canada in 1985[6] and about 1,800,000 VCRs and 1,000,000 VDPs in Canada by 1990 as maximums. The minimums may be about half these figures for a variety of reasons.

C. CORPORATE STRATEGIES

The original thrust in VCR and VDP came from the electronics manufacturers, joined thereafter by representatives of the entertainment production industries and to a lesser extent the computer and software industries. Early recognition that players without programs were unsaleable led to joint venture companies formed by the hardware and content industries. Agreements to standardize technology were made which narrowed the field to three systems in the mass consumer market -- Philips/MCA/IBM (Laservision or LV system), RCA (CED system), Matsushita (VHD system) -- all incompatible. It appears that corporate strategies now are locked into fighting for dominance in the world marketplace based on sufficient support base in a home region to sustain the effort, namely; Philips with a base in Europe, RCA in North America and Matsushita in Japan.

Almost the entire spectrum of large corporations involved in consumer electronics, entertainment production and distribution, publishing and information is involved in some way in the three marketing areas. Their participation may take one of three fundamental strategies characterized as "hit-and-run", "segmentation" and "long-haul".

a) A "hit-and-run" strategy is characterized by temporary consumer enthusiasm, intensive promotion, low to modest price, rapid sales, stiff price competition, market saturation and/or product withdrawal. This is viable for multi-product firms and

when low per unit capital investment is required, e.g. CB Radio, video games.

b) A "segmentation" strategy assumes a product will only survive competition in a market niche with a modest to high ticket price based on high specialization and reputation, e.g. stereo audio systems, large screen TV projectors.

c) A "long-haul" strategy entails gradual penetration of the market, an emphasis on reliability and sales support, staying power, consumer confidence and inherent appeal to a mass of consumers.

The prospective competition between VCRs and videodisc players due to incompatibilities of standards will induce some consumer reticence and fragment the market. This could slow the economics of mass production but in the long run the staying power of the consortia of multinationals should prevail.

Faced with the basic problem that players and content are interdependent, the videodisc industry has seen in the last decade a coalescing of interests into these three main groups -- RCA/CBS/GEC, MCA/IBM/Philips, and Matsushita/GE/Thorn-EMI. Within these groups many relationships with other huge multinationals have been established either as partners, distributors, replicators of discs, franchisees of the rights to produce hardware, etc. Each group's strategy is based on the belief that its particular technology is right for the market and right for the time. Each group is strongly represented in all three

regions -- Europe, the U.S. and Japan.

1. The RCA Group

This group (see Appendix to this Chapter) is backing the RCA SelectaVision stylus capacitance electronic disc (CED) player which has few features (no freeze frame, limited browsing, no stereo, no interactivity) on the strategy that the consumer, when offered a less expensive ($500 U.S. or less) high-quality playback machine, will forego the features and the absence of stereo sound (which is not available on the TV set in any case).

RCA's emphasis is on a consumer interest in conventional procured content -- recent or classic movies. Price analysis of player and disc shows that per-viewing cost of a movie would be less than in the Philips laser system, more than in Pay-TV and possibly more than in VCR rental. The corporate strategy presupposes that given enough price difference between VCR and VDP machines and between pre-recorded cassettes and discs plus other factors such as increasing variety in procured content, the videodisc player has a significant potential.

RCA developmental and initial promotional costs probably total close to $200 million dollars.

The RCA group's launch on March 22, 1981 was based on selling 200,000 players (plus 50,000 under the Zenith label) and 1 million discs in 1981. RCA has been very aggressive in securing programming rights on a non-exclusive basis. RCA fell well

short of its goal in 1981 with 116,000 players consigned to dealers and 60,000 in the hands of consumers. Prices were discounted as low as $269.00 (U.S.) by some retailers.

The basic group strategy would appear to be similar to the razor blade approach -- dominate the market with a simple cheap and reliable instrument and profit from the continuing sale of consumable items -- in this case, discs. The good news in 1981 for RCA was the unexpected demand for discs which averaged 18 per player sold -- more than twice expectations. It would appear that RCA with CBS would have control of this aspect of the industry for some time. RCA has announced it will do no custom pressing until at least 1984, and only Sanyo of Japan has been licensed outside of RCA and CBS to do replication for them. Should they succeed in becoming the dominant technology, at least in North America, they could set both the terms of procurement of content and the pattern of distribution. The major profit center would then be replication and distribution. Sears and J.C. Penney in their recognition of RCA potential dominance established early positions and are pleased with the sales of discs while recently removing themselves from VCR cassette rentals as too complicated.

RCA's assessment is that VCRs will continue with strong sales but that the disc purchaser is a different person and more similar to the color-TV buyer. "Seventy-five percent of the pyramid (TV buyers) support the other 25%. We're aiming at the

75%, not the 25," stated S. Sauter, RCA Vice-President and General Manager. He continued, "The videodisc is a product for everyone."[6] RCA research shows that the disc player, unlike the VCR, was preferred about equally by men and women while the VCR is a male dominated item.

In answer to rumours of RCA divesting unprofitable operations, its Chairman, Thornton Bradshaw, recently reaffirmed that RCA is "committed to probe the potential of videodisc with everything we've got." Toward this goal disc replicating capacity is being tripled in 1982 and a stereo VDP is forecast for May 1982. RCA still projects 7.5 million annual sales by 1980.[7]

The RCA group has shown little interest in the educational or industrial training field but its R & D operation has for some years been working on the optical-laser digital disc for information storage and retrieval and could be strong in this market also. Zenith, a group member, is rapidly diversifying in the home entertainment and home computer field.

2. The Philips Group

Europe's largest consumer electronics manufacturer, N.V. Philips, developed an optical-laser videodisc in 1970 and shortly after made agreements with MCA, Inc. (who had also developed a similar technology) to adopt the Philips standard. MCA would specialize in replication and software (see Appendix to this Chapter).

In 1979 MCA and IBM formed a joint venture, DiscoVision Associates, for the production of discs and for entry into the industrial-educational market. DiscoVision Associates in joint venture with Pioneer Electronic Corp. of Japan formed Universal-Pioneer to produce an industrial player which is the basis of the 11,000-unit General Motors Videodisc Network. Pioneer through U.S. Pioneer markets the LaserDisc for the consumer market comparable to the Philips' Magnavox Magnavision player. Recently Philips, IBM, Pioneer and MCA agreed to market their compatible systems and discs under the LaserVision label to reduce consumer confusion. (Late data - see Note p. 49.)

The Sony Corporation which had developed an optical laser technology conformed to the Philips/MCA standard and now produces an industrial model and has a contract to provide the player for the Ford Motor Co. for their videodisc dealer network.

The essential strategy of the LV group is that the consumer will prefer a machine that offers stereo sound, near random access, various speeds of fast forward and reverse, and still frame. The disc does not require a caddy and there is no disc or stylus wear. This strategy seems to be targeted more toward the current VCR owner profile and the audiophile -- i.e. the middle income to affluent male, frequently single, and in his mid-thirties. It assumes a knowledgeable consumer somewhat demanding of technical quality and versatility. The LV group certainly has ambitions toward the larger market but believes consumer aware-

ness and the development of programming which warrants the features will take time.

There is, of course, a fundamental division in this group -- Philips sells hardware, DVA (MCA/IBM) sells programs. Neither can succeed unless the other makes a total initial commitment in getting the players and the programs into the market. DVA had experienced considerable problems in mass replication and has now proposed closing the Costa Mesa, CA mass replication plant and turning over all consumer disc replication to Pioneer Electronics in Japan. DVA would only replicate interactive and industrial discs in the U.S. (See Note p. 49.)

Philips has felt that the amount and variety of programs on disc is insufficient to support the heavy marketing of the players. Philips, which retains the ability to licence mastering and replication, is eager to see as much activity in this area as possible. Its view is that besides royalties earned, the greater accessibility to replication by program producers would lead to a more varied content available and therefore more player sales.

The major concern of the Philips group is that it might be overwhelmed by the initial RCA campaign. Although the North American mass market is very important in an overall strategy of reduced costs through mass production, Philips and Pioneer may be patient. They could maintain a good per-unit mark-up selling to the sizeable market which appreciates the features. They claim that 80,000 units are in consumer hands as of the end of 1981.

There are claims that the optical laser player may be able to reduce sharply its manufacturing costs with development of the solid-state laser and more highly integrated circuits, whereas the CED system may be at its lower cost limits.

In Europe, Philips would appear to have the edge in timing and dealer structure. The Japanese market may be difficult to enter if it moves to a single standard (VHD).

3. The Matsushita Group

Matsushita Electric Industrial Co. (see Appendix to this Chapter), the world's largest manufacturer of consumer electronics had earlier developed a capacitance stylus videodisc player (VISC II) somewhat similar to RCA's. It decided, however, to standardize on a capacitance non-stylus player developed by its majority-owned subsidiary, the Japanese Victor Co. This player known as the JVC VHD/AHD (video high density/audio high density) fits between the Philips and RCA players in both price and features. With an adaptor it can do virtually everything the optical laser player can but only at a comparable package price. Its greatest strength probably lies in a protected Japanese market. Marketing of the player in North America is not expected until July 1982 and a few months later in Europe.

The VHD player without adaptor does have stereo sound (unlike RCA SelectaVision) and with a special adaptor can playback true digital audio records. An important problem for

marketing has been the apparent absence of adequate program content, but it is claimed that this will be solved in time for the launch.

Unlike VCRs, which are almost entirely of Japanese origin (except for Philips-Grundig with a small share of Europe), the videodisc player was primarily U.S. in development and origin (again excepting Philips). There is no great faith among analysts that Japan is potentially a strong VDP market and already 7 per cent of homes have VCRs vs 4 per cent in the U.S. while Japanese interest in pre-recorded content is said to be rising.[8]

Pioneer's Laserdisc has not been marked with any great initial marketing success. How the VHD player will fare when introduced there in mid 1982 is unknown but given the strength of Thorn-EMI in the U.K. player arriving at least concurrently with the RCA's CED will be successful in that market.

Some of the delay in proceeding with the VHD player has been attributed to developing an "international" player. This implies that any VHD disc recorded in PAL, SECAM or NTSC (various TV picture standards) can be played on the single device.

GE enters as a partner in shared technology. Through its acquisition of Admiral and combined with certain Japanese firms the group (see Appendix in this Chapter) is third in sales of color TVs which places them ahead of members in the Philips group and behind both RCA and Zenith. GE sees the disc player and wide screen as a good source of future profits in the mature TV set industry.

Analysis of the Matsushita position indicates some weakness in entering the North American market late. Despite its claims to the contrary, it may be difficult to acquire and replicate sufficient software by June, 1982. These problems are not as great in Europe, particularly the U.K., where introduction of its VHD player release will probably precede RCA with a better dealer structure, and with software more attuned to the consumer market.

4. Thomson-CSF

The Thomson Brandt and Thomson-CSF organization is a huge appliance and electronics manufacturer 51 percent owned by the French government. Its combined sales are 36 billion FFr, 42% of which is export. Almost 10% of income goes to R & D. Three

years ago, Thomson-CSF introduced a transmissive optical laser videodisc designed for the industrial and educational market which found small acceptance in North America. They are, however, pursuing further lines in the development stage.

Possibly together with Japanese interests they are preparing a consumer model which most likely is not based on optical laser technology.

In addition to the industrial model Thomson-CSF is working on a "professional" model -- the VIDEL (video enregistreur-lecteur) -- a record and playback machine of broadcast quality, in effect a "video xerox" because the recording can produce copies. This machine is still some time away but has application to such uses as a video "Hansard" and in the archiving of video and film content.

Thomson-CSF is in association with the Xerox Corporation with respect to information storage and retrieval devices.

D. PROGRAMMING INDUSTRIES

As noted the three main videodisc groups are primarily hardware and hardware distribution related. CBS, Inc. has joined RCA, MCA has joined Philips, and EMI has joined Matsushita. Whereas virtually every major consumer electronics manufacturer in the world is associated in some way with one of these groups, the program production industries are not as well represented. Left out of equity partnership are the major Hollywood producers and distributors with the exception of MCA's Universal Pictures.

The Hollywood majors, i.e. Paramount, Warner Bros., United Artists, 20th Century Fox, Universal et al. are all actively seeking ways to increase the revenue potential of existing and future product. Except for the "blockbuster" film, the majority of the public is not going to movie theatres. Studies indicate that consistent movie-goers are primarily young and single. If the majority of the public will not go to the theatres then Hollywood can go to the home. Two avenues of exploiting the home market are available - Pay-TV and Home Video.

However, Time-Life Inc. in the form of its wholly owned Home Box Office (HBO) distributes 60-65% of all Pay-TV content and Showtime half of the rest. The dominant position of HBO has been strongly contested particularly by Paramount Pictures without result. The Hollywood suppliers usually charge a Pay-TV operator about 35-50 cents a subscriber for a middle quality feature film and consider their "fair share" about 35% of the

gross Pay-TV revenue. HBO, with its dominating position, is reputed to pay much less.

Four Hollywood majors (Paramount, United Artists, Universal, 20th Century Fox) in joint venture with Getty Oil formed Premiere Theatre -- a satellite delivery of movies to cable systems. Prompt action by the U.S. Department of Justice and the courts struck down the arrangement on anti-trust grounds (undue preference to their own system). Success in appeal is deemed unlikely and the group has virtually conceded defeat.

Another alternative is to distribute movies by disc and tape in hopes of a better return. Home Video rights now represent 10-15% of revenue deals. The release pattern or "windows" in which Hollywood distributes product, e.g. first theatres, then Pay-TV and tapes, then network TV and 16 mm, and finally syndication, is according to total revenue in each category but also on total return per individual exposed. Because Hollywood has found tapes for VCR a viable market there are signs that the window on pre-recorded content has been advanced and the release to Pay-TV retarded. The reasons are:

a) greater revenue per viewer;

b) direct advantage of initial theatrical promotion to which Pay-TV makes no contribution; and

c) the product is out before the pirates can exploit the market.

Hence, Home Video is becoming the "second window" for release, ahead of Pay-TV.

For this purpose all the major Hollywood producers have set up distributing branches to specialize in tape and disc. As a matter of conventional financial wisdom producers and distributors do not sell a movie outright but lease it for use, retaining all future rights. The present structure in the video-disc industry is not particularly to their liking. They do not have the control over replication and distribution they would wish. RCA/CBS which do not envisage custom pressing until 1984 seem headed in the same direction as HBO with a system that could control the marketing if it gains dominance. While the attitude of some of the majors toward disc is lukewarm, they may prefer disc over tape because it does reduce piracy and, at the outset, is more likely to be sold rather than rented. In the VCR area, rental of tapes has created some problems of ensuring honest royalties. The licensing of custom replicators such as 3M by Philips is seen as a positive step and DVA does custom pressing for clients who use their own label.

In September 1981, the 9th U.S. Circuit Court of Appeals declared that Home Video taping is illegal reversing the earlier decision in regard to MCA and Disney versus Sony that off-air taping for private consumption was considered "fair use". MCA will now extend the suit to all VCRs, not just Betamax, but not go after individual consumers. The most likely outcome is:

a) the Supreme Court will permit home taping; or

b) the courts will set a small royalty to be paid by the VCR manufacturer and on blank tapes to a Copyright Tribunal; or

c) Congress will legislate exemption similar to its action in 1971 permitting audio taping for personal use.

The Motion Picture Association of America favours a European approach of a charge on VCRs and blank cassettes, but as a fixed charge and not a percentage of the selling price. The funds would be distributed by a Copyright Royalty Tribunal.

It is not expected that the forthcoming action will significantly retard the sales of VCRs but may be beneficial for VDPs.

U.S. analysts who earlier cautioned the record production industries to go slow in Home Video are now saying that its time to get started. In the U.K. (7 percent VCR homes), unlike the U.S., pop video music is making headway which is pulling established music distribution into handling video, creating pop video music charts and developing a younger video customer.[8] The U.K.'s Music & Video Week, October 10, 1981 has two "Top 20" lists, one for general video and one for music video. The top five on the music list were also on the general list.

Cassette	Music Top 20	General Top 20
Pink Floyd Live At Pompeii (Polygram)	#1	#7
Woodstock (Warner)	#2	#8
ELO: Live in Concert (VCL)	#3	#17
Rock Flash Back; Deep Purple (BBC)	#4	#18
Slip Stream; Jethro Jull (Chrysalis)	#5	#20

The record companies have been slow to enter the tape and disc market with software. The reasons given are:[9]

a) insufficient numbers of players in the mass market to warrant costs;

b) the demographics of the average record buyer are strikingly different from the VCR owner -- the former is younger, less educated or affluent;

c) the question of music rights has not been solved to any extent. In the U.S. the Screen Actors Guild, American Federation of Musicians, the Directors Guild, and the Screen Writers Guild have all come to agreement with the producers in terms of "made for Pay TV" and "made for Home Video" content. However, the original music and lyric rights are subject to protracted case by case negotiations.

d) a basic unfamiliarity with video production and what form it should take;

e) present absence of stereo in CED, and lack of applications in videodisc generally because of the monaural low-fi TV set; and,

f) a lack of risk money to experiment.

Record companies are well represented in the videodisc consortia, e.g. Philips-Polygram, CBS-Columbia Records and EMI-Capitol Records which positions them well in the replication queue. Should the RCA CED player become dominant, then CBS, through its equity with RCA has secured a large priority to replication rights. In Canada, major acts like Ann Murray are working with video, and video recording facilities exist. (See Chapter VI, The Record Industry, p. 303.)

E. MARKET ANALYSIS

1. Consumer Market

The consumer desire for stereo and other features may be an important factor. If demand for better TV sound and musical programs (visual records, Hollywood or Broadway musicals) becomes significant, then RCA will have to proceed early to its stereo model and leave considerable consumer confusion over obsolete machines and incompatibility. Basically it is RCA's belief that the consumer will not want to be bothered with hooking up to extraneous speakers and will be satisfied with the monaural TV set and its poor musical performance. However, it will provide for the stereo option of possibly a $100.00 mark-up.

If videodisc does appeal to the mass consumer then RCA SelectaVision will likely be the most popular player in North America. RCA may find much slower rates of consumer acceptance initially than shown in its own projections. The 5 million disc players projected by 1985 in the U.S. will probably be closer to 2-3 million.[10] Philips/MCA/Pioneer may sell a third of this amount. After 1985, penetration should proceed rapidly because replication costs should drop significantly, music may become a strong factor and Hollywood may emphasize the disc format.

The videodisc and VCR in the home are not seen as parts of an omnibus TV set by the manufacturers. While there is a definite trend toward the home entertainment center, this will probably take the form of optional add-ons to a compatible TV set

which provides easy attachment and reduces redundancies, e.g. tuners in both VCRs and the set. These groups based as they are on strong color TV set and VCR marketing are looking to exploit the whole spectrum of TV-related devices and are not wedded to the videodisc.

In Chapter III - Economic Analysis, a large number of projections concerning future VDP and VCR proliferation are derived from reports of manufacturers, brokerage houses, and proprietorial studies. The competition between VDPs and VCRs and between both of these and other delivery systems, e.g. Pay-TV, conventional broadcasting, is discussed. While opinions vary, the most recent analysis with some advantage of hindsight comes from Paine Webber Mitchell Hutchins Inc., a New York investment banking and brokerage firm in Part III of its "Video Revolution" report which states:

> In the second half of the decade, we believe the superiority and economy of the video disc as a playback medium for pre-recorded material will sharply curtail VCR growth among the less affluent portion of the population . . . In terms of video discs, we believe that this consumer product will eventually become very popular. However, like the black and white television set, the color television set, the video cassette and the personal computer, the product will initially be slow to catch on. This will be due to the newness of the product, its expense and, once again confusion over the various formats. Hence, unlike some industry and analyst projections which call for the sale of millions of players and billions of dollars of video discs by mid-decade, we do not see this occuring until about 1990.

The author of the report, Lee S. Isqur, commented in Videodisc News, September 1981:

It seems to me that this product has been accepted as fast as any new consumer electronic product that's come on the market. My theory is that somewhere between 1983 and 1985 it will be recognized that videodisc is indeed breaking out . . . If rental takes off . . . disc will probably be the superior format (over VCR).

The Paine Webber estimates for Players and Prerecorded Content is shown in Table I-3 below.

Table I-3

Pre-recorded Video Product Sales - U.S.

(In thousands)

	Video Cassette Recorder Sales (Units)	Pre-recorded Video Cassettes (Wholesale)	Video Disc Players (Units)	Video Disc Sales (Wholesale)	Total Sales Pre-recorded Video Products (Wholesale)
1990E	4,500	$1,000,000	5,000	$650,000	$1,650,000
1985E	3,500	440,000	2,000	150,000	590,000
1984E	3,300	325,000	1,400	90,000	415,000
1983E	2,800	250,000	1,000	45,000	295,000
1982E	2,000	175,000	700	25,000	200,000
1981E	1,400	125,000	350	10,000	135,000
1980E	780	85,000	40	2,500	87,500
1979	470	40,000	4	200	40,200
1978	400	20,000			2,000

Source: PWMH Estimates.
Note: Pre-recorded video cassette estimates based on assumption that unit sales will approximate three units for each VCR in the first year after sale and one unit for each VCR after the first year. Wholesale prices are assumed to be $20-30 per unit. Video disc estimates based on assumption that unit sales will approximate five units for each player in the first year after sale and three units for each player after the first year. Wholesale disc prices are assumed to be $7-8.

Note: PWMH estimates for 1981 VCRs were wrong by only 39,000 or 2.8%. However, VDPs estimate twice reality but their disc to player assumption proved a third of actuality.

Another recent view comes from the San Jose, California think tank. Strategic Business Services Inc. in their report Optical Storage Media (Videodiscs): New Developments, Vol. III:

> The most probable scenario is that, following a decisive success by RCA, which will capture a major portion of the videodisc market in the next two to three years, the solid-state laser optical systems of 1983-84 will stage a comeback, due to their advanced features and possible tie-in to home computers. If, however, the RCA campaign in 1981 flops, the probability is very high that VCRs will dominate the market, effectively eliminating the videodisc as a viable product.

Unfortunately the results for 1981 are not definitive enough to declare RCA either a "decisive success" or a "dismal flop." The empirical evidence of the marketplace is simply not substantial enough yet to predict with certainty whether videodisc technology will be persuasive in the home by the end of the decade. However, the majority of technological prophets still estimate in the range of 10%-30% of U.S. homes so equipped by 1990.

2. The Training and Education Market

This market is primarily the domain of the optical laser technology although the VHD system has commissioned experiments in interactive instruction. The single frame addressibility and rapid access inherent in the LV system makes it an ideal ETV device, allowing still frame, slow motion, and branching sequences. In the LV format both DVA and Sony have produced industrial players incorporating micro processors which permit highly flexible user control of the content delivery. The discs

themselves can hold one or more computer software programs (dumps) governing playback features. Often in educational applications a mini-computer is associated with the VDP to enhance the programming capability and permit alphanumeric overlays.

General Motors was the first large client using 11,000 DVA 7820 players in its Videodisc Network. Ford Motor Corp. followed with the Sony player and AMC is destined for the DVA player. These machines are used for both sales assistance and in service training. Early surveys indicate dealer satisfaction significantly greater than with previous 8mm film or videotape networks.

The potential training market is reputed to consist of any organization or institution with needs in excess of about 150 units to service departments or branches. At this number the cost of discs including mastering equals videotape. Considered as prime industrial clients are multi-branch banks, travel agencies, fast food chains, the military and government departments which need either on-going training or communication with the public. Some survey research indicates videodisc is considered premature for corporate communications but for in-house training other studies have shown good cost effectiveness.

There are no market projections in this area but DVA reports steady growth and the recent sale of 27,000 players to a single client. Forecasting the training market is subjective at

best, but given the scope of the A/V market and the disc's proven advantages, it is reasonably safe to assume its eventual dominance as the delivery system for large corporate users.

The education market is not held in high regard by the videodisc hardware manufacturers. They point to financial austerity, lack of large central purchasing, low profit margins, and purchase resistance due to an unhappy history of technology in the schools.

Educational experiments are plentiful with the Universities of Nebraska, Iowa, Utah, Utah State, and M.I.T. much involved. In Canada, the Ontario Institute for Studies in Education is developing a videodisc system using a unique micro processor and computer-assisted instruction in a two-year project funded at $1.2 million. Most of the experiments include additional computer support for more sophisticated interactive diagnosis of learner problems and real time evaluation of learner performance.

Probably the most developed formal learning system approach is the ABC Video Enterprises and National Education Association "SCHOOLDISC" collaboration on a long-range instructional project to increase literacy and language comprehension for grades four to six. The NEA terms videodisc the technology of the future.

Many other applications of videodisc are less interactive and more appropriately considered as electronic publishing involving information storage and retrieval. Major reference

publishers such as McGraw-Hill, World Book Encyclopedia, Encyclopedia Britannia are developing videobooks and video adjuncts to printed texts which depend on the huge storage capacity and single frame access of the LV disc. Sears has experimented with placing its catalogue on a disc for in-store customer reference. It uses both still frame and motion sequences.

In the training sector some of the notable applications are: Miles (Labratories) Learning Centers with 350 DVA players in teaching hospitals, Bank of America for teller training, Columbia Savings and Loan with eight programs promoting bank services, Exhibit Technology, Inc. developing videodiscs for exhibit and point of purchase display, and IBM Guided Learning System for in-house and client individualized instruction.

IBM has noted six factors which influenced it to convert from tape to disc.

a) 15% increase in video image quality

b) still frame capability

c) random search capability

d) accurate addressing

e) computer controlled programming

f) disc life. [10]

Many applications of videodisc technology (LV) to military training have been studied. Companies actively involved are Coloney Productions, WICAT, Preceptronics, Hughes Aircraft,

Grumman, and Sperry. These firms have developed materials on videodisc such as technical manuals, maintenance and repair sequences, recruiting information, and visuals for simulation devices. Given the high cost of new weapon systems, much of the current thrust is for low cost simulators for which visuals from videodisc sources are ideal, e.g. the view from the pilot's cockpit or the tank commander's periscope. In Canada, the Department of National Defense is working in these areas.

At the present time virtually all videodisc education and training efforts are in the optical-laser format. The VHD system is amenable to interactive programming and may also enter this market, however, DVA and Sony have a good head start. The major drawback in this area is the high cost of initial production and mastering. In quantity, the disc with all its inherent advantages costs less than tape. While it is not possible to predict the eventual size of this market, there has been no slackening in the pace of developments to date.

3. The Information Storage and Retrieval Market

This huge market which embraces such areas as electronic data processing, "the office of the future," digital telecommunications and Telidon-like systems, may be profoundly affected by videodisc technology.

At present videodisc is an analog device which is most easily explained as being compatible with the TV set. It produces a TV picture. Within a year or two, the digital

videodisc or computer compatible disc is expected to appear on the market. This disc is often referred to as the DRAW (direct-read-after-write) disc since it will be possible to record on a blank disc on the user's premises and playback data immediately. In this capacity the disc acts as a data memory. The advantages are that a huge amount of information can be stored relatively cheaply and accessed more rapidly than magnetic tape. While it is not possible to reuse a disc, a certain amount of updating is possible.

Both the analog optical laser disc and DRAW disc have application to information storage and retrieval. The analog disc in either its analog form (TV pictures) or recorded with data (techniques and standards are now being developed) is a very high density storage medium. It is not at present or in the near future likely to be user recordable (unlike the DRAW disc) but it does compress huge amounts of information into a small space. A breakthrough in mastering and replication such as the rumoured Quixote Corp. process is possible but not substantiated at this time.

If the present analog disc is recorded in digital (data) techniques the current consumer LV player with some adaption could provide any one of these functions from a specially recorded two sided disc.

a) Mass read-only data archives for home and business computers (3200 megabytes or 3,300 200-page books with a random page access time of 5 seconds)

b) Interactive computer-aided instruction

c) Digital audio (59 hours of TV quality or 4 hours of top quality stereo sound per disc)

d) Intelligent, talking encyclopedias

e) Electronic publishing (88,000 offset-quality pages).

Even in its present analog form the LV disc is already the basis for certain information storage and retrieval systems. Pergammon International Information Corporation has developed the Video Patsearch system which has stored all U.S. patent applications since 1971 on eight discs. The user has a set of discs, a player, and a terminal. The search is done through a communications link to Bibliographic Retrieval Services Inc. and the instructions come back which tell the player to locate the image -- usually within two seconds. The images include both text and drawings and hard copy print-out is possible. The point is that the mass storage of data is at the user end and the slow speed telephone link is only used for reference and indexing information. This system is currently being tested by the Canadian Patent Office.

Noted later in this report are many other similar projects. In Canada both the National Library and the Public Archives are

actively exploring videodisc applications to information storage and dissemination.

The DRAW disc which permits user recording has still not reached the marketplace as the optimum technology is still being developed. Photographic techniques as well as metal oxide processes are being assessed. Early work was conducted by many of the same consumer electronics corporations as noted earlier, e.g. Philips, RCA, Thomson-CSF in digital recording. A new set of companies with experience in computer peripherals, e.g. Storage Technology, Optimem and Control Data, have joined in. IBM is, of course, a 50% partner in DiscoVision Associates and intimately involved in the mastering and replication processes. The purpose of the DRAW disc would be to provide increased on-line memory faster than tape and comparable to magnetic disc but which is cheaper, more compact and uses less physical floor space.

The following table compares storage costs essentially by the cost of the drives.

Table I

Cost Comparisons for On-line Storage

		M bytes	$1000/ Drive	$1000 per 10 G bytes*	$1000 per 100 G bytes
1973	IBM 3330-11	200	28	1,430	14,300
1975	IBM 3350	317	43	1,300	13,000
1978	CDC 33502	635	27	430	4,500
1979	IBM 3370	571	29	480	4,800
1981	IBM 3380	2,500	98	392	3,920
1982**	Philips Disc	2,000	20	100	1,000
1983**	Philips Pack	100,000	50**	51	51

*Gigabytes or billion characters
**Estimates

Sources: Datapro 70 Industry Reports; U.S. Government Schedules (GSA); Computer World, Jan. 23, 1979; IEEE Spectrum, February 1979.[12]

Comparisons with magnetic tape are even more advantageous. It is claimed that optical disc permits hundredfold reductions in numbers of units of media in storage and in rates of media mounting and a thousandfold in average access time for archival data. "The data now found on 100 magnetic disc spindles and backed up on 500 or 1,000 reels of tape can be put on 10 optical disc spindles and no backup, reducing capital investment by over 10 times."[13]

Because of these advantages, digital optical disc (DRAW disc) becomes an integral part of EDP systems and in particular that area which has been labelled "the office of the future." N.V. Philips is structuring a system called "Megadoc" at about $500,000. N.A. Philips is working on a system of much larger

capacity. Drexler Technology and OCLI have discs for sale now and Kodak, 3M, Fuji and Agfa are in development. Small OEM drives are being developed by Thomson-CSF, N.V. Philips, Xerox (Shutgart, Optimem), Hitachi, Hewlett-Packard. Large PCM and captive systems are attributed to Storage Technology, Burroughs, Control Data (Magnetic Peripherals, Inc.) and unknown specifications to Fijitsu, Bell Telephone, IBM and DiscoVision. Toshiba is already marketing a small document oriented device called the "electronic file cabinet" at about $60,000 U.S.

While cost comparisons with microfiche and microfilm storage are not as favourable, the advantages of videodisc in accessability of information retrieval may out-weigh such cost differences. The reputed next generation of data storage, the magnetic bubble technology, may not be a factor since developments in this area have been curtailed recently.

The scope or extent of this market is impossible to project since the videodisc technology is simply a part of the larger area of information systems. Its potential impact, however, is to facilitate this revolution through generating further cost efficiencies. It will have a profound impact on such questions as centralized or distributed data storage, the degree to which telecommunications links are necessary, and capability of the small home or business computer to stand alone. These questions then may be best answered in political or economic rather than in technical terms as matters of national policy. For example, the

decentralization of Telidon pages to local dialing areas could remove long distance charges and speed access but weaken the support for long haul communications.

F. IMPLICATIONS AND CONCLUSIONS

1. Bigness

Not just giant multi-nationals but consortia of them have been necessary to put together a videodisc development and marketing operation. R & D, production capacity, replication, program sources, distribution, marketing and servicing require an initial risk in the order of $200,000,000. A situation of "critical mass" is involved and ultimately huge volumes of production with the attendent economies of scale will be necessary to recover and profit from the investment. These factors mitigate against indigenous developments.

2. Non-regulation

These consortia represent almost all the significant consumer electronic product manufacturers plus some of the large data handlers and entertainment providers. Neither the publicly nor privately-owned regulated telecommunication carriers are represented. The consortia seek to expand into a field which is not greatly regulated nor dependent on existing carriers or broadcasters. This suggests the development of a delivery system, Home Video, which is parallel to existing delivery systems but in many cases is vertically integrated with program producers and distributors.

3. Control of Profit Centre

The corporate strategies are now locked into three systems in the belief that each group has the staying power to secure a

significant share of the market with the ability to determine the profit center. This applies not only to manufacturers of the hardware in-house or under license, but pertains to all aspects of replication and distribution. While the producers of content may elect to distribute in all standards, the standard which becomes dominant in the marketplace may provide the controlling group great influence over this delivery system. This would be moderated if replication and mastering are accessible and widely available and if the distribution system is open to all or many content providers.

4. Conclusions

On the basis of the evidence presented here and later, only broad conclusions about the consumer market can be made.

a) The three corporate groups backing the videodisc technologies represent a huge act of faith (and risk) that there is a large market on which to recover developmental costs. It would be absurd to dismiss the videodisc at this time given their strength to create a consumer demand and sustain the "long-haul."

b) Should consumer videodisc fail altogether, all groups are still heavily involved in VCRs which would then certainly appear to be destined to become pervasive. Home Video as a significant content delivery system will be a fact with or without the disc.

c) The use of pre-recorded VCR content is growing at a great rate. If videodisc players succeed and discs are rented

then the implications to present entertainment delivery systems will become that much more acute. The most popular and most immediate content will be available for Home Video first before all other delivery systems except theatrical.

d) The newer or more sophisticated videodisc systems have a large potential in the instructional and educational markets. The impact in formal education will probably be minimal for some time but the development of industrial "networks" and "learning systems" is already well underway.

e) Optical data storage technology has matured to the point of being able to offer a type of mass storage capability remarkably better than any presently available; as hardware and appropriate subsystem architectures emerge, computer users will find great improvement in the range and effectiveness of the services available to them.

ENDNOTES

[1]Business Week, July 7, 1980.

[2]This figure of 200,000 VDPs is based on RCA's 60,000 in the U.S. in 1981 and Toshiba, Hitachi, Zenith and Radio Shack sales of CED worldwide added to Laservision's 80,000 VDPs. No accurate figures are available since EIA does not report VDP sales at this time. VCR figures are in part taken from many sources. See The Videoplay Report, Vol. II, No. 23, Nov. 9, 1981.

[3]Foster Reports: New Video Technology and its Impact on Commercial Communications, Foster Advertising Limited, September, 1981, p. III.

[4]EIA figures as reported in Video Marketing Newsletter, Jan. 25, 1982.

[5]Information from Video Probe Index - Home Testing Institute 10,000-home survey as reported in Video Week, Vol. 2, No. 51, December, 1981.

[6]Foster Reports.

[7]Weekly Television Digest "White Paper," Dec. 14, 1981, Vol. 21:50.

[8]The Videoplay Report - interpretations from figures supplied by Ken Winslow.

[9]These reasons are a summation of points found in the literature and most particularly reflect the views of panelists at the 2nd Annual Billboard Video Music Programming Conference, Los Angeles, Nov., 1980.

[10]Comments by D. Filter of IBM GLS at Columbia Business School and American Video Institute conference on Interactive Videodiscs and their Corporate Applications, Columbia University, Nov. 3-6, 1981.

[11]Laub, Leonard, Laser Disc Technology: Progress and Promise, a seminar Science Council of Canada, Dec. 1981, Ottawa.

[12]Goldstein, Charles M., "The Potential Impact of Optical Disc Technology," Telecommunications and Libraries, Chapt. 7, Knowledge Industry Publications, White Plains, N.Y., 1981.

[13]Laub, Laser Disc Technology, p. 16.

APPENDIX
CHAPTER I
CORPORATE ANALYSIS
OUTLINE OF VIDEODISC CONSORTIA

1. RCA Group

The RCA Group comprises:

a) RCA Corp. ($8 billion annual sales) makes players and discs;
b) Zenith Corp. ($1.2 billion annual sales) makes players 1983;
c) CBS Inc. ($4 billion annual sales) makes disc, sells programs and records;
d) General Electric Company (U.K. 3.5 billion annual sales) makes players and sells in U.S.

Brand names of RCA Capacitance Electronic Disc (CED) Selectavision; Elmo, Hitachi, Sansui, Sanyo, Tandy, Toshiba, Zenith; the RCA group also has the following arrangements:

Sears & Roebuck Co. - retail players and discs

J. C. Penney - retail players and discs

Sanyo - makes players for U.S., discs in Japan
- major supplier to Sears, Penney

Beta/Taurus - West Germany - software and distribution in Europe

MGM - agreement with CBS for replication and distribution

Gaumont - software in France and francophone Africa.

This group comprises a huge hardware manufacturing, distribution and servicing network - RCA - 5,000 dealers; one of the world's largest record companies - CBS-Columbia Records; a major color TV manufacturer - Zenith; a huge U.K. organization, and two of the three largest U.S. retailers - Sears and J.C. Penney. The notable strengths are that this group represents close to 60% of all color TV sales in the U.S. and has marketing and distribution resources well in excess of the other groups in respect to the U.S. market. Its link with Sanyo includes replication of discs at KOFU. The European connection may be frustrated through weak representation of RCA dealers and technical difficulties in producing players for PAL/SECAM standards.

2. Philips Group

The Philips Group consists of:

a) Core

N.V. Philips ($18 billion annual sales) with affiliation to N.A. Philips (North America)

MCA Inc. ($1.5 billion annual sales) (Universal Pictures)

IBM ($25 billion annual sales and rentals)

Pioneer Electronic Corp. ($1 billion) (U.S. Pioneer)

b) Joint Ventures:

DiscoVision Associates - 50/50 MCA & IBM (See Note p. 49)

Universal Pioneer - 50/50 DiscoVision & Pioneer

Optical Programming Associates - Philips, MCA and Pioneer - has the task of developing non-linear programming, eg. "How To Watch Pro-Football" and "The National Kid's Disc."

Pioneer Artists - a program development company, especially musical programs, wholly owned by U.S. Pioneer.

c) Marketing and Manufacturing

Magnavox - wholly owned by N.A. Philips

Philco and Sylvania - purchased recently by N.A. Philips as part of GTE Consumer Electronics.

These three brands represent the fourth largest group of color TV marketeers with about 15% of U.S. sales.

Sony ($3 billion annual sales) - industrial videodisc

Trio-Kenwood - disc players

Grundig - disc players

Sharp - disc players

Sanyo - optical disc players for Europe and Japan but possible also Sears under its label.

Pye (in Europe), Philips (in Europe). Other brand names include Advent and Gold Star.

d) Replication

3M licensed by Philips for replication using photopolymerization techniques.

Sony - replication - conventional stamping

Magnetic Video (20th Century Fox) - replication in U.K. and possibly U.S.

Blackburn U.K. - Philips photopolymerization techniques - See Chapter II.

DiscoVision Associates - U.S. - thermal injection - See Chapter II.

Discodar Associates of Montreal has a formal agreement with N.V. Philips for replication first in Blackburn and subsequently in a Montreal plant.

e) Software

Primarily this has been developed by MCA using Universal's library. Agreements have been made by Philips with MCA and Paramount for U.K. market using CBS distribution (CBS indicates it is free and willing to distribute in any format).

ABC Video Enterprises - educational disc based learning systems.

Warner Communications - there seems to be some connection particularly through existing alliance with Pioneer for audio records in Japan. DiscoVision Associates provides Warner, Columbia, United Artists, Paramount and others with discs bearing their own video labels.

PolyGram Pictures (part owned by N.V. Philips and Siemen A.G.) has mutual agreements with MCA and ties to Casablanca Record and Filmworks. PolyGram has long been associated with N.V. Philips in the development and specifications of the "Compact Audio Disc," a true digital audio record of very superior quality which might revolutionize the audio record industry. The Pioneer Laserdisc in particular can be made compatible to this PCM disc with the addition of an adaptor.

3. Matsushita Group

The Matsushita Group comprises

a) Matsushita Electric Industrial Co. ($10 billion annual sales) has $4.5 billion in consumer electronic sales through its various subsidiary companies. Listed as producers of the VHD are:

Quasar (formerly Motorola, Inc.)

Panasonic

Japan Victor Co.

Other companies which are noted as potential suppliers of players are:

Sanyo

Toshiba (in Japan)

Hitachi

Other brand names include: GE, National (in Japan), NEC (in Japan), Sansui, Sharp, Yamaha (in Japan). Obviously this line-up has immense production capacity but most notably it represents almost the same structure which together with RCA is marketing the VHS VCR.

b) Thorn-EMI (U.K.) - the huge group is in partnership with Matsushita. Thorn would produce players for Europe and EMI the software generally (EMI owns Capital Records).
c) General Electric ($25 billion annual sales with $6 billion in consumer products).

Note: At the time of publishing, there were strong rumours in the trade press but no formal announcement that IBM/MCA had withdrawn from DiscoVision Associates by selling their combined 50 percent of Universal-Pioneer to Pioneer. DVA in future would simply manage the patents and Pioneer would take over the entire business. The Costa Mesa plant would only do premastering and all replication would be done at Kofu in Japan.

CHAPTER II

TECHNICAL PERSPECTIVES

INTRODUCTION

The organization of this chapter is in three parts: technical characteristics, technical descriptions and programming the videodisc. The purpose of Part One on technical characteristics is to provide a statement, readable by laymen as well as technically qualified people, on the basics of the technology and of the various implications for its use in different applications. Parts Two and Three will provide more detailed technical information. Both Part One and Part Two will deal with subject matter through an examination of the technology's application to the consumer mass market, the education training market and the information storage and retrieval market.

Additionally, there will be a description of various manufacturers' or developers' product from state of the art through near future to longer term expectations. Before examining the market applications, Part One will describe briefly some of the earlier developments of videodisc technology.

PART ONE

TECHNICAL CHARACTERISTICS

A. VIDEODISC TECHNOLOGY

As early as 1928 John Baird, the British television pioneer, experimented with the recording of video signals on a wax disc. There seemed to be little development following Mr. Baird's work until the 1960s when Westinghouse and the 3M Company developed a way to record a single frame of video on an audio-type disc. Now, Video Disk/Videodisk/VideoDisc/Videodisc has become a new word in the English language.

There have been numerous systems developed throughout the world. In fact, five years ago an unpublished Secretary of State research paper showed that there were some 40 systems in various levels of development. By that time, Thomson-CFS had demonstrated a system, Philips and MCA had agreed on a disc format, and RCA had demonstrated Selectavision in New York. Similarly, in the past 5 years, RCA, Robert Bosh, SRI, Harris, Xerox EOS, Philips Labs, and Hitachi had either demonstrated or announced plans for digital optical disc players as either stand alone systems or as part of a full information storage and retrieval system. Few of these systems have advanced from the drawing board and "bread board" stage to prototype, and fewer still have tested the waters of the various markets. Fear of market fragmentation through lack of standardization has led many

companies to abandon promising research and, as an alternative alternative, to obtain patent licences from another corporation. Additionally, lack of development capital has inhibited or arrested development of numerous concepts and systems.

For example, systems such as TelDec, a phonograph-based disc system, jointly sponsored by Telefunken of Germany and Decca of Britain came out in 1975, and by 1979 had failed in the marketplace. This was due to lack of software and a limited (10-12 minute) playing time. The reportably erasable disc developed at the University of Toronto by John Locke and Craig Willis failed to attract adequate financial support. Systems such as Matsushita VISC, a phonograph-type system somewhat similar to RCA was dropped in favour of JVC's (a Matsushita subsidiary) VHD system.

Only the largest of companies have been able to support the sustained R & D effort necessary and most of these organizations have found it desirable to have associations or special agreements with otherwise rival companies.

B. CHARACTERISTICS OF THE TECHNOLOGY BY MARKET APPLICATIONS

1. General Description

The videodisc earned its name because it physically appears not unlike a conventional phonograph (audio) record or disc and because it can reproduce material for video or TV screen presentation. The videodisc looks similar to an audio disc and the player has a spinning turntable. It has the capability to hold and to reproduce any type of "information" such as data for computer usage, bank records, encyclopedias, insurance policies educational institutional programs, and most obviously motion pictures and other entertainment material with equal ease.

An audio disc contains 6 grooves/mm while a videodisc may contain 100 times that. In comparison to a human hair there would be about 50 to 75 videodisc grooves in the same width.

In fact, the comparison goes beyond physical properties. For a videodisc system to succeed it should also have the potential which helped to make the audio disc a universally accepted technical device. The software (i.e. the content) must be available, cheap and varied; the quality of reproduction must be good and competitive with alternative technologies; the playback equipment must be reliable, easy to use and relatively inexpensive; and machines and discs of different manufacture should be compatible.

Where the similarity to its "parent" ends is the key factor of compatiblity. Phonograph records or audio discs are

universally playable on all makes of record players. Not so with videodiscs and this is where the market place may assert a decisive influence on the success or failure of this emerging industry or on the longer term future of some manufacturers' systems now at advanced stages of development.

Currently there are many videodisc systems, mostly falling into two categories -- capacitance systems and optical systems. The former operate with a stylus not unlike a conventional record player. The latter uses a laser to "read" the disc and there no physical contact between the optical reader and the disc. These are not the only systems but they do describe the two main types of videodisc technologies.

A glance at Exhibit I, which follows, will provide an overview of the varieties of approach and the companies involved. There are both grooved and grooveless contact or capacitance type systems and reflective, refractive and photographic optical systems.

It is important to note that while there are capacitance or contact systems designed for the consumer, all of the industrial applications use the optical approach. There is the natural expectation, whether by the ordinary citizen or by officials of large corporations, that discs should be interchangeable or compatible with all players. There may be some flexibility in this expectation. Business and industrial use may not demand standardization or compatibility because of special needs and

conditions. This would be a situation similar to the word processing equipment industry.

In the case of the mass consumer market, the system which can quickly become popular may, over time, come to dominate the market. The developers' problem is that consumers may reject the videodisc simply because of a lack of standardization. The strategy of companies to exploit and dominate the market is discussed in Chapter I on Corporate Strategy.

Exhibit I

VIDEODISC SYSTEMS

	contact		optical (non-contact)		
	grooved	grooveless	reflective	refractive	photographic
Industrial			Sony Discovision	Thomson-CSF	(McDonnell-Douglas)
Consumer	RCA	JVC/ Matsuschita	Magnavox (Philips) Pioneer		

It a reflection of the varied approaches in the development of ıe technology that there are reported more than 30 companie: working on optical memory systems based on videodisc technolog . In addition to those described later in this section it has be ı reported that Control Data, Hewlett Packard, Storage Technolo· Corporation, Burroughs, IBM (outside its interest in DiscoVisi ı Associates) and Honeywell are involved. However, none of ıese companies as of writing have released significant informati about their plans.[1]

Ex bit II shows a Magnavision videodisc player.

Vic odisc systems are not direct substitutes for videocassette ecording (VCR) systems. Both play pre-recorded programm s but videodiscs are less expensive than their tape counterpa ts ($20.00-$30.00 vs $60.00-$90.00). However a household type videodisc player (VDP) cannot record a program for later vie ng and discs are not erasable for new use. On the other ha d, the consumer will not accidentally erase a pre-recorded ›rogram from a videodisc. Moreover, it is an information stor ıe device of unsurpassed capability and can be linked to and "ı ad" directly by computers.

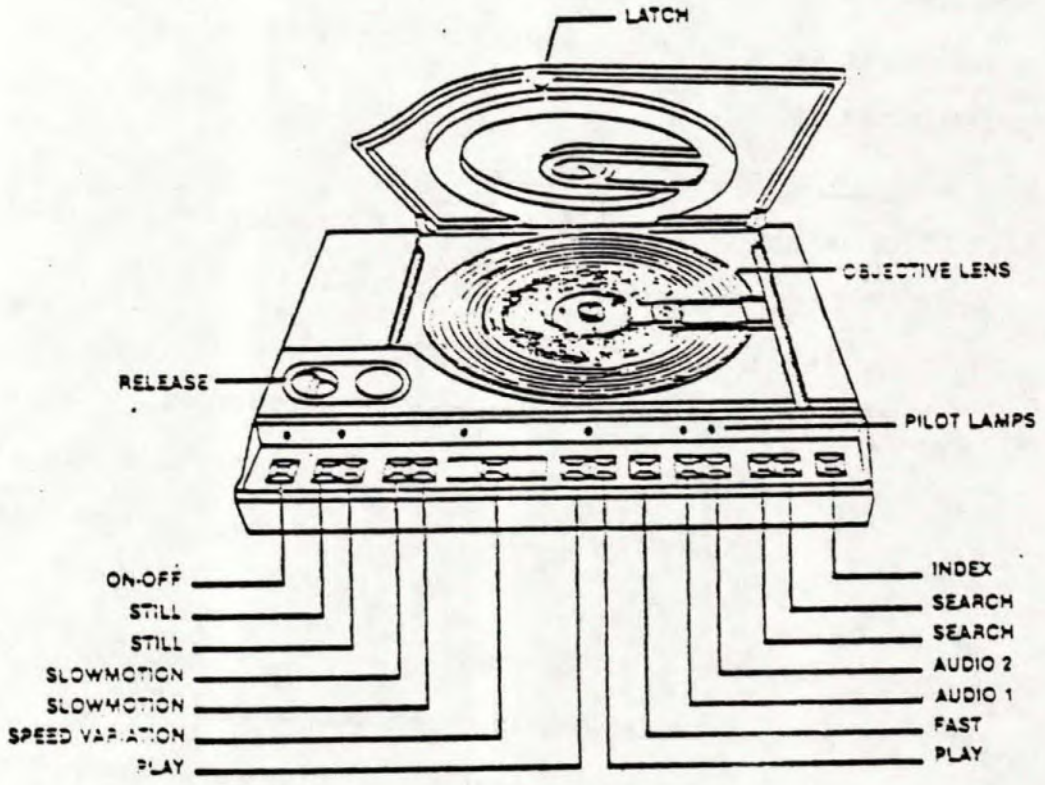
Th use of magnetic tape, which requires careful storage, requires ontact between the tape and a contact head and this causes w .r of both tape and the head. The optical disc has no contact v ı its reading head and consequently there is ırtually no wear either ısc or reading head as a result of ıse. An

RCA technical manager expects that the optical disc may offer one to two orders of magnitude improvement in price over tape and several orders of magnitude improvement in volume storage costs.[2]

It is for this reason and for reasons of longevity of storage that the U.S. Library of Congress contracted with Xerox-OES to supply an optical-disc based system for storing and printing 5.5 million library cards. Similarly, Philips has provided a large optically based data storage unit to the U.S. security agency at Fort Meade.

Exhibit II

Magnavision Video Disc Player Controls



Typical Video Disc Player Controls

Another important feature is the capability to record data quickly. For example, U.S. government agencies have a strong interest in using videodisc storage systems for recording satellite information. As much as 90% of the data is currently lost for lack of equipment capable either of recording data or storing it at the required very high rates and volume. For example, the RCA optical system has recorded at rates of 50 megabits per second and is developing a system to operate at 320 megabits per second.

2. Analysis of Disc Technology

This is not to suggest that disc technology is free from problems. These fall into the following areas:

(a) compatibility between systems;

(b) problems of mastering and replication, which is difficult, has to be done in factories or laboratories and for Canadians, outside the country;

(c) the cost of lasers in optical systems, and possible wear in capacitance systems;

(d) problems of achieving broadcast quality in program or film reproduction; and

(e) the ability to erase and update.

a) Compatibility

Because of large technical differences, discs from one system are not playable on another. While there are reports of

evidence from laboratory demonstrations that Thomson discs have been played on a Philips system, and that TelDec and RCA discs have been played on optical players, for practical purposes, each system is entirely distinct and uses incompatible discs and players.

b) Mastering and Replication

Consumer market discs, unlike tapes, require in-plant production techniques for their programs. However, businesses and institutions require a system to produce one disc, perhaps with a few duplicates, on which they can "write" as well as "read" their material and other stored information. To meet this need some companies are developing or have developed a direct-read-after-write or DRAW system for the economic production of single discs.

c) Laser Technology

Gas lasers are used in optical systems and are probably the single most expensive component in this kind of videodisc player. Solid state lasers may replace the gas-type in the longer term and at greatly reduced cost. Until then, the cost of the laser component accounts in great measure for the significant price differential between optical and capacitance systems.

Capacitance or contact systems may have have the drawback problem of disc and head wear because of contact between the stylus and the disc. However, RCA claims to have demonstrated more than 200 plays without any noticeable wear. For many

purposes that is probably quite sufficient, but in certain applications a potentially high frequency rate of play may be a significant factor in the decision to choose between capacitance and optical systems.

d) Broadcast quality

Various videodisc systems do not achieve broadcast quality in picture resolution nor indeed high enough resolution for text purposes. When compared to videotape, which also fails to achieve broadcast quality, this may not be much of a problem except possibly in institutional or remote broadcast applications.

Studio high resolution monitors may alleviate some of the problems in text uses. However, to have a good text display system, work will have to centre on high resolution encoding on the disc, a process which would require redesigning current commercial, and probably prototype digital storage systems.

e) Erasure/Revision

Current commercial disc systems are set when pressed at the factory. Only by using an integrated microprocessor in the player can material be jumped over (not played) and thereby be considered deleted. It is not possible to erase or update these discs.

The prototype industrial storage systems can "write" on discs but not erase them. By leaving spaces in the disc material

it is possible to add more material, a form of updating, but in time the disc is full.

It is reported that two companies, Energy Conversion Devices and Corning Glass, have announced developments of erasable materials, probably based on thermo-magnetic phenomena, but industry-expert opinion[3] is that it will be some time before this development capacity is practical.

3. Consumer Market Applications

For the consumer, videodiscs may represent a substitute or alternative conventional "free" TV, Pay-TV, movie theatres, videocassette players and to a lesser extent phonograph records and audio tapes.

Videodiscs are cheaper than pre-recorded videotape cassettes and provide a better quality picture and sound. With carousel-type systems, stereo capability is an option and this capability could underlay a new kind of home video music programming, i.e. operas, musical comedies, rock concerts, documentaries, etc.

A price of twenty to thirty dollars for discs of first-run movies could provide an additional and valuable distribution system for films. Such an option may be more attractive with increased home penetration of large-screen TV projection systems.

4. Education/Training Market Applications

Videodisc systems, depending on their sophistication, have the capability to replace or augment films, film strips, tapes and certain kinds of manuals and "how-to" books. Videodiscs could also be the basis of Telidon-type reference systems in education settings but that capability will be the subject of the section on the information storage and retrieval application.

The simplest application is when the user draws out information sequentially and the only user input is to push the start and stop buttons. However, it is possible to structure the information to involve the user. For example, consider a "how-to" lesson (cooking, engine mechanics, home repair, physics, mathematics, etc.) broken into segments so that the viewers become learners. They can press start and stop buttons as needed to set the pace of the lesson. The simplest videodisc players on the market can provide this kind of operation.

More complex players allow for random-access selection of viewing segments or sub-programs, branching, responses to true or false or multiple-choice questions and following a remedial path. For example, the first few thousand tracks can be used to hold a microprocessor program to take the learner through a series of stills and/or motion segments. This is the type of program which is in present use by General Motors. In addition, the viewer can also have the choice of an alternate language by using the second audio channel when it is so prepared.

If the computer system were to incorporate a light pen there is a further capability. Then, it is possible to combine information from the videodisc and from the computer to display alternately the information from each source. An example of this may be a short movie and slide presentation on a automobile engine. The computer can command the videodisc to display a certain engine and ask the student to use the light pen to point to a key part of the picture such as the exhaust manifold. The system would check the user's response and display the proper reinforcement from either computer or disc or a combination of both.

Another example is a program sponsored by Smith-Kline to teach doctors to develop or update their skills and knowledge in a complex field. Using an ACI computer, a DVA PR-7820 player and WICAT developed intermediary devices, doctors can follow a programmed learning track of several hour's duration. Doctors can choose several levels of complexity depending on their requirements. As the disc program progresses, case studies, patient history, hospital tests and results are all presented. The doctor is then asked to make a diagnosis, prescribe further tests, recommend treatment and so on. His choices are then reviewed with him and the reasons for his mistakes explained.

This program probably represents the highest level of complexity thus far achieved with the interactive videodisc. In its true sense it is not a videodisc program, it is a computer

program. The videodisc coupling, however, is a key item since without it a computer of enormous cost and complexity would be required.

Defense Advanced Research Projects Agency (DARPA) sponsored another kind of program developed by Massachusetts Institute of Technology (MIT) called "The Aspen Project." It involves two videodisc machines, a relatively sophisticated computer, a graphics generator and a touch sensitive video display. Through the preparation of an extensive series of stills and computer interaction the viewer is able to take a simulated tour through the city of Aspen. The viewer is able to travel forward or backward or turn left or right and sees the appropriate view as their direction of travel changes. As the viewer approaches City Hall for example a voice asks, "Would you like to see the interior of City Hall"? If yes, he can have presented detailed visuals or a short film of the interior details of the building. There are consumer as well as educational and training applications for such a scheme.

Another reported project of this same type is one by Peace River Films. It would allow, for example, a handicapped person to explore and experience a wilderness area that would be otherwise inaccessible to him. Three cameras would record a visual walk along a variety of chosen trails photographing still frames every 2-1/2 feet and in three directions -- forward, left and right. Supplementary detailed motion sequences and slides

would be presented on specific points of interest. Ambient and specific sounds are to be recorded and would include such things as bird calls which could later be identified by the second track on the disc. Other visual material may include aerials, maps, microscopic details and general information. The project will thus allow a handicapped visitor, or someone just interested, a wide-ranging personalized surrogate tour.

The role of the interactive videodisc will certainly begin to grow in the near future. The ultimate is to provide in effect an opportunity for an interactive discourse between learner and programmer and not between learner and machine. The challenge therefore will be to produce enough software which will be useful and interesting enough (not to mention cheap enough) to be able to effect a knowledge acquisition by the viewer.

In the longer term we can expect that the use of the videodisc in education will go beyond stimulus-response to approach simulations. Systems will become smaller, cheaper and accordingly more attractive to the marketplace. An important application could be in conjunction with flight simulators or air traffic control simulators. Combinations of videodisc with computers will provide increasingly more effective applications.

For instance, Hughes Aircraft Corporation, in searching for a cost-effective alternative to technical manuals, turned to videodisc. Using a Thomson system as a basis for their Training and Maintaining Information System (TMIS), Hughes now want to

extend this application to job sites as a work bench or job maintenance and training aid.

Hughes describes the system as an "interactive partner in the trouble shooting and repair process."

> Faced with malfunction the technician enters a description of the symptoms on a simple keyboard, using plain English. TMIS may then present one or more queries on the display. As the technician enters his responses, TMIS searches its stored knowledge and displays new queries to narrow the list of possible causes for the observed fault. When it is isolated TMIS displays the proper corrective action.[1]

The system is presently in use in the U.S. Army for maintainance of the M-60 tank, and with Phillip Morris in Richmond, Virginia.

5. Information Storage and Retrieval Applications

In the area of information storage and retrieval, videodisc technology may find its most important use. A good way to perceive its application to the information storage retrieval and archival fields is to compare with current and known future alternative technologies.

a) Optical Disc compared to Microfilm

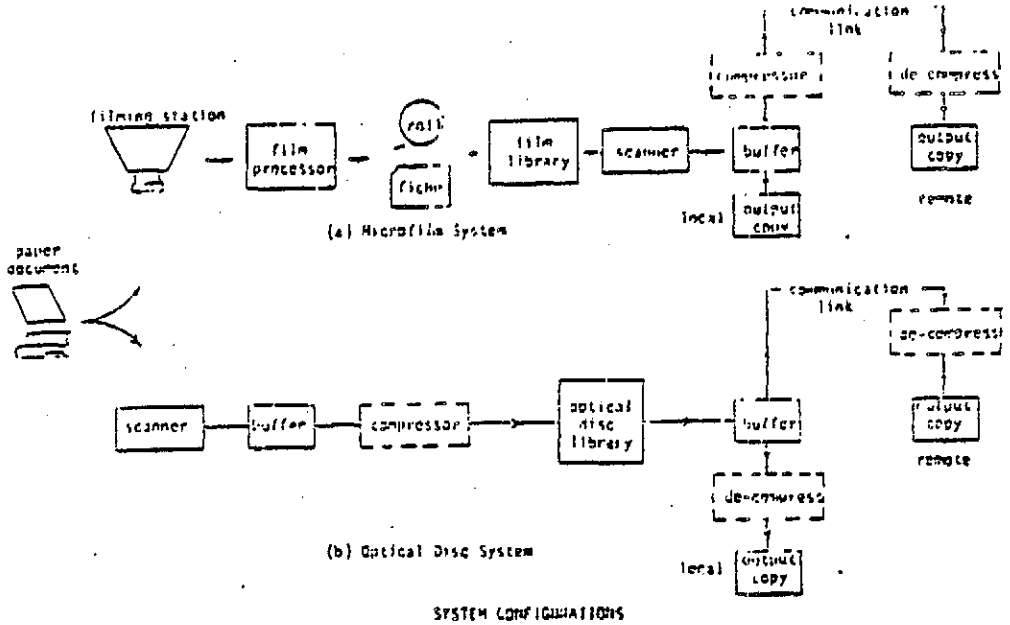
Both microfilm and videodisc have many desirable features as a mass storage media for document preservation, retrieval, and dissemination. Yet with the strong demand for rapid dissemination of documents to "remote" locations, the compatibility of the storage medium with the communication channel becomes an important factor. Optical discs provide such an advantage

because they can be linked directly to electronic or computer circuits.

Exhibit III illustrates the differences between the two systems. In the top portion we can see the configuration of the microfilm system. The filming station and the film processor create the microfilm images (roll or fiche) of the paper documents. The films can be organized into modules (cartridges, carousels, etc.) with a conventional retrieval method to project the image of the requested document. This ties up the film module and prevents other users from having access to the same module during that period.

A computer-assisted retrieval system could access the document to transfer rapidly the image to a buffer storage by means of electro-optical scanning. This would also permit electronic transmission of the image to remote locations by means of a communications carrier link. The compressor is optional and it permits a 10 to 1 reduction in transmission costs in which the image reconstruction may be either softcopy display or hardcopy.

Exhibit III



SYSTEM CONFIGURATIONS

Parameter	Microfilm	Optical Disc
1) recording method	photographic micro-imagery	laser beam recording
2) storage compaction	photographic size reduction	redundancy removal
3) data entry process	photographic filming	electro-optical scanning
4) conversion rate/machine	few pages per second	same
5) life expectancy	archival	about ten years
6) duplication	photographic method	digital regeneration
7) method of retrieval	automatic film retrieval and photographic projection, or electro-optical scanning	automatic control of mechanical motion in conjunction with electro-optical scanning
8) output	microfilm viewer, electronic softcopy display, and hardcopy	softcopy display and hardcopy
9) dissemination method	mail hardcopy, or scan the film for electronic transmission	stored in a form suitable for electronic transmission
10) auxiliary storage	buffer is required to provide rapid services to multiple users	same
11) file updating	selective partial updating	may need a new disc
12) supplies and services	many micrographic vendors	very limited
13) access/retrieval time	about 10 seconds	within seconds
14) suitability for computer processing	must be scanned and converted into a digital format	already stored in a digital format
15) history/performance	known for decades	newly developed product
16) media cost	0.2 cents/page	0.02 cents/page

Exhibit III also shows a system configuration of an optical disc system as a storage and retrieval medium. The scanner converts the image of a paper document into digital data with a buffer used for data formatting and processing. The recording and retrieval processing are both computer controlled with a compressor that is also an optional item. Another buffer serves as an interface between the disc file and the users, local as well as remote.

The table below these figures makes a comparison between the two types of storage media.[3] The major points to be noted are:

- Though most microfilm is of archival quality, it is subject to wear and tear by the frequency of retrieval, mechanical motion for display, and the heat generated by the light source.

- The duplication of film can experience a 5 to 15% degradation per generation of photo-duplicating process. With optical discs using the DRAW method, the accuracy of the duplication is immediately verified.

- The data on optical discs are already in a electronically transmittable form while the microfilm must be scanned.

- Since film comes in smaller basic units with fewer pages than an optical disc it will be easier to replace a piece of film in order to update a few pages.

- The access time for an optical disc is a few hundred milliseconds to a few seconds; for microfilm it is about 10 seconds.

- The cost comparison assumes that a basic film module (100 feet of 16 mm roll film) costs $6, and stores 3000 pages at 24X. A $10 optical disc can store 2×10^{10} bits. An 8 1/2" x 11" page scanned at 200 dots an inch generates 3.74×10^6 bits. With a compression of 10:1, a videodisc can store 53,000 pages. The cost compares favourably for optical discs at .02 cents/page as opposed to .2 cents/page for microfilm.

Therefore, if an organization has already made a large investment in archival quality microfilm, the change to videodisc may not be sufficiently advantageous and cost efficient unless there are certain additional requirements:

- if the information is required on a immediate access or machine-readable form, then videodiscs may be more appropriate;

- if colour is a significant requirement, then videodisc is preferable;

- if quality of transmission reproduction is needed, the microfilm scanning device (which has not been used widely to date) may not be as acceptable as videodisc quality.

Depending on the application, each of the above parameters should be closely observed as technological improvements occur

with both technologies, i.e. capacity for revision, speed of access, reproduction and direct-read-and-write.

Moreover, it is important to note that the microfilm system used here for comparison purposes is an ideal system. Most locations currently using microfilm do not have the full array of equipment presented. Therefore a disc system with more standard features than a "standard" microfilm system is even more attractive than this analysis would suggest.

Videodisc compared to Magnetic Bubble Memory

Magnetic Bubble Memory is at an early stage of its developmental cycle, but it is expected to have advantages for storage density and speed of access. The major focus of this section is how soon bubble could become a viable competitor, and what functional advantages bubbles have to either compete with or to supplement the use of videodiscs.[4]

Videodisc and bubble memory systems compare as follows:

- videodisc has a storage capacity of 2×10^{10} bit/in^2. Current bubble memory products are at 10^6 bits/in^2 storage density, advanced research prototype chips have obtained 10^8 bits/in^2 and there are predictions of 10^{10} bits/in^2;

- bubbles are more modular than discs both in terms of data storage and of selective access. Integrated circuit economics are such that low cost can be maintained for larger capacity modules if the larger capacity also has a higher storage

density. This may be true for videodisc systems but experience is not yet sufficient to know for certain. For example, a decrease in track width should increase capacity but such a decrease requires greater accuracy and better performing laser reading systems which may raise the costs substantially;

- the access time for bubbles is shorter than mechanical seeking time for videodisc files;

- the bubble memory requires a special packaging system in order to maintain the memory devices. Magnetic media are an unstable form of storage and bubbles require an even higher degree of environmental control. Consequently, its suitability for archival use is debatable.

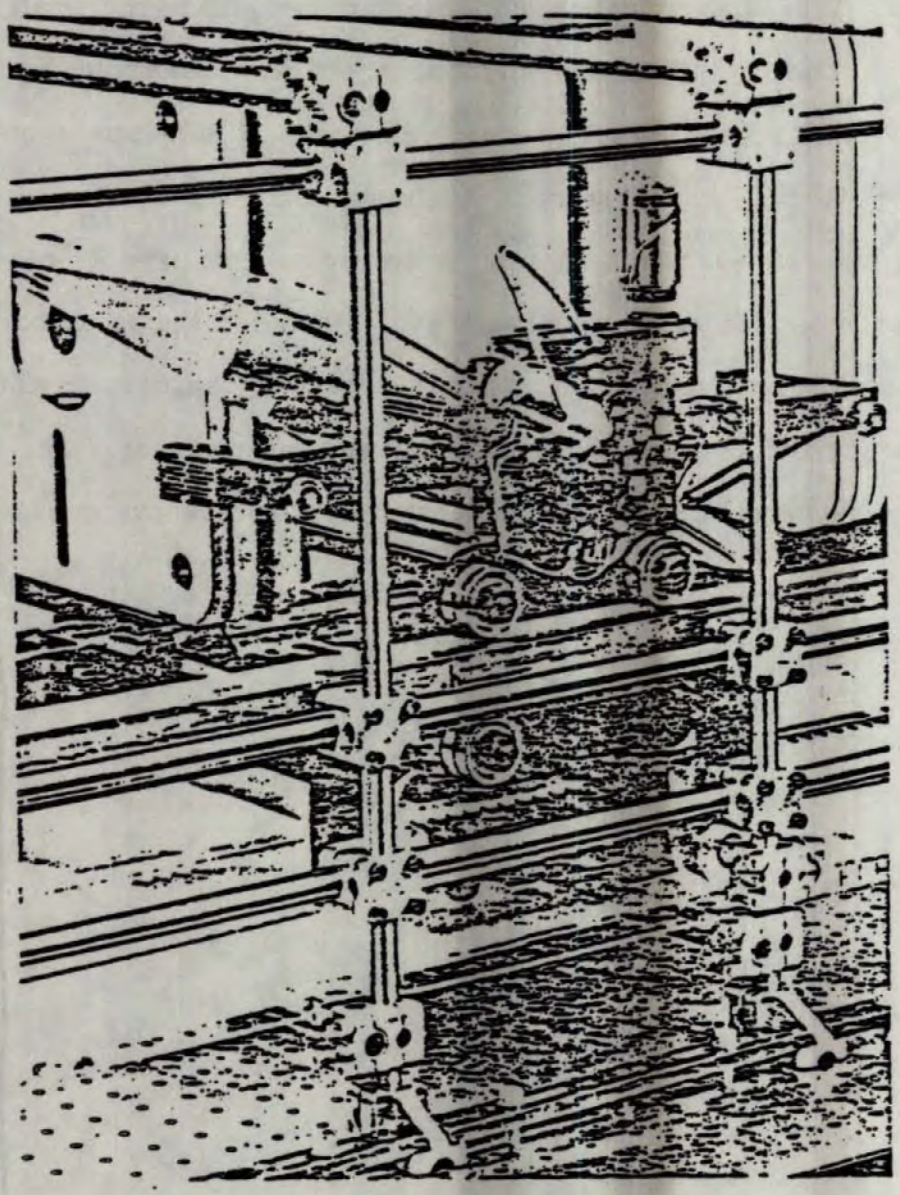
Videodisc compared to Magnetic Tape

The videodisc is capable of handling the equivalent of 250 reels of 6250 bpi magnetic tape, 1800 magnetic disc packs (IBM 3340), or 30,000 drums of disc packs with 3.2×10^7 bits on each disc. Industry experts predict that storage systems with capacity as large as 10^{12} bytes (8×10^{12} bits) will become dominant in the industry. Such capacity will require larger facilities by user firms in addition to the ongoing need to rewind (every 6 months) and recopy (every 1 to 2 years) the magnetic tape.[5] The latter can be a very costly procedure to maintain a sizeable tape library. The manpower alone can add to the cost of maintenance because most magnetic tape archives

require operator assistance in order to find, carry and mount the tape.

Videodisc selection and playing can all be automated with an automatic "juke box" such as the Philips example in Exhibit IV. The access time for a videodisc with a juke box system can range from 5 to 10 seconds while related files on the same disc can be retrieved in less than a second. This is not without its problems because of the time taken to bring the disc up to speed. Therefore, even with fast random access of the data on the disc, a trade off between more disc drives and discs or "juke boxes" may be necessary to optmize large scale storage systems.

Exhibit IV



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Requirements for bulk storage of 10^{12} bits (or a terabit) have been reported mainly for government agencies. These applications include the U.S. Census Bureau for its statistics, the U.S. Law Library for its holdings of cases and judicial material, the National Institute of Health for "digitized" x-ray files and Social Security files for some 350,000 reels of magnetic tape. While banking applications can survive with tape archival systems, the cost savings of a videodisc system could be quite significant.

Optical discs have substantial advantages over tape for archival applications. The unstable characteristics of magnetic tape under even ideal room conditions have caused a tremendous interest in optical videodiscs. Most estimates are that these discs, if stored under room temperature, will maintain integrity of the surface and pits for longer than ten years. For example, under normal room conditions 3M reports that the DVA disc will last 100 years, Thomson-CSF 60-70 years and other discs like the Drexler 20-25 years. Under ideal storage conditions it is expected that these discs will last much longer.

By law many industries require the maintenance of archival data for a considerable number of years. The greater the data access frequency or the greater the quantity of information for storage, the greater the need for an automated system. For this reason, videodiscs hold much interest for data processing managers.

PART TWO

TECHNICAL DESCRIPTIONS

A. INTRODUCTION

After having dealt with the technical functions and their implications in relatively non-technical language, the purpose of this part is to set out for the more specialized reader some of the technical details.

B. CAPACITANCE SYSTEMS

RCA and JVC are the main developers. Both systems utilize changes in electrical capacitance to re-create a video signal from a conductive polyvinyl chloride disc. The capacitance variation being discriminated to accomplish this task is in the order of 0.35 femtofarads. Both are aimed primarily at the consumer market.

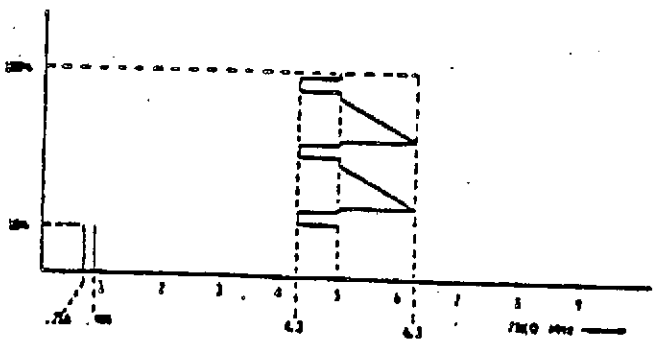
Educational or industrial versions may come at a later date depending on the success of the initial entry.

CED

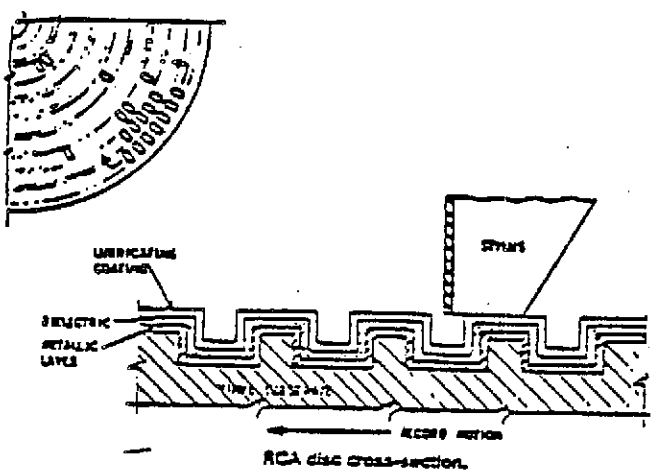
The RCA system is called CED for Capacitive Electronic Disc. The disc is 304 mm in diameter and is approximately 1.78 mm thick. The disc rotates at 450 RPM or 7.5 revolutions per second and therefore has four frames or eight video fields per revolution. The information itself is on the disc in the form of rectangular pits, the orientation of which is at right

angles to those in other systems. The pits are from 0.25 to 0.5 um long and about 4 um wide. The depth is approximately 0.35 um.

Exhibit V



Frequency spectrum, RCA system.



RCA disc cross-section.

Exhibit V illustrates the cross section of a typical disc side which consists of a laminate of a lubricating coating over a dielectric which, in turn, is deposited over the pits. Identical triple-layer laminates are on either side of the disc which allows both sides to be stamped at once. The disc needs no further processing after the stamping takes place. Because it is unprotected from dirt or handling, both of which will damage the surface, it is placed in a protective case or "caddy" and boxed.

The RCA system is sometimes referred to as a "captive" system because the disc operates with a mechanical pick-up that travels in a groove on the disc surface. This fact, together with the four frames per revolution characteristic make it unlikely that any form of a still frame would be possible. The latest version of the player has a digital display of the elapsed time on the disc as well as a way to move the stylus across the surface of the disc without destroying the picture or the walls of the grooves.

Stereo recording also seems possible through differential FM modulation of the carrier signals, even though stereo is not on the initial discs to be released.

Recording can be done in real time by laser, electron beam or stylus but at present it is being done by stylus at 1/5 speed in order to control quality with the simpler technology. During recording the chroma is separated from the composite signal and translated down from 3.58 to 1.53 MHz where it modulates an

interleaved subcarrier at 1.53 MHz. The luminance bandwidth is 3 MHz (compared to the broadcast standard of 4.2 MHz) and the chroma is ± 0.5 MHz and is interleaved with the luminance. Masters are made from any type of original material but are transferred to 2" videotape as part of the final pre-mastering. RCA has not sought secondary suppliers and therefore mastering requirements are not generally available.

The playback time of RCA discs is one hour per side and one disc will be capable of carrying most movies. This factor in conjunction with the simpler replication methods may result in relatively lower costs for pre-recorded discs for CED payers.

VHD

The Japanese Victor Company (JVC), a wholly owned subsidiary of Matsushita, has developed a system with many similarities to the RCA system; nevertheless the two are non-compatible. The Video High Density (VHD) system uses a disc of conducting plastic, which has a protective caddy enclosure (like RCA), but the rotational speed is 900 RPM and the surface of the disc is without grooves. Horizontal location of the stylus on the flat surface is servo-controlled through control tracks on either side of the signal track. This allows slow motion and still frame capability with relative ease. However, because there are four fields in each revolution, still frames will consist of two video frames and consequently some of these "double-exposures" are slightly blurry and sometimes jerky.

The sapphire stylus should last about 2,000 hours and the disc about 10,000 hours. Because of the contact involved, a still frame will cause disc wear after about an hour. To help alleviate this problem, there has been discussion of an automatic release to function with the still frame mode.

The track pitch is 1.35 um, the video carrier wave has a pedestal of 6.7 MHz and a frequency deviation of 1.4 MHz. The luminance bandwidth is 3.1 MHz. The capacity of the system is one hour on each side of a 260 mm disc, 1.8 mm thick.

The basic machine is a linear-play device. A microprocessor based random access unit is an optional accessory as is a pulse code modulation unit for digital playback of audio discs. Stereo sound or two mono channels are a standard feature of the basic unit.

As this system is not projected to appear on the market until June 1982, there is no technical requirements yet available for recording material. However, masters, are claimed to produce up to 20,000 pressings, are prepared by exposing a photoresist on glass with a laser beam modulated by the signal in real time and the photo-etched pattern is then used to produce galvanic stamping masters just as in conventional audio discs.

The main problem in pressing is to achieve a consistent and homogeneous conductive mixture of plastic material containing dispersed carbon and to press the mixture with absolute uniformity throughout the disc. As in the RCA system both

compression and injection molding techniques have been investigated.

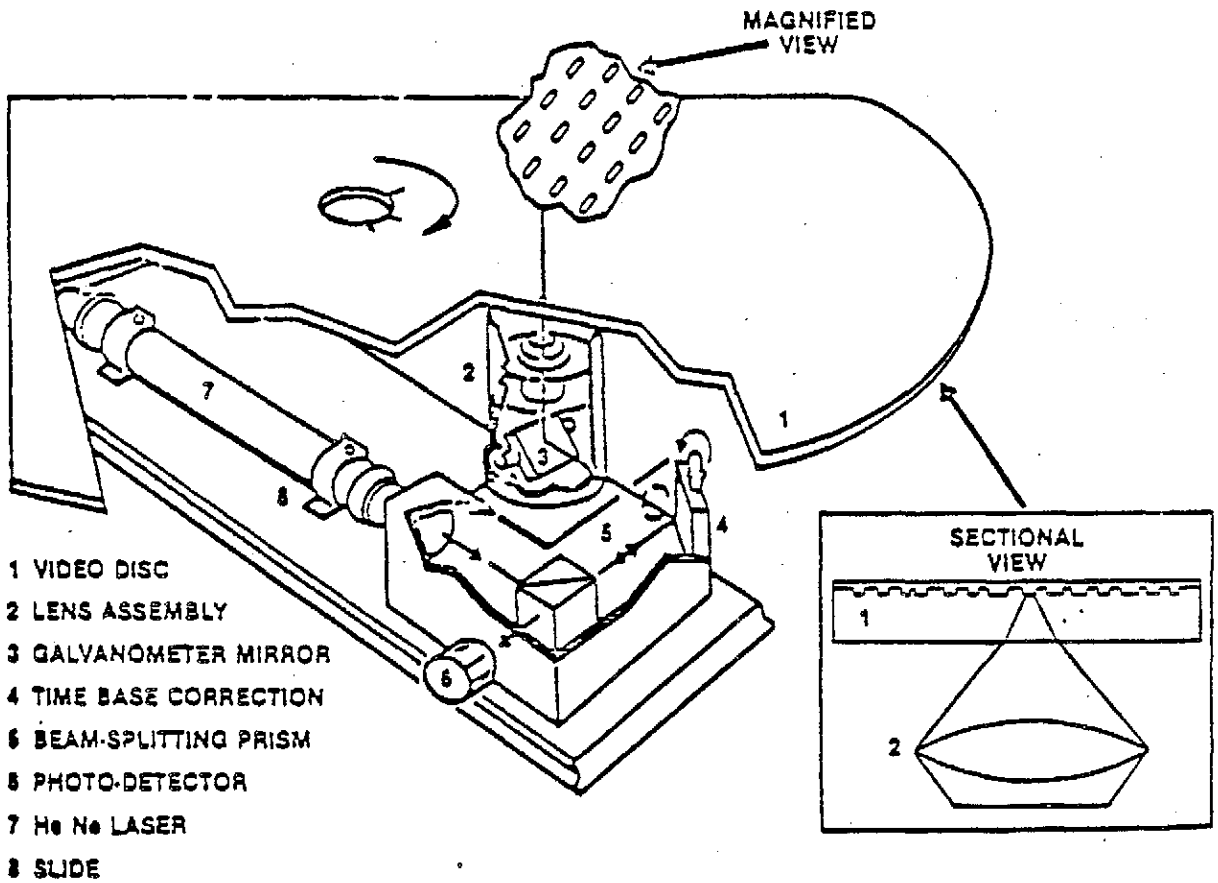
C. OPTICAL SYSTEMS

There are three kinds of optical systems: transmissive, reflective and photographic. There are transmissive and reflective storage and retrieval systems available and operational in the industrial market place. There are also reflective units and software available in the North American consumer market.

All units operate with some form of a light beam and do not have any wear problem because only the light beam contacts the disc. Optical systems therefore represent a more developed technology and the players are more complex and costly than their contact-type counterparts (See Exhibit VI).

Exhibit VI

PLAYER OPTICS



The exploded drawing above demonstrates the laser and optics module

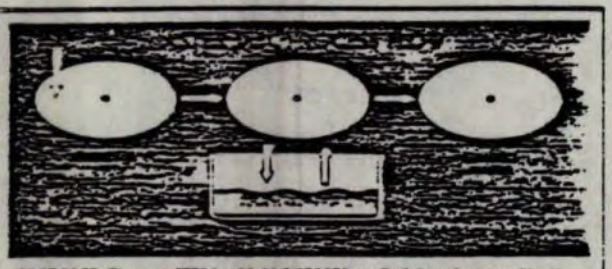
1. Transmissive Systems

The ARDEV system now owned by McDonnell-Douglas corporation is of special interest because it uses photographic film as the basis for the disc. The film is exposed using a 1 mw laser and after the exposure the film is processed using standard photographic processing solutions. After the film is dry it can be played back on a separate player which utilizes a 6 volt bulb as the source. The information on the disc is recorded digitally and the audio can be compressed at 300:1 to give 30 seconds of audio with each still picture. These discs can be replicated using a diazo process.

The priority of the company, now known as the Videodisc division of McDonell-Douglas Electronics is to develop a desk top manuel videodisc copier. However, some industry experts question whether the contact system of reproduction yields dense enough information for storage applications.

Exhibits VII and VIII describing the system are supplied by McDonnell-Douglas.

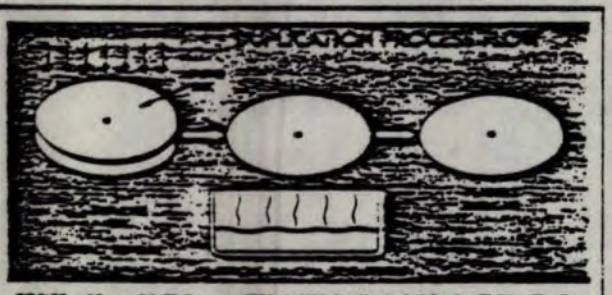
Exhibit VII



RECORDED FILM MASTERS ARE PROCESSED IN THE SAME MANNER AS CONVENTIONAL FILM. DEVELOPED MASTER DISCS REQUIRE NO SPECIAL HANDLING, AND MAY BE EASILY CLEANED.

MASTERING

No clean room required ☐ Low-powered HeNe laser ☐ Less than 60-minute turnaround, for a 30-minute master ☐ Local, inexpensive recording equipment ☐ On-site recording by user ☐ Remote recording capability ☐ Potential for low-cost home recorder ☐ Interfaces easily with existing standard VTR equipment ☐ Real-time recording ☐ Economical masters (insensitive to quantity)

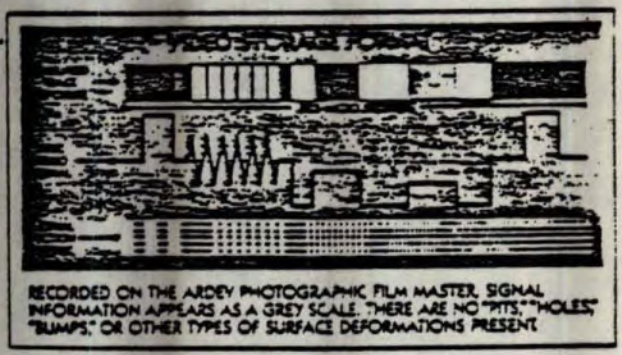


COPIES ARE MADE FROM MASTER DISCS BY SIMPLE CONTACT PRINTING METHODS. A COLLIMATED HIGH INTENSITY, LARGE AREA ILLUMINATION SOURCE EXPOSES THE DUPLICATE. THE COPY DISC IS THEN REMOVED AND PROCESSED IN A MANNER SIMILAR TO AN OZALID PROCESS, UTILIZING ANHYDROUS AMMONIA UNDER PRESSURE.

ANY QUANTITY OF COPIES CAN BE DUPLICATED — FROM ONE OR TWO, TO HUNDREDS OR THOUSANDS — AT EXTREMELY LOW COSTS COMPARED TO OTHER VIDEODISCS. FURTHER, THE SPEED AT WHICH COPIES CAN BE PRODUCED IS SIMILAR TO THAT ENCOUNTERED WITH HIGH-SPEED COMPUTER OUTPUT MICROFILM DUPLICATION. WITH AN AUTOMATED DISC COPIER, CYCLE TIMES OF 2-3 SECONDS PER DISC ARE NOT IMPOSSIBLE TO ACHIEVE.

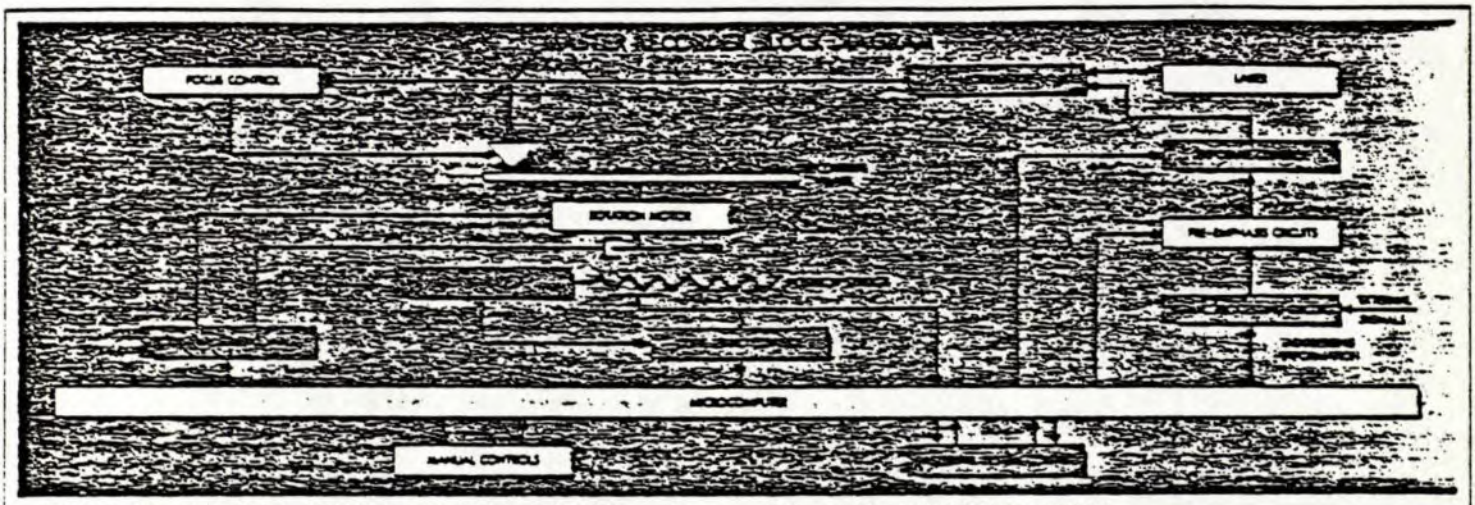
DUPLICATION

No clean room required ☐ Economical duplication (insensitive to quantity) ☐ Easy, economical contact printing process ☐ Anhydrous ammonia development ☐ Rapid duplication, processing time — approximately 60 seconds ☐ Linear grey scale properties ☐ Low-cost duplication equipment ☐ Potential desk-top-size duplicator ☐ On-site duplication by user ☐ Potential high-speed duplication



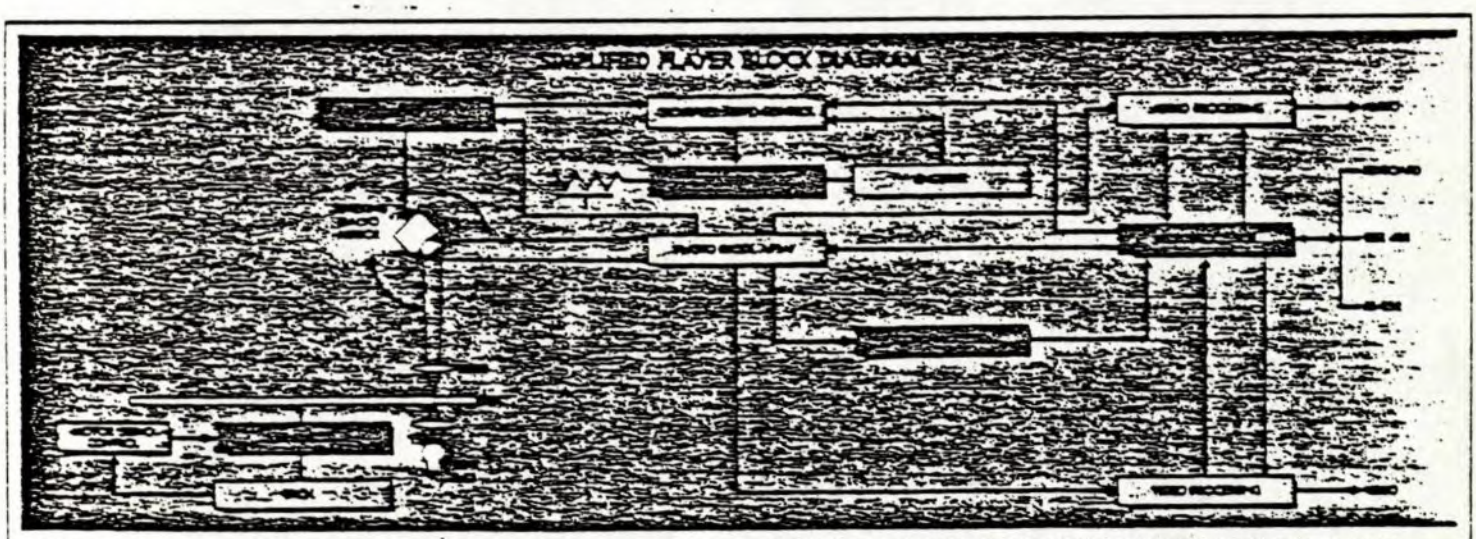
RECORDED ON THE ARDEV PHOTOGRAPHIC FILM MASTER, SIGNAL INFORMATION APPEARS AS A GREY SCALE. THERE ARE NO "PITS," "HOLES," "BUMPS," OR OTHER TYPES OF SURFACE DEFORMATIONS PRESENT.

Exhibit VIII



KODAK BLACK-AND-WHITE FILM IS USED TO MAKE ARDEV MASTER DISCS. A LOW-POWER LASER EXPOSES THE SENSITIVE FILM COATING ON THE SURFACE OF THE DISC, IN A VARIETY OF SIGNAL (ENCODING) FORMATS, DEPENDING ON THE DATA BEING RECORDED. THE MATERIAL RECORDS WELL, PROCESSES QUICKLY AND NORMALLY, AND HANDLES EASILY. STRAIGHTFORWARD, CONVENTIONAL FILM PROCESSING TECHNIQUES AND PROCEDURES ARE USED.

SINCE RELATIVELY LITTLE ACTUAL LASER POWER IS REQUIRED TO WRITE THE SIGNAL TRACK, IT IS POSSIBLE TO COMMERCIALIZE A RATHER SMALL RECORDER, FOR ON-SITE USE BY THE CUSTOMER.



BOTH MASTER AND DUPLICATE DISCS MAY BE PLAYED BACK ON ARDEV MACHINES. A UNIQUE FEATURE OF THE ARDEV PLAYER IS THE 12-DIODE ARRAY READ HEAD. AS A RESULT UP TO TEN TRACKS MAY BE READ, EITHER SEQUENTIALLY OR SIMULTANEOUSLY. THE 12-DIODE ARRAY READ HEAD ALSO PROVIDES THE ARDEV PLAYER WITH A PARTICULAR ADVANTAGE WHEN USING INTERACTIVE TRAINING PROGRAMS: THE ABILITY TO PLAY BACK STILL FRAMES, WITH COMPRESSED AUDIO, WITHOUT THE NEED FOR EXTERNAL STORAGE CIRCUITRY/PERIPHERALS.

Thomson-CSF of France was one of the first companies to enter into videodisc development. They began work on their system in 1968.

In the optical transmissive system the light from a laser beam is passed through a thin, flexible and transmissive plastic disc. The disc is 304 mm in diameter and 0.15 mm thick. Rotational speed is 1500 RPM in Europe (PAL/SECAM) and 1800 RPM for North American systems (NTSC). Each revolution corresponds to one videoframe so that random access and information storage is practical.

The disc records information through the implantation of a series of "pits" between 0.1 and 0.25 um deep. The number of pits per second is a measure of the luminance modulated F.M. carrier while the length of the pits is a measure of the audio and chroma F.M. modulated signals which are added to the luminance carrier. Because the disc is transmissive, the differential light path between the areas of pits and no pits modulates the laser beam as it passes through the disc and is collected by the photodetector. The laser in the system generates a 1 mW helium-neon light beam.

In recording, a more powerful laser is focused onto a coated glass disc. The beam is modulated by variable width and frequency pulses and the process continues in a spiral of pits of varying length and spacing. Once the disc has been exposed and the surface developed and made electroconductive through

conventional galvanic mastering processes, duplicating masters are prepared for replication by embossing or photopolymerization.

The player itself is microprocessor controlled. The basic unit includes the capability for program branching, random access, fast forward and reverse, slow motion, freeze frame and step frame. The playing time per side is restricted to 30 minutes but the laser can focus on either side of the disc without flipping so that the effective length of the program is one hour per disc. The unit can hold more information per disc side but then there is a loss of random access and freeze-frame capabilities. Because the Thomson-CSF is an industrial model the extra program length is of secondary importance.

Because the thin plastic disc does not require a reflective coating nor a protective coating, replication is relatively inexpensive. The disc is flexible but it is extremely sensitive to dirt, dust and handling therefore has a protective caddy, which as with the capacitance systems, is inserted into the player.

2. Reflective Systems

Reflective systems are the most common type in use today. This is because since 1978, DVA (DiscoVision Associates) has shipped its industrial player to 11,000 General Motors dealers in North America as well as to other customers.

Pioneer, DVA, Magnavox and Sony utilize the Philips/MCA patent. It is a non-contact laser operated system which uses reflective discs. The discs are either 203 or 305 mm in diameter and approximately 2 mm thick. Track density is about 600 per millimeter. If recorded in the constant angular velocity mode (CAV), one revolution corresponds to one T.V. frame. The alternate method of encoding is constant linear velocity (CLV).

Constant angular velocity means that the picture is encoded on the disc so that one revolution corresponds to one T.V. frame, and therefore when the laser follows the same track repetitively, the result is freeze frame. The laser moves from the centre outwards at a constant speed and the rotational speed also remains constant at 1,800 RPM (NTSC)

In CLV the pits maintain a constant relative speed as they pass the pickup unit. This means that as the laser tracks outward and the circumference increases the disc slows down to as little as 625 RPM.

CAV is a good technique for educational and information retrieval applications where a freeze frame feature is a requirement; CLV is also a good technique for entertainment discs because of the need for content space.

The coding process is very similar to that used in the Thomson-CSF transmissive system. A full 60 minutes of video can be stored per side with CAV, only 30 minutes with CLV.

In the reflective disc, there are a series of rectangular pits with the number of pits per second being a measure of the video modulated F.M. carrier signal. The length of the pits is a measure of the two audio modulated F.M. carriers that are added to the video carrier to produce pulse width modulation for the sound.

Playback uses a 1 mW helium-neon laser beam which illuminates the surface of the pits and is bounced back by the coating which reflects the laser beam for decoding by a signal detector. The depth of focus of the beam is between 1 and 2 um. Therefore, minor surface defects and blemishes on the clear protective covering do not affect the picture.

Master discs are glass upon which is a vacuum deposited chromium layer. On this layer is a photo-resist. The recording operator exposes a laser beam to the "resist" at a power fifty times that of playback. Alternatively, it is possible to use an even higher powered laser beam to burn holes in a thin metal alloy on the glass disc.

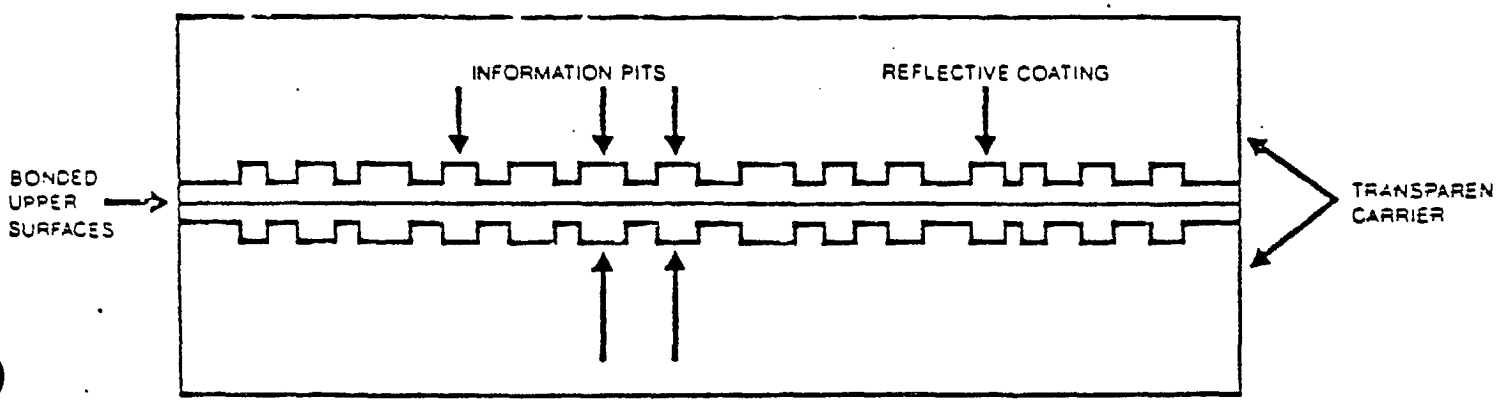
Replication of reflective-type discs has been approached by several different methods. DVA uses injection molding. Sony Corporation plans to utilize compression molding techniques as it does the audio replication. N.V. Philips, together with 3M Corporation, use the photopolymerization or "2P" technique.

"2P" involves coating a disc with a photoresist and then applying a stamper. The photoresist is cured by exposure to

ultraviolet light and normal processing follows. The "2P" process has the advantage of eliminating the problems of mix consistency and uniform pressing.

Regardless of the technique a permanent pattern on plastic is the result and the disc at this point is very similar to a Thomson disc. In the case of reflective discs, however, a reflective film is deposited, a protective surface layer is added and a second disc is bonded to the back to create a double sided disc of appropriate thickness (See Exhibit IX).

Exhibit IX



Double Sided Disc

D. INDUSTRIAL USER RECORDING SYSTEMS

N.V. Philips has developed an optical recording system to permit user in-house digital recordings. The "Philips Air Sandwich" disc design is as follows:

(a) the center part is a (round) sheet or layer of tellurium alloy;

(b) above and below the tellurium layer is a thin layer of clean air; and

(c) plastic encoats the whole.

The tellurium alloy has a lower melting or burning temperature than the plastic. The recording laser (light) beam penetrates the plastic and then burns the pits in the tellurium alloy. The playback laser also penetrates the plastic to read the recorded information.

The discs are pregrooved and preformatted. This does not require as expensive or complex recording equipment, because the header material is already on the disc and a laser can track an existing groove more easily than it can cut its own. Preformatting is done on the tracking grooves, and not on the recording groove in which a capacity of about 10^{10} user bits per side is available.

Error detection and correction is done automatically as the system is writing on the disc. If the error rate in the sector being recorded equals or exceeds the error-correction acceptance threshold, a secondary error-checking "reject" code is written,

and an "enable-next-sector" signal is blocked. In this way "bad" sectors are rewritten in which errors at readout may only be caused by disc degradation or improper reading. If the sector recording satisfies the error-checking capability of the system, an "accept" code is written and the "enable-next-sector" signal is then given.

The objective of this procedure is to raise the error-rate of the optical discs from the region of 10^{-5} (which is acceptable for image data) to better than 10^{-12}. Philips believes this system to be a more efficient means of correction which does not decrease the usable disc capacity as does the use of error-correction codes. There is room for debate on this claim because while the Philips system would have almost 30% of storage capacity devoted to error correction routines, RCA indicates a requirement of only 10% in its error-correction coding system.

Philips agreed to develop a recorder and transfer that technology to Magnavox, its North American subsidiary. The latter is to build a controller to interconnect the recorder to a DEC PDP-11 computer and to a digital player of a more rugged design and electronic sophistication than the ordinary videodisc player.

The capacity is one billion bytes of which 700 megabytes are usable per disc side; useful capacity per sector is 4,000 bits. With the use of glass discs, the archival life is

estimated at more than 10 years. A data rate of 2 megabits per second and a random access time of 75 milliseconds is expected.

Exhibit

PHILIPS D.O.R. DIGITAL OPTICAL RECORDING

Philips has been exploring still-frame audio capacity in which the sound is separated from the video so that sound can continue over a still-frame visual. Magnavox recently completed the construction of five prototype of these 5 M bits per second laser optical read and write digital systems.

RCA Digital Optical Disc. RCA in its optical as opposed to its capacitance (consumer) system also uses a tellurium disc. Recording data rates are in excess of 50 megabits per second and storage capacity is over 10^{11} bits per disc with the same laser and optic systems used to write and read. RCA has under development a system that will operate at 320 megabits per second to be used for mapping and data image processing by the U.S. Air Development Center.

RCA's error rates are 10^{-9} (one bit error per disc) achieved by use of an error-detection-and-correction (EDAC) codes. They add check bits to the data and the resulting information is redistributed with the check bits, allowing a 10% storage reduction. In order to reduce the Bit Error Rate (BER) below 10^{-9} RCA would have to make a substantial change in its formatting which is not in its present plans.

It is reported that RCA plans to release their digital optical system in 1982 at an estimated price of $500,000 per system with discs costing $50 each. RCA has also done some work with erasable discs and is evaluating the Corning Glass erasable medium. An RCA spokesman indicated that if both erasable and

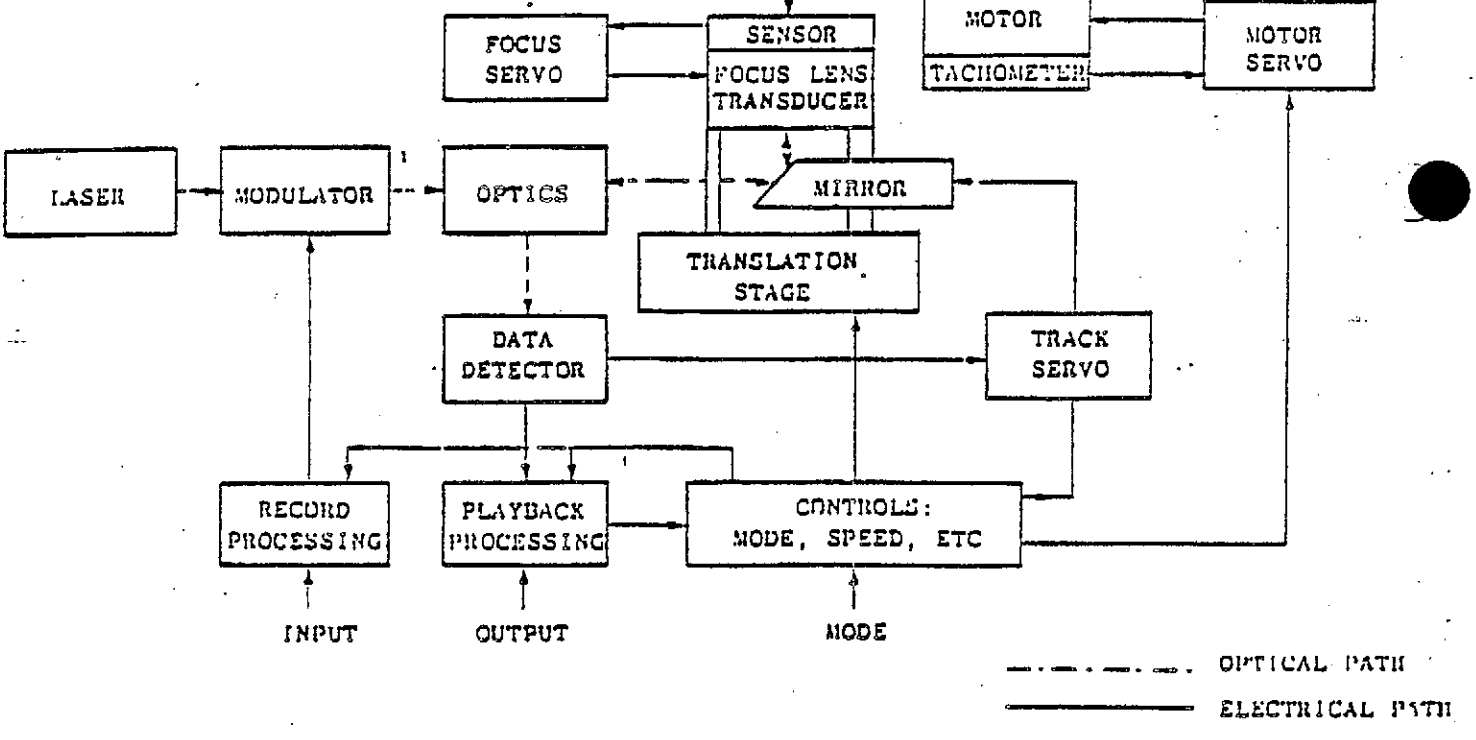
non-erasable discs were on the market, erasable discs would capture 50% of the market.

Exhibit X illustrates RCA's optical disc drive which is presently under development. There are three control systems in this unit which are common to most units: motor speed; laser focus; and, movement onto the track. The servo arm is mounted below the disc and this prevents the laser head from dropping onto the disc in the case of a power failure. This drive is intended for a "juke box" system holding 100 discs for a total storage capacity of 10^{13} bits of information.

Exhibit X

RCA OPTICAL DISC SYSTEM

RCA OPTICAL DISC SYSTEM



Thomson-CSF, through an agreement with Xerox Corporation is developing a write-once and read digital optical disc system for lower cost data storage.

The Thomson disc is a sandwich of plastic substrates with a thermal sensitive layer. The player has the following components: a read and write head composed of radial and vertical servoactuators which focus a laser beam on the sensitive layer with a light-spot diameter of about one micron; a moving arm which shifts the head onto required tracks; an electronic control set; and an electronic interface for coding and correlation of data.

Each 12 inch disc holds 10^{10} bits of information. Access times could be as quick as 100 milliseconds. Data transfer rate is 5 to 10 megabits per second. The disc will be able to be replicated after the user has recorded his documents on it, either by the user or through a service bureau.

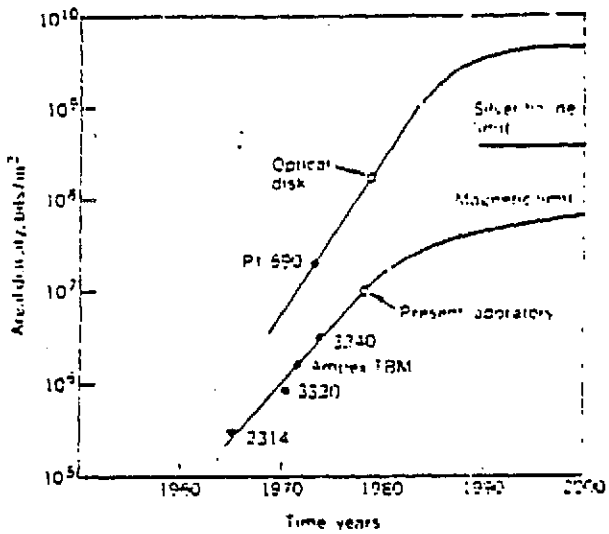
Thomson expects to implement error-correcting codes to obtain an error rate of 10^{-12}.

E. FORECASTS OF FUTURE TECHNICAL CAPABILITIES

1. Coding and Information Content

Magnetic recording has a limit of 10^8 bits/in^2 for content density, while optical recording can be expected to rise above 10^9 bits/in^2 as a result of current research. The access time and cost product for optical disc is extremely low, moreover the cost for disc as for all media will decline over the decade (See Exhibit XI and XII).

Exhibit XI



[6] Areal recording density vs. time for various recording mediums, showing that the ultimate optical disk limit exceeds that for magnetic recording.

[7] Access time vs. price for various storage technologies puts the optical disk in a favorable position.

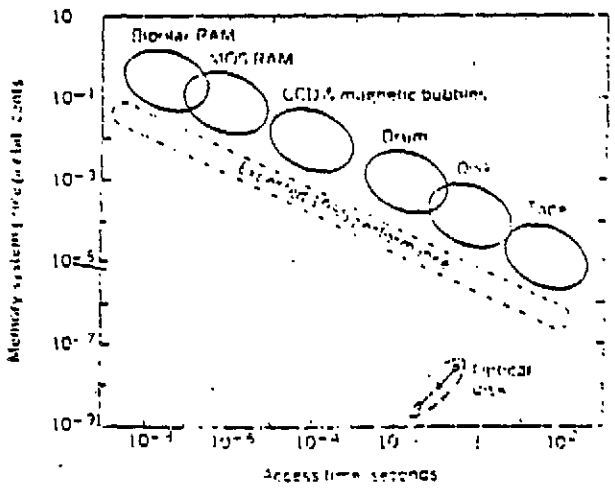
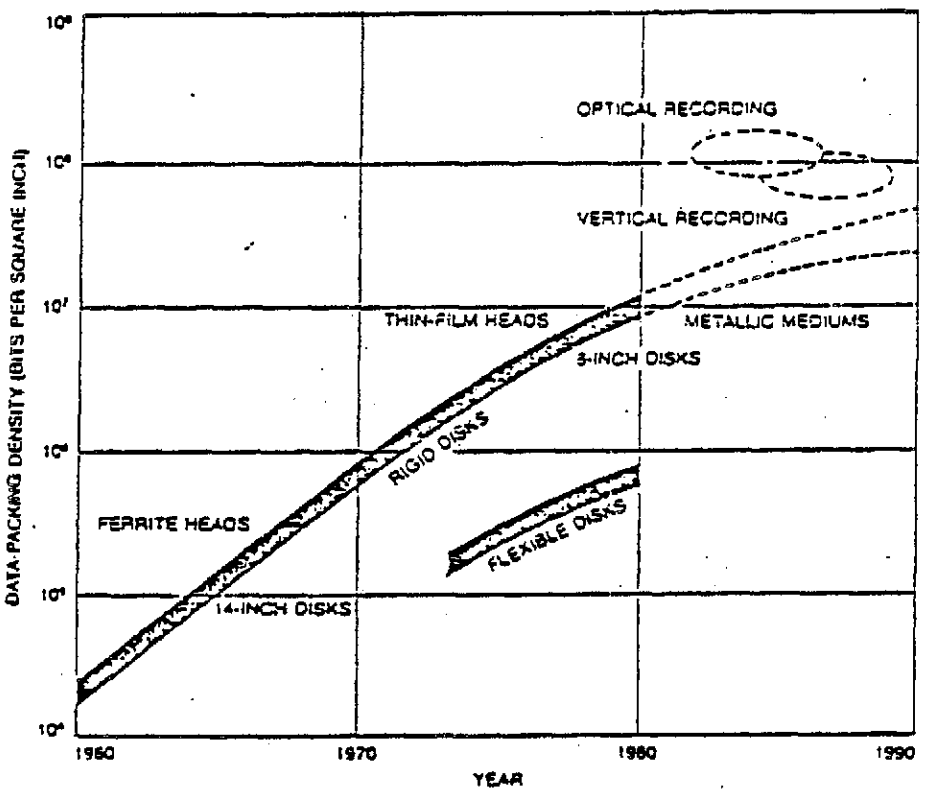


Exhibit XII



ADVANCES IN DISK TECHNOLOGY are reflected by advances in the packing density of data, expressed in this chart as bits per square inch on the surface of a disk. In rigid disks the magnetic medium is coated on an aluminum substrate; in "floppy," or flexible, disks it is coated on Mylar plastic. Two improvements are foreseen for the magnetic technology: the use of metal film instead of iron oxide as the medium on rigid disks and the recording of data in regions of magnetization oriented vertically, or perpendicular to the plane of the disk, instead of horizontally, the current practice. Optical disk technology might attain the greatest storage density.

In the next few years rapid developments of optical disc sub-systems can be expected:

- capacities of approximately 2 x 10^{11} bits on a single replaceable disc;
- larger, mass storage capacity through multi-disc units with capacities of up to 5 x 10^{12} bits;
- carousel or other "juke box" arrangements for products with very large capacities, up to 5 x 10^{13} bits.

Rewritable discs can be expected within the next five years.

Another improvement in the optical disc is the use of diode laser (semiconductor) technology which will remove the heat problem for the currently used gas laser. The expectation for diode lasers also include lower cost and longer life.

It is not expected that information densities will exceed 1300 M bits per square inch until late in the 1980s. However, by 1990 optical disc capacities of 10^{11} bits per side are projected. Track spacing will be reduced but not to less than 1.25 or even 1.5 microns for the next several years.

2. Home Information Systems

When considering the possible applications for a consumer market use of the information retrieval capability of the video-disc optical memory system, the idea of the "Live Encyclopedia" is a viable and attractive product. This new home information system would cost about 10% to 20% more than the present bound

encyclopedias, available today at between $700 to $800, yet it would have a considerable advantages over the printed versions:

- Bound encyclopedias have access problems due to their indexing systems since they have the combined objectives of being both an educational tool and an informational retrieval tool.
- As an educational tool it should permit a curriculum format, allowing the user to go from an introductory chapter through to specialized sections.
- As an information retrieval tool it should permit immediate access to detailed sections while permiting backward references to preliminary material or related topics.

A "Live Encyclopedia" would offer this branching capability with an additional advantage of a "Global View" feature which would allow varying levels from the highly knowledgeable to the casual user a "browsing" technique to access the information.

The Encyclopedia Britannica is divided into two major sections; the Macropedia, or quick reference guide; and the Micropedia, where detailed information is available in full text. For example, in the Micropedia, the topic of great white shark would be included in a chapter on fish but it would be under the specific reference "sharks" in the Macropedia.

In the Macropedia there are over 8000 illustrations and 4200 entries with an average length of 3214 words each. With

some 300 words per minute, or 50 words per ten-second picture, a total of 1,350,000 words per disc is possible. This capacity would permit the entire text of the Macropedia to be contained in a commentary on 10 discs which would have a total of 270,000 full color TV frames and 750 hours viewing time.

In playback, the still frame mode of the videodisc player would be controlled such that the entire audio frame track is read into a frame storage device (e.g. magnetic disc) for one disc rotation time (33 ms). After reading the audio track the controller would direct the player to play the related adjacent audio track continuously for 10 seconds. Exhibit XIII illustrates the proposed playback procedure.

While the video is displayed on the TV monitor, the compressed audio track is processed for time expansion. A CCD register is filled with the 4.2 MHz compressed audio and readout at 10 kHz normal audio rate. The size of the CCD register must be at least long enough to hold normal 10 kHz audio for one disc rotation time of 33ms. Such a CCD register should have about 1000 stages and a clock rate of 12.6 MHz. After ten seconds of decompressing the audio track and simultaneously displaying the video track, the process is repeated for the next pair of video and audio tracks. Additionally, it is possible to intermix the still pictures with sections of normal motion picture and audio, but with a reduction of the total viewing time.

The "Live Encyclopedia" could be offered with several levels of accessing methods in which a consumer could subscribe to a simple accessing mode with a numeric (calculator like) keypad. In this mode he would be prompted through his search with several menus indicating various choices. The second mode would include a alpha-numeric keyboard and a higher level programming system would allow him to use key-word retrieval to permit him access to specific segments.

Exhibit XIII

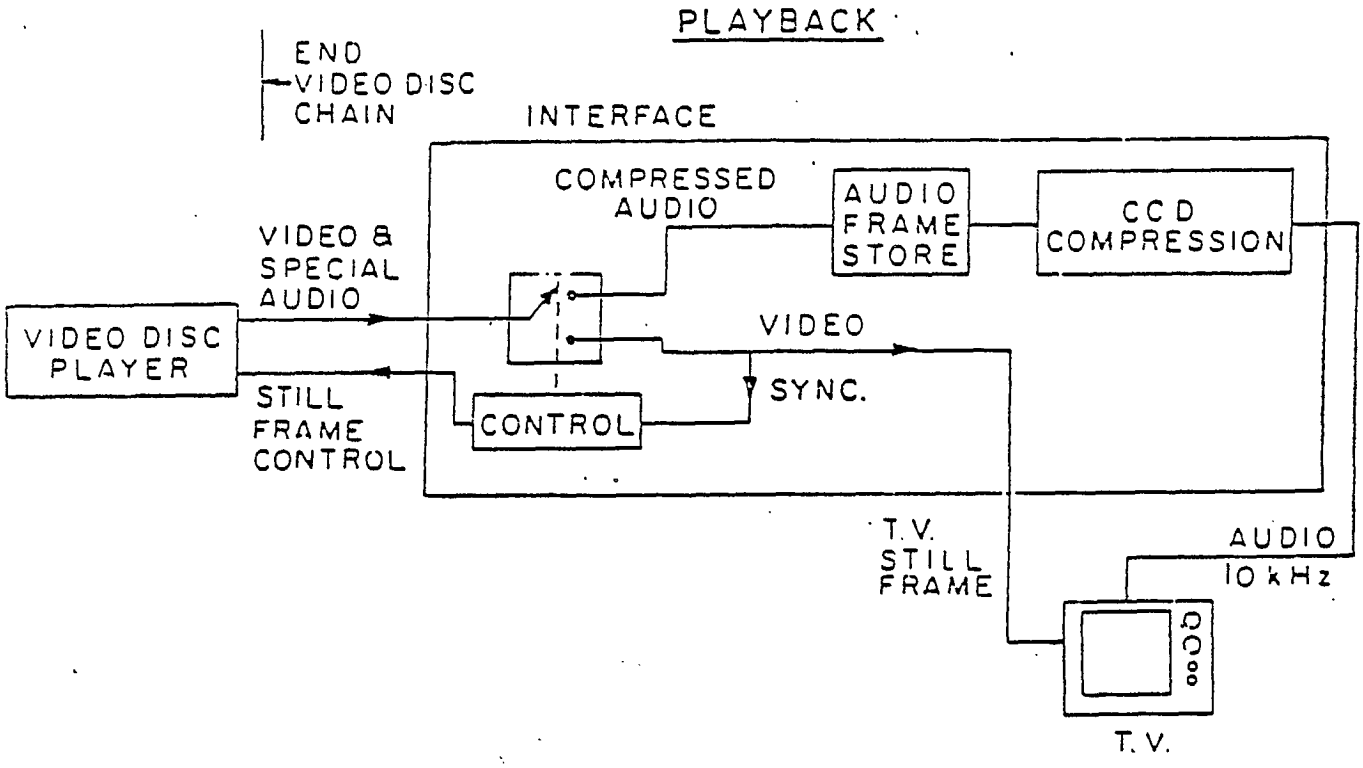


Figure 3.1

Playback of a talking encyclopedia disc.

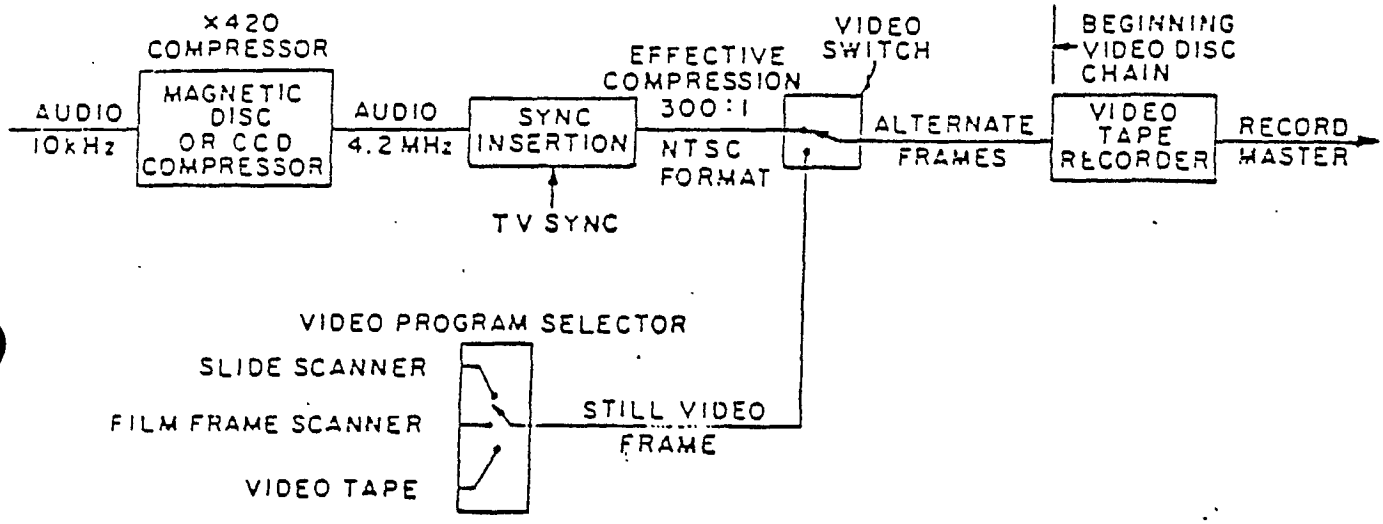
This application would be of most interest to the National Library, National Museums, and similar institutions in assembling program packages for use by the public. The fabrication of this "Live Encyclopedia" disc would require special processing of the audio tracks for an overall time compression of 300. The audio tracks must be formatted to conform to the NTSC standard. Exhibits XIV is a block diagram illustrating the recording of a talking encyclopedia disc.

The audio commentary is first limited to 10 kHz bandwidth and then time compressed by a factor of 420. Time compression can be achieved by recording the 10 kHz audio in real time on a special magnetic disc at extremely low speed (4.3 rpm) for 10 seconds, then replaying at the normal 1800 rpm speed. The resulting compressed audio will have a bandwidth of 4.2 MHz. After insertion of NTSC synchronizing signals, the effective compression is 300 to 1, with the compressed audio now compatible with the NTSC video format.

The video frame associated with the audio commentary is selected from either a slide scanner, or video tape. The still video frame is interleaved with the compressed audio frames such that the video and compressed audio frames alternate. This interleaved format is fully NTSC compatible and can be recorded on video tape and used as a program source at the beginning of the videodisc chain.

Exhibit XIV

RECORD



The principle of this technique would be the extension of the audio information associated with each video still frame. By encoding alternate tracks with time compressed audio of 10 kHz bandwidth, the program duration per track is about 10 seconds. This disc would thereby contain 27,000 full color video still frames and a total of 75 hours audio commentary. This format does not require any alteration of the normal consumer player and yet would increase the viewer's interface time from a half hour of a full motion video presentation to over 75 hours in the still frame presentation. Manufacturers have stated that it is feasible to compress audio to the level in which 30 seconds for each track could be obtained. This would extend the entire playing time to over 200 hours per disc.

3. Office Information Systems

The combination of the microprocessor and the videodisc with other forms of computer technology can realize a tremendous advantage in overall office information systems. Whether in combination with mini-computers or large main-frames, it can realize the potential of a new form of information system which offers executives and managers pictorial and graphic information on which to make decisions.[7]

This has been addressed in studies which have demonstrated that executive and professional decision-making can be well enhanced by this new form of "live data."[8] Initially, most automated office systems utilizing videodisc technology are

based for the most part on the use of central registry control over mail and internal memos.

One example of a prototype system for this type of application is the N.V. Philips "Megadoc" system,[9] being developed for large scale document handling. It stores 25,000 documents per disc in high resolution (2400 lines) and 50,000 in low resolution (1200 lines). Documents can be accessed within 75 milliseconds on a screen or provide a hardcopy in one minute. It uses a data compression technique which basically ignores all the blank spaces within a document while it can reproduce the document exactly.

The image storage above will be mixed with digitally encoded alphanumeric data. This form of encoding optimizes on the storage of the system by a factor of 10. Exhibit XV below illustrates the difference between the various modes of storing a typical typewritten of 8 1/4 by 11 1/4 (referred to as A^4).

Exhibit XV

10^{10} BITS/DISC

40,000 TRACKS/SIDE

128 SECTORS/TRACK

1 PICTORIAL A4 32 TRACKS

HIGH RES./WITHOUT COMPR.	2,500 A4's/DISC
HIGH RES./WITH COMPR.	25,000 A4's/DISC
STANDARD RES./WITH COMPR.	50,000 A4's/DISC
ALPHA NUMERICAL	500,000 A4's/DISC

The Megadoc project has been developing in the laboratory for the last 7 years but is not expected to be commercially available for another 3 to 5 years. Presently, there are four prototype systems operating in Europe.

The Megadoc videodisc has 40,000 grooves which are divided into 128 sectors which provides 1,000 bits each for storing addressable information.

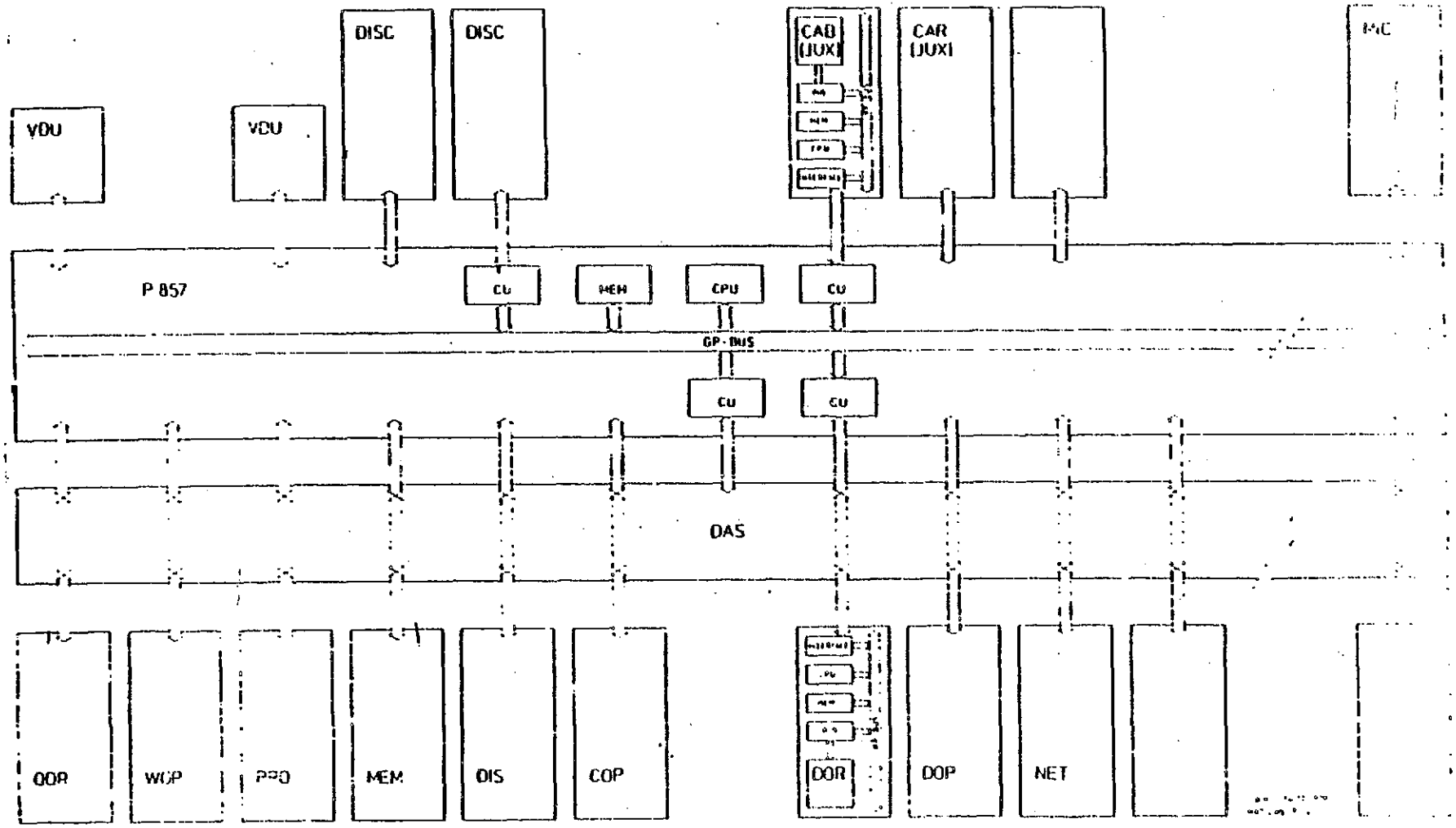
The optical reader is under the control of a conventional Philips P857 minicomputer, which requires a special interface to connect the computer to the optical recorder. As you can see in Exhibit XVI on the following page their is an interface to the recorder from the computer which feeds it new data. The recorder is a digital system which permits it to act as a conventional magnetic storage system. The abbreviation glossary below lists the equipment illustrated in the exhibit.

MEGADOC ABBREVIATION GLOSSARY

ODR - Original Document Reader
MEM - Transfer Memory
DIS - Document Display
DOR - Digital Optical Recorder
DOP - Digital Optical Player
JUX - Juke Box Modular System
PRO - Picture Processor
NET - Network Interface
COP - Hardcopy Unit
WOP - Word Processor
DAS - Data Switch
SYS - Software System

Exhibit XVI

MEGADOC SYSTEM HARDWARE



The use of a videodisc "juke box" permits 64 videodiscs to be handled by the system. The transfer of document information from one peripheral to the other will operate at a transfer time of one second for every 8 1/4 by 11 1/4 inch document. A simultaneous exchange between different pairs of peripherals will be possible with a maximum of 6 pairs out of 16 peripherals.

The Original Document Reader (ODR) is a laser scanning peripheral capable of reading documents as oddly sized as 11 x 17 inches into the system. The reader then transfers the document into recordable information bits in one second. The encoded document is then transferred into an "outboard" memory unit which has an 1/0 rate (input and output) of 4 megabits per second which is the same rate at which the ODR "reads" the documents. This is hooked into an available laser printer which can copy a document in one second.

Further development on the Megadoc system is expected to increase the total output rate of the memory to 300 megabits per second. This will permit the system to store high resolution documents using only document compression up to as many as 1.5 million documents.

Exhibit XVII

Another videodisc storage and retrieval system presently in prototype form is the system developed by the I.T.T. Research Institute of Chicago, Illinois.[10] Figure XVIII below is a block diagram of the components of the system. The size of each block is proportional to the cost of the component (except for the mastering equipment, which had used as a service). The image dissector, unlike a standard TV camera, does not do a raster scan but each of the four million (2000 by 2000) is individually addressable under control of a Visacom VC5000, which is comprised of a DEC PDP 11/03 cpu, analog-to-digital and digital-to-analog converters, and four megabit memory.

An entire page is captured at very high resolution with the image dissector and stored in memory. The image in memory is manipulated by computer software to extract a portion of a page. A standard TV signal is then created from the image of the page portion. This enables a good resolution in displaying a very legible page portion.

Exhibit XVIII

PROTOTYPE SYSTEM

PART THREE

PROGRAMMING THE VIDEODISC

A. PRODUCTION: THE PROGRAM PRODUCER'S ROLE

Programming material onto discs has not yet become an exact and standardized procedure. There are, however, some known basic production techniques as well as some difficulties to be realized and avoided.

1. Concept

There are several ways to prepare material for videodisc replication. Slides, flat art, motion pictures, videotape, computer and original video are resources on which to base production. The organization of the basic material is of paramount importance to the producers who must develop and follow closely a good and logical flow diagram. In some cases it may be as easy as determining a start and an end while in others there may be a requirement for computers, storyboards and a small army of designers and programmers.

Someone, and it may be the replicator, must make certain determinations as to where the program will start, whether it will have indexes, choices or pause points, where it will end and how it will end.

The following diagram provide graphic illustrations of the programming steps in producing an interactive videodisc.

Having given these illustrations, the step-by-step instructions for entering into the microprocessor are shown in Exhibit XIX, Microprocessor Programming Instructions.

Exhibit XIX

Microprocessor Programming Instructions

Program Step	Value	Command	Comment
0	151	PROG	Enter the "program write" mode
4	5	SRCH	Search to the index frame and freeze
6	2	RCLL	Call up register 5
8	360	STOR	Load 2 in register 5 for decrement
12	370	STOR	Load reward "tell" frame location
16		HALT	Load penalty "tell" frame location
17	0	AUD2	Stop program until next instruction
19	181	SRCH	Turn off channel 2 audio
23	7381	ASTP	Locate frame 181
28	7381	SRCH	Play to frame 7381 and freeze
33	3	INPT	Search to frame 7381 and freeze
35	33	BRCH	Accept user response from touch pad
38	47	BRCH	0 Invalid response
41	55	BRCH	1 Correct response
44	33	BRCH	2 Incorrect response
47	6	RCLL	3+ Invalid response
49		SRCH	Recall register 6
50	30	WAIT	Search to reward "tell" frame
53	0	BRCH	Freeze reward frame 3 seconds
55	7	RCLL	Return to index frame
57		SRCH	Recall register 7
58	30	WAIT	Search to penalty "tell" frame
61	1520	SRCH	Freeze penalty frame 3 seconds
66	2120	ASTP	Locate review start frame 1520
71	5	DECR	Play review section to frame 2120
73	28	BRCH	Subtract 1 from register 5
76	0	BRCH	Go to quiz if register 5 0
		END	Go to index if register 5 = 0 Exis to "program write" mode

A typical videodisc pre-mastering, mastering and replicating workflow for a videodisc with microprocessor programming is in Exhibit XX.

Exhibit XX

Videodisc Workflow

Approx. time	
	1. Telecine or video transfer to IVC 9000 videomaster. Can include U-matic videocassette with digital frame count.
	2. U-Matic videocassette is approved for quality of tranfer.
	3. Tape master drives laser which exposes photo resistant coating on glass based disc.
	4. Glass based disc submerged in chemical bath - result: removal of unexposed coating leaving "bump" like surface texture.
1 week	5. Acid etching on nickel master from contact with glass disc surface. Result: nickel master surface has "pits" instead of "bumps."
	6. Through a similar etching process the high quality nickel master is used to make a "mother" with bumps.
	7. A check disc can be made at this stage. In this case the mother is used in the injection mold process for a small quantity of check discs.
	8. Usually curing of the injection molded disc takes place in four (4) days. A check disc may not require the full 4 days.
	9. Reflective aluminum is vaccum deposited on the surface of each check disc side.
	10. A check disc side is sent to producer or other representative to verify frame count and microprocessor program.
1 week	11. Program verified and returned to DVA.

12. Verified program keystroked into the PROM burner - when program is "in" a program print-out is run.

13. Print-out is approved by producer who proofreads it against original program.

14. Approval is phoned to manufacturer.

1 week

15. Completed PROM data edited into audio track two of the videomaster head.

16. Repeat step 3 - to expose photoresist glass master.

17. Repeat step 4 - chemical bath for glass based master with bumps.

18. Repeat step 5 - acid etch high quality nickel master with pits.

19. Repeat step 6 - from nickel master make mother with bumps.

20. From mother make several daughters with pits.

21. From daughters generate injection molding stampers with bumps.

22. Begin disc quantity injection molding process - final discs have pits.

5 weeks

23. Discs cure 4 days.

24. Finished disc sides machined and bonded together.

25. Bonded sides coated with 6 mil of poly-vinylcloride.

26. Two sided disc remachined for hole size and roundness.

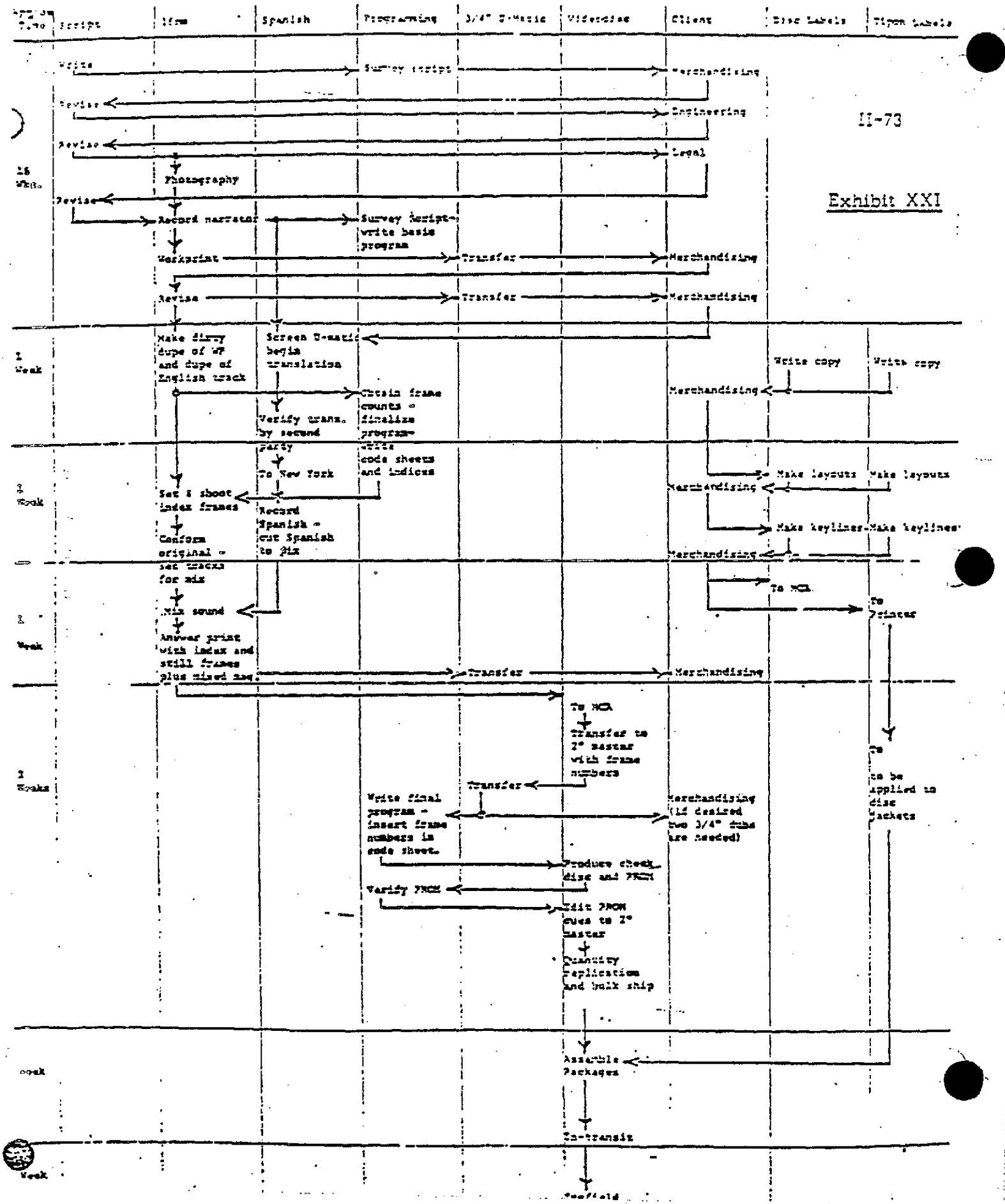
27. Each two sided disc quality checked.

28. Discs undergo label application and are inserted in sleeves.

For a more detailed example of videodisc production workflow and critical path see Exhibit XXI.

EXHIBIT XXI

Exhibit XXI



2. Preparation of a Master Disc

After a decision is made on the material to be recorded on the disc, the program must be transferred to a high quality videotape in preparation for disc mastering.

It is necessary to plan the mastering process carefully, for there are many systems in existence and even more procedures for set-up and operation. Hence, careful technical planning with the replicator is a requisite for the quality and success of the final product.

In almost all cases at least several transfers must be made before final release copies are produced. During these steps a 2" master tape provides a signal which has encoded the lead-in track, frame numbers, chapter stops, automatic stops and the lead-out track. The only other step of involvement for the producers at this point is to give approval of the first proof copy or "check disc" before volume replication is started.

The check disc also must have all frame numbers and programming verified. If a microprocessor program is to be encoded on the disc, then it too must be carefully checked at this point. Any error here may result in the rejection of all discs produced because the mistake is incorporated into a physical part of the disc and cannot be corrected after replication.

3. Film and Tape

It is likely that the original material will be film or tape. Normal production procedures are for the most part satisfactory for linear play type programs. If tape is used, then the control track should be coherent and synchronization signals must be up to proper levels so transfers will be satisfactory. If film is the medium then it should be formatted within SMPTE recommendations to allow for picture cutoff (TV safe areas: 90% safe action, 70% safe title).

If the program is to have freeze frames, then the transfer and preparation process is more demanding. A normal video frame consists of two fields each 1/60 second sequentially interlaced to create a 1/30 second frame. If there has been any movement of the image between or during the recording of the first and second fields, an unsatisfactory freeze frame will result due to interfield jitter within the frame, and a flickering blur will appear on the edges of the moving object. This problem is further amplified in systems such as the proposed JVC method which uses 4 fields or 2 video frames in its still frame mode. At present, there is no way to avoid this interfield jitter which is caused by freezing motion in video.

Exhibit XXII

THE STILL FRAME

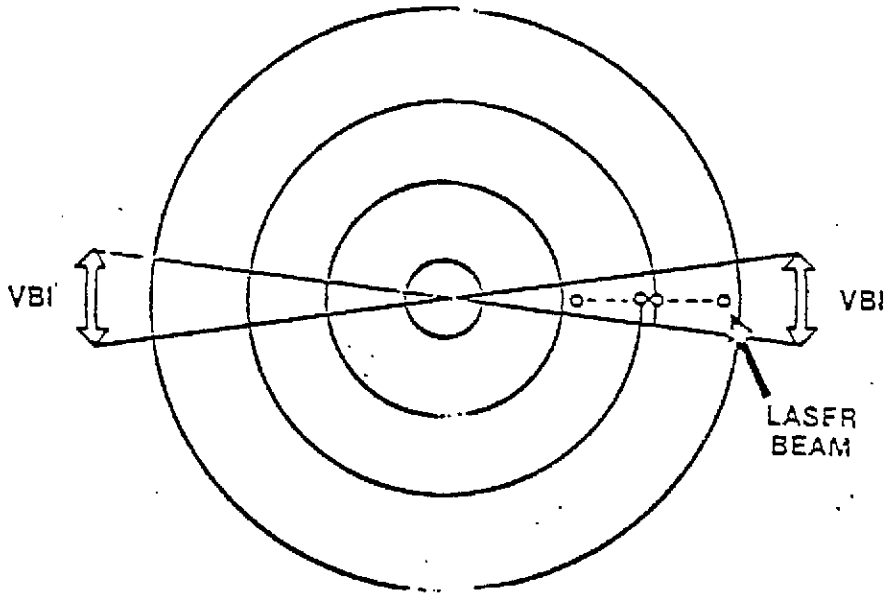


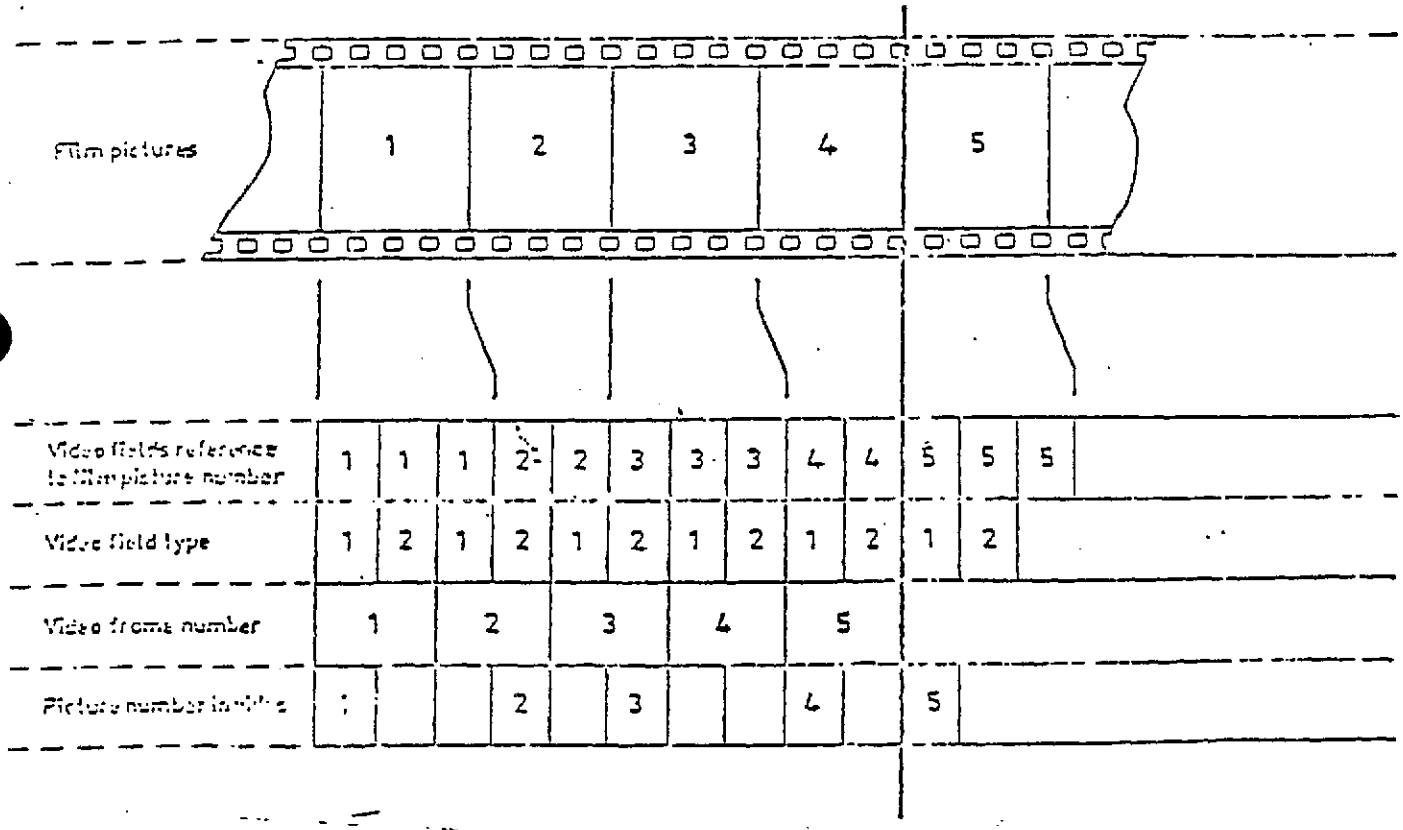
Exhibit XXII illustrates the freeze-frame mode. The laser beam moves away from the center as the disc spins and each single revolution constitutes one frame. In freeze-frame mode, the same spiral track will be reread by the light beam. At the vertical blanking interval (VBI), when the beam would normally begin to read the next track, it jumps back and rereads the same track and will continue to do so until it is activated into selecting another frame or motion continuity.

In film it is possible to overcome the same problem. In normal 24 frames per second (FPS) film to tape transfer, the 24 FPS of the film must be reconciled with the 30 FPS of the videotape system. This is done by allowing every other film frame to occupy three video fields instead of just two. This still creates a problem in freeze frame. The player now has an "extra" field to confuse its counting system. This is overcome electronically in the DVA system by inserting a "white flag" which is able to signal the laser to begin the freeze frame at the proper point.

Because video to film relationship is now effectively 1:1, a good freeze frame will result. The video frame's two fields are both taken from the identical image on the film frame which has had its motion stopped at the time of original filming. (See Exhibit XXIII)

Exhibit XXIII

Film/Video Conversion Process



An even simpler method of film preparation would be to shoot original film at 30 frames per second. This would eliminate the need for the white flag since a 1:1 relationship between film and video frames is created. Unfortunately, the 30 FPS film system is not a standard in common use. Therefore, when the freeze frame capability of any player system is considered an important feature, careful consideration of the source material must be made to insure that field interlace does not cause objectionable instabilities of the display.

FOOTNOTES

[1]Brochure, TMIS, Training and Maintenance Information System. Hughes Aircraft Company, Ground Systems Group, Fullerton, California. n.d.

[2]The list of companies developing digital optical players and recorders is indicative of the seriousness with which industry views this area. Included are such well-known names as IBM, Exxon, Xerox, Philips, RCA, Bell Laboratories, Thomson-CSF, Wang Laboratories, Control Data, Storage Technology, Burroughs, NCR, Hitachi, Toshiba, Sony, JVC, DiscoVision Associates, Hewlett-Packard, Magnavox, General Electric, Kodak and McDonnell-Douglas. Many smaller firms are involved as second source suppliers. A number of companies will not even admit what they are doing.

Some of the developments noted indicate that:

a) IBM is believed to have digital optical disc development programs in its San Jose, CA, and Austin, TX facilities, as well as ongoing work at its Yorktown Heights, NY research centre.

b) Exxon is thought to have the most advanced digital optical system with its Star player from the Star Division of Exxon Enterprises, Inc. at Pasadena, CA. Curiously, this division is up for sale.

c) Xerox, through its Optimem Division in Palo Alto, CA has a product line with a 1 Gigabyte drive using the DRAW technology which is expected on the market in 1983 at $3-$4,000 U.S. This is far below the cost expected by industry analysts. Its optical document storage system based on the above disc is expected to reach the market at the same time for $15-20,000 U.S.

d) The Toshiba Corporation's DF-2000 document filing system developed to some extent by SRI International of Menlo Park, CA, combines a laser-scanner and laser printer module with an optical-disc memory module as a system priced at $60,000 for delivery beginning late 1982. Analysts suspect the price will be closer to $45,000.

e) The developments by N.V. Philips and N.A. Philips have been described before. Essentially N.V. Philips is developing the digital optical recorder (DOR) in a system called MEGADOC which is designed for the automated office and priced in the $500,000 U.S. range. The North American affiliate is working on even larger systems of document data storage and retrieval for application to government, the military, and huge corporations, i.e. oil companies.

f) RCA's Applied Physics Laboratory in Camden, NJ is working on a high performance opto-electronic system using a more powerful laser. It is reported to store 12 Gigabytes of data and record at 50 megabits a second. There is also work being done with Corning Glass on an erasable disc. The system is expected to cost $500,000 U.S. with discs at $50.00 and be out sometime next year.

g) Little is known about Kodak's work. It is reported to be close to a photo-reflective disc based on photographic foils.

(i) Another development is the Quixote Recorder developed by Quixote Corporation that allows fast processing of discs without the need of master metal tooling. Copies can be played satisfactory on existing optical players. In contrast to the "Ardev" photographic based system it is a "pit" technology.

[3]Interview with Mr. Richard Kenville, Manager, RCA's Applied Physics Labs.

[4]Strategic Business Services, Impact of Videodisc Technology (Optical Memories) on Existing Media and Equipment, vol II San Jose, 1980.

[5]R.L. Hunt, "Special Applications Market for Optical Videodisc," IGC Conference, July, 1976.

[6]K. Broadbent, "A Review of the MCA DiscoVision System," Journal of SMPTE no. 83, July, 1974.

[7]Peter Schipma, "Text Storage and Display via Videodisc," IIT Research Institute Report, 1979.

[8]James Martin, "Principles of Computer Data Bases." 1978.

[9]Dr. J.A. De Vos, "Megadoc; a Document Archiving System," July 1980 at Institute Graphic Communication Conference.

[10]John M. White, "Mass Storage System," IBM Systems Journal, October 1978.

CHAPTER III

ECONOMICS OF THE VIDEODISC

A. INTRODUCTION

It is contended that videodisc applications to the consumer and business sectors of the economy are practically limitless. The development and application of this technology to all of these various uses, however, face numerous obstacles, both technological and economic.

In the consumer-entertainment market, the videodisc is faced with competition from video cassette recorders (VCRs), and cable and pay television. Prices, features and availability of both hardware and software of videodisc and the VCR will likely be significant factors in consumer decisions.

Questions have been raised about the potential of the demand for videodisc to support three different, incompatible technologies, and whether in fact the mass consumer market will readily adopt the videodisc. The development of this market will depend on a variety of supply and demand considerations, and the structure of the industry itself. In Canada, industry related to videodisc is very slight. In the U.S., Europe, and Japan,

the industry is developing, but is likely to go through various adjustments and "shake-outs" in the next few years.

This chapter is a much simplified and reduced version of the full economic analysis prepared for the Videodisc Study Project. Some of the original content is synthesized within the context of other chapters such as the Chapter I - Corporate Analysis.

Also, it should be noted that the sale by DiscoVision Associates (owned equally by MCA and IBM) of its 50% interest in Universal-Pioneer at the time of publishing this report withdraws DVA from its videodisc business and leaves it all to Pioneer except for management of the patents. Pioneer has indicated it will take over DVA's responsibilities and retain much of the existing staff. It expects there will be no interruptions in fulfilling existing commitments and plans to open a U.S. pressing plant within a year.

It was not possible to reflect this change of ownership throughout the following content.

B. SUPPLY ANALYSIS

The success or failure of the videodisc system will depend partly on the quality, performance features and costs of the hardware, but perhaps more essentially on the quality, quantity, variety, costs and marketing of the software.

1. Videodisc Hardware

As outlined earlier, three different player units have been developed, employing three different, incompatible technologies. The following compares the costs of the different videodisc players.

a) LV: Philips-MCA System

(i) Magnavox

The Magnavox Magnavision player was the first videodisc player to become commercially available in the U.S. in late 1978 selling for $775.00. Magnavox is planning to add a second unit to its line, a step up model with remote control, fast and slow motion, freeze frame, stop, search and index.

(ii) Pioneer

U.S. Pioneer was the second manufacturer to place a player in selected markets (LaserDisc - $749.00 U.S.). Pioneer also plans to add a higher-priced remote model to its line.

(iii) Universal Pioneer Electronics

This Japanese firm is currently manufacturing an industrial model of the laser optical videodisc player (DVA 7820) and is

reported to have sold over 10,000 to General Motors. Price varies with volume with a single purchase cost of about $2,800.00 in Canada.

(iv) Sony

Sony is currently supplying its industrial players to the Ford Motor Co. With a larger micro-processor memory than the DVA 7820, it is reported to sell singly at close to $4,000.00 U.S.

b) CED: RCA System

The first CED model produced and marketed was the RCA Selectavision Videodisc Player at $499.00 U.S. In mid-October, 1981 it was launched in Canada at $699.00. A compatible system is marketed by Zenith, Sears, and Radio Shack, under their own brand names.

c) VHD: Matsushita-JVC System

The signal guided video high density (VHD) system is not expected on the U.S. market until June 1982. The video players are expected to be supplied in the U.S. under such brand names as Panasonic, Quasar Technics, National and Sharp.

d) Thomson-CSF System

A fourth videodisc system does exist but only for industrial and educational purposes. This is the Thomson-CSF player, which is an optical laser-based transmissive system. It is priced at about $5,000 in Canada.

The videodisc player, as is the case of VCRs, stereo systems, tape recorders, cameras, the other such video/audio

equipment, will carry a variety of features and may range from a basic stripped-down model to a stepped-up or more sophisticated model. A recent survey of retail outlets in the U.S. revealed that the average selling price of an RCA player was $486 and discounted as low as $269; the most common selling price for a LaserDisc player being $699.[1] (discounted as low as $539.50). The VHD player is expected to retail in the U.S. for approximately $650.

The VCR industry in Japan is rapidly becoming a major industry in production, exports, and sales. During the 1980's, VCRs replaced color televisions as Japan's biggest foreign exchange earner. Manufacturing 90% of the VCRs sold worldwide, Japan produced .8 million VCRs in 1977, 1.5 million in 1978, 2.2 million in 1979 and in 1980 the figure was 4.5 million, up 102% from 1979. Estimates by the Japanese Ministry of Trade and Industry projects a total of 8-8.4 million VCRs in 1981 and between 10-12 million in 1982. Of these, 60% are VHS and 35% Beta (5% others). Distribution in both Japan and the U.S. was about 65% VHS and 35% Beta. For Europe the split was 70%/13%/17% for VHS/Beta/ V2000. By contrast, the total number produced in the U.S. in 1980 was 764,000 units.

Table III-1 contains one estimate of the cost elements of producing and marketing the videodisc player in the U.S., with costs expressed as a percentage of the retail price.

Table III-1

Estimated Cost Structure: Videodisc Players
(U.S.-Made Player)

Item	Cost (as % of Retail Price)
Production	45
Manufacturer's Margin	12
Distributor's Margin	13
Retailer's Margin	25
Sales Tax (U.S.)	5
	100

Source: Mackintosh International, Euroview Report: Video Disc Players (England: Mackintosh House, 1980).

2. Videodisc Software

Software will be critical for the videodisc system and its success will to a large degree be determined by the software market. This includes the consumer home-entertainment market and the business/educational market.

a. Home Entertainment

i) Availability and Quality of Discs

Since the videodisc player can only be used for playback of pre-recorded programs, software will be the key to its marketing. There must be plentiful, high-quality, inexpensive pre-recorded programs if it is to make significant inroads in the home entertainment market.

The high number of rejects at the manufacturing level for every videodisc which reached a retail outlet added to the cost of retailing the discs. The originally announced price of $15.95 for a feature movie jumped quickly to $24.95. However, DVA claims that rejects are not that significant in terms of cost. It points out the analogy to integrated circuits for which a 20% success rate is considered good. The material cost of rejects is slight. It now appears that DVA will close much of its Costa Mesa, CA replication plant and turn over mass replication for the consumer market to the Pioneer plant in Kofu, Japan. Currently, RCA reports a disc return rate of only one percent.

Nor has there always been a plentiful supply of software. When Magnavox introduced its Magnavision in late 1978, it

published a catalogue of 202 titles, most of which were unavailable. The MCA mid-1980 catalogue included 150 titles of which over one-half were feature films. Pioneer advertised a variety of programs of which approximately one-half are movies and claimed to have approximately 100 movie titles available for videodisc.

RCA produced a list of 100 titles when it officially mass-introduced its Selectavision on March 23, 1981. Approximately one-half of these titles were movies. RCA released 25 more titles in May 1981 and reached 151 titles by the end of 1981. In early 1982 it expects to stamp 186 titles with 32 of them for CBS and by the end of 1982 RCA/CBS may reach 400 titles.

JVC-VHD expects its initial VHD library to include at least 160 major motion pictures, approximately 40 of which will be musical to utilize the system's stereo sound.

ii) Program Sources and Supply Alignments

A major source of programs for software are the movie studios. Other sources include TV networks, music recording companies, and independent producers.

The manufacturers of the three formats of videodisc have entered into a variety of alliances for the purpose of supplying programs for discs and for pressing the discs.

LV Format. With the pressing of 3 million laser discs to date, DiscoVision Associates has been the primary producer and has recently licensed the 3M Co. of Minnesota for the mastering

and replication of LV videodiscs. In the same format, Pioneer Electronics has recently opened a replication plant in Japan.

DiscoVision has also signed custom pressing agreements with a number of producers and suppliers of programs for the LV disc, which includes two leading software companies -- 20th Century Fox Video, Inc. (formerly Magnetic Video) and Paramount Home Video. Fox Video is the largest marketer and distributor of pre-recorded software. Under this arrangement the discs will be pressed by DiscoVision Associates and distributed world wide by Fox Video, and in the U.S. in conjunction with Pioneer Video.[2]

Recently, Columbia Pictures Home Entertainment, and Disco-Vision concluded an agreement on production of laser discs. In another arrangement Pioneer Artists has signed an exclusive agreement with Covent Garden Video Productions for rights to home video discs of the Royal Ballet and the Royal Opera[3]

CED Format. RCA has pursued an aggressive purchasing policy of hundreds of titles from a large number of sources, including Paramount Pictures, United Artists, and Walt Disney Productions. Also RCA discs are pressed and replicated for the MGM/CBS Home Video label. CBS Inc. has a disc pressing plant under construction for CED disc replication. By the end of 1981 RCA produced about 3 million discs and estimated a disc/player ratio of 18 to 1 which far exceeded expections. The first CED stereo disc, a Paul Simon concert, has been mastered (a big LV

Pioneer seller) for June, 1982 release. RCA originally did not intend custom pressing until 1984, but now may do so earlier.

VHD Format. VHD Programs Inc. has concluded an agreement with United Artists which makes available to VHD Programs Inc. the entire library of theatrical features for release on VHD videodiscs. VHD Programs also received licensed videodisc rights to future United Artists films.

VHD Programs Inc. also recently announced a new custom pressing agreement which gave it access to the MCA film library. VHD Programs Inc. is also negotiating with Walt Disney Productions, Filmways, Time-Life Films, Warner Home Video, and Columbia Pictures for programming.

iii) Program Distribution

A number of companies (wholesale or manufacture) have entered the disc software business to provide programs for the disc. A wholesaler or manufacturer is a company which has acquired the license or the right (exclusively or non-exclusively) to offer a program for sale or rental on specific video formats for personal use at home. Between the wholesaler or manufacturer and the retailer there are a wide variety of intermediate distribution methods.

Finally come the retailers of the software. Examples of the methods by which video software is made available to the public are presented in Table III-2 which provides profiles of a few selected manufacturers or wholesalers of programs.

The software retail network can be divided into four categories: video software specialists, hardware/software specialists, general electronic and general merchandise outlets. RCA's surveys have indicated 70% of CED discs currently are sold through hardware dealers. This is an important consideration for RCA because if it does permit extensive custom pressing, control of disc selling may be lost by the dealers. In the face of heavily discounted player sales, this is the dealer's only real profit opportunity. While RCA may want to further the sale of "blades" through as wide distribution as possible, the dealers may become reluctant to promote the "razors" when lacking a profit incentive.

TABLE III-2

Profile of Selected Wholesalers or Manufacturers of Video Programs

Columbia Pictures Home Entertainment
(a division of Columbia Pictures Industries Inc.)

Programs for Beta, VHS videocassettes and for LV videodisc system. Include titles from Columbia Pictures, Cinema V Ltd. and Quartet Films. Videocassette duplicating facilities. Independent reps. marketing cassettes and discs to retailer.

Walt Disney Home Video
(a division of Walt Disney Productions)

Programs for Beta, VHS videocassette and VHD disc format. Duplication is handled by U.S. Video & S/T Cassette Duplicating., Manufacturing reps. and direct mailing. Sale or rental (one of only 2 major studios to adopt a rental program. Authorized dealers pay a single fee to Disney to acquire a cassette for a period of 13 weeks and may rent it any number of times. Emphasis is on rentals. Disney cassettes rent for $26 to dealers for 13 weeks.

Nostalgia Merchant
(owned by Garrett Enterprises)

Over 150 classic movies; serials (i.e. 15 episodes of Captain Marvel); cartoons; and other films from United Artists, Warner Bros., Hal Roach, Wrather Corp., Republic & RKO, provided on Beta & VHS VCR formats. Sale direct to consumers. Also through 2000-3000 retailers. Forbids rental or exchange. Licenses titles to Video Classics of Australia, and plans to distribute directly in Canada.

20th Century Fox Video, Inc.
(formerly Magnetic Video Corp.)

Primary distributor in U.S. of feature films with over 300 titles in its catalog. Beta and VHS formats in cassette; LV disc format. 1000 cassette duplicating machines on its premises. Custom pressing of discs by DiscoVision. Retail mail order club. Four field offices and 80 independent distributors. Over 6000 retail outlets. Sale & rental. Distributing outlets in France, U.K., Canada & other countries. Also distributed through Sony outlets.

Table III-2 (continued)

Warner Home Video
(subsidiary of Warner Communications)

Source of programs include Warner Bros. Pictures, Orion Pictures, The Ladd Co., New World Pictures, on Beta & VHS formats. Only channel for distribution is WEA Corp., with 8 branches and 22 district offices. Rental & lease/purchase.

Pioneer Video Inc.
(marketing subsidiary of U.S. Pioneer Corp.)

Programs from Paramount Pictures, music contracts with individual artists, and opera and ballet from Covent Garden Video. Discs pressed by DiscoVision Associates. Pioneer and Paramount dealers and representatives.

Paramount Home Video
(subsidiary of Paramount Pictures Inc.)

Paramount programs for videocassette and videodisc (LV) 81 titles currently on video cassettes. Discs pressed by Disco-Vision Associates. Paramount retailers and distributors.

Source: The Video Programs Retailer, July/August, 1981.

(vi) Program Rentals

The patterns of program distribution have undergone changes since the introduction of the VCR. At this time there is little systematic rental plans for videodiscs. This is probably attributable to the overall shortage of copies in spite of the slow player sales. Initially there were considerations of having sufficient programs widely enough distributed to support VDP sales. Subsequently player owners purchased far more software than expected. When disc rental will be a factor is unknown but RCA may permit custom pressing earlier than 1984 which would hasten the process.

In the case of videocassette rentals, some studio distributors maintained a sale-only policy (20th Century Fox), others rental-only policy (Disney). The problem centered on securing the greatest return to the program producer while ensuring accurate accounting. The sale-only policy could not ensure that the retailer having made the initial purchase didn't put the cassette in the rental market which increased the number of "exposures" and then resold a discounted used tape. The major studios maintained that each rental was a showing and should constitute a performance fee but had no way of enforcing this.

A rental-only policy would mean that cassette would be rented to a dealer for a fixed time (e.g. 13 weeks, and returned or re-licensed for another period). Any cassette in consumer

collections would be deemed pirate tapes since none of these titles were to be sold.

The sale only approach assumed that the total royalty would satisfy the producers and any of these titles offered for rent by a dealer or club would violate the sale contract to the dealers.

The approach the studios then took was to issue two different packages for tapes of each title. Sale tapes could only be sold, rental tapes could only be rented. In the face of massive dealer resistence, this approach was softened slightly to setting up two categories -- the rental-only type and the L/P or lease purchase tape which the dealer could sell or rent and then sell. Within the rental-only category, a classification system has begun. Warner Home Video, for example, has designated "A" and "B" titles and licenses, "A" titles by 28-day cycles in a sliding scale -- $22.00 the first cycle, then $18.00, then $13,00, and $12.00 for the fifth and any subsequent titles ("B" titles cost half this amount). This means the dealer initially rents the title at $4.50 a week and must re-rent the tape a number of times a week to make a profit. The L/P arrangement allows the dealer to buy the tape on the installment plan.

The Warner Home Video plan still has not pacified the dealers nor have other similar plans suggested by competing studios.

MGM/CBS Home Video's plan is to charge dealers $60.00 for a 90-day licence but give the dealer the right to purchase after

the "window" is closed. MCA videocassette and Paramount Video Distribution are more strongly attuned to sales, whereas Walt Disney Telecommunications has labelled the U.S. Home Video industry "tremendously troubled" because in the company's view some studios treat movies as a commodity (for sale) rather than an event (for rent). Its president, James Jimarro, noted that the business is one of "growing hostility" between retailers now that Hollywood wants to regain control.

Some criticism has been made that these approaches will severely limit the amount of choice the dealer can offer the consumer. It has also been noted that while rental exceeds purchase by 20 to 1, shortly after release this changes rather rapidly and dealers may be caught with leased tapes for which there is little rental demand. Some of these plans and the attendant accounting is deemed so complicated that merchandisers like J. C. Penney are planning to leave the videocassette rental business.

The whole area of Home Video rental distribution is in some confusion as each of the major suppliers has a different system as it tests for the most acceptable and profitable approach.

v) Software Prices and Costs

Retail prices in the U.S. of discs released to date range from a low of approximately $10.00 to a high of approximately $29.95. A few exceptional titles exceed $30.00, such as the long-playing movie "Jesus of Nazareth" which retails at $99.98.

Table III-3 contains two estimates of the distribution of costs in the production and marketing of the videodisc.

Table III-3
Estimated Cost Structure: Videodisc

Estimate A

Item	$	Cost (% of retail price)
Factory Cost		
Manufacturing	1.00	4
Royalties to Producers	2.00	8
Promotion	1.50	6
Overhead	.25	1
Miscellaneous	.25	1
Profit	6.50	26
Total Factory Cost	11.50	46
Wholesale Price	13.50	54
Retail Price	25.00	100

Source: Television Digest, March 3, 1980. Estimate made by Argus Research, Inc. of the RCA CED format disc.

It has been estimated that the per copy cost of videodiscs breaks even with the cost of videotapes at about 100-250 copies, depending on the size of the tape, and then rapidly becomes cheaper in larger numbers. In other words, the marginal cost of producing discs declines much more rapidly than does the marginal cost of tape and this is shown in Table III-4.

Table III-4
Per Copy Costs for One-Hour Motion Visual Program

Medium	Quantity			
	1	10	100	1000
16 mm film	$3,591	$624	$242	$187
3/4 inch video cassette	65	55	50	47
1/2 inch video cassette	67	37	27	23
Video Disc	3,500	350	40	13

Source: E. Sigel et al., Video Discs The Technology, the Applications, and the Future (New York: Knowledge Industry Publications, 1980. Data based on information issued by Disco Vision Associates.

Table III-5 shows a comparison of per copy costs of disc vs tape. As shown, the crossover point is somewhere beyond 150 units.

TABLE III-5

Video Disc vs. Video Tape
Per Copy Cost Comparisons

	Disc				Tape			
Qty.	Type I 30 Min	Type I 60 Min	TypeII 30 Min	TypeII 60 Min	3/4" 30Min	3/4" 60Min	1/2" 30Min	1/2VHS 60Min
10	212.50	420.00	256.50	508.00	28.75	42.50	23.10	26.10
30	75.83	146.66	91.16	177.33	26.75	39.25	21.10	29.00
50	48.50	92.00	58.10	111.20	25.25	37.00	19.85	26.90
100	28.00	51.00	33.30	61.60	23.75	35.25	18.30	25.35
150	21.16	37.33	25.03	45.56	23.75	35.25	18.30	25.35
200	17.75	30.50	20.90	37.30	23.75	35.25	18.30	25.35
300	14.33	23.66	16.76	28.53	22.75	33.65	17.55	23.90
500	11.60	18.20	13.46	21.92	22.00	32.00	16.75	22.40
1000	9.55	14.10	10.98	16.96	21.25	30.85	16.25	21.40
1500	8.86	12.73	10.15	15.30	21.25	30.85	16.25	21.40
2000	8.52	12.05	9.74	14.48	20.95	30.00	15.95	20.75

Video Disc Front End Costs

Type I

Tape-to-tape encoding	$ 550 per side
Manufacturing set-up	1,550 per side
	$2,050

30 min. disc - $ 7.50 each
60 min. disc - $10.00 each

Type II

Tape-to-tape encoding	$ 550 per side
Manufacturing set-up	1,650 per side
Data Entry	60 per side
Check Cassette	120 per side
	$2,480

30 min. disc - $ 8.50 each
60 min. disc - $12.50 each

All prices U.S. dollars.
Source: DiscoVision Associates, July, 1981.

b) Business/Educational Software

Much of the software produced and contemplated for industry is geared for educational and training purposes.

Most of the educational programming currently available on discs is not original but has been transferred to the disc from existing audio/visual formats. However, there does exist a small but growing industry, comprised of a number of experimental and pilot projects, to develop educational and training programs specifically for the disc to take advantage of its various capabilities.

In addition to the various special experimental projects being conducted in the U.S., Sandy Corporation of Michigan has become involved with programs for the DiscoVision Associates model PR-7820 industrial videodisc player. M. J. Petro Productions, Inc. of Windsor, Ontario is producing much of the videodisc content for GM Canada. The discs are bilingual and the production is Canadian except for mastering and replication.

GM chose videodisc for this purpose over videotape or film because of the videodisc's almost instant access to any program segment. Similarly the U.S. Armed Forces, Hughes Aircraft Company, Boeing Aerospace Company and others are placing instruction manuals on the disc to assist in training workers in the manufacture, use, and maintenance of equipment.

C. MARKETING STRATEGY

RCA is aiming the marketing of its videodisc at today's television markets. They claim that its CED player is not designed for the affluent, sophisticated video and stereo oriented purchaser whose prime interest would likely be a VCR with all of its various features. Rather, RCA has focused on the market of the American middle class; the family centered, simple-machine-operation preference, TV-oriented purchaser who enjoys movies and is not served by cable/pay TV.

It is claimed that RCA's sought-after market of the middle-America purchaser is reflected in the programs offered on the CED discs. Their opening catalogue appears to be more "classic" than "hit" oriented. Its target market for the CED is not the gadget-prone audio/videophile, single young males, who are interested in the latest and highly- promoted recent releases, but more the stay-at-home, color TV watching type of family.

RCA claims that its videodisc system is family oriented, like color TV, while the VCR is male oriented. They believe that some distance must be kept in prices between a disc player and the VCR and between discs and tape cassettes.[4]

While on the one hand RCA has placed itself in a very price competitive position with LV feature offerings, it claims to be in a better per title revenue generating position. MCA's LV listings used to range from $5.95 to $29.95, but now include

nothing below $10.00. RCA's listings are more narrowly priced between $19.98 and $27.98.

A problem that faces MCA DiscoVision is that the special features like random access which typify the LaserVision format are only possible if recording is done at 30 minutes a side (CAV). Since the market so far is predominantly for feature films this doubles the disc sides per release. There has been some shift away from (CAV) to the 60 min. a side format (CLV) or linear programming which reduces the cost of manufacturing a feature but loses the special feature and begs the question of why the consumer should pay roughly $200.00 more for an LV player than the CED player. Partly to overcome this objection and to develop programming which utilizes the full capabilities, Optical Programing Associates, a joint venture of MCA, IBM and Pioneer, has been specializing in developing non-linear programs, e.g. "How to Watch Pro Football." The B. Green Co. has recently produced for OPA an interactive children's program, "The First National Kid Disc." They also produced "Massage - a Touch of Love," which is mildly sensual.

In this regard pornography is notably absent from videodisc software. The initial launch of VCRs was much supported by this content which was otherwise unobtainable. Already STV in the U.S. is moving to X-rated material to improve saturation. Whether the disc companies will ease their approach in time is unknown but this is certainly a competitive weakness with respect

to VCRs. A major, if not the major influence, in the LV format is IBM which is unlikely to permit or tolerate much latitude in this regard.

Magnavox executives, in contrast to RCA executives, have been more conservative and cautious in assessing the market for videodisc. Their envisaged market is the "upscale customer" -- the affluent, selective, videophile. Magnavox believes that the mass consumer market's video entertainment needs can be satisfied through other methods such as pay, cable, public, and broadcast TV, which are accelerating through satellites.

Magnavox officials also disagree with the RCA view that the videodisc will serve an entirely different market than the VCR. Magnavox has indicated that 93% of the customers who have purchased the Magnavox Magnavision videodisc players also possessed a VCR.[5]

Suppliers of programs for home video are also engaged in a form of market strategy in determining how much of what to release, how soon, and in what way. Two very different views are held by 20th Century Fox and by Paramount Pictures.

20th Century Fox, operating through its Fox Video subsidiary, is the number one supplier of movies for home video. The strategy of Fox is to offer as large and diverse a video movie catalogue as it can. Its policy of "close releasing" involves the release of films in video form as soon as possible after their first theatrical appearances. Paramount Pictures, on the

other hand, through its Paramount Home Video division has opted to concentrate on a relatively small catalogue of hit movies and to follow a policy of "distant releasing," i.e. release of a movie in video form long after its first theatrical run.[6]

Paramount has an 80-title catalogue which reflects the contrary view that it holds regarding movie release for video. Paramount's believes it has an obligation to the theatres and cites this as one reason for maintaining a considerable time interval between theatrical exhibition and video release. Paramount has taken the position that a picture's performance in theatres should determine whether it will be released for video, and a "close release" policy would not provide sufficient time to make this determination.

The two studios also had adopted different positions in how movies should be made available for home use -- sale or rental. 20th Century Fox until recently forbade rentals on the grounds that it was not certain it would obtain its fair share of the royalties. Paramount favored both sale and rental.

All studios releasing for video do agree, that their films will increasingly become available on home video well before they are presented on pay/cable TV, satellite TV, or broadcast.

D. DEMAND ANALYSIS

The ultimate judge of a product in the marketplace, and the determinant of its success or failure, is the consumer or user. Some interesting questions arise regarding the demand side of the market for videodisc. Who are the potential users in the consumer and business markets? Will the videodisc system appeal to the mass consumer market or will it be concentrated in particular segments of the consumer market, designated by age, education, income levels? Where can it be expected to face its most serious competition? How realistic are industry projections of a vast consumer market for the videodisc?

The major problem in attempting to analyze various aspects of demand is that the videodisc is just emerging in the marketplace. A wide variety of opinions have been expressed on the potential of the videodisc in the marketplace, including projections of sales and expected household penetration. The most optimistic of these opinions and projections, naturally, have originated in the industry, which hopes for a vast consumer market and is attempting to stimulate this market with its statements and promotions. In contrast to these optimistic views, some industry watchers and analysts have expressed reservations regarding the market appeal of the videodisc, while others regard the situation as too premature to make any predictions.

These various views are examined along with whatever data is available on various aspects of market demand for the

videodisc. Reference is also made to the videocassette market in the hope that it may shed some light on aspects of demand for the videodisc.

1. Market Demand: Some Theoretical Concepts

The two primary sources of demand for the videodisc system are households, interested in it primarily as an entertainment device, and industry/institutions, interested in the videodisc for a variety of purposes including training and education, storage and retrieval, etc. Each of these markets will be considered.

2. Household Demand

The VDP is so new that no distinctive profile of the videodisc system has emerged. On the other hand, a general profile of the VCR owner has been established.

Some of the characteristics of the typical VCR owners in the U.S. and Europe are illustrated in Table III-6. Additional information on the characteristics of the typical VCR owner, and the use he makes of the VCR are contained in Tables III-7 and III-8.

TABLE III-6

Profile of VCR Owner: U.S.A. and Europe
(U.S. Dollars)

Characteristic	U.S.	Europe
Age	69% of owners between 25 and 44 years of age Median age - 37	35 years (median)
Income	81% over $25,000, with median of $33,000 - $35,000	$27,500 (median)
Education (some college)	76-84%	68%
Percent Purchasing Pre-Recorded Programs	44-48%	41%
No. of Pre-Recorded Programs Owned (median)	3.8-4.3	3.8

Source: Kalba-Bowen Associates, The Expanding Home Program Video Market, January, 1981. International Tape/Disc Association, Inc., A Time Report: The 1980 European Home Video Market, New York, October, 1980. Mart Magazine, June 1981, p. 16.

Table III-7

Primary Uses of VCR[1]

Uses	% of survey group responding
Record TV Programs when not at home	67%
Record one TV program while matching another	44%
Record TV program while watching it for repeat viewing	30%
Playing pre-recorded programs	25%
Watching home movies shot with a video camera	4%

[1]European market

Source: International Tape/Disc Association Inc., A Time Report: The 1980 European Home Video Market, New York, October, 1980.

Table III-8

VCR Owners Who Buy Prerecorded Content

Type of Program	% of Owners Who Own Type of Program	Average No. of Titles Owned
Recent Movies	78	7.0
Classic Movies	39	4.7
Adult Entertainment	16	6.3
Children's Entertainment	8	6.3
Variety	7	3.1
How-To/Hobby	2	2.2
Educational	2	1.4

Source: Kalba-Bowen Associates, The Expanding Home Video Program, January, 1981.

There has been some discussion on the question of whether the VCR and the (VDP) will find a market in the same segment of the consumer sector, or whether they will appeal to two completely different sets of consumers. Of the evidence in existence, it would appear that to a reasonable degree the VDP and VCR are competitive products in the same market. For the purposes of this study, it is assumed that the profile of the typical VCR owner can be viewed as a reasonable approximation of the profile of a typical VDP purchaser. Furthermore, it is assumed that the demand and sales of VCRs, which have been on the market for a longer period than the VDP, and for which more market information and data are available, can be taken as reasonable proxies of the market for the VDP.

3. The Current Videodisc Consumer Market

a) Sales

To date, only estimates of sales of the VDP are available. RCA claimed that 26,000 CED disc players were sold to consumers in the first five weeks following their introduction in March, 1981, projected a target of 200,000 sales by the end of the year.[7] Results were about 60,000 in the hands of consumers following 130,000 in distribution.[7]

Comparing the sale of videodisc players to other new technologies in their history of development, RCA executives point out that their distribution of over 100,000 players in the first year still indicates an excellent potential market.

Videodisc industry officials also claim that the videodisc system has experienced a much faster start in the market and greater market penetration in its beginnings than the VCR. However, RCA seems to have made little headway since the initial launch.

Information on sales of VCRs and the videodisc in the Canadian market is very sparse. In a small sample survey in Canada in November 1980, 1% of the people contacted owned a VCR. Another attempt to estimate VCR sales in Canada is illustrated in Table III-9. In this Table, an estimate of the annual sales of VCRs in Canada for 1978 and 1979 is based on calculations of imports of VCRs into Canada for the three-month period September -November, 1978. Since no VCRs are produced in Canada, all purchases are imported.

Arriving at an estimate of VCRs in Canadian homes is difficult. Given the fact that VCR sales have been increasing at about 70% each year but discounting for the unfavourable exchange rate, import duties, and the greater availability of TV signals in Canadian urban centres as of the end of 1981 there are probably 100,000 to 150,000 home VCRs in this country split 70% VHS and 30% Beta.

Table III-9

Imports of Colour Video Cassette Tape Recorders into Canada

Price Range ($)	Sept., Oct., Nov., 1978*			Estimated Annual 1978-1979**	
	Quantity (Units)	Value ($)	Average Unit Price*** ($)	Quantity (Units)	Value ($)
Up to 750	6,710	3,863,922	576	26,840	15,455,688
751-1,500	464	473,570	1,021	1,856	1,894,280
Over 1,500	143	396,032	2,769	572	1,584,128
TOTAL	7,317	4,733,524	647	29,268	18,934,096

*Actual

**Estimate based on 3 month actual data

***Dollar values are based on selling price F.O.B. plant.

Source: Canada, Department of Industry, Trade and Commerce, Colour Video Cassette Recorders, Ottawa, Occasional Paper.

The marketing of the videodisc in Canada has lagged considerably behind that of the U.S. A survey of retail outlets in Windsor and Toronto, Ontario in late June and early July, 1981 showed only the Magnavox Magnavision unit on display. A random sample of audio/video retailers in Toronto showed only two of twelve outlets contacted having a videodisc player on display. The supply of discs at these outlets, however, was extremely limited. Other dealers were not inclined to stock the videodisc because, in their opinion, the uncertainties in the market for the videodisc did not justify the investment that they would be required to make to market them. By Fall 1981 both Zenith and RCA have entered the Canadian market.

Dealers in general appeared more optimistic about availability of discs for the RCA format than for the Magnavox and Pioneer LV system, even though they believed the LV format to be superior due to its greater capabilities. Prices quoted for the Magnavox Magnavision ranged from $1100 to $1600, as compared to the $779 list price in the U.S.

b) Sales Projections: Industry and Independent

For every optimistic opinion and projection regarding the sales and success of the disc, there is an equal opposite pessimistic opinion, and this only serves to underscore the fact that the videodisc technology and industry is very new and forecasting the behavior of the consumer in a new and untried market can be tenuous at best.

Table III-10 outlines three recent estimates (1981) of video sales by industry watchers. Many of the early videodisc projections appear to have been overly optimistic and have been scaled downward, e.g. the estimate of VDP sales VDP by Argus Research Corp. in early 1981 of 3,000,000 for 1985 is 25% less than the 4,000,000 unit sales Argus projected a year earlier.[8]

Table III-10

Industry Analysts' Projections - U.S. Market
VCR, VDP and Prerecorded Program Sales, 1980-1986

	1980	1981	1982	1983	1984	1985	1986
	(thousands of players)						
VCRs							
Annual	805	1,000	1,300	2,000	2,500	3,000	3,500
Cumulative	1,995	2,900	4,300	6,300	8,800	11,800	15,300
VDPs							
Annual	35	350	750	1,500	2,500	3,000	3,500
Cumulative	40	390	1,090	2,590	5,090	8,090	11,590
	(millions of units)						
PR Program Unit Sales							
VCR (cassettes)	3.0	6.0	7.8	10.0	13.0	18.0	24.0
VDP (discs)	.3	3.1	8.7	15.8	35.6	56.6	92.7

Projections made by Argus Research Corporation and reported in The Videoplay Report, April 13, 1981.

Note: By the end of 1981 the projections for VCRs were too low. The EIA reported 1,360,998 VCRs sold in the U.S. Cumulative total is estimated at 3.3 million. VDP sales were about half of the estimate for 1981.

Table III-10 (continued)

B. Retailers' Estimate of Video Sales, 1980-82

VIDEO DISCS

Sales to dealers in units	
1980	300,000
1981 (est)	4,000,000
1982 (est)	10,000,000

VIDEO CASSETTE RECORDERS

Sales to dealers in units	
1980	805,000
1981 (est)	1,200,000
1982 (est)	2,000,000

VIDEO DISC PLAYERS

Sales to dealers in units	
1980	40,000
1981 (est)	350,000
1982 (est)	500,000

VIDEO TAPE (prerecorded only)

Sales to dealers in units	
1980	3,000,000
1981 (est)	5,500,000
1982 (est)	10,000,000

PROJECTION TV

Sales to dealers in units	
1980	57,000
1981 (est)	75,000
1982 (est)	100,000

VIDEO TAPE (Blank only)

Sales to dealers in units	
1980	15,000,000
1981 (est)	19,500,000
1982 (est)	25,000,000

COLOR CAMERAS

Sales to dealers in units	
1980	115,000
1981 (est)	180,000
1982 (est)	300,000

Source: MART Video Sales Guide, New York, Morgan-Grampian Co., May, 1981.

Table III-10 (continued)

C. Videodisc Player and Disc Sales, 1980-90

Year	Videodisc Players (units)	Videodiscs (000)
1980	40,000	316
1981	475,000	3,709
1982	1,200,000	13,059
1983	2,200,000	29,434
1984	4,000,000	58,234
1985	5,000,000	94,634
1986	5,000,000	127,634
1987	5,000,000	157,634
1988	5,000,000	187,634
1989	5,000,000	217,634
1990	5,000,000	247,634
Cumulative	37,919,000	1,137,556

1990 penetration of U.S. TV homes - 40%

Average no. of discs per player in 1990 - 30 discs

Projection made by Wertheim & Co., Inc., a New York brokerage firm and reported in Videodisc News, March, 1981.

Note: This estimate for VDP is among the most "bullish" and by the end of 1981 proved twice too high for players but slightly low in its number of discs.

Indications of the worldwide growth of VCRs are the following projections on Table III-11.

Table III-11

International Home VCR Manufacturer Sales to Domestic Distribution (in thousands)

	1979	1980	1981	1982	1983
Japan	475	915	1,300	1,800	2,400
(cum)	(1,320)	(2,150)	(3,450)		
U.S.A.	475	805	1,400	2,000	2,700
(cum)	(1,100)	(1,910)	(3,310)		
U.K.	125	350	750		
(cum)	(218)	(568)	(1,320)		
W.Ger.	150	475	700	925	1,200
(cum)	(235)	(710)	(1,410)		
France	86	144	220		
(cum)	(140)	(284)	(504)		

Source: Ken Winslow: The Videoplay Report, Nov. 9, 1981.

c) Dealer Reaction to Sales Progress

Despite the claims of RCA officials of its sales being on target, most (78%) dealers handling the RCA disc player indicated disappointment with sales in the first few weeks following its mass introduction in March, 1981.[9] The biggest drawback conveyed to dealers by prospective buyers was that the system only played pre-recorded discs and, unlike the VCR, could not be used to record programs off the air.[10]

RCA claims that the disc player is a family purchase, but there is conflicting evidence from surveys of retailers on this question. The demographics of the videodisc buyer as outlined by some retailers is an affluent, non-blue collar individual with two or three children, for whom a VCR is too complicated in comparison to the disc player.[11] Most retailers reported VCRs outselling the videodisc by a large margin.[12]

Practically all dealers did not believe that the price of the videodisc was a favorable factor in influencing the buyer. Some stated that price would have to drop to about $300 for it to be a feature attraction in marketing.[13] Contrary to RCA's hopes the heaviest purchasers were in the central states rather than in the large non-cabled coastal urban markets.

4. Factors Affecting Household Demand for Videodisc

a) A VDP Projection for Canada

The typical U.S. VCR owner is portrayed as affluent with a median annual income of about $35,000, median age in the mid-30's, and with a college education. There are no firm statistics on the VDP purchaser at present, except they seem to parallel VCR experience.

Assume that this portrait also applies to the potential VDP buyer and that a typical Canadian VDP purchaser would have an annual income of at least $25,000 and would be in the 25 to 44 age group. The households within these limits which also owned a color TV set in 1980 numbered 764,500. Assuming an average cost of $850 for a videodisc player in Canada, the consumer expenditures on videodisc players would be $650 million if this market was completely saturated.

If sales of videodisc players were to increase by the rate predicted by Argus Research the total of 765,500 cumulative units would be reached by the end of 1985. This rough estimate of the potential market in Canada is based on the very tenuous assumption that all households in Canada with incomes in excess of $25,000 and whose heads are within the age group 25-44 years of age are potential purchasers of the videodisc system. This is highly unlikely, as some may prefer other video products.

b) Video Substitutes and Complements

Rapidly changing technology has brought new video products into the market and changes in existing video products. In the case of disc and tape, some analysts are contending that they are sharing the market in competition with each others, while others are maintaining that they are geared to separate markets.

Most hail the disc as the new technology, and argue that as soon as the video disc catches on with the consumer, it will surpass tape. However, in terms of home entertainment it is tape that is basically the new technology and the one which the consumer has been getting used to. Consumer audio tape formats only really caught on during the 1970's, and since 1976 the U.S. consumer has purchased more tape units than TV sets by 75%. Lately sales for tape recorder/players have been 6.5 times higher per year than sales of traditional record players.[14]

The disc is a programmer/manufacturer oriented product, and its success depends on the presentation and availability of created programs that individually must appeal to the consumer. Without programs to satisfy diverse interests, the videodisc has limited appeal. The VCR, on the other hand, is a user-oriented product. In essence, the versatility of the VCR far exceeds that of the videodisc as illustrated in Table III-11.

Table III-11

Comparison of Services: Videodisc vs Videotape

Videodisc* Features	Videotape** Features
1) Playback pre-recorded programming	1) Playback pre-recorded programming
2) A few hundred program titles	2) Records programs
3) Stereo	3) Erase tape and re-program
4) Disc more durable, with longer life	4) Records one program while TV viewer watches another.
5) Rapid search and retrieval	5) Used with video camera
	6) Optional tape changer permits 20 consecutive hours of recording and playback
	7) 15,000 titles of programs
	8) Stereo developed (Akai VCR has stereo capabilities

*Magnavox Magnavision Player

**Sony Betamax Home Videotape Recorder

The main attractions of the disc as opposed to tape are: durability; rapid search and retrieval; long storage life; less storage space; greater clarity of picture; stereo sound. New developments, however, are improving these features in the VCR as well some of which are highly valued by the consumer, and which the videodisc cannot duplicate.

Some industry representatives contend that the VCR and the videodisc can co-exist, arguing they offer different capabilities. How strong these features are as selling points with the consumer, however, is debatable. Estimates on the basis of recent VCR market growth show videodisc hardware growth would have to exceed 75% per year, compounded annually for five years, to displace the VCR.

While some authorities in the video industry contend that the VCR and the videodisc are complementary and can co-exist, there is ample evidence that the two are competitive and do appeal to separate segments of the consumer market.

Existing products are always experiencing changes as technology advances, and this is true of recent progress in VCR technology which may enhance its appeal. Virtually every VHS and Beta hardware maker is planning full function portable VCR's, with some of the portables weighing as low as 8-3/4 lbs.

Indicative of this advance, General Electric is also entering this fast growing portable VCR market with a 13 lb. VHS unit and a new color camera. Along with this introduction, GE

has unveiled a top-of-the line 25 inch color console TV and a widescreen projection TV, both offered with a simulated stereo. The increasing popularity of the portable VCR should lead to an increase in the sale of color video cameras.

Many of the firms currently manufacturing the traditional TV, have added projection TV and stereo TV to their line of products. The large screen of projection TV could be a plus-factor in the sales of other video equipment such as videodisc and VCR, as well as pay and cable TV. Stereo pre-recorded video cassettes are also about to be launched on the U.S. market which could erase any advantage that the stereo feature has given the videodisc over the VCR.

In the line of new software for VCRs, the most recent introduction is quarter-inch size video-cassette tapes, retailing for $49.95 for pre-recorded full length feature films. Some in the industry believe that the quarter-inch VCR format is the format of the future. Technicolor, Canon and others are expected to enter this quarter-inch VCR market strongly.[15]

5. Videodisc, Videocassette, and Cable/Pay Television

Rapid expansion of cable/pay TV may also affect videodisc player penetration into the home entertainment market. If the major programs on videodiscs continue to be movies, and if such movies become available on cable/pay TV, the two forms of audio/video will be in direct competition with one another.

Studies show that there is a correlation between VCR owners and cable/pay TV subscribers. Over 50% of VCR owners had pay TV before acquiring a VCR and about one-third of households indicated that their subscription to pay TV had influenced their decision in purchasing a VCR. Such a relationship cannot be expected for pay/cable TV and videodisc. VCR owners would use their VCR recorder/player to tape movies and programs from cable and pay TV, whereas the non-recording feature of the videodisc system makes this impossible, and reduces the videodisc to the status of a substitutable product with cable/pay TV.

A recent sample survey in the U.S. and Canada conducted by DMT, a New York-based research firm on home electronic products showed that 38% of those who do not currently subscribe to cable TV indicated that they would likely do so in the future. A lesser interest was expressed in the videodisc systems.[17]

The Gallup Syndicated Home Video Consumer Survey Program[18] showed that the success of VCRs was largely on the basis of its appeal as a product which tapes TV programs. Another recent survey showed that 75% of VCR owners thought that the prices of pre-recorded tape were too high.[19] In addition, there have been recent reports of a rapidly growing market for rentals of pre-recorded tape and a large increase in rental outlets. A rental fee of $5.00 for a tape of a major film compared to a purchase price of $25-$40 for a disc could be a major factor in consumer decisions. The rapid trend toward tape

rentals at significantly lower prices than disc purchase is a factor in the disc-cassette issue that cannot be disregarded. While it is not the intention at present of disc distributors to go into rentals, the durability of the videodisc, particularly the LV disc, makes this market attractive to dealers.

6. Videodisc and other Potential Hardware

Some videodisc industry officials are optimistically predicting that the videodisc will be the turntable of the 1980's, replacing common phonograph record players and, with the capacity to play full-size (12 inch) digital-audio discs by using an outboard adaptor to decode the signals (the VHD/AHD system), it will become the standard for digital audio. This view, however, is questionable in the face of recent developments to produce a separate digitalaudio format.

A development still in the experimental stage is the Philips/Sony Compact Digital Disc (CD) player, which uses the same laser technology but is incompatible with the current video disc players. Both Sony and Philips had been working to develop a digital audio disc system, but in 1980 Sony abandoned its system and joined forces with Philips. The Philips/Sony CD system was first displayed at the Tokyo Audio Fair in 1980. The CD digital records are only about 4-3/4 inches in diameter and are played by a little solid-state optical laser. With a 80-90 dB signal to noise ratio the achievements in high fidelity are considered a breakthrough.

The Philips/Sony digital-disc player is expected to be on the market in 1982, with the player priced in the $400-$1,000 range and with discs costing about the same as analog LP records. In addition to carrying audio signals, the disc can also provide text information for display on a TV screen. It has been contended that Philips and Sony have chosen to separate home digital audio from the videodisc because of the advantages of a smaller disc and player, and simplified electronics and optics.

There are at least three other digital-audio systems being developed: one by Telefunken, one by JVC (which is compatible with the JVC videodisc) called AHD (audio-high- density), and one by DRC-Soundstream in the U.S., in which the record is stationary and only the player's parts move. It is maintained, however, that standardization will be essential for the digital audio systems to survive, since a player is useless without records, and record manufacturers would likely be unwilling to make a number of different versions of every record to fit different players. The Philips/Sony alliance hopes to establish the world-wide standard with its CD system. It has close ties to Polygram, one of the world's largest record conglomerates, as well as Polydor, Mercury, and Decca.

Another development is the concept of solid data storage which may obsolete digital audio before it has become entrenched in the marketplace. In solid data storage, the consumer has

access to a central library via a telephone line and a terminal, and can receive a pure signal ready for amplification without any moving parts.

7. Prices of Videodisc and Other Video Products

At current prices, videodisc recorders are on the average less expensive that VCRs. VCRs currently sell in the U.S. for between $600 and $2,000 depending on the features of the equipment. In contrast, prices of VDPs range from the modest RCA player, which lists for $500, to the higher priced LV players at about $775 per unit. Similarly, the disc is less expensive than pre-recorded cassettes.

Using U.S. prices and assuming $800 as a median VCR price and $60.00 as a median program purchase price, the RCA-CED player is 38% less than a VCR ($500 vs. $800) and a CED disc containing a feature film is roughly 65% less than an average VCR pre-recorded feature program ($20.82 vs $60.00). There is some evidence that the price of VCRs is showing signs of dropping in competition with the videodisc.

Prerecorded videocassettes show a ratio of 20:1 rental to sales for newly released feature films which drops to 5:1 for older movies and classics. There appears to be only a limited segment of the buying public which can afford a sizeable collection of purchased VCR software. However, the ratio of software ownership to player is much higher with VDP owners than with VCR owners. While discs are less expensive to purchase than casset-

tes, the price of discs cannot compare with the rental price of cassettes. Soon this may produce a major disc rental industry in response to the videocassette rental system.

Similarly the prices of pay/cable TV cannot be discounted in the entertainment media struggle. Most pay/cable TV broadcast services are available at a lower cost per month than the price of one major feature disc. To the extent that consumers purchase the videodisc for the movie programming it features, pay/cable poses a direct competitive alternative, and given its varied programming for a fixed price, could well be much more attractive than the videodisc to the average Canadian and American family.

On the basis of factory cost of the videodisc player in the U.S., an estimate is made in Table III-12 of the composition of the retail price that the consumer in Canada is expected to face.

Table III-12

Price Structure for Imported Videodisc Players
Canada

Item		$
U.S. Import Cost		$285.00*
Equivalent Canadian Price (1.17 factor)		333.45*
Tariff (most favored nation 12.5%)		41.70
	Total	$375.15
Importer's Margin (28%)**		105.04
	Total	$480.19
Manufacturer's Sales Tax		43.22
	Total	$523.41
Retailer's margin (28%)**		146.48
	Total	$669.89
Retail Sales Tax (7% Ontario)		46.89
Price to Consumer		$716.78

*Based on manufacturer's price of 57% of U.S. retail.

**Estimated, applying figures used for the U.K. as found in Mackintosh International, Euroview Report: Video Disc Players, England, Mackintosh House, 1980.

Basically, while the prices of VDPs and VCRs are higher in Canada than in the U.S., the price differentials between videodisc and videocassette, and the differentials between the various brands are relatively the same. VCRs in Canada list from approximately $1100 to $2200, while the VDPs range from approximately $700 for the CEDs to $1100 for the LV equipment, or roughly 50% more than the list prices in the U.S. Prices of software for the VCR and VDP are also higher in Canada.

The rental of hit movies on video cassette in Canada is becoming a major industry with a number of outlets established specifically to rent, as well as sell cassettes. A variety of options are open to the consumer, such as joining video clubs, purchasing a VCR and obtaining a certain percentage of the price as a credit in the form of free rentals, etc. The latter is becoming popular.

The price of rentals of cassettes of major movies, if a consumer belongs to a video club (usually with a membership of $50) range from $3 to $8 per day. As in the U.S. this is considerably less expensive than purchasing a pre-recorded cassette or purchasing a disc for the VDP, which in Canada range from approximately $25 to $40.

The question of whether prices are or will be a factor in a consumer decision to purchase one format or the other depends on how sensitive consumers are to the prices of these products.

Some published reports on sales based on surveys of retail outlets in the U.S. have revealed that the middle to higher range priced, full-featured VCR units were selling the best.[20] People may well feel that if they are spending money on a VCR they might as well go all out, and try to get the best value and the most service possible for the money they spend. Consumers who are interested in video apparatus such as the VCR tend to begin their shopping by looking at the cheaper models but are then attracted by the great capabilities and advanced features of the more expensive models, which they generally end up purchasing.

U.S. dealers reported that customers who had purchased the videodisc player were knowledgeable of its capabilities and the differences between the formats.

It was the opinion of buyers that the LV system was more technologically advanced than the CED. A factor to be considered in such reports, however, is that most likely the early buyers of videodisc systems tended to be the sophisticated video and stereo oriented purchaser who wanted the technology of the laser format. Such reports would not likely cause concern at RCA, which has publically stated that its CED player is designed for the family centered, budget minded, middle-class purchaser. It would not appear that prices have been a dominant factor in consumer decisions in their purchases of a VCR vs. a VDP.

With respect to prices of videodisc players alone, some dealers have indicated that they could sell more VDPs only if

price was substantially lower. But if major price reductions are required to stimulate sales following the initial surge of sales on the heels of the RCA campaign in March, it can only be concluded consumers are not yet ready for mass market purchases of the videodisc at current list prices or prices slightly below list.

8. Industrial/Commercial/Educational Applications and Demand

The videodisc can do much more than recycle movies or concerts, but can be made to communicate with the viewer, and can be made to change, respond, and interact according to viewer input. It is these interactive videodiscs that hold promise for extensive use in the business/education world.

Although the videodisc cannot record, its rapid search-and-retrieval time gives it an advantage over the VCR for storing and accessing information. Where a VCR has to run videotape back and forth to reach a given point, a videodisc can simply raise and locate its stylus to any given point in a matter of seconds. Using such techniques as single-frame advance and freeze frame and interfacing the disc with other apparatus such as mini-computers, provides the videodisc system with numerous interactive possibilities. It appears that the nature of the optical video disc is highly compatible to the needs of industry and education.

There are currently several projects throughout American universities assessing the video disc as an instrument for education. Brigham Young University, in conjunction with Mitro Corp., designed and created a computer link between a microcomputer and video disc player. The program, Time-shared Interactive Computer Controlled Information Television (TICCIT), has produced several interactive discs.

The Nebraska Educational Television Network has produced several optical video discs. One disc about gymnastics concentrates on beginning tumbling. Another focuses on Spanish instruction. A college level disc for individualized instruction in educational psychology has been received favorably. The NETV is also planning to develop programs for the hearing impaired. Other programs will be developed for the hearing impaired by the Barkley Centre/Media Development Project for the Hearing Impaired.

WICAT, Inc. in Orem, Utah, is believed to have developed the first disc program for individualized instruction, an optical disc entitled, "The Development of Living Things." Other WICAT projects are underway for the Navy and the Army Communicative Technology Office.[21]

Utah State University established a project, aimed at teaching retarded children. Another study teaches students how to use a library card catalogue.

The Masachusetts Institute of Technology has developed a bicycle repair course on video disc in which computer-controlled random access capabilities allow the student to examine the repair process.

MIT has been looking at the use of the videodisc for delivering instructional programs in connection with a Corporation For Public Broadcasting supported non-broadcast distribution project.

The potential of the videodisc as an educational aid was the subject of a major study conducted by WICAT, Inc. The WICAT study compared achievement levels and study time between traditional college level classroom students in a biology class and students exposed to the same biology lessons on videodisc. The results showed disc students reducing study time by as much as 30% over classroom students, and at the same time outscoring the latter by 15 to 21% on test scores. WICAT concluded that the delivery of classroom instruction via videodisc was not only feasible, but superior as well.[22]

In industrial applications, videodisc technology is challenging conventional media. Sandy Corporation, in Southfield, Michigan, has produced more than 30 hours of programming for 6,000 Chevrolet dealerships nation-wide.

American Express is designing a Travel Information Processing System (TRIPS) linking videodisc players to a computer network enabling potential travellers to take a brief tour of

possible destinations and to view colour photos of hotel rooms or resort locations at a Travel Agency before making a reservation.[23]

Magazine discs are also being contemplated. Transmedia Communications Network, has been formed for the purpose of producing and marketing videodiscs in conjunction with special interest magazines. The primary thrust of the discs will be of a how-to nature and will be targeted at the specific readership of particular magazines.

One potentially significant use of the videodisc may be as an electronic catalog. For example, Sears, Roebuck & Co. in the U.S. has initiated an experiment to place its 236 page summer catalogue on a videodisc to test the future in catalog retailing of this technology.[24] One of Sear's objectives in employing this technology is to reduce its printing and distribution costs, which in 1980 totalled $100 million.

It would appear, as in the case of Sears, industry will examine closely the potential of videodisc as an inexpensive, economical alternative to existing systems. It has been estimated that to store the same amount of information on magnetic discs as on one video disc would cost $40,000 on disc packs alone, whereas the videodisc costs only a few dollars.[25] Various sectors of government will also likely employ the videodisc for various purposes such as storage,

instruction, etc., and some Departments in the U.S. government have already adopted the videodisc for selected purposes.

In the U.S., the military has invested a large stake in the development and use of videodisc. A six-foot high stack of maintenance manuals on the Army's M-60 battle tank has been transferred onto a single disc.

The U.S. Army is planning to obtain laser optical videodisc players and compatible microprocessors for use in its newly developed JOIN (Joint Optical Information Network) recruiting system. This system will provide an electronic questionnaire for the prospective recruit, gathering information on his education, job experience, areas of interest, etc.

While interest in the potential of videodisc in business/education/government is widespread, and numerous pilot and experimental projects have been initiated, no data currently exists that would permit a quantification of the current demand, for videodisc players and discs in these sectors. Similarly until such time as it is clearly established which areas videodisc will be commercially viable, it is impossible to attempt to quantify potential sales. This matter is further complicated by the fact that a new technology such as videodisc may have marketable potential through interaction with other technology which has yet to be explored.

9. The "Electronic Revolution"

There is considerable literature devoted to societal changes often referred by some title such as the electronic revolution. While this section is not concerned with these larger issues, the role of videodiscs and videocassettes are certainly reflected in the whole marketing of consumer electronics which has been accelerating in recent years and are assumed to be a part of this "revolution."

A number of projections have been made which estimate the growth of such facets of consumer electronics as video games, large screen TVs, VCRs and VDPs, Teletext and Viewdata services, digital audio, etc. "Video go," an RCA study released in late 1981 has projected the penetration in U.S. households of various video sources in the year 1990 (see Table III-13 below).

Table III-13

U.S. Household Penetration of Video Sources - 1990
(% of TV Households)

	1990	1979
Network Stations	100%	100%
Independent Stations	80%	72%
PBS	92%	90%
Cable	50%	23%
Pay Cable	35%	10%
Subscription TV	7.7%	0.5%
Direct Broadcast Satellite	5%	--
VCR	17%	.1%
Videodisc Players	28%	--
Home Computers	13%	.1%
Video Games	20%	14%
Teletext & Viewdata	33%*	

*Note: Since the FCC didn't proceed with mandating videotext circuitry in TV receivers, the estimate for Teletext and Viewdata services has been reduced to 8%.

Other projections are reasonably similar with the exception that the more recent ones tend to lower VDP expectations and increase those for VCR. The most conservative still project 20% VDP homes at the end of the decade.

A major implication of these projections is a fragmentation of audience at the expense of network viewing. This topic is treated in detail later.

E. CONCLUSIONS

The Home Video industry is growing rapidly on the strength of the video cassette recorder. Since the videodisc player's function is essentially the playback of prerecorded content, the consumer has yet to find compelling reasons of economy, picture and sound quality or of unique or more immediate content to warrant mass purchase. Expenditures to develop and promote VDPs and discs have been far greater than profits to date, but there seems to be no slackening of faith by any of the three groups targeted at the consumer market. RCA which has conducted extensive marketing has not yet demonstrated that its technology is reaching the "75%" of consumers which do not match the VCR demographics.

In the case of VCRs, there has been steady, almost explosive growth and the utilization of prerecorded content is rising faster than VCR ownership as video stores, video clubs, and video magazines proliferate. Whether the consumer will be enticed to videodisc if such developments take place as the prices of players come down and discs enter the rental stream is not certain. If 1981 can be considered the first year of the videodisc, then the results do not compare unfavourably with color TV, microwave ovens, and a number of electronic innovations.

The Canadian picture is even less clear since recent figures are unavailable. The best estimates are that VCRs have

penetrated about 150,000 TV homes. This would be 2% of homes in Canada compared to 4% in the U.S. and 7% in Japan and the U.K. Among the reasons given for this smaller growth compared to the U.S. are the higher costs due to exchange and duty and lower levels of disposable income. However, these reasons are not valid when comparisons are made with the U.K. with its even greater per household penetration. Explanations of this phenomenon are usually based on the storage of existing TV entertainment channels and the desire for recent U.S. movies. It is too early for any significant data on consumer behavior in Canada with respect to videodisc. The number of owners is probably too small to reflect any pattern other than a desire for novelty. Whether videodisc will proliferate in Canadian homes will ultimately be a reflection of its success to the South.

Endnotes

[1]Videoplay Marketing Newsletter, May 30, 1981.

[2]Dealerscope, June, 1981.

[3]Leisure Time Electronics Reports, June 1, 1981.

[4]MART Magazine, June 1981, p. 44.

[5]Ibid.

[6]K. Winslow, "Quick Release May Make the Difference," Video, June, 1981.

[7]Videoplay Report, March 30, 1981.

[8]Nordmedia Inc., The Video Business Guide, N.Y., August 1980, p. 94

[9]Video Week, April 30, 1981.

[10]Globe and Mail, April 15, 1981.

[11]Video Business, June, 1981, p. 54.

[12]Ibid., p. 58.

[13]Ibid.

[14]Audio, April, 1981.

[15]Billboard, June 6, 1981.

[16]Merchandising, June, 1981, p. 87.

[17]Leisure Time Electronics, Summer, 1981, p. 77.

[18]The Videoplay Report, March 30, 1981.

[19]Video Week, June 1, 1981.

[20]Audio Marketnews, Vol. 7, May, 1981, p. 24.

[21]E. Sigel, et al., Video Discs, The Technology, the Applications, and the Future (New York, Knowledge Publications, 1980), pp. 73-74.

[22]Videodisc News, May, 1981.

[23]Ibid., December, 1980.

[24]Business Week, May 11, 1981.

[25]Videodisc News, May, 1981.

CHAPTER IV

VIDEODISC AND THE LAW

A. INTRODUCTION

The purpose of this chapter is to explore the legal interpretation of videodiscs, a new device certainly not envisaged in the Copyright Act[1] of 1924. At first there was some worry that they might be considered "contrivances" and not subject to copyright protection under the law and therefore someone could buy the disc for "Les Plouffes" and play it on a broadcast or cable channel having satisfied all obligations through the discs' purchase.

Such was not the case. The legal requirements of aspects of home video are well known. Full protection is provided through copyright. VCR's of all formats have been determined to be "dramatic works" and are afforded the same protection as cinematograph works.

On the other hand, videodisc is a technology still in its early stages of development. Therefore, consideration of the legal aspects of videodiscs will limit itself to what protection the law can now provide rather than explore what may be.

A close and critical look will be taken at the legal aspects of the three main phases of commercial videodisc exploitation: the production of the videodisc, its use and its eventual protection.

It must be stressed that this analysis focusses on the current situation under Canadian Copyright Law, and in selected foreign jurisdictions. It did not attempt to be an exhaustive review of all the possible rights and responsibilities that exist in law in respect of videodisc or a video work. That analysis is beyond the terms of references of this study. It would include detailed analysis of some on all the following issues:

- trademarks and patents
- proprietary rights
- breach of contract
- unfair competition
- privatization of services
- censorship
- privacy
- freedom of information
- access to government information
- national security
- contempt of court
- libel; defamation; negligent misstatements; misleading; advertising

Various of these issues are addressed later in this chapter. As well some legal analysis is available. A review that addresses some of these issues is found in Richard Hahn's paper to the Canadian Bar Association's seminar on the future of film, television and home entertainment "Great Expectations". Hahn identifies a number of these rights and obligations in the Video field beyond copyright.

For instance, of Defamation he says:

> In producing video programmes, references to any individuals or identifiable groups of individuals which deprecate their reputation and good name by false statements must be carefully avoided. The rights of the individual in defamation are personal and do not survive the death of the individual. However, care must be taken to ensure that any references to any persons who are dead may not be inferred as references to their relatives or close associates.
>
> The laws of defamation have been applied to the embodiment of words or actions in films and television production. The potential for liability for damages for defamation is substantial.[2]

With respect to privacy:

> The common law does not recognize the principle of invasion of privacy or the rights of a person to prevent another from using his name or likeness. Some jurisdictions, noteably in the State of New York, have established this right by statute. To date, the Provinces of B.C., Manitoba and Saskatchewan have passed specific legislation governing the right to privacy. However, the Courts in Canada have not otherwise enforced this right at common law. Recently, this provision was used to prevent a Canadian Company from using "Here's Johnny" for portable toilets.[3]

And trademarks:

> Titles of video productions, names and visual representations of characters, events and places may be protectable matter as trade marks.

. . . In choosing a trade mark, it should be distinctive and it should not describe or deceptively mis-describe the product or service with which it might be used. The trade mark should not be confusingly similar to other marks whether they may be registered trade marks or unregistered marks. Care must also be taken to avoid use of geographical names or names which are primarily surnames of individuals. These constraints may inhibit the protection of names of characters but would not necessarily prevent protection of fictional events and places.

. . . In general, rights in trade marks are derived from actual use. Furthermore, case must be taken to indicate by notice that a particular name or design used as a trade mark. In Canada, rights are also derived from the application for a trade mark registration based upon proposed use. Additional rights in Canada may be derived from the making known throughout Canada of foreign products and services. This may occur through spillover advertising from the United States.

Depending upon the country, protection may exist for registered marks and unregistered marks. Therefore, care must be taken to insure that all necessary searches and applications for registration are made in countries where trade marks may be used.

. . . In the audio-visual field, revenues from trade marks are generally derived when the producer licences others to produce the various merchandising products or to engage in services using the trade mark. In Canada, care must be taken in such licensing or protection may be lost.[4]

B. PRODUCING THE VIDEODISC

The industrial making of videodiscs is bound to be constrained by numerous laws and regulations governing labour, machinery, products, and every other aspect of the actual manufacture, not to mention tax provisions relative to such manufacture and subsequent distribution of the finished product.

This part of the chapter will be concerned with the legal principles found primarily in Copyright legislation[5] governing the recording of intellectual material on a videodisc. It will address the two basic questions of what may legally be recorded on a videodisc and how it can be done.

A videodisc can only contain material that already exists in a different fixation, or material that was specifically created for a videodisc production. Difficulties arise mostly with the recording of pre-existing material. The first topic is pre-existing works and then with "original" works (i.e. "original" in that they were created for the specific purpose of a videodisc production) are analysed. Finally, miscellaneous laws and regulations related to such productions are reviewed.

1. Pre-existing Works

Material contained in many other media, such as films, music, magazine articles or data bases can be transferred to disc. These works existed prior to the development of videodisc technology and were probably not created with a view to videodisc

distribution. The videodisc manufacturer must satisfy himself that he is assigned all necessary rights to transfer of material from another medium on to his projected videodisc.

Questions to answer are: Which works are protected by copyright? What is the extent of copyright protection? Which authorizations are needed? Which exceptions may apply? These questions are answered through analysis of: (a) The Canadian Copyright Act, (b) Authorization needed, (c) Compulsory Licences.

(a) The Canadian Copyright Act

Through international conventions and domestic legislations, the creator of a work is, generally speaking, protected in all other countries as if he were a national of that other country. This principle of international copyright law is known as "national treatment." Canada has adhered to the 1928 (Rome) Text of the Berne Convention. Accordingly, section 4.1 and 4.2 of the Canadian Copyright Act extend protection to foreign authors who are nationals of countries with which Canada has international agreements.

In making a videodisc in Canada the only applicable legislation is Canadian law. The Canadian Copyright Act, is exhaustive in that copyright or copyright-related protection does not exist in Canada except in accordance with the Copyright Act, and the Act grants certain exclusive rights to owners of copyright in certain works. But the Act is inadequate, because it came into

force in 1924 and it is limited by its failure to reflect technological advances in the area of communications.

The Ilsley Commission of 1957, the Economic Council of Canada's report in 1971 and the Consumer and Corporate Affairs working group and report in 1977 have all suggested revisions. The current Department of Communications and Consumer and Corporate Affairs task force may resolve the contradictions among the different reports.

(i) Works Protected

Section 4.1 of the Copyright Act lists four categories of works protected in Canada: literary, dramatic, musical and artistic work. The work is only protected under Copyright when it is "fixed," that is "in some material form, capable of identification and having a more or less permanent endurance."[6] The work must also be "original" which means that "the product must originate from the author in the sense that it is the result of a substantial degree of skill, industry or experience employed by him . . . It does not mean the work must be the expression of original thought."[7]

Section 2 of the Act describes what may be included in each category. Except for musical works, this section does not attempt to define the categories but merely lists some of the material that may come within the ambit of one or the other category.

While "literary works" can include maps, charts (i.e. marine maps), plans, tables and compilations, their common denominator is that they are fixed on paper, whatever their nature (e.g. sheet of music)[8] or appearance (e.g. maps, charts and plans, which would presumably look more like artistic works).

The second catogory, "Dramatic works" includes "any piece for recitation, choreographic work or entertainment in dumb show, the scenic arrangement or acting form of which is fixed in writing or otherwise."[9]

"Musical works" refer to "any combination of melody and harmony, or either or them, printed, reduced to writing, or otherwise graphically produced or reproduced."[10]

Finally, "artistic works" include "works of painting, drawing, sculpture and artistic craftmanship, and architectural works of art and engravings and photographs."[11]

Section 2 of the Act goes on to define the phrase "every original literary, dramatic, musical and artistic work" as including:

> every original production in the literary, scientific or artistic[12] domain, whatever may be the mode or form of its expression, such as books, pamphlets[13], and other writings, lectures, dramatic or dramatic-musical works, musical works or compositions[14] with or without words, illustrations, sketches, and plastic works relative to geography, topography, architecture or science.

Therefore, the careful conclusion is to assume that most works will fit or be made to fit in one of the four categories

established by Section 4.1 and therefore, the probability of their being protected by copyright is high.

Three special kinds of works now deserve our attention: cinematograph productions, contrivances by means of which sounds may be mechanically reproduced, and compilations.

Cinematograph productions will fall within the "dramatic works" category. To be a "dramatic work," the cinematograph production must be one "where the arrangement or acting form or the combination of incidents represented give the work an original character."[15]

And, in another section, 3.1.e, it is defined that "if such original character is absent, the cinematographic production shall be protected as a photograph."

It may now be concluded that the cinematograph production which is not of an "original character" as expressed in Section 2 will be protected as a mere photograph, itself falling within the category of "artistic works."

In short, then, a cinematograph production may be either a "dramatic work" or an "artistic work" in the nature of a photograph, depending upon its original character or absence thereof. The distinction is important both in terms of ownership of the copyright and in terms of duration of protection.

Contrivances by means of which sounds may be mechanically reproduced are generally referred to more simply as "mechanical contrivances." These are sound recordings. Section 4.3 protects

them "in like manner as if such contrivances were musical, literary or dramatic works." It is important here to understand that copyright will subsist in the contrivance per se, quite apart from any copyright which may, or may not, subsist in the recorded work.

Compilations are included in literary works.

> Copyright may be either in respect of the matter or the arrangement. Therefore in the case of works that depend for their quality of novelty on arrangement only, there need be no originality in the material itself. It is only in the compilation - in its form and arrangement - that originality exists, and this is sufficient.[16]

It is therefore clear that compilations in the nature of a data base would be proper subject matter for copyright protection in Canada.

To summarize, works falling within the ambit of the Canadian Copyright Act are every literary, dramatic, musical and artistic works as these are defined in the Act, as well as cinematograph productions, sound recordings per se, and compilations including those in the nature of data bases.

On the contrary, and recalling Section 45 of the Act, no other work is protected. The two most important categories of works thus left out are broadcast signals and performers' performances. Therefore, broadcasters and performers must turn to other legislation or to their own negotiated agreements for protection.

(ii) Public Domain

Works whose period of protection has expired are said to fall into the public domain. Because of the intricacies of classification the term of copyright protection will be varied and complicated. However, it is generally dependant upon the life of the author, if the work was published during the author's life time problems arise when the work is anonymous or pseudonymous; the work is a collaboration amongst several authors, or the work is a posthumous work.

Section 5 of the Act provides protection during "the life of the author and a period of fifty years after his death."

Within the category of artistic works, photographs are isolated, they are protected only for a period of fifty years from the making of the original negative from which the photograph was directly or indirectly derived.[17] It will be recalled that, depending on their "originality character," cinematograph productions will fall within the dramatic work or the artistic work category.

Mechanical contrivances will be protected for a period of fifty years from the making of the original plate from which the contrivance was directly or indirectly derived.[18]

A final exception is to be found in Section 11 which provides that "works prepared or published by or under the control of Her Majesty or any government department (shall be protected) for a period of fifty years from the date of the first publication."

(iii) The Meaning of "Copyright"

Copyright is often described as a bundle of exclusive rights granted by legislation to the author of certain specific works. In Canada, these rights are enumerated in Section 3.1, where:

> "copyright" means the sole right to produce or reproduce the work or any substantial part thereof in any material form whatever, to perform, or in the case of a lecture to deliver, the work or any substantial part thereof in public; if the work is unpublished, to publish the work or any substantial part thereof.

The Act goes on to describe a long list of rights that can be reduced to the following:

- the right to produce or reproduce the work or any substantial part thereof; (s. 3.1)
- the right to produce or reproduce a translation of the work; (s. 3.1.a)
- the right to make any record or other contrivance by means of which the work may be mechanically delivered. (s. 3.1.d)

The other rights listed in Section 3.1 will only take their full meaning once the videodisc is produced and ready for exploitation. In terms of strict production, the three rights mentioned above are those most likely to be infringed by the videodisc producer.

These rights are quite independent of each other. Thus, the re-typing or the taking of photographs of a novel for

example, prior to embodying this "adapted" copy in a videodisc, would constitute an infringement of the right to reproduce, quite apart from the making of the videodisc itself which would constitute an infringement of the right to make a record.

Moreover, with respect to the right to make a record, it must be pointed out that recent Canadian jurisprudence establishes that this right is infringed by whoever actually makes the record without authorization. Section 3.1 is not exhaustive, one must also look at Section 4.4 where we find that the making of a videodisc including a pre-existing musical work taken directly from an existing sound-recording would constitute a double infringement if not authorized. It would infringe on the exclusive right to make a record of the musical work and the exclusive right to reproduce the sound-recording.

It could also infringe Section 12.7 on "moral rights" where the author:

> has the right to claim authorship of the work, as well as the right to restrain any distortion, mutilation or other modification of the work that would be prejudicial to his honour or reputation.

However, since practically all Canadian courts have been reluctant to give much importance to this section, it is safe to assume that "moral rights" will not be the subject of much judicial development in Canada.

To summarize, where a videodisc is produced of pre-existing works, copyright principles will apply in Canada provided the

works recorded on the videodisc are original literary, dramatic, musical or artistic works envisioned by the Copyright Act, and provided the works are still within the term of protection. Authorizations will be needed by the "maker" of the videodisc to reproduce or translate the pre-existing works as well as to make a contrivance by means of which the work may be mechanically delivered.

(b) Authorization Needed

(i) Ownership of Rights

Section 12.1 states that "the author of a work shall be the first owner of the copyright therein." Unfortunately, there are many exceptions to this rule.

Photographs are treated differently. Section 9 provides that copyright resides in the owner of the negative. It is therefore possible that the actual photographer would not be the owner of the copyright in the photograph he took.

Further, Section 12.2 provides that:

> in the case of an engraving, photograph, or portrait, the plate or other original was ordered by some other person in the absence of any agreement to the contrary, the person . . . by whom such plate or other original was ordered shall be the first owner of the copyright.

This is the only instance, under Canadian copyright legislation were the copyright in a commissioned work would be vested in the commissioner.

The Act, however, does speak of works made in the course of employment. Where ownership resides in the employer if the work

was made in the course of employment (s.12.3) and where the Crown is involved, Section 11 provides that any work prepared for the Crown is owned by the Crown.

Mechanical contrivances are treated in terms of ownership much as photographs. The owner of the copyright in the contrivance per se shall be the person who was the owner of the original plate from which the contrivance was directly or indirectly derived, at the time when such plate was made.[19]

One must be particularly careful when dealing with cinematograph productions. As was seen earlier, these productions may either fall within the category of dramatic works or within the category of artistic works where they would further be assimilated to photographs, depending on the originality of their character. This leaves two possibilities with respect to copyright ownership. In the first the "original" cinematograph production will be a dramatic work and the copyright will be vested in the author.[20] Whereas the "non-original" production will be a photograph, the copyright in which will be vested in the owner of the negative, unless the production was commissioned.

(ii) Assignment (Section 12.4)

Assignment can be a mere part of the copyright. For example, the author of a dramatic work may have assigned his sole right to make a record while retaining his sole right to produce a translation. The assignment may be for a limited period of

time, and cannot be for a period of more than twenty-five years after the author's death.[21]

Therefore, the prudent videodisc producer who wishes to use a pre-existing work will attempt to trace all possible assignments and to obtain contractual guarantees that the person who is granting him an authorization to use a pre-existing work for the purposes of a videodisc production does indeed have the right to grant such an authorization.

Finally, no assignment is valid unless it is in writing, signed by the owner or his agent.[22]

(iii) Union Contracts

Certain works are not protected by copyright, for instance, broadcast signals and performers' performances. Performances of performers is the one that creates the most problems.

However, performers may derive some protection from the common law as well as from contracts. The videodisc producer would be well advised to obtain authorizations before reproducing a given performance on a videodisc.

In Canada, the major performers unions[23] have all taken or are taking a close look at the new videodisc technology. It is assumed that they will be negotiating standard contracts to govern the use of their works and other contributions in videodisc form.[24] However, the proposal of a "standard contract" by one group or association does not necessarily entail acceptance of that contract by videodisc producers. Therefore, it may

be expected that model agreements will indeed evolve but will not be a mere acceptance of union proposals. Furthermore, it must be pointed out that most legislations will hesitate to force the acceptance of a model contract by inserting it directly in the legislation.

(c) Compulsory Licences

Statutes which deprive the copyright owner of his right to refuse the grant of an authorization can be found in sections 7, 13, 14, 15 and 19 of the Copyright Act and are generally referred to as Compulsory licences.

While sections 13, 14 and 15 are of no interest for this study, section 7 would allow the reproduction of any work twenty-five years after the death of the author, provided that certain formalities have been accomplished and that royalties have been paid to the copyright owner. Such royalties would be calculated at the rate of 10% of the "publication price."

Section 19 is of greater interest in that it may allow for the making of a contrivance by which a work may be mechanically performed provided that such contrivances have been lawfully made and that certain formalities (including the payment of a minimal royalty) have been fulfilled. In such circumstances, the copyright owner is compelled by the statute to grant his authorization for the making of the subsequent contrivance. The section is applicable to literary, dramatic and musical works, and although it is presently used strictly to make sound-

recordings, it is possible that it might also apply to the making of video-recordings.

In any event, Section 19 is the subject of much heated doctrinal debate and opposing judicial decisions. Should the the statute ever be revised, Section 19 will probably be the first to be amended.[25] Meanwhile, perhaps it offers easy legal mechanisms for the production of videodiscs and would warrant a specific detailed study that the present overview cannot undergo.

(d) Conclusion

In dealing with pre-existing works, the videodisc producer must be aware that written authorization to transfer the pre-existing work onto the videodisc will be needed in most instances, unless the work has fallen into the public domain. Even where the pre-existing work is not one of the works protected by the Canadian Copyright Act, such as is the case with performers' performances for example, common law principles would probably be found to prevent the videodisc producer from benefiting freely from the fruits of someone else's labour. Consequently, contractual guarantees should be sought from the owner of every contribution in the material to be recorded on the videodisc.

2. Works Created for a Videodisc Production

In dealing with works created especially for videodisc the legalities will remain the same. Whether the work transferred on a videodisc was pre-existing or whether it was created for the specific purpose of being recorded on a videodisc, it remains that there is a work which is being recorded, a work which is distinct from the videodisc per se. In other words, there is always a "pre-existing work."

To be sure, the practical situation is going to be different. For example, it may be that where a work is created specifically for a videodisc production, there will be an employer-employee relationship between the videodisc producer and the author of the work.

At the very least there will be a contractual relationship between the two, so that the videodisc producer will not have to go through the sometimes extremely difficult searches for a copyright title that is clear. While gathering his material for a videodisc production, the videodisc producer will in effect be gathering the very contributors from whom he must obtain the necessary authorizations. This alone is a very important benefit in dealing with "original" videodisc productions. The producer is sure of dealing with the author himself, therefore with the first owner of copyright.

Under those circumstances, contractual arrangements themselves would be made easier in that they could very well be

modelled on the contracts now in use in the sound-recording and motion picture industries.

Therefore, authorizations which were needed with respect to pre-existing works would also be needed with respect to works created specifically for a videodisc production.

> To sum up, the producer of a videogram . . . has to negotiate with and secure the consent of all those who have contributed to the creation of the videogram or pre-existing work, including the authors and composers, producers of films . . . producers of phonograms and performers.[26]

3. Other Legal Aspects

This section will look at other legal aspects of the disc including possible deposit requirements once the videodisc is produced.

(a) Legal Aspects Related to Contents

These fall into two categories, proprietary rights and delictual acts.

(i) Proprietary Rights

Claims may be made against the unauthorized use of certain materials, like the use of one's own portrait. A videodisc may include trademark infringement, could involve a breach of confidentiality, it could involve breach of contract and finally, claims of unfair competition are likely to be made whenever a videodisc embodies material similar to that found on another videodisc or even, another medium.

(ii) Delictual Acts

Even where the videodisc production does not infringe a copyright or some other proprietary right, the inclusion of certain material in it might constitute a delictual act. For example, a videodisc embodying a public affairs program which would discuss a legal action that is still sub judice could amount to a contempt of court. Similarly, the making of a videodisc embodying seditious, blasphematory or obscene material could constitute an offence under the Criminal Code and the videodisc revealing certain confidential government documents might pose a threat to national security.

Less obvious situations, are those where a videodisc might contain defamatory or negligent statements which could give rise to legal claims in damages as well as to injunctions directed to restraining the distribution of the videodisc.

(iii) Preventive Measures

These questions are not specific to videodisc, but are the daily fare of all communications industries. A guideline is for the videodisc producer to use the prudence and code of ethics developed in the newspaper, film and television industries. Admittedly, there will always remain certain cases where the videodisc producer, not unlike the newspaper publisher or the television program director, will, in the face of uncertainty, have to make a personal decision to accept the risk of legal proceedings against the distribution of a particular production.

(b) Legal Deposit

(i) National Library of Canada

It would appear then, that a videodisc published in Canada would fall within the meaning of "book" under Section 11.1 and 2 of the National Library Act[27] and would therefore be subject to legal deposit requirements.

However, Section 4 of the National Library Book Deposit Regulations[28] exempts a number of documents from deposit requirements, among other things educational kits of non-book materials.

As an extrapolation of the latter regulation, it has been the National Library's policy not to require the deposit of videodiscs or cinematographic works. However, since January 1, 1978, deposit has been specifically requested of educational kits of non-book materials.

Thus, an educational videodisc or a videodisc kit containing important print material would be subject to deposit in the Canadian National Library.

(ii) Deposit Requirements in Quebec

It is the policy of la Bibliotheque Nationale du Quebec[29] not to request deposit of film and audio-visual work. The more logical depository would be the Cinematheque Nationale where the Loi sur le Cinema[30] provides that the owner of any new cinematographic or audio-visual work produced in Quebec must deposit one copy of that work with the Cinematheque Nationale. However, that section of the Act has yet to be

proclaimed. Meanwhile, the conclusion is that videodiscs are not subject to deposit requirements in Quebec.

C. USING THE VIDEODISC

The fact that a videodisc has been lawfully produced does not imply that it can be used freely, without regard to the interests of contributors of material embodied in the videodisc. Consequently, the particular uses of a videodisc may give rise to claims from the owners of the rights in the embodied contributions, irrespective of the fact that the videodisc has been lawfully made. This section is concerned with possible infringements of the rights in the contents of the videodisc and not with the protection of the videodisc per se. It is taken for granted that the videodisc being used is one that has been lawfully produced.

The guiding principle is that the use of a videodisc will entail a use of the embodied material which will be lawful only if authorized as a result of an agreement or, from the operation of the law itself.

1. Uses Authorized by Contracts

It is imperative for the videodisc producer to determine what exploitation will be made of his videodisc at the time he is acquiring rights for production. This will allow him to obtain the necessary authorization for such exploitation.

The authorization he will need is again dependent on what rights are conferred by the Copyright Act. On the other hand, it is not necessary for the producer of the videodisc to try to

cover every possible use by third parties. For example, if the producer himself does not intend to perform in public, by means of his videodisc, the works embodied in it, it would not be his responsibility to acquire necessary authorizations for such performances.[31]

But a videodisc producer who intends to sell or license his videodisc for Radiocommunication should ensure that he does have the authority to allow for such a use of the protected works embodied on his videodisc.

The task of ensuring that all necessary rights for a normal exploitation of the videodisc are indeed granted is not unlike the one faced by a film producer who, in acquiring rights for the actual production of his motion picture, customarily acquires rights for secondary exploitation.

It must be expected that some rights will not be assigned to the videodisc producer for the simple reason that they will have been pre-assigned to a collective.[32] In those instances, certain standard clauses in the nature of a waiver are usually inserted in the contracts.

It is always a good procedure to take advantage of the signing of a contract to clarify any situation which the Copyright Act leaves in ambiguity. For instance, "Radiocommunication" is not defined in the Copyright Act. The question is left upon whether it encompasses cable and satellite distribution as

well as conventional broadcasting.[33] Such a question could and should be resolved by contract.

Similarly, the use of a videodisc in an information storage and retrieval system might result in a "reproduction" of the work embodied on that videodisc. It is unclear whether the Copyright Act ever envisaged in its Section 3.1 the right to reproduce as encompassing such a "reproduction." It may be wise for the videodisc producer who intends to exploit his videodisc by making it available to such systems to ensure that this question is resolved in his agreement with the authors of the works embodied in his production. On the other hand, no authorization is needed to effect what is clearly not an act reserved exclusively to the author. Thus, for example, it would serve no purpose to negotiate an authorization to lend the videodisc to the public as there is no "public lending right" in the Canadian act.

2. Uses Authorized by Law

A videodisc may be used in such a way as to be covered by one of the exceptions provided for in the Copyright Act. Because the Act is rooted in print technology, only a few of those exceptions might be applicable to videodisc uses.

One of those is Section 17.2.a titled "fair dealing." The section is often said to be the legal basis for a "right to quote." This interpretation is incorrect, the so-called "right

to quote" is in fact a result of Section 3.1 which vests in the author an exclusive right to reproduce his work.

Rather, Section 17.2.a comes in as a defence when an exclusive right of an author would otherwise have been infringed upon. The courts, having established that an infringement has occured, will then consider whether that infringement is "covered" by the defence of fair dealing.

The second most often encountered misconception about the fair dealing provision is a confusion between the "fair dealing" itself and the purposes of that "fair dealing." It is often believed, for example, that anything done in the course of research or private study is ipso facto a "fair dealing." This is not the case. Canadian jurisprudence is well set on this.

In spite of these limits, the "fair dealing" provision remains the most important exception to the exclusive rights of authors, precisely because it can be used against any encroachment of any exclusive right. Libraries, archives and educational institutions in particular are likely to find in that exception an opened door into rather wide manoeuvering grounds.

Section 17.2.d of the act exempts " the publication in a collection, mainly composed of non-copyright matter, bona fide intended for the use of schools." Educational videodiscs could therefore fall into this category.

Finally, attention must be brought to a peculiar section buried in the part of the Copyright Act that deals with performing rights societies.[34] Section 50.7 reads in part:

> In respect of public performances by means of any radio receiving set or gramophone in any place other than a theatre that is ordinarily and regularly used for entertainment to which an admission charge is made, no fees, charges or royalties shall be collectable from the owner or user of the radio receiving set or gramophone, but the Copyright Appeal Board shall, so far as possible, provide for the collection in advance from radio broadcasting stations or gramophone manufacturers, as the case may be, or fees, charges and royalties appropriate to the new conditions produced by the provisions of this subsection.

This exemption might be applicable to discs embodying aural works exclusively, and the possibility exists that it could also apply to at least the sound portion of a videodisc, provided of course that the videodisc is a product of the "groove" technology.

The above are the main exceptions to be found in the present Copyright Act that might be applicable to videodisc uses. During studies for the revision of the Act, more exceptions have been sought by educational institutions, libraries and archives. These did not address the new technology of videodisc storage of information, but were mostly directed to "traditional" reproduction technology, notably photocopying. It is therefore doubtful that a new Act would introduce drastic new principles or rules to govern uses of protected works embodied in a videodisc.

3. Legal Consequences of Certain Uses

By virtue of Section 19 of the Act, once a literary,

dramatic or musical work has been recorded in Canada on a contrivance capable of delivering sounds mechanically, with the consent of the copyright owner, this work then becomes subject to a compulsory licence for the making of other such contrivances. Given the minimal royalty provided for in the Act[35] and the possibility that the making of a videodisc might give rise to a future compulsory licence at least against the sound portion of the disc, a copyright owner of a musical work, for example, might prefer withholding his permission to use his work in the videodisc production.

An even more important concern of the copyright owner in the work to be recorded on a videodisc is the possibility that distribution of the videodisc might result in effecting a publication of his work.

So long as his work remains unpublished,[36] the author enjoys a copyright protection of much greater quality. Finally, the revision process of the Copyright Act has given hold in Canada to the European Common Market theory of "exhaustion of rights" whereby certain rights of the author (namely that of territorial compartmentalization) would be exhausted upon publication of the work.

These possibilities arising from the making and distribution of a videodisc are certainly important enough to give copyright owners some pause. It is presumed that their impact might be most felt in the royalties that the videodisc producer

will be called upon to pay to the copyright owners of works embodied in the videodisc production.

D. PROTECTING THE VIDEODISC

This section looks at the rights of the videodisc producer, focusing at protection under present Canadian law, particularly copyright. Also because videodiscs will probably find a market in foreign countries, it reviews the protection provided in selected foreign legislations.

1. Protection in Canada

(a) Copyright Protection

To be protected by copyright, a work must be included within the categories of Section 4.1, namely "original literary, dramatic, musical or artistic works." It will be recalled as well that the definition given of that phrase in Section 2 of the Act includes "every original production in the literary, scientific or artistic domain, whatever may be the mode or form of its expression."

The particular medium of the videodisc does not seem to be an obstacle to its being protected by copyright. However, it remains to be seen if this "new work" can be made to fit within one of the four categories of Section 4.1.

(i) Cinematograph Productions

In the eyes of the layman, videodiscs are analogous to films. But they cannot be in law because videodiscs are not works produced by a process analogous to cinematography which is a process involving the shining of a light through a transparent

film and the capturing on a screen of the resulting "filtered" image. Videodiscs do not meet the requirements of this definition.

(ii) Dramatic Works

Section 2 of the Copyright Act defines "dramatic work" as including "any piece for recitation, choreographic work or entertainment in dumb show, the scenic arrangement or acting form of which is fixed in writing or otherwise . . ."

There are two important elements here. The first is that the definition is not limitative, it only identifies to illustrate what may be included in "dramatic works." The second element is that the requirement for fixation refers to any material form as opposed to a strict fixation in writing. It would therefore appear that a dramatic work expressed in no other form than a videodisc would be protectable by copyright in Canada.

Although the videodisc might be an acceptable expression of a dramatic work, this does not necessarily entail that the videodisc is a dramatic work. Much jurisprudence exists on what is to be considered a dramatic work. The Courts appearing to be extremely liberal in their construction of what constitutes copyright, and also as to what constitutes a dramatic work.[37] Thus, provided that a work satisfies the normal requirements of originality,[38] it would appear that if it meets with the liberal jurisprudential criteria of what is a dramatic work,

it would be protected as such, even though its sole form of expression is a videodisc.

The protection afforded such a work would be that afforded dramatic works in general. By virtue of Section 3.1, the owner of the copyright in that work will have the exclusive right to produce and reproduce the work, to perform it in public, to publish it, to transform it into a non-dramatic work, to record it on a mechanical contrivance, to communicate it by radio-communication, and to authorize all of the above. As well, the dramatic work would benefit from the protection of Section 12.7 of the Act, relating to moral rights.

The first owner of the copyright will be the author.[39] If the dramatic work's only form of expression is the videodisc, it is possible that the producer would qualify as "author" for the work. Attention will have to be brought to the particularities of employer-employee relationships.[40]

Finally, it will be noted that the duration of copyright protection in a dramatic work is the life of the author and an additional period of fifty years.[41]

(iii) Mechanical Contrivances

Section 4.3 of the Act deals with mechanical contrivances. These are " records, perforated rolls, and other contrivances by means of which sounds may be mechanically reproduced . . . "

It may be argued that videodisc comprised of a sound as well as a visual portion could be protected as a whole under

Section 4.3. However, the safer interpretation would be to consider that only the sound portion of the videodisc would fall within the class of mechanical contrivances.

Though Section 4.3 states that such contrivances are protected "in like manner as if such contrivances were musical, literary or dramatic works," presumably depending on the category of work recorded, other sections of the Act render this comparison virtually useless.

Thus, the first owner of copyright will not be the author, as is normally the case with literary, dramatic and musical works, but the owner of the plate from which the contrivance was derived.[42] Moreover, term of protection will not be based on the date of the author's death or the date of the first publication of the work, but on the date of the making of the plate from which the contrivance is derived.[43]

Even a more important distinction is that the rights granted are not those of Section 3.1 but the mere right to reproduce any such contrivance or any substantial part thereof in any material form.[44] By way of illustration, the owner of the copyright in a videodisc protected as a contrivance would not have the sole right to communicate his work by radiocommunication.

On the other hand, it is interesting to note that mechanical contrivances are not subject to the compulsory license of Section 19.

To summarize, videodiscs would enjoy, in Canada, the full benefit of copyright protection, provided they fall within the category of dramatic works. Otherwise, the aural components of the videodisc would benefit from the limited protection afforded mechanical contrivances.

The only recommendations made to the government that deal directly with videodiscs are to be found in the 1977 Keyes-Brunet report,[45] which argues that videograms generally (motion picture films, videotapes and videodiscs) should be protected by copyright as a specific category of works; the ownership of copyright should rest with the "maker"; that the term of protection be fifty years from the date of making; and that the rights granted be the rights to reproduce, to perform in public, to broadcast and to adapt the videogram.

(b) Other Forms of Protection

The videodisc producer might enjoy other remedies against unauthorized exploitation of his production. An example would be the Copyright Act's specific protection to authors, that their specific edition is protected indirectly by the exclusive rights granted to the author of the literary work expressed in that specific edition. Videodisc producers could follow that example by obtaining an assignment on their behalf of the rights of authors in the contributions embodied on the videodisc.

Apart from this "indirect" copyright protection, it would also appear that videodisc producers would benefit from

protection deriving from certain common law principles. The theories of reliance, passing off, and unjust enrichment may have some application in the cases of unauthorized exploitation of a videodisc.

2. Protection Under Foreign Legislations

International copyright conventions have consecrated the principle of "national treatment," that is works are protected in each country according to the laws of that country.

The countries whose legislation was surveyed in this exercise were chosen either on the basis of their legal affinity with Canada, or on the basis of their present interest in videodisc technology. They are: the United States of America, France, Japan, the United Kindgom, Australia and Germany. Table 1 summarizes the results of this survey.

As we can see, except in the case of France, videodisc are protected.

TABLE IV-1

Country	Date of Act	Discs Protected	Applicable Sections	Term of Protection
USA	1976	yes	102	life + 50 years
FRANCE	1957	no		
JAPAN	1970	yes	16, 29	50 years after public or if not public, after creation
UK	1956	yes	13.10	varies according to registration under UK Films Act 1938 - usually - until registration 50 years
AUSTRALIA	1968	yes	98.2	publication + 50 years
FRG	1973	yes	section 2 qualified by 94, 95	publication + 25 years

It can be expected that most countries will extend protection, in one form or another, to videodiscs. It is logical to assume that protection would normally be found in the respective copyright laws of each country, yet the examples given above show that this is not always the case. France (and, it may be presumed, the countries in France's sphere of influence) is a notable example of a restricted view of copyright subject-matter. However, even under that jurisdiction, the laws of unfair competition would fill the void left by the absence of copyright protection. It is expected that such an alternative would exist in the majority of countries and therefore, videodiscs are protected throughout the world, albeit with varying degrees in the quality of protection granted.

E. CONCLUSION

Although the legal obligations enumerated in this chapter may appear an impossible burden to the videodisc producer, it must be recalled that they are not different from the obligations assumed daily by other producers of information. It is to be expected that in time, routine procedures will be established as they have been in other cultural industries and the production of videodiscs will go on lawfully, without having produced the feared overhaul of present legal principles.

On the other hand, it is too early to come to a similar conclusion upon review of the legal aspects of <u>using</u> a videodisc. This uncertainty stems from a variety of reasons: 1) all the possible technical uses of a videodisc are not yet known; 2) it is still unclear who the users themselves are going to be -- will they mostly be governments, corporations, educational institutions or individuals? 3) the motivation of users is unknown - legislators, may find it easier to favour disinterested enterprises, such as education and archives, than commercial ventures, such as entertainment. In the area of videodisc uses, therefore, it is probable that adjustments will have to be made in the law. Whether these adjustments will indeed be made is wholly dependent, of course, on public acceptance of the new technology.

Finally, it is obvious that the protection of videodiscs is completely inadequate under Canadian law and will not be adequate until the Copyright Act is revised of replaced by a new Act.

Endnotes

[1]An Act respecting copyright; 1970 R.S.C. chap. C-30.

[2]R. Richard Hahn "The Acquisition of Rights in the Video Field", paper presented to the conference on "Great Expectations", the Future in Film, Television and Home Entertainment, sponsored by the Canadian Bar Association and the Media and Communications Law Section, Vancouver, March 27-28, p. 4.

[3]Ibid., p. 4

[4]Ibid., p. 5, 6, 7.

[5]Ibid.

[6]Canadian Admiral Corporation Ltd. vs. Rediffusion Inc. et. al. (1954) Ex. C.R. 382, 14 Fox Pat, c. 114; 20 C.P.R. 75.

[7]Fox, Harold G.: The Canadian Law of Copyright and Industrial Designs, 2d edition, 1967 The Carswell Company Ltd., Toronto; 848 p., p. 41.

[8]An inclusion which appears to be in direct contradiction of the definition given in the Act of "musical work".

[9]Copyright Act s.2.

[10]Ibid.

[11]Ibid.

[12]Given the disappearance of the words "dramatic" and "musical" it must be presumed that "artistic", in this sub-section, has a more embracing meaning then it has in the definition of "artistic work".

[13]As was established earlier, "pamphlets" are already included within the definition of "books", which leaves us with a redundancy within a redundancy!

[14]"Compositions" is not defined in the Act and one is left to ponder what the difference might be between a "musical work" and a "musical composition", assuming of course (from a reading of the French version of this sub-section) that "musical" does qualify "composition".

[15]Copyright Act, s. 2.

[16]Fox op. cit. p. 110.

[17]Copyright Act, s.9.

[18]Ibid., s. 10.

[19]Ibid., s.10.

[20]This, of course, raises the other problem of trying to establish who is the author of a cinematograph production:

> La loi canadienne, elle, est silencieuse. Elle ne dit pas que l'oeuvre cinematographique est une oeuvre de collaboration, et elle ne designe pas le titulaire du droit d'auteur @. . .f
> Dans la pratique les contrats passes a propos de la realisation de l'oeuvre, reglent le probleme de la designation du droit d'auteur. En l'absence de stipulation il semble que la jurisprudence se prononce pour le producteur, et ce d'autant plus, qu'un lien de preposition existe presque toujours entre le createur et le producteur.
>
> Boncompain, Jacques: Le droit d'auteur au Canada; Le Cercle du Livre de France Ltee, 1971, 406 pages; et pp. 157-158.

[21]Copyright Act, s. 12.5

[22]Ibid., s. 12.4.

[23]Association of Canadian Television and Radio Artists; Union des Artistes; American Federation of Musicians.

[24]For a view of the situation at the International level, see Davies, Gillian: Legal problems deriving from the use of videograms; in Video Rights, vol. 1, no. 2; November 1980, ISSN 0143 8573.

[25]For a broader discussion of compulsory licenses, see Noël Wanda: Compulsory Licenses and Copyright; RIDA 108, April 1981, p. 51.

[26]Davies Gillian: op. cit. p.11.

[27]An Act respecting the National Library; 1970 R.C.S. chap. N-11.

[28]Consolidated Regulations of Canada; 1978, vol. XII, chap. 1109.

[29]Loi sur la Bibliotheque Nationale du Quebec; 1977 L.R.Q. chap. B-2.

[30]Loi sur le Cinema; 1977 L.R.Q. chap. C-18.

[31]The right to perform in public is an exclusive right of the author, by virtue of s. 3.1.

[32]Individual owners of copyright may assign certain specific rights to an organization who will then administer those rights collectively. In Canada, the better known collectives are the Composers, Authors and Publishers Association of Canada (CAPAC) and the Performing Rights Organization of Canada (PRO). Both administer performing and radiocommunication rights in musical works.

[33]See Canadian Admiral Corp. Ltd. v. Rediffusion Inc.; C.P.R. Vol 10 Sec. II p. 75; that case is widely held in Canada as the case that put to rest the possibility of a "cable distribution right". The case, however, was decided on May 21, 1954, in the trial division of the then Exchequer Court of Canada and was never appealed.

[34]ss. 48 to 51 exclusive.

[35]Copyright Act, s. 19.5.

[36]"Unpublished" in the copyright sense, which does not mean that the work in unknown or inaccessible. The concept of "publication" is at the center of most discussions in the copyright community.

[37]See Perry, Rose-Marie, op. cit. p. 268; Fuller v. Blackpool Winter Gardens et al; (1895) 2 Q.B. 429; Kantel v. Grant, Nisbet & Auld Ltd. et al; 1933 Ex.C.R. 84 at p. 95..

[38]Means that the product must originate from the author in the sense that it is the result of a substantial degree of skill, industry or experience employed by him.

[39]Copyright Act, s. 12.1.

[40]Ibid., s. 12.3.

[41]Ibid., s. 5.

[42]Ibid., s. 10.

[43]Ibid.; duration of copyright protection will be fifty years from the making of such plate.

[44]Ibid., s. 4.4.

[45]A.A. Keyes and C. Brunet: op. cit. p. 82.

Appendix I

Richard Hahn prepared the following "Checklist for Acquisition of Rights" and presented this at the Bar Association Seminar in Vancouver.

Preparatory Checklist for Acquisition of Rights Agreement

In preparing agreements for the acquisition of rights in the video field the following issues must be initially addressed:

- What is the Intellectual Property and Material Object which will be embodied in the final production?
- Who are the persons who own or control the Intellectual Property or Material Object?
- What is the production role of the person from whom the rights are acquired and is there a possibility that this role may change?
- Is the Intellectual Property which is being acquired based upon other works in which rights subsist?
- What are the valuable elements of the Intellectual Property being acquired which even of themselves are protectable as Intellectual Property or otherwise?
- What is the form which the production will initially take i.e. film, television programme, videodisc?
- What are the possible forms which the production may subsequently take i.e. will there be sequels, remakes or other derivative works such as, novelizations or merchandising?
- What means of communications will be used for both the initial production and future productions?
- What collective agreements exists which govern the licensing or acquisition of rights. Which of these are optional and may be superceded by contract?

- Is there a possibility that any of the rights in the production or any of the elements of the production may revert to the grantor by virtue of statutory provisions such as copyright or by virtue of breach of contractual provisions?

- Where pre-existing productions are being acquired, what are the possibilities that a claim will be brought for breach of warranty of title and in such an event what is the financial position of the entity warranting title?

Appendix II

Checklist for Acquisition of Rights[1]

1. DATE

2. PARTIES

3. AUTHOR: Name; Citizenship and Residence at Date of Creation and Publication

4. IDENTIFICATION OF OBJECT OF GRANT: Title; Description; Paticulars of Existing Registrations;

   Type : Literary; Artistic; Dramatic; Musical; Photograph; Choreography; Sound Recording; Videotape; Video Disc; Motion Picture.

5. PUBLICATION DATA: Data; City; country; Name and Address of Publisher.

6. IDENTIFICATION OF RIGHTS GRANTED:

   (A) ALL: Assignment; Employment.
   (B) SPECIFIC: (i) Material Object; (ii) Intellectual Property.

   a) Perform in public; Communicate by Radio, T.V., Satellite; Reproduce; Translate; Edit.
   b) Convert into: Novel; Abridgments; Merchandising; Remakes; Sequels; Other Forms.
   c) Receive Royalties from Rights Not Granted (Subsidiary Rights)
   d) Sublicence to others
   e) Negative Rights to Restrict Against Competition by Grantor for duration of exploitation of Production

7. EXTENT OF GRANT: Duration: Term of Copyright and/or renewals or specific terms; Territory; Exclusive vs. Non-Exclusive; Possibility and effect of Reversion.

8. OBLIGATIONS OF GRANTOR: Delivery; Conditions of Acceptance; Responsibility for changes and corrections; Non-Competing works; Option on future works.

9. OBLIGATIONS OF GRANTEE: Exploit vs. Non-Exploit; Methods of Marketing; Protection of Rights: Notice, Deposit, Registration, Prosecution.

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(1) R. Hahn.

10. COMPENSATION: Fees; Royalties; Accounting.

11. COMPLIANCE WITH GUILD AGREEMENTS: Compensation, Credit, Exclusions.

12. WARRANTIES OF GRANTOR: Ability to enter into Agreement; Existence of copyright in Berne Union and U.C.C. countries; Publicity and Privacy; Defamation; Non-Existence of Impediments or Claims; Particulars of Reversion of copyright; All Elements of work included in grant.

13. INDEMNITIES: Claims of third parties; Inclusion of all Damages and Costs.

14. GENERAL TERMS AND CONDITIONS: Notice; Assignment; Jurisdiction; Enurement; Independent Contractors; Execution; Waiver; Limitation of Terms of Inconsistency with Collective Agreements, Laws, Statutes, Entire Agreement; Survival of Warranties or other terms; Arbitration; Termination: Expiration, Breach, Bankruptcy.

CHAPTER V

HARDWARE AND SOFTWARE INDUSTRIES

PART 1

HARDWARE INDUSTRIES

A. INTRODUCTION

To date it has been estimated that over $1,000,000,000 in private funds have gone into research and development preparatory to the marketing of videodisc products. Of this sum, virtually none has come from Canadian sources or been expended in Canada.

The reason for this is evident. Canada has minimum consumer electronics research and production capability. The production of Electrohome Ltd. of Kitchener, Ontario, the largest Canadian firm in this industry, represents a small fraction of the overall Canadian market.

There is little incentive or need for the three major videodisc groups, RCA, Philips, or Matsushita, to include Canadian based development or to involve Canadian secondary

suppliers. Consequently the latter have not developed expertise in the area.

Estimates provides earlier indicate that videodisc technology could have multi-million dollar sales in Canada by mid-decade. Should this be the case, Canada would meet its needs in this area primarily through imports of technology, content and systems software.

The following examines the potential Canadian participation in the "hardware" component of the videodisc industry including the manufacture of players, secondary component suppliers, and discs.

B. THE CANADIAN MARKET

A survey of Canadian electronics manufacturers and distributors with respect to videodisc was commissioned by the study group. While an effort was made to be as complete as possible by contacting all the firms likely to have an interest in the topic it is possible that a situation was overlooked or withheld due to confidentiality.

1. The Radio Corporation of America (RCA)

In Canada, RCA Ltd. has branch offices across Canada with production plants in Don Mills, Ontario - record division; Midland, Ontario - colour picture tubes; Prescott, Ontario - televisions, and St. Anne-de-Bellevue - photo detectors (electric eyes).

RCA introduced videodiscs to Canada in mid-1981. According to Daryle Beatty, Vice President Sales for International Activity, the RCA plant in Indianapolis, Indiana will manufacture all videodisc players and discs for North America. The construction of other disc mastering and replication plants is not expected in the near future because RCA officials estimate set-up costs to be in the vicinity of $20 million and design and construction up to two years.

This apparently is not an indication of a desire by RCA to continue as the sole replicator of its CED style discs. RCA is prepared to license frim to replicate videodiscs compatible with

its system. Although its contents that the more software available, the better it will be for RCA. custom pressing and replication licensing agreements (outside of CBS) are not expected until late 1982 at the earliest with Fox Video and Paramount as the first contenders.

2. Philips Electronics Ltd.

Philips Electronics Ltd., the wholly owned Canadian subsidiary of N.V. Philips of the Netherlands, intends to market the N.V. Philips optical laser videodisc player in Canada.

Philip's Electronics Ltd. has branches across Canada. It has range of divisions concerned with consumer products, telecommunications, lighting, scientific and electronic equipment, automotive products, broadcasting equipment, medical X-ray equipment etc. The divisions are located in Scarborough and Strathroy, Ontario and in St. Jerome, Quebec.

Philips Electronics Ltd. will obtain Magnavox players from their American counterpart's plant in Knoxville, Tennessee. The Philips players which are of the optical laser type, are available in Canada. DiscoVision Associated will continue to manufacture Magnavox in California for the foreseeable future.

3. Panasonic Canada Ltd.

Panasonic Ltd. is manufacturing and marketing its parent's Matsushita-JVC VHD machine in Japan and Panasonic Canada plans to

introduce the VHD videodisc player into Canada in late 1982. This date is conditional on the availability of adequate quantity of suitable software.

The videodisc players will initially be manufactured in Japan but a joint venture between Matsushita and General Electric may manufacture the disc players in the U.S. There are no plans to manufacture disc players or discs in Canada. Discs will be produced in Japan, England and the United States.

4. Thomson-CSF Canada Ltd.

Thomson-CSF Canada Ltd. is a division of Thomson-CSF in France. They have commercial representatives in Toronto, Ottawa and Montreal.

Thomson-CSF manufactures an industrial videodisc player with a transmissive optical disc. The disc players are manufactured in Paris and exported to Canada. Thomson-CSF Canada Ltd. has no manufacturing facilities in Canada at this time.

To date they have sold six videodisc players in Canada; five to Bell Northern Research and one to the Public Archives of Canada.

The Ottawa office was unable to provide any indication of future plans for Canada since all planning is done at the head office in Paris.

5. GTE Sylvania Canada Corp.

GTE Sylvania Canada Corp., recently purchased by N.V. Philips, currently imports all of their consumer products from the United States except for small black and white and colour televisions which are imported from Korea. They also expect to import all videodiscs players and discs to be sold in Canada. They have no plans for Canadian manufacturing of videodisc players or discs.

6. Hitachi Sales Corp. Canada Ltd.

Hitachi Sales Corp. Canada Ltd. plans to introduce the RCA style capacitance system in Canada. They have not as yet set a definite date for entry into the Canadian market.

7. Sanyo Canada Ltd.

Sanyo, aligned with the RCA group, will produce the CED disc player for the U.S. market. Sanyo Canada Ltd. are planning to market the RCA capacitance system in Canada this fall. Fisher Corporation, a subsidiary of Sanyo, will market the optical laser type but their plans for Canada have not been determined.

Sanyo plans to manufacture the CED players in Japan and export them to Canada. They have no plans to manufacture videodisc players in Canada at this time.

Sanyo, like Hitachi, has no interest in the videodiscs themselves except for their availability. They too will have to rely upon RCA for their supply of discs.

8. Toshiba of Canada Ltd.

Toshiba, a potential hardware supplier of the Matsushita VHD videodisc players, will produce the RCA CED system in Japan for the Canadian market under its own label.

Toshiba of Canada Ltd. conducted a series of demonstration workshops across Canada to introduce the RCA capacitance player and their VCR Product Manager, Mr. Siefarth noted its entry into the Canadian market in the fall of 1981.

Toshiba, like Hitachi and Sanyo, are in the hardware business only. They have no interest in the discs other than to ensure that there is an ample supply for their players.

9. Electrohome Ltd.

Electrohome is the only Canadian owned company currently manufacturing consumer electronic products. According to Mr. Bob Parker, Electrohome's Product Manager, they have no immediate plans to introduce a videodisc system to the Canadian market, but they expect to go with either the VHD or CED by mid-1982.

Electrohome has no plans to manufacture videodisc players now nor do they see much possibility of manufacturing them in the future. The company is skeptical about the possible success of the videodisc technology and point to the great competition in the Canadian home entertainment market from cable and shortly,

pay TV. They could not justify the set-up costs required to make videodisc players.

10. Sony of Canada Ltd.

Sony has decided not to join any of the groups competing in the consumer videodisc market. Sony manufactures the Betamax-Video Cassette Recorder and they feel that tape will prevail over disc in the consumer marketplace. They do have an optical laser industrial model which Ford and Ford of Canada dealers will use.

Sony of Canada has pre-mastering facilities in Toronto. Although all mastering and replication is currently done in Japan, Sony may build a mastering and replication unit in Palo Alto, California where it currently has research facilities.

C. CANADIAN MANUFACTURING AND PARTICIPATION IN THE VIDEODISC INDUSTRY

Early inquiries indicated there was very little interest in videodisc technology among Canadian manufacturers other than those involved in the consumer electronic industry as noted above. This view was borne out through discussions with senior representatives of manufacturers of both consumer and commercial electronic equipment.

The survey did identify one case of a Canadian manufacturer working on an aspect of videodisc technology. Matrox Electronic Systems Ltd. is developing a control sub-system for an unnamed U.S. principal for a data storage videodisc application.

Several electronic and data system firms reported they looked at videodisc but concluded that it was too late to become involved with an industry leader, and that the technology is too well advanced to start up independent activity in Canada. Canadian manufacturers feel that there are other areas of business pursuit which are more appropriate to them and more profitable.

For specific scenarios involving small, medium and large investments, see Part III of this Chapter.

D. FEASIBILITY OF VIDEODISC REPLICATION IN CANADA

Record companies surveyed included both large companies such as Quality Records and CINRAM, and smaller companies such as Golden Records. With one exception, none of those interviewed companies have a current involvement with videodisc. The exception is CINRAM which, according to its president, is "the only firm presently capable of pressing videodiscs in Canada." They are not however, currently involved in the production of videodiscs.

All of the record companies expressed interest in videodiscs but most lacked the resources to enter into videodisc manufacturing.

The estimated costs of constructing a manufacturing plant and facility for videodisc replication vary from as low as $5 million for CED type discs through $15-20 million to $30 million to replicate optical laser discs.

DISKODAR Inc. has stated an intention to build a plant in association with AFEM Productions Ltd. in Montreal.

DISKODAR has a non-exclusive licence from N.V. Philips in Holland to pre-master, master, and eventually press videodiscs. It also has temporary arrangements with DiscoVision Associates, 3M, Sony and NV Philips for mastering and replication. The production target date of the last quarter of 1983.

DISKODAR reports involvement in market studies to delineate more clearly the potential market for videodiscs in Canada.

PART II

SOFTWARE INDUSTRIES

A. INTRODUCTION

Applications of the videodisc technology in the digital optical recording configuration have a significant potential market which includes the mass storage of information, both as a read only and as a read/write medium. Forecast to be a significant aspect of the office of the future, these applications should be a serious competityor to present technologies such as microfiche, magnetic tape, high capacity magnetic-disc drives.

The videodisc aspect which involves the high-density and/or high-resolution storage of the data is only a part, but an essential part, of systems which involve other components such as optical recognition scanners, computer interfaces, monitors and terminals, "juke boxes" to hold the discs, and even hard copy print-out terminals. All of this has to be organized and controlled by packages of sophisticated software.

B. THE CANADIAN SCENE

To gather some idea of how Canadian industry and research stood in relation to the software and information storage/retrieval applications of videodisc, a small survey was conducted. This included both research into either videodisc for hardware or software modifications and development in specific applications or new uses.

1. Research and Development

a) O.I.S.E.

The Ontario government is funding a research project at the Ontario Institute for Studies in Education (OISE) under the direction of Dr. William Olivier. This unit has been given a $1.25 million grant to find a cost effective method for the production of interactive videodisc materials. OISE has produced several hundred hours of instructional material for industrial and manpower type training and for continuing education. They are also working on a text book for the production of instructional video.

The system involves a consumer model LV player, a unique micro-processor, some applications of Telidon, and the software.

b) N.R.C.

The National Research Council has developed an authoring language for Computer Aided Instruction (CAI) called Natal-74 (National Authoring Language). In a small demonstration project designed to illustrate some possible videodisc uses, the NRC

linked an optical laser videodisc player to a PDP-10 computer controlled by Natal-74 which allowed them to use the disc system in place of a carousel slide projector. The results were easier identification, and superior access storage of material than with the projector/carousel system.

c) University of Toronto

The University of Toronto, Computer Graphics Group is planning in the future to do work with interactive videodisc. This research would utilize earlier experience based on using tape.

d) Microdesign Ltd.

Microdesign Ltd. is a software company which designs programming methods for microcomputers. It has been doing work on speech compression in digital form for possible use with discs.

Microdesign also was involved in a later stage of a project conducted by Zapsystems of Toronto (see below) to solve some of the engineering problems encountered in connecting a computer and a videodisc system.

Microdesign have an intention to submit a proposal to provide design avionic maintenance manuals on videodisc.

e) Zapsystems Ltd. (Toronto)

Zapsystems is a "travel systems" company which offers computer assistance to travel agencies. It recently worked on a joint project with American Express where ZAP hooked up a

computer to a videodisc player to create consumer demonstrations for travel agencies. It used an optical laser system with computer assisted random access memory.

f) GEM Research (Victoria)

GEM Research is primarily involved in educational software and their research with videodiscs is centered on linking an Apple microcomputers with a DiscoVision videodisc players. GEM is concerned with the software problem of creating programming using "an intelligent interactive branching system" which could be used for industrial training and educational instruction.

2. Applications

Several Federal Government departments have shown interest in videodisc applications including the Public Archives, the National Library, Museums, National Defense, the Departments of Consumer and Corporate Affairs, and Employment and Immigration, see Chapter V - Federal Government Involvement in Videodisc Technology. As well, a few private sector companies have considered or are involved in commercial applications.

Cable Systems Engineering, a division of Rogers Cablesystems Incorporated, has investigated possible applications as a tie-in to their cable services. Applications such as picture storage of catalogue pages and the capture of broadcast images by frames on videodiscs were of interest but a record capability was essential for current material. Because such a

capability does not exist, Cable Systems is no longer investigating videodisc applications.

Goodwood Data Systems Ltd., a firm which develops and manufactures airport information processing systems, is also interested in commercial application for videodiscs.

Goodwood has begun a preliminary study to consider incorporating videodisc into computer-aided learning systems to replace alternative sources of electronically generated images such as tape.

Bell Northern Research is experimenting with a number of Thomson-CSF players as sources for switched video in fibre optic telecommunication systems. In such a system the home terminal would request programming from a central exchange. To permit a greater flexibility in consumer demand for tune-in at the beginning of a program, the Communications Research Centre is looking into the possibility of videodisc playback using multiple scanning lasers on each playback machine.

PART III

STRATEGIES AND CONCLUSIONS

A. Business Opportunities for Canada

The following material was presented at a seminar arranged by the Science Council of Canada on December 3-4, 1981 to examine the developments in digital videodisc. This section is the work of Leonard Lamb, Vision Three Inc., Pasedena, CA and is included to provide wider dissemination for interested Canadian industry. It provides some indication of the parameters involved.

"Three categories of business opportunity are invoked here: small, medium and large investment requirement. Each is tailored to make use of special features of Canadian funding, markets, national initiatives and industrial capabilities.

The opportunities are presented here in broad form; one of the purposes of this seminar is to stimulate business thinking in Canada in this area of technology.

Small Investment

A systems business, based on the assembly of purchased components and exploiting clever architecture and kay original contributions. One example of a commercially attractive system is a production and editing system for programs for interactive

educational videodiscs. Digital editing systems for audio and video are just beginning to emerge from the dark ages of tape splicing and manual button pushing. Given the availability of computer-controllable tape and disc drives, the major original components of an editing system are its architecture and its software. This is a strongly idea-dependent business.

A good editing system whose hardware is expensive and/or unwieldy can still be the basis of a service business; $100 to $500 per hour can be charged for time on a system which permits consistency, ease or versatility beyond the standard. Revenues from a service business can pay, in whole or part, for development of engineered hardware product for sale. Subsequent financing pays for tooling and the company becomes a significant manufacturer of down-market or dedicated products, all carefully planned via market analysis and selling to a customer base educated by the company's service business.

Investment to first revenue: $100,000 to $500,000

Time to first revenue: 6 to 12 months

Revenue potential: $2 million/yr (service); $20 million/yr (manufacturing)

Medium Investment

A manufacturing business concentrating on a well-defined range of products salable without a large sales or service force. An example of such a range of products is what might be called "electronic filing cabinets." In the modern office, paper documents and electronically created (via WP) documents are about equally common; they are also equally orphaned by the filing methods traditionally used.

The creation of filing machines which receive, scan and electronically store paper documents while communicating with word processors and computers, communicate among themselves locally and remotely, respond to queries from multiple, sometimes remote workstations, print paper copies of desired documents and permit merging of both types of documents mandates a broad range of architectural and engineering capabilities. Success here requires lots of good ideas but equally requires soundness in all the traditional engineering, manufacturing and marketing disciplines.

The initial investment sets up the company to develop and engineer its first line of products. Sales are handled through third parties (e.g., retailer, OEMS); service likewise. Some of the initial investment goes to R&D aimed at broadening and

solidifying the company's product philosophy and to adding to the design of the initial products aspects of modularity and expandability which keep those initial products respectable as new products emerge and which provide for easy and coherent evolution to those new products.

Investment to first revenue: $2 million to $10 million

Time to first revenue: 18 to 30 months

Revenue potential: $50 million/yr to $100 million/yr.

Large Investment

A major manufacturing enterprise selling a product of known strong demand while investing in new products of expected strong demand; plans call for constant growth rate indefinitely. An attractive example of such a business is the manufacture of disc drives. All computer products are targets for placement of disc drives. The total disc drive market is at $10 billion annually and growing rapidly. Many startup companies of 3 to 7 years of age are now very prosperous and stable.

The recommendation here is to buy a young, healthy, medium-sized (i.e., about $70 million annual revenue) disc drive company, move

it bodily to Canada (where, for whatever reason, there are no manufacturers of disc drives, just lots of customers), get it back in operation with the same product line ASAP, get the revenue stream back in motion and then start diverting some of those revenues, together with government grants, into R&D for optical disc products, eventually to manufacture those.

Investment to First Rewvenue: $50 million to $100 million

Time to first revenue: 9 to 18 months

Revenue potential: $200 million/yr to $500 million/yr."

B. Chapter Conclusions

The potential size of the domestic videodisc market, the multinational domination of export markets and the entry costs for disc replication are inhibiting factors to the development of a Canadian videodisc manufacturing sector. None of the multinationals engaged in videodisc technology for consumer or other applications plan to design or manufacture any of their hardware or software requirements in Canada.

The RCA group, which will market its CED consumer player in the Canadian market, will consist of RCA Canada Ltd., Hitachi Sales Corp., Sanyo, and Toshiba of Canada Ltd. and possibly Electrohome Ltd. The Philips group will consist of Philips Electronics Ltd., and probably GTE Sylvania Canada Corp. in the consumer market and Sony in the industrial market. Panasonic and possibly Electrohome will market Matsushita's VHD system. (Electrohome has yet to decide between the CED and the VHD system.)

Thomson-CSF Canada Ltd., is already selling their optical laser transmissive disc system for industrial training use in Canada through their own sales force.

As might be anticipated, none of the three above groups which manufacture consumer players has indicated an intention to produce or assemble disc players in Canada. Panasonic, Hitachi, Toshiba and Sanyo will manufacture their CED disc players in Japan and RCA in the U.S. Philips and Pioneer will manufacture

their LV players in the U.S., Europe and Japan. The VHD Group centered on Matsushita will manufacture its player in Japan and possibly Europe. It appears that all videodisc players sold in Canada will be imported.

The same situation applies to the discs produced or marketed by these consumer electronic companies. However, at least two Canadian firms, DISKODAR Inc. and CINRAM Ltd. have expressed interest in videodisc replication.

Canadian research and development in videodisc applications currently underway is primarily directed toward the development of programming for interactive videodiscs. It is expected that as the feasibility and efficiency of the optical digital disc becomes more certain, government and business attention will turn to industrial applications of the technology.

CHAPTER VI

CULTURAL CONCERNS, EDUCATION AND TRAINING

Part One

CULTURAL CONCERNS

A. Introduction

The culturally-based industries taken as a whole are big business in Canada and are deemed vital to a sense of national cohesiveness.

Many of the issues are, however, the same as for more conventional industries: providing jobs for the skilled and semi-skilled; ensuring opportunities for our intellectual and creative talent; and maintaining an industrial base adequate for the needs of a modern, developed nation in a world becoming vastly more sophisticated in its technology and trade. All of these factors apply, of course, within the context of a huge geographical area and a relatively small population and domestic market.

On March 31, 1979, the Prime Minister, Mr. Trudeau, stated at the Juno Awards:

> The cultural activities are the ones in which Canadians engage themselves the most . . . The cultural industries are bigger than steel in Canada, they're bigger than pulp and paper. Some six billion dollars a year. It's a big industry. And we have to remember that -- we the audience, we the outsiders, we the government, we the onlookers -- that if an artist creates and performs for himself or herself, he's also up against industrial competition in Hollywood, in Europe and other parts of the world. And that's why its not any more possible for any country to be without a cultural policy than it is to be without an industrial policy.

This concern is not new. The Minister of Communications, Francis Fox, in a speech during the fall of 1980 to the International Institute of Communications stated:

> Even in the days when the chief vehicle for cultural invasion was the motion picture screen, the flow of traffic was overwhelmingly one way. Proliferation of satellite channels, coaxial cable systems, video cassettes and discs, as well as other broadcast technology, could easily turn that flow into a tidal wave sweeping everything before it, including traditional values and the treasury of national, regional and local expressions.

Thus, these seem to be the basic considerations:

a) The strength of our cultural industries is vital to the nation's well being;

b) The advent and success of the new delivery systems VCRs and VCPs, will represent more competition, and hopefully new opportunities for growth.

B. BROADCASTING/PERFORMANCE INDUSTRIES

1. General and International Considerations

Home video will have a significant impact on the broadcasting and telecommunications industries. This is not to suggest that home video will eliminate conventional broadcasting including cable TV and pay TV, but that there will be intensified competition for the consumer's time and disposable income.

First of all, it appears that there is a shift in consumer spending habits and in the use of leisure time. The often-mentioned North American "baby boom" is in the process of the "nest building" cycle. This group is a large population bulge advancing through the age group statistics but is, however, somewhat divisible in terms of income. The leading edge of the group is relatively affluent and this is where the audio/videophile is found.

Social characteristics have not changed all that much, such as "keeping up with the Joneses." "Most consumer durables are sold to people actively emulating the social behavior of those in a more elevated economic stratum. Leisure expenditures are a way of improving one's lifestyle." The Wertheim Industry Comment, January 2, 1981,[1] goes on to say:

> The dominant durable in the postware period has been the automobile, the single product most identified with prestige for the American family. When one considers the amount typically spent on an automobile above the minimum level required for transportation, one begins to appreciate the extent to which Americans will spend money for comfort, enjoyment and prestige.

> It is our view that the next principal area for prestige expenditures is the Home Video center or, as we prefer to call it, the home screening room. Over the next 20 years, we expect to see an important percentage of family rooms, recreation rooms and living rooms converted or divided into viewing areas, complete with video cassette recorders, videodisc players, pay/cable hookups, video programmable games and projection or large screen television sets.
>
> To put the entire package together using the most expensive equipment in each category would cost under $7,000 (U.S.). A Chevrolet Citation costs more.

This quotation is typical of a number of industry analysts which then recommend variously MCA, RCA, Columbia Pictures, Warner Communications, etc. as wise investments. What is not conjecture is that never have color TV set sales been so great and that VCRs are in such great demand that dealer mark-ups have firmed in spite of steadily rising manufacturing capacity. (Just before the Royal Wedding, Thorn in the U.K. had four jets in the air at a time, airfreighting VCRs from JVC in Japan.)

In attempting to project the rise in VCR and VDP sales, a number of analysts believe that there is an analogy to color TV. Other analysts hold that the growth will not be as explosive. What the latter critics may have missed is that color TV sets were first available in the U.S. in 1954. Sales were almost negligible until about 1961 when there were full programming schedules in color. The analogy to color TV may hold when the videodisc player is supported by a full line of cheaply rented programs available earlier than from Pay-TV and the same kind of sales explosion could happen.

The above referenced Wertheim report indicated that a comparison of VCR/VDP sales growth with color TV set sales showed a much quicker consumer acceptance, and in the case of VCRs a pattern of almost exponential growth not reached by color TV until about the eighth year. A cautionary question remains: is it a phenomena like CB radio that suddenly tops out? There is no indication of this so far.

The whole area of home entertainment, so far, is one of growth. The cross relationships are not so clear. There have been a number of statements recently forecasting the doom of conventional broadcasting as the home viewer begins to take control of programming choice. Most of these are discounted primarily with the suggestion that the networks do have the resources to fight back. There does seem, however, to be some drop in total prime time viewing of conventional TV (the U.S. networks are reported to have lost 3.6 share points in 1980) and evidence of some audience fragmentation in VCR and pay cable homes.

A study undertaken by Media Science Newsletter divided homes into three categories:[2]

1) Non new electronic media homes -- those homes equipped only with a conventional TV set restricted to off air reception.

2) Basic new electronic media homes -- those homes with one or more of the following: basic cable, STV, MDS, DBS, video games.

3) Advanced new electronic media homes -- those homes with one or more of the following: pay/cable, VCR, VDP, 2-way cable, picture phone, videotexz, home computer, movies on demand, keyword video.

The projected TV market segmentation for 1980-1990 is as follows:

	% of U.S. TV Homes		
	Advanced NEM	Basic NEM	Non-NEM
1980	13.6	19.2	67.2
1990	61.1	21.4	17.5

The switch in relative position between "non new electronic media homes" and "advanced new electronic media homes" from 1980-1990 is almost a complete inversion of to-day's situation.

An analysis of the changing patterns of use of the TV set in prime time in the three types of homes as their relative numbers changed according to the preceding table, produces the following table.

Projected Prime Time Audience Shares
1990 vs. 1980
In Total U.S. TV Homes

	1980	1990
VCR/VDP/Videotext Home Computers	.5	13.5
Pay/cable	1.7	11.6
STV/MES/DBS/Videogames	1.0	4.1
Basic Cable	1.1	5.3
PBS	3.3	2.4
Other Commercial TV	11.6	14.8
3 Networks	86.5	60.4

Source: Media Science Newsletter.[3]

These columns are not percentages and do not add up to 100, but they do indicate a large shift in shares of prime time audience away from the three networks and to a lesser extent a shift from conventional television generally.

RCA, which owns NBC, "cable," satellites, record divisions, etc., comes to similar but more conservative conclusions. It notes in its "Video 90" study that in 1979 in the U.S. out of the 45.4 hours of average weekly TV viewing, almost 97% came from network and independent TV stations. By 1990 over 13% of viewing will be spent with other sources.[4] These are U.S. projections, but doubtless have some relevance for Canada.

Table VII-1
Competition for the TV Viewing Audience

	1979 Average Weekly Viewing 45.5 Hours		1990 Average Weekly Viewing 48.1 Hours	
	Hours	%	Hours	%
Network Stations	39	85.8	35	78.8
Independent Stations	5	11.0	6.4	13.0
All Others*	1.4	3.2	6.7	13.2

*Note: The "all other" category may appear to be understated since the newer video products will not have the same high penetration as TV sets. Penetration in homes of all other by 1990 is estimated at: Pay Cable - 35%, STV - 7.7%, DBS - 5%, VCR - 17%, VDP - 28%, Home Computers - 13%, Video Games - 20%, Teletext and Viewdata - 33% (amended to 8% with failure of FCC to mandate circuitry in TV sets).

Source: "Video 90," RCA Study, 1981.

The projected decline in viewing of conventional television has already produced considerable speculation in the advertising industry on how to adjust to these changes and how best to reach the consumers. Various mechanisms for introducing advertising content into cable and pay/cable have been discussed. There is also much speculation on advertiser supported Home Video. While the latter may have a beneficial effect on publishing, the same could not be said for conventional broadcasting if commercial revenue is redirected into video magazines on disc or cassette and/or if discs and cassettes, for example, those with "do it yourself" content, are subsidized for target audiences by the inclusion of commercial messages. Given a good penetration of

players and a reduction in costs of replication, such a scenario has possibilities. The basic consideration for conventional television will be whether the demand for broadcast advertising time grows sufficiently to offset Home Video induced fragmentation.

The impact of Home Video on Pay-TV is again a matter of conjecture. From the consumer's point of view, feature films are probably cheaper via Pay-TV and therefore, why buy or rent players and discs and/or cassettes? That begs the question of why subscribe to Pay-TV when most movies become available on conventional TV? The answer seems to lie in the immediacy of availability, personal convenience of on demand viewing, and, as in Pay-TV, its uninterrupted and unedited nature. It appears certain that feature films for Home Video will have release window before Pay TV, a situation that would give Home Video a strengthened competitive position. In a decade, however, a large proportion of the population may utilize both Home Video and Pay-TV.

The impact of these developments on the telecommunications industry is again speculative but a major consequence could be the weakening of such concepts as the "wired" nation. Analysis of the costs of a switched two-way broadband network usually assumes that all the myriad services now found or contemplated in cable plus a number of others, such as high quality picture-phone

and the accessing of huge video libraries, could be available in a single wire, i.e. optic fibre.

The reality, however, may be that a large share of the cost could only be supported by consumer purchase of entertainment services which are now or will be served by Pay-TV and Home Video. The Hollywood majors and other distributors will try not to see their product delivered by the common carriers and thus permit the carriers to become the profit centers. This in part may be an important reason for Hollywood's support of Home Video.

2. Canadian Broadcasting Considerations

Canadians watch 23 and a half hours of television a week which reaches 98% of the population. Over 50% of the homes in Canada subscribe to cable and 70% have it available, and as of writing, Pay-TV licence hearings are underway and Home Video pre-recorded content is making a penetration into Canada.

Pay-TV subscribership may not move as swiftly as in the U.S. Canadians already are better served in numbers of channels and Pay-TV is a re-selling job here rather than a marketing tool for initial cable purchase as it is in the newer U.S. systems.

Home Video, for reasons enumerated before, will also have slower growth in Canada. There are not the large segments of population with limited choice in conventional broadcasting, but in time, overall penetration will not be far off that of the U.S.

Canadian broadcasting both public and private, have the skills and facilities to mount Home Video production either from broadcast material or made especially for discs or cassettes. The CBC has produced, in both languages, many specialty programs which may have a new market in disc and cassette form and more importantly, CBC has the experience to do more of these kinds of production to meet new home video demands. CBC could be a major producer of all kinds of content for Home Video.

The private sector has excellent program production facilities and marketing skills. Together with in-house and

independent producers, they may be able to exploit the international and domestic markets for Home Video and Pay-TV.

While the new delivery systems are making new sources of income available to producers, the content must have a wide international appeal. Also, if the efforts mounted do not have world class production values, they may not be viable in either the domestic or international market.

A Canadian strategy, therefore, will need to pool strengths, i.e. from among the combined resources of the performing arts, the independent producers, the broadcasting system including cable, the private and educational broadcasters, to make substantial quantities of programming which is Canadian in character and world exportable in quality.

3. The Performance Industries

The 1978 survey of leisure time activities showed an increase in the rate of public participation in the performing arts that was more than five times the rate which could have been predicted from demographic data. The younger age groups and the more formally educated groups made up the largest segments of the audience. Notwithstanding this remarkable growth rate in audiences, Table V-1 indicates that subsidies from all levels of government and private donations provided 43% to 57% of income for the performing arts.

Table V-1

The Performing Arts, 1978

	Dance	Music	Opera	Theatre
No. of Companies	21	34	6	92
Average Season (weeks)	42	38	18	35
No. of performances	1,759	1,935	361	16,111
Avg. Cost/Performance	$7,800	$10,300	$20,300	$2,400
Audience	1 mil+	1.5 mil+	425,000	4.3 mil+
Avg. Cost/Audience	$12.13	$13.34	$17.20	$8.84
Total Income	$12 mil	$19.7 mil	$6.9 mil	$34.2 mil
Federal %	30	20	17	20
Provincial %	11	15	10	16
Municipal %	5	5	5	5
Private %	11	75	15	9
Earned %	43	44	52	50
Total Expense	$12.4 mil	$20.4 mil	$7.4 mil	$35.1 mil
Deficit	$.4 mil	$.7 mil	$.5 mil	$.9 mil
Deficit %/Income	3.3	3.6	7.2	2.7

Source: Statistics Canada. Survey of the Performing Arts, Ottawa, 1978.

The year 1978 marked large gains over 1977 in performances and audience but whereas all four activities had a surplus in 1977, Table V-1 shows deficits for 1978.

By 1980 the leveling of grants and rising costs due to inflation had placed most companies in a serious financial position and the financial situation is still difficult.

Just the same, many of the companies have great achievements to their name and accordingly deserved their international reputations for excellence, e.g. Stratford Festival, Shaw Festival, the Royal Winnipeg Ballet, Les Grands Ballets Canadiens and the National Ballet. Their works and repetoire have

substantial potential for the electronic market either as studio adaptations or in the "live from . . ." treatment.

Activities along this line are already taking place outside Canada. Covent Garden in London (Royal Opera House, Royal Ballet) has completed arrangements whereby works are electronically produced by the BBC in exchange for one domestic telecast. The master recording belongs to the theatre and is available for distribution in other media. Pioneer Artists (Laservision) is reported to have secured the exclusive rights in videodisc to Covent Garden properties. The West End Producers Association in London (England) is also reported to be negotiating the rights for secondary release for theatre properties.

In examining the question of the new video markets as revenue sources for the performing arts, the National Economic Research Associates of Washington, DC have produced estimates of the potential VDR/VDP revenues. Using the Theodore W. Anderson, The Emerging Video Disc Market, Argus Research Corporation projections, NERA states that if those projections are accurate, 1990 annual sales of cassettes and discs in the U.S. could reach 207 million and 848 million, respectively. When projected to cultural programming it follows:

> We would, of course, expect some portion of cassette and disc purchases to be of cultural programs. If the video disc and video cassette markets resemble the phonograph record

> market, then cultural program purchase patterns are likely to resemble those of classical and dramatic musical (e.g., opera or Broadway musicals) records. According to sources at CBS Records, approximately 4 percent of total sales in the United States are of classical or dramatic musicals. If the video market resembles this market, then we would expect cultural programs to account for about 4 percent of total annual sales of video cassettes and video discs. Assuming a 15 percent share of royalties, performing arts companies' earnings from this aftermarket could reach $2.8 million by 1985 and $14.6 million by 1990.
>
> The video disc and video cassette markets are, in a very real sense, likely to be by-products of the original programming market. That is, cassettes and discs offered for sale will be reproductions of programs developed initially for showing on cable. Indeed, both ABC and CBS are anticipating sales in these video aftermarkets sufficient to finance some of their production costs, and, in the case of ABC, to move the network's operations @cultural cable channelsf from the red into the black.[5]

While this trend is regarded with some enthusiasm by the major performing arts companies in Canada, they see certain problems. This extension of the market to Pay-TV and Home Video can strengthen the top companies by providing additional revenue and more awareness in the general public. It can, however, lead to much more centralization and focus on fewer international companies -- those capable of mounting the "definitive" work and engaging the super stars. For example, the competition for our National Ballet is that the Royal Ballet would market a "Sleeping Beauty" on Canadian Pay-TV as well as on cassettes/discs worldwide. The question is not quality but quantity: how many versions of "Sleeping Beauty" are required?

Home video may make it possible to distribute electronically such limited appeal content in an economically viable way. Domestically, it becomes available to a larger segment of the population who can not always get to theatres, and it could be accessible in all libraries and schools. However, the integration of our national performing arts into our electronic programming industries has been limited for practical purposes to those productions undertaken by the CBC. (The Norman Campbell ballet productions are probably among the finest works adaptated and translated to the electronic medium in the world).

C. THE FILM INDUSTRY

1. General and International Film Considerations

While the analysis of videodisc technology is central to this study, it is necessary to examine the impact of both videocassette and videodisc, ie home video, on the consumer market. They both involve the dissemination of pre-recorded content direct to the consumer in addition to the established services --- off-air broadcasting, cable-TV, theatres and soon pay TV.

The Corporate Analysis chapter reported that several consortia of multinational companies are pursuing this market vigourously. The growth of VCRs in the U.S., Europe and in Japan demonstrates significant consumer acceptance of the product as a recording device and as a playback device of pre-recorded material. Home video may grow in the United States such that by 1985 10% of homes will have either a VCR or VDP and by 1990 the figure may be nearly 30%. In Western European countries the equivalent forecasts are from 10 - 20% in 1990. The growth in Canada, it is reasonable to assume, will be in the same order or as that of the U.S. or perhaps a little less because prices may remain relatively higher.

Movies constitute the bulk of pre-recorded cassette viewing. The initial foray of videodisc into the marketplace has not been overwhelming but it is still too early to forecast

accurately its final impact. The point is that Home Video is here and it will grow.

In the face of declining box office receipts in the U.S. (despite the good 1981 summer), Hollywood (a term more generic than geographical) must enlarge its customer base. Two avenues are open: Pay-TV and Home Video. Home Box Office (Time-Life Inc.) dominates pay TV in the U.S. with 60-70% of all pay TV homes. Thus this distribution process is not under the control of the Hollywood majors. Attempts to dislodge this control have been futile so far and attempts to circumvent it through initiating a new satellite delivery service failed in the courts on anti-trust grounds. The alternative of Home Video remains open.

Hollywood's distributors market their films in accordance with the principal of maximum payment per view. Cinemas receive a feature first because the distributor's return is about 65% of box office admission. Next in line (until recently) was Pay-TV but the viewer or subscriber generated individual return dropped significantly. Hollywood gets about 35% of the Pay-TV gross. Thereafter conventional broadcasting purchases the feature, first for networks and then for syndication.

However recently, Home Video has begun to receive and distribute films at the same time or before Pay-TV. Reasons for Hollywood to adopt this approach are as follows:

1. the distribution profit centre in Pay-TV is in other hands (as it is in broadcasting);

2. the total cost to the consumer in the home may average out to the cost of going to cinemas, which for many reasons (admission and other expenses, domestic responsibilities, transportation time and cost, fear (in the U.S.)) are finding it harder to attract moviegoers as before;

3. the immense initial promotional investment directed toward theatrical viewing has little residual value in Pay-TV, except for the Pay-TV packager/distributor, but could be immediately beneficial to secondary sale in Home Video;

4. the economics of pay-TV require a menu of offerings in which the subscription price cannot be directly related to an individual film other than in some range of negotiated price, an approach the film industry does not favour;

5. the entire menu or monthly package of films draws about 35% of the Pay-TV gross, about $.50 per subcriber;

6. the ability to increase Pay-TV returns is limited without an alternate avenue of release and home video may return $1.00 or more per feature;

7. Home Video is a delivery approach which is better than theatrical release or broadcasting in terms of freedom from censorship and from content requirements and restrictions. Moreover, it by-passes delivery channel monopolies or oligopolies such as cable, broadcasting and the telephone companies or PTTs.

Each existing delivery system will have its place but the advent of home video points to a slow shift in the hierarchy of the revenue sources ("windows" of release). All forms of delivery remain parts of a mix in the funding and profitability of product.

The advent of Home Video may increase the need for more product and perhaps a differentiated product for audiences whose numbers would not justify the costs of feature film or conventional broadcasting programs. On one hand, the content producers may be in a stronger position because of the increased demand to fill all the theatres, channels, tapes and discs, etc. but, on the other hand, the expense of promotion, mass marketing and distribution of product may tend to limit numbers of significant releases. In the motion picture industry, a dozen or so pictures a year make large profits, and the remainder do indifferently, or even lose money, but they keep the theatres open. Eventually they may break even or obtain a return through TV and third world theatres. However, home video may herald a new, important source of revenue for good pictures, which for one reason or another are not top grossing films.

Videodisc also permits a new kind of interactive entertainment film, which would not probably work well in theatres nor in conventional off-air broadcasting. Joint venture companies working in the LV format (Optical Programming Associates,

Associates, Pioneer Artists and MCA-Thorn EMI Program International) are trying to develop program with interactive features. Some examples could be dramas with multiple endings (your choice of Who Shot J.R. or Agatha Christie redone).

Another important factor is the possible development (work is underway) of a new high definition TV standard for "film" production and possibly dissemination. It is conceivable that in time videodiscs using this better format for television picture quality, coupled with a compatible wide-screen TV set could increase the competitive edge of home video over broadcast or cable for the delivery of feature films.

Some distributors may think in terms of video clubs (like record or book-of-the-month clubs) where the selection is made by the organizers with some choice for the subscriber. Somewhat similar is the "brand name" approach. Rather than promoting the individual titles the consumer comes to identify a particular label with a particular type of product. Perhaps in these approaches there lies an industrial strategy.

2. Canadian Film Consideration

The Canadian feature film industry grew dramatically in recent years with the help of the CFDC, co-production agreements and the Capital Cost Allowance (see Chapter III). (However, in the recent past there has been a sharp demise in investor

interest due possibly to changing requirements in the CCA, and a sharp reduction in new projects).

Canada has demonstrated it has the talent, technicians, and resources to produce world class motion pictures. But, to be viable, this product must have both an international and Canadian market. Canadian Pay-TV may provide additional important stimulation and revenues. In the case of Home Video, this market will develop in the U.S. and spread northworld into Canada, Hollywood's second largest market. Hence, the same problems of access to distribution for Canadian product as in the motion picture theatres industry may arise. The provision of mastering and replication of videodiscs in Canada will have little cultural significance if the content is all or mostly all foreign.

The basic question is whether the Canadian film industry can profit from the domestic and international home video market. Such participation could be an important new source of income. In recent film negotiations in Europe, the Home Video rights have averaged 10-15% of the revenue in producer's distribution agreements.[6] The problem remains of how to ensure Canadian film's entrance into the mainstream of Home Video distribution.

The NFB has, over the years produced innovative and outstanding films, of all kinds. Its reputation for documentary films is second to none. The NFB library contains much that has

potential in a specialized Home Video market internationally and more that should be readily available in Canada as disc and tape players penetrate homes, schools and public libraries. Moreover, the NFB may be in an excellent position to supply profitably now and in the future the demands for content needed to back-up sales of players.

D. THE PUBLISHING INDUSTRY

To date, the impact of videodisc or videocassette on printing and publishing in the consumer market has been slight. The initial development has been the videomagazine which in its few examples has been along the lines of Playboy/Penthouse.

Sears has recently experimented with its catalogue on videodisc complete with Cheryl Tiegs modelling sportswear.

However, the publishing industry or at least its major multi-nationals are investigating and experimenting with the various capabilities of videodiscs and videocassettes. This is also true of their interest in digital data storage and retrieval systems. Whether it can be called the "electronic revolution" or the "information society" publishers are moving rapidly to acquire technological and production skills. Some of them have acquired A/V houses in the last fews years.

Indicative of the extent of electronic publishing in the U.S. is the following Table VI-1.

Table V-
Leading Educational Publishers'
Involvement in Electronic Publishing

Rank Based on 1980s Revenues	Publisher	Educational Revenues (in millions) 1980	1979
1	Scott, Foresman*** Microcomputer software agreement with Texas Instruments. South-Western agreements with Radio Shack and Apple.	$230***	$221
2	Harcourt Brace Jovanovich	194**	187**
3	McGraw-Hill Various types of courseware, including microcomputer software and telecourses; films of video tape, manuals for computer training.	188	182
4	Houghton Mifflin Time Share Corp. computer software, used to enhance text materials. National marketing began in 1980.	145	142
5	CBS Educational Publishing Prototype programs, continuous monitoring of activities relating to microcomputers in education for classroom management and instruction	135	130
6	Prentice-Hall Acquired Deltak, Inc., which has over 2000 video-based training courses in 1979	146	127
7a	Scholastic Scholastic Productions unit formed to seek non-print publishing opportunities for print product. Disc projects in works.	110	100

Table VI-1 (continued)

Rank Based on 1980s Revenues	Publisher	Educational Revenues (in millions) 1980	1979
7b	Macmillan Macmillan Electronic Media is developing markets in cable and commercial TV and exploring opportunities for creating and marketing educational and reference materials in electronic formats.	110	105
8	Xerox (Ginn & Co. Xerox Educ. Pub.)	90	90
9	Addison-Wesley Commitments for elem., high and college computer courseware, first school materials - Math.	76	65
10	Wiley*	60-65***	55
11	Harper & Row* INDAX data base	60***	64
12	SRA Instructional materials that can be used with commercially available personal computers.	55	55

* Fiscal years ends April 30.
** Includes general books.
***Estimate. Breakdowns of FY 1981 sales not available when this Table was being completed.

Source: Supplementary Material to Seminar: The Print Publisher in the Electronic World, New York, July, 1981.

The publishing industry recognizes that its role of information provider is quite compatible with the new electronic technologies. For example, on the local level the newspaper is well situated as the local data base provider for theatre and restaurant guides, yellow pages listings, little league and high school scores, local news, real estate listings, etc. The reporting staff exists. It already enters the editorial and advertising copy into word processors (data storage) which can be easily indexed and made accessible. This suggests that the new technologies may not put the newspaper out of business but rather may extend its reach, services, and profit opportunities. The same analogy can be drawn to almost any area of publishing. It depends on moving with the technology and the consumer's needs. The field trial experiments are now numberless.

Many experiments being done by universities and various industries, to apply videodisc, particularly with a computer interface, to educational and training materials and there are many indications of major publishers following these activities and developing their own. Both ABC/NEA (National Education Association) and SRA (IBM) are doing significant work in producing videodisc educational courseware. Control Data is experimenting with interfacing its mainframe computer based PLATO learning system with videodisc storage. It would appear that the publishing industry has assessed these learning system approaches to educational material and are not pursuing them until the player situation warrants such action.

Therefore, major textbook companies, e.g. McGraw-Hill, Macmillan, are working on video publishing more in terms of programs rather than learning systems. Both the Encyclopedia Britannica and the World Book Encyclopedia are developing videodisc adjuncts to their volumes.

Possibly the best illustration of the potential use of video technology by a large publisher is Time-Life Inc. It has diversified extensively into video through its ownershjip of Time-Life Films, Time-Life Television, Time-Life Multimedia, Home Box Office and various cable and TV holdings. Time-Life Films has been the distributor of BBC programs such as "The Pallisers" and "Anna Karenina" plus the co-producer and distributor of the complete works of Shakespeare. Time-Life Multimedia distributes films and cassettes to the educational market which again includes much BBC material such as the "Ascent of Man" and the Sir Kenneth Clark series "Civilization." Probably no other huge publishing company is as well poised to undertake the mass market distribution of videodiscs and videocassettes with programs of an educational, informational, or cultural nature. In the various series of Time-Life books there is a wealth of illustrated material easily "convertible" for videodisc.

Many publishers, through their expertise in gathering and handling knowledge, their capability to store and edit this information, and their developed channels of reaching the

consumer, are as well situated to enter the Home Video market as most broadcasters and film producers.

In the educational field, Ontario has enacted guidelines for textbook content which may set a kind of precedent for audio visual (A/V) material. Its Ministry of Education in conjunction with the Ontario Institute for Studies in Education (OISE) is developing a videodisc learning system including the accessory hardware to produce an interactive A/V teaching aid. The educational sector is becoming aware of videodisc developments.

At one time, Torstar together with Neilsen-Ferns Productions was examining the possibility of transfer of books to video. In particular, they were interested in the video possibilities of the Harlequin Enterprises properties. This idea is illustrative of video production made-for-Home Video and/or broadcast, e.g. "Romance of the Month" subscriptions, and in effect a video paperback.

Moreover, when the mass consumer market is well penetrated by Home Video devices, the schools will probably follow. This development could provide a larger market for A/V materials and curricular content and an opportunity for Canadian publishing.

The vital concern is the possibility of the large importation of foreign educational content due to economies of scale. Canadian children now spend about two-thirds as much time watching U.S. programs as they spend in school. It may be appropriate for educational authorities to develop agreements on

standards of equipment and the development of content. In this way, although the hardware may remain foreign, the program content could be predominately Canadian in character.

E. THE RECORD INDUSTRY

As noted earlier, video music has been slow to develop in North America and appears more advanced in Europe. The ABC made-for-cassette/disc "Physical" with OIlivia Newton-John is the first example of music Home Video providing the original distribution followed by a network TV secondary exposure of a "cleaned-up" version. The transition of the audio record production industry to A/V records would seem to be very advantageous to the industry and an early priority due to its level growth in the past two years. However, there are four problems hampering development.

First, the cost of a video music production is probably at least twice that of an audio production in a recording studio. Second, there are few ways to recover the additional cost of video such as film/TV release when player populations are low and product is perishable over time. Third, the demographics of existing VCR and VDP owners are significantly different from the youth audience for most popular music. Finally, serious copyright problems have yet to be resolved.

This is not to say the picture may not change dramatically. As player penetration grows and the copyright problems resolved, video music may present the record industry with a new price structure for a greater perceived value.

Canada does have a considerable resource in popular musicians and performers. Many are of first rank international

stature. Canada also has excellent recording facilities. Musical video is only in the developmental stage and may provide a new opportunity for the Canadian recording industry.

The number of video "records" is increasing as interest in the media grows. World class record groups have in the past used video as a promotional medium for "Tops of the Pops" TV shows, especially in Europe, and for product promotion to radio programmers, booking agents, etc. This material can now find other use in disc and tape productions. In Canada, acts like RUSH, Ann Murray, etc. have been working with video projects. As well, it is reported first rate recording studios are now becoming equipped for video as well as audio productions. Nevertheless, the obstacles to international success will be similar to those in other media.

PART TWO

EDUCATION

A. INTRODUCTION

There appear to be two central issues in the discussion of the use of videodisc for education; the potential for more accessible and better flexible adult education and the need for Canadian content.

There is a change occurring in many of the school systems across the country which reflects the age distribution patterns within the population. There are diminishing numbers of children in schools due to a decline in the birth rate and decreased immigration. However the number of adults participating in continuing education activities is increasing. This increase in the participation rate of adults is likely to continue for a number of reasons.

First, adults are becoming a larger proportion of the population in Canada. Second, because of the tight job market and the rate of technological change many workers find themselves in need of retraining or upgrading in mid career. Third, any increase in leisure time is likely to increase the demand for education.

An adult has many demands upon his or her time because of work, family or community related responsibilities. Therefore, as a learner the adult needs and will demand flexible learning opportunities from the education system. Educational institu-

tions have begun to respond to the need of this new clientele, in most cases, by offering regular academic programs and some non-credit offerings at times which are convenient. To develop more flexible programming, they offer distance education programs which permit the adult learner to study when and where it is most convenient.

For the adult learner, videodisc systems hold much promise. They offer a sophisticated medium to the educators and greater convenience to the learner. The potential of videodisc to meet the needs of the adult learner should be turned into reality.

An increasing rate of technological change coupled with a growing number of people in the work force over 25 years of age means that the demand for upgrading and retraining will increase if Canada is to maintain a competitive position in the international marketplace. The Committee on the Future Role of Universities in Ontario summarizes the problem: "Rates of economic growth are below the levels of previous years. Clearly, new strategies, new systems and new technologies are required."[7] The education system must help to prepare the work force to meet these new challenges.

The private sector also will meet some of these needs. For example, there are estimates of 80 to 100 million dollar expenditures in the United States for corporate internal education. Teaching tools such as videodisc systems have shown promise of being more cost effective than traditional methods.

As a medium, videodisc offers the instructionsl designer a combination of variable methods never before available. These include the individuality of CAI (Computer Assisted Instruction) and CML (Computer Managed Learning) coupled with learner response instruments that range from key-pads to light pens. With a videodisc system, the student can become an active rather than a passive learner.

The videodisc system due to its portability and potentially low cost can eventually offer the freedom to learn at home, in school or in the workplace in both urban and rural communities.

B. Analysis of U.S. Experience

While there has been obvious growth of activity in the development of educational applications for videodisc, a major portion of available literature is devoted to theoretical discussions regarding this new technology. This theorizing emerged in the early 1970's along with the prototype units of videodisc hardware. Michael Dann, speaking at the 1973 International Market for Video-cassette and Videodisc Programmes and Equipment, raised the issue of software development which remains pertinent today. He noted that by 1976 half a billion dollars would have been spent on hardware development but less than one percent of that amount on software; and he cautioned that "Preoccupation with converting existing material to cartridge, tape, disc, or film threatens to hold back this industry for a decade". Almost a decade later the videodisc industry is only just getting underway, with its software suppliers scrambling to keep up the market's potential.

By 1977-78 several important papers had been prepared for the U.S. National Institute of Education, notably: Ludwig Braun's "Micro-computers and Video Disc Systems: Magic Lamps for Educators," Dustin Heuston's "The Promise and Inevitability of the Videodisc in Education," and Lester Eastwood's "Motivations and Deterrents to Educational Use of 'Intelligent Videodisc' Systems." The latter provides a comprehensive analysis of the barriers and benefits involved with videodisc technology.

Eastwood's discussion of barriers is prefaced with the statement that the "barriers are imposing." They have so far managed to withstand any large-scale incursion of technology in education."[8] He lists the educational barriers as ". . . deterrents due to attitudes and traditions, difficulties in marketing to educators, institutional and legal constraints, inappropriate facilities and staffing, failings of educational research and development, and the difficulties faced by the educational software production and distribution industry."[9] In addition he cites economic obstacles in the form of ". . . likely high software costs, cost-reducing engineering breakthroughs needed, and problems that still face the videodisc in the commercial market -- competition, lack of standardization, and copyright battles."[10] He also discusses the technical problems of standardization, reliability, read-write capabilities, and the user-machine interface.

In his detailed analysis of these potential barriers, Eastwood makes numerous suggestions for overcoming the obstacles -- concepts which are reflected in the writings of other experts. Four areas for attention predominate:

- the need for co-operation among specialists;
- the need for quality instructional design of courseware;
- the need for videodisc developments to be user-oriented; and
- the need for creative exploitation of the technology, especially with regard to the concept of "visual literacy."

The majority of videodisc projects discussed in the literature review appear to originate with the purpose of exploring the potential of videodisc hardware. There was little evidence of projects addressing the user-orientation need. The Nebraska Videodisc Group describes their mandate as "pioneering the design and development of videodisc programming . . .@andf developing a number of new techniques and procedures that enhance and expand videodisc capabilities."[11] While the variety of programs which the Group has developed reach a wide range of end users, these programs appear to have been developed from the perspective of "what the machinery can do" rather than "what the user needs can be met." However, this analysis is not absolute -- certainly the Group's work on behalf of the hearing impaired has responded to a very real user need. Another videodisc project which appears to fulfill the recommendations of user-oriention theorists, is the ABC/NEA SCHOOLDISC project. In this case the work began with specially selected teacher-consultants who "had one overriding charge -- to use the rich technical resources of a great television system to increase literacy and language comprehension for upper elementary students."[12] The teachers began their work with an understanding of the needs and capabilities of the students -- the end users.

Bork's description of "individuals essentially doing solo efforts at writing courseware" is supported by the examples found

in the literature. Numerous projects have been concerned with interfacing videodisc players to microcomputers, all in apparent isolation from each other. Three separate projects are noted in the review which address the feasibility of simultaneous display of computer-generated information and videodisc images on the same screen. Again, these projects appear to have been carried out in isolation, even though two of them took place in the same state, at Utah State University and at the University of Utah. Thus, the theorists' plea for co-operation among specialists and the need for ". . . close contact with one another and . . . rapid communication of findings" does not appear to be answered.

The need for quality instructional design is more universally recognized. By 1975, Edward Schneider of Brigham Young University, predicted that "interactive applications will make a real contribution to the quality of education, but not until instructional development becomes a matter of production, instead of experimentation."[13] In late 1978, the National Science Foundation initiated a research thrust "to develop innovative and compelling concepts for teaching and learning in science education".[14] This WICAT study, funded by the National Science Foundation, is an example of effective videodisc instructional design. What is lacking in the review of U.S. activities is more evidence of this sophisticated use of videodisc technology.

Similarly, while the theories of "visual literacy" are

gaining recognition, there is little evidence in the literature of videodisc projects specifically designed to explore this concept. However, this is partly a result of the youth of the technology. Some of the most recent work in disc production shows encouraging evidence of creative exploitation of videodisc capabilities.

The application of videodisc technology in education and training is an endeavour that is barely four years old. In the words of Dr. Leo Leveridge, the ". . . opportunities for significant innovation in communication for education are unlimited."[15]

In a stimulating article found in the March, 1981 Videodisc News, Dr. Paul R. Kent of the University of Texas Health Science Center, challenges the videodisc observer to recognize the "conceptual transition" initiated by the technology.

"This is the third great conceptual transition that technology has made possible for visual media." Kent describes the first transition as the advent of photography, and the second as the invention of moving pictures.

> The videodisc is the ticket to the third major transition: to interactive video. The media experience is no longer predetermined by the beginning, the end, and everything that goes in between . . . This is a new form of media; it is a new art form; and it requires a new way of thinking.

A similar recognition of the need for new thought was reached from a different perspective by Andrew Molnar of the National Science Foundation. In his words:

> . . . we are approaching the limits of our educational and instructional systems . . . While the information explosion has brought a vast and growing amount of knowledge to our doorstep, we are fast reaching the human limits of our ability to absorb and use it . . . If we are to master information, we must expand human ability to learn and comprehend and we must create new intellectual tools to extend human capacity to reason and to "work smarter".[16]

Molnar goes on to suggest that a relatively new concept may provide some solutions:

> Recent work on the information processing functions of the brain shows that the right hemisphere of the brain primarily performs the specialized functions related to spatial imagery and the left hemisphere processes serial, analytical, or linguistic information . . . Recent research using interactive graphics shows strong positive effects of mental imagery on both learning and memory. Technological systems may be capable of organizing information into a form that can improve learning and extend long term memory well beyond the mnemonic devices used in memory training.[17]

In a paper published in 1977, Richard Ingalls also discussed brain hemisphere research and the emerging concept of "visual literacy." As he explained, "Television approaches the right hemisphere, whereas school approaches the left hemisphere. Were the learning situation to use both hemispheres simultaneously, the learning potential of all students could be greatly enhanced."[18] Ingalls suggests that videodisc technology may provide the means:

> Computer-assisted instruction is primarily linear, or left-brain oriented. Video is primarily visual, or right-brain oriented. Therefore, we will have the capability of video combined with the computer. This combination may provide for its own very unique learning situations which could be greater than video or computers on their own.[19]

Briefly let us review some examples of the educational as

opposed to "training" experiments that are currently underway.

As mentioned previously, the ABC/NEA SCHOOLDISC program was announced in January 1980, to supply instructional materials for grades 4 through 6, with a goal of providing one hour of video material for every two weeks of school.[20]

Dr. Joan Sustik of University of Iowa has a pilot project to use a videodisc system controlled by an external micro processor for a variety of uses in the educational environment, including medical applications, dance, architecture and art history.[21]

The Museum of Fine Arts in Boston produced a videodisc in November 1980 of 200 slides from its collection. The intent was to provide a demonstration of the use of videodisc as a tool for art historical resarch.[22] Videodisc is also being used in North Dakota high schools to assist in teaching english literature.[23]

There is some evaluation of these activities going on. Results of a WICAT study, sponsored by the National Science Foundation have shown videodisc to be powerful new educational tool. In a 22 month comparitive study of disc classroom instruction of introductory Biology at Brigham Young University and Brookhaven Community college the researchers found that "the delivery of science instruction via intelligent videodisc has proven not only feasible, but superior in some situations to traditional college science instruction."[24]

C. THE IMPACT IN CANADA

Canadian institutions are discovering the educational application of videodisc technology. The following is a summary of the findings of a limited survey undertaken for this study:

a) Thirteen percent of the respondents indicated that their institution was extremely likely to use videodisc in the near future while fifty-three percent responded that it was likely. On the negative side, fifteen percent felt it was unlikely that they would use videodisc and thirteen percent that it was extremely unlikely.

b) When respondents were divided into public and private sectors, it became clear that there was a higher level of interest among the institutions falling into the latter category.

c) Private sector institutions reported less likelihood of involvement. The positive responses were primarily from the military and business with no interest indicated by any of the trade and vocational schools contacted.

d) In terms of current activity, development of videodisc applications in Canada appears to parallel the U.S. activity in that it is the military and university institutions which are leading the way.

e) The Ontario Institute for Studies in Education has embarked on a two year project, the Interactive Computer-based Videodisc System for Skills Training, which has been funded by the Ontario Ministry of Colleges and Universities. The project courseware for training a machine lathe operator is being developed by a project team comprised of twenty people associated with OISE and additional groups from cooperating agencies and field trial participants. It is anticipated that this project, if successful, will place Ontario in the forefront of the videodisc field and the large number of agencies involved in the development will ensure a higher level of awareness of the potential of the medium.

f) Both Sheridan College and the Canadian Forces Base Trenton have videodisc hardware and are currently exploring possible uses. Respondents from Sheridan felt that the technology was suitable for any courses but especially for distance education. The training potential was of particular interest to the military, both in a group situation as well as individualized instruction.

g) Knowledge of the technology and its capabilities is greatest with individuals who are personally rather than professionally interested; stated another way, the motivation for becoming knowledgeable about videodisc technology usually comes from within the individual rather than from institutional or corporate policy at this time.

h) Continuing education was recognized by 45% of the sample as a potential application. Again, as in the case of technical awareness, after a cluster of response in the "top three" potential applications, all other possibilities were noted by one-third or less of the sample. There was an average of three applications mentioned per respondent.

i) There was an interesting divergence of response with regard to the two general areas of application -- training and education. Those who supported videodisc for training applications tended to be very enthusiastic. "The disc technology allows immediate evaluation of students in skills training which requires drilling" was noted by one respondent. "Industry can use the disc more than educators as it is best adapted for training. Educators are not 'trainers' as education is too 'free form.'" This comment by an educator is representative of the conflicting opinions concerning the application of videodisc to education. Some respondents thought the disc would add to the teacher's and student's productivity; others thought that the disc would make the teacher superfluous.

j) Some of the earliest videodisc projects have involved exploring the technology's potential for education of the physically handicapped. It is apparent that there is little or no Canadian awareness of this important activity. Only four respondents suggested this area; three of these were representatives of school boards and one represented a public library. None of the provincial ministry representatives made any comments in this regard.

k) A majority of representatives from public libraries, school boards, publishers and community colleges envisaged that the technology would permit greater extension of their institutions' services to the public. For example, a spokesperson for the Book Society of Canada suggested that " . . . disc would be an extended use of what the publisher does well already . . ."

l) Institutions involved in adult education and distance education had a positive approach to the use of videodisc technology. For example, representatives of the Ontario Educational Communications Authority suggested that the disc's ". . . ease of distribution would mean a wider spread of correspondence

programs and skill training . . ." and looked forward to the delivery of adult education by disc as a continuation of their work in computer-managed-instruction and computer-assisted-instruction.

There appears to be considerable interest in the new videodisc technology and its potential for education and training, but few institutions are actually involved in active evaluation or development. Because the majority of the institutions contacted are at a similar level of awareness and interest a common mechanism for information sharing and collaborative development may be an optional method to advance Canadian utilization of educational applications of videodisc technology.

In the face of a new technology with tremendous programming potential there is an imperative need to protect the Canadian cultural identity. Canadian developed videodiscs about Canadian issues should be available to school systems and the general public. As a nation we are already inundated by American film and television programs. The school systems are suffering from financial constraints and publishers may not see the Canadian scholastic market as sufficiently lucrative to warrant development. This means that two potential producers of Canadian videodisc programs may not be able or unwilling to allocate the resources needed for development.

It is crucial that some mechanism be determined to ensure that Canadian culture is protected by the development of Canadian programming.

PART THREE

TRAINING

A. Introduction

The earliest applications of videodisc technology to training were probably in the military and intelligence communities and a great deal of experimental work is still being pursued. The first major public introduction of the technology was the 12,000 dealer General Motors Videodisc Network which replaced an earlier 8mm film "Mini-Theater" A/V network. The GM Videodisc Network is based on the DVA 7820 player and Zenith Color TV in unit cabinet which can be wheeled from area to area. The content is used to assist in direct selling, sales training, and service training and varies in the amount of interactivity permitted the viewer. This is a "stand alone" system in so far as the sophistication of the playback and interaction requires no more computer programming power than is located in the player.

Many of the training applications, as noted in the previous section on Education, may use a less advanced player, e.g. the Pioneer VD-1000, and an outside computer. Even the early Hughes Aircraft TMIS (Training and Maintenance Information System) based on the Thomson-CSF player incorporated extensive outside computer and system software. These systems have gone further to incorporate responses by light-pen or touch sensitive screens which avoid the necessity for keyboard entry and its tedious verbal communication, e.g. correctly trace the fluid flow in an

automatic transmission. This question of stand-alone or augmented systems has been the topic of recent research.

In industry and the military, one of the problems is maintaining uniformity and quality of instruction. An example of videodisc applied to this problem is the CPR (Computer/Videodisc Learning System) developed by the American Heart Association to solve the problem of how to train great numbers of people in the techniques of cardio-pulmonary resuscitation when faced with the high turnover of volunteer CPR trainers. A similar problem is faced by multi-branch business with high turnover of initially unskilled help. The problem is to bring new entrants up to adequate competence with the minimum of expense in managerial time.

In the area of industrial training, the videodisc will only proliferate if it can demonstrate cost effectiveness in the task of instruction and in competition with other A/V media.

B. Stand-Alone vs. Computer Interfaced

In training applications most educators highly regard the capability of interaction between the learner and the content. The student can proceed at his/her own speed, be tested in progress, reinforced (positively or negatively) on the results, and directed to more practice, alternate learning sequences or provided with enrichment. The sophistication of these capabilities are a function of the amount of computer software and therefore "memory" needed to control the training experience. The two players designed for industrial training are the DVA 7820 and the Sony. The former has an 1K memory or 1,000 programming steps and the Sony has 4K or 4,000 steps. It is possible to program multiple memory "dumps" but the practical limit seems to be 2 or 3 on a disc side. Most of the research work in U.S. universities has been based on using the cheaper consumer optical laser player and interfacing it with an outside mini-computer. This is the approach that Ontario's Institute for Studies in Education has taken as noted before.

The contention of the manufacturer is that the "on board" memory is sufficient for practical industrial training applications and leads to a standardized delivery system which is not dependent on a host of add-ons and interfaces at each location and is compatible with any other corporation's learning system which uses the same hardware. The educator's position is that the additional expense of the industrial model is almost equal to

interfacing a much more powerful mini-computer and this can lead to the further addition of text overlays, easier software updating, and "user friendly" features such as light pens, touch sensitive screens, and voice commands.

The only study on this problem found in the literature was based solely on working with various configurations and did not make an economic or outside user analysis. It concluded:

> Although we have been enabled to deliver almost as complex a program with a stand-alone videodisc player as with a computer-interfaced player, we have had to sacrifice the flexibility that is essential to developing quality interactive programs. We would also have to limit the length of presentations in exchange for the user-friendliness we need. For both reasons we will continue to give the main emphasis of our development efforts and experimental programming to systems in which a relatively inexpensive external EDP @electronic data processor; dedicated to executing interactive educational programs is interfaced with a videodisc player and in which sound is provided to still frames by audiotape.
>
> Manufacturers would be well advised to concentrate on developing low-cost, high quality, durable optical videodisc players designed for easy interfacing with commonly available, inexpensive microcomputers and other external EDPs, rather than adding to the cost of their players by enhancing the power of their built-in EDPs which only duplicate some of the functions of the computers that are required anyway to meet educators' and industrialists' special needs.

It should be noted that the consumer model most applicable to an external computer, the Pioneer LaserDisc, is being brought out in a new model which does not have a remote control jack. Interfacing would require opening the player and voiding the warranty.

While the educationist's point of view is well taken for sophisticated training which more closely parallels the advances in CML (computer managed learning), the manufacturers are much more interested in an industrial "mass" market. For many typical training applications the "on board" computer memory appears adequate. In more advanced training, particularly in simulations, two or more VDPs may be required simultaneously and therefore must be controlled by an external computer.

C. Efficiency of the VDP for Training

As yet, no cost benefit analyses of the VDP in a training mode appear in the literature. However, many studies in the area of computer assisted instruction and mediated learning in general have demonstrated cost effectiveness.

General Motors has conducted some subjective evaluations with its dealers on the GM Videodisc Network System. These evaluations are basically comparisons with the earlier Mini-Theater network and in some cases reflect identical content on disc as opposed to 8mm film. With respect to the most popular and least popular operational characteristics of the Videodisc Network dealers and salespeople generated the following matrix (Table VII-1.)

Table VII-1

Rank Order Matrix
Most and Least Popular
Operational Characteristics

	Extremely Useful	Very Useful	Useful	Not Very Useful	Not Useful At All
"Instant Access"	88%	11	0	0	0
Fast Forward/Reverse	33	33	11	22	0
Slow Motion	33	22	44	0	0
Variable Speed	11	11	55	22	0
"Step Frame"	22	22	56	0	0
Product Quiz	33	44	11	0	11
Quiz Answer Replay	33	44	11	0	11
Index Categories	88	11	0	0	0

Top ranked categories are underlines under each heading.

Note: While Product Quiz and Quiz Answer Replay (branching sequences) are ranked top in the Useful category, they are also ranked top in the Not Useful At All category.[26]

Table VII-2
Perceived Quality of Information/Training
Salespeople and Managers
(Excellent responses)

	Mini-Theater		Video Center	
	Sales	Mgrs.	Sales	Mgrs.
Quality of Product Information	30%	11%	45%	44%
Quality of Sales Training	27%	11%	44%	22%

Table VII-3
Effectiveness of Mini-Theater
and Video Center with Customers

	Mini-Theater	Video Center
Highly Effective	26%	41%
Effective	37%	44%
Somewhat Effective	28%	7%
Not at all Effective	5%	1%

Source: These tables are reproduced from "Practical Applications of the Optical Videodisc" by John Hardigan, unpublished paper presented at industry conferences.

The following cost analysis of a videodisc learning system were developed by Symtec, Inc. of Southfield, Michigan. A $10,000.00 (U.S.) system would have a configuration as follows (Symtec design):

48K Apple I	$1,395.00
Apple II Disk Drive & Ctl	598.00
Light Pen*	250.00
VideoData Processor*	1,500.00
VideoDisc Controller*	150.00
Color TV	300.00
Pioneer Laser Disc	750.00
System Software	2,500.00
System Authoring Program	2,500.00
	$9,940.00

*Symtec produced

The highest cost of the Interactive Video approach is that of producing the videodisc itself. Second in cost is the computer software and the considerations for overall educational program designs. Typically, materials and services to produce a videodisc featuring, for example, 8 minutes of motion and about 50 still art pictures would cost between $25,000 and $75,000. Some disc production, depending upon the producer, the difficulty of filming and other such considerations could reach over $100,000. To these costs, the computer program could range between $2,000 and $3,000

all the way up to $30,000 or more; again depending upon difficulty. Then, a coordinated interplay of educational methods to insure these factors act in concert must be developed. Numerous companies exist which can provide overall production supervision. Typically, charges for this service range between $10,000 to over $30,000.

The total cost to provide the materials required to make a videodisc and computer program can be as little as $40,000 to as much as $250,000. To this cost, one must add the disc mastering and duplication charges. Mastering can range from $3,000 to $8,000 and duplicates are between $7.50 and $25.00 per copy depending on number of copies required. If the total computer and videodisc production cost and mastering costs reach $80,000, and a user has 1,000 locations to service, the amortized production costs are $80 per location per program. To this, add $20 for copies of both the video and computer discs and you get a $100 cost per station per program. Further, if a program requires 2 hours for each student to complete the material using a 5 day, 40 hour week, the cost per user is only $.10 each. Even if we add in the depreciation of the hardware over a 8 year period at $5,500 per system, the cost per user is only $.21 to $.42 per user hour.

Using user cost per hour figures of $1.00 per hour per student including hardware depreciation, the using organization could fund a library of as many as 6 different programs per year.

Even at a smaller scale per user costs are reasonable. Consider only 10 stations of a total cost of $100,000 and a library of 56 programs costing $500,000. With 5 year depreciation of the hardware and one year expense of the software, total cost is $520,000 or less. Operating on a 5 day, 40 hour week with 50 weeks per year and assuming each play is 2 hours in length, the cost per play over a 10-station network is only $52 or $26 per hour. Such a system could handle 10,000 users per year at a one play per user per year basis. To expose each user to all 5 programs, the capacity is 2,000 people per year, each receiving 10 hours on the system at a cost per head of only $260.

All of these examples make no attempt to consider economies in programming or videodisc preparation and further assume a hardware cost of $10,000 per station. Given some yearning toward economy of production and quantity pricing for the hardware, it may be possible to reduce these costs by half.[26]

The assumptions used above seem reasonable and do indicate the ranges of costs involved in software designs for highly interactive training packages.

D. Selected Case Studies

The number of experiments and demonstrations of videodisc applied to training are too lengthy to list. A few examples not cited earlier will probably serve to indicate the range of activities.

1. Electronic Warfare Training

The U.S. Naval Personnel Research Development Center is investigating the use of microprocessor-based training systems at remote sites for a variety of Navy tasks. A specific project is an interactive video learning system to train Navy Operations Specialists in tracking targets on a radar scope while subjected to enemy jamming so that they can correctly identify the types of jamming and carry out the appropriate corrective actions. Initially the program uses a Betamax videotape player but will evolve to videodisc after "debugging." The first results indicate a significant gain between pre-test and post-test measures, very positive student attitudes, an absence of media problems, and low maintenance problems. However, there was a rapid skill decay (need for frequent refreshers) and a failure by most trainees to extract key features of jamming types (need to revise presentation).[25]

2. Training and Maintenance Information System

The basic TMIS configuration consists of a CRT display, keyboard, microcomputer, dual floppy disc drive, line graphics generator, video disc drive and the operational software. Hughes

Aircraft claims that it becomes a cost effective instructional system which combines instructor, reference library, simulator, examiner and refresher course in one self-contained portable unit. In the maintenance role it can replace the task of pouring through thousands of pages of manuals by responding to the initial request and using a series of queries direct the technician to the appropriate repair sequence. "System theory, flow charts and other unnecessary data don't intrude and compete for space and reading time."[26]

3. Imagetics

Emerson Electric Co., Sony and Imagetics, Inc. have combined to develop a videodisc learning system marketed by Emerson using a Sony industrial VDP interfaced with a microprocessor and a light pen. Imagetics provides a patented training methodology based on enhancing mental images acquired by the student as a result of a learning experience.

A sample program has been developed to train an Amoured Cannon Vehicle crewman to perform the pre-operation check, the power on procedure, operate the system, employ the M-36 sight and gun controls, arm the system and fire.

Earlier Imagetics flight simulation training for Boeing and British European Airways was developed but not on videodisc. It was said in the case of BEA to have produced a 36.5% reduction in training time and better retention of learned skills. The

videodisc is claimed to be the "missing link" that allows the widespread application of the training methodology.[29]

ENDNOTES

[1]Landover, David J. & Francine S. Blum, The Videodisc Goes National, Wertheim Industry Comment, Wertheim Research Dept., NY, Jan. 2, 1981.

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[3]Ibid.

[4]See "A Television Digest White Paper," Television Digest, Dec. 14, 1981. Edited from Dec. 5, 1981 forecast prepared by RCA Consumer Electronics, including data from "Video 90," RCA corporate study of next decade, started early in 1981.

[5]Material found in a report by the National Economic Research Associates of Washington, D.C. entitled "Will Cable Save the Arts?"

[6]The Videoplay Report, Vol II, No. 23, Nov. 9, 1981, p. 8.

[7]The Challenge of the '80s. Preliminary report of the Committee on the Future Role of Universities in Ontario. March 1981, p. 4.

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[11]Merrill, Paul F. and Bennion, Junius L. "Videodisc Technology in Education: The Current Scene." NSPI Journal vo. 18, no. 9, November 1979, p. 24.

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CHAPTER VII

SUMMARY OF IMPLICATIONS TO NATIONAL DEVELOPMENT

A. CONSUMER MARKET - RESULTS & CONCLUSIONS

Home video by 1990 will be pervasive in the United States perhaps one in three homes; in Canada somewhat less, about one in five or four homes; and in other OECD countries, varying levels of significant penetration. The use of pre-recorded content (PRC), discs or cassettes, may rise to 70% of VCR owners and naturally 100% of VDP owners. Rental, rather than ownership, will be significant. Hollywood and company may release in all probability content for Home Video before or concurrently with Pay TV.

Kalba-Bowen Associates reports from a survey on American VCR owners's preferences that, "while current and classic movies currently dominate PRC sales and rental markets, the increasing availability of more entertainment, educational and informational programming will also appeal to consumer tastes." The researchers found that outside the general movie category, the most desired categories of non-movie entertainment programming were programs starring major recording artists, performances of major stars,

and recordings of theatrical events. They also noted that the owner preferred to rent cassettes rather than buy (2 to 1) and that the greater the interest in a program category, the greater the interest in buying the cassettes.

The role of videodisc in Home Video is not as certain but most of the projections still appear optimistic. About 150,000 players of all kinds are now in use. LaserVision has been in the market for about two years and RCA since March. The VHD is planning a June 1982 United States appearance. LaserVision (Magnavision, LaserDisc) is aiming more toward the present VCR owner demographics and will be in price competition with the VCR. machine. RCA, with its lower-priced Selectavision is going after the mass market -- the 75 per cent of U.S. homes without cable and who are not interested in either the complexity or features of VCRs and LaserVision.

Prior to the RCA launch, the company claimed it would sell 200,000 CED players under its own name and 50,000 under Zenith. The March target of 26,000 was met but the ultimate target failed by half. Analysts' views range from a complete bust to wait and see. The real boom may not be apparent until 1983. Recent industry news letters report RCA sales of discs per customer has exceeded pre-launch expectations.

Both LaserVision and SelectaVision have the corporate backing to sustain a long campaign. If RCA withdraws from the

marketplace then LaserVision's sales approach to marketing based on the higher priced, many featured, more adaptable player, may triumph slowly. A 60/40 guess is that RCA will tough it out and emerge by late 1982 or early 1983 in a dominant position. There seems to be little middle ground -- either the SelectaVision will boom or bust.

This uncertainty does not drastically affect the study results of the consumer market. Pre-recorded content in home video will become pervasive. If SelectaVision does not become the dominant North American consumer standard, there might be freer access to replication and distribution. RCA which earlier indicated it had no plans for custom pressing at least until 1984 is now rumoured to be reconsidering this policy and talking 1983 or even late 1982.

An estimated impact of home video on the big three American networks is a decline in prime time set usage from 86.5% to 60.4%. Similar reductions could occur in Canada because home video has the clear potential to enjoy the long tradition of wholesale acceptance of US programming and the entrenched public appreciation of American entertainment values. Consequently it appears imperative that Canadian entrepreneurs and the creative community seek out areas in which to compete, both at home and internationally.

Initially four kinds of programming well produced in Canada may have good home video market potential: popular music,

children's programs, educational programming, and special interests programming (e.g., natural history and cultural productions). Significant domestic penetration by Canadian programming via Home Video in these areas could provide a strong domestic base for export marketing. These areas are expected to be of considerable interest to consumers in other countries. And, with respect to musical production, there could be important spin-off benefits for the Canadian audio recording industry because of the promotion of Canadian artists and musical groups.

Additionally, as Canadian film and broadcasting producers make feature presentation for theatres, Pay-TV and conventional broadcasting, there should be provision for home video replication and distribution.

The achievement of a significant Canadian share of the essentially brand new home video market represents a special challenge. The multinationals are utilizing old and established resources for content most of which is American, but new deals and procedures are coming into existence. The lines are not yet set in concrete. To break into the market, to cut costs and duplication of effort, and to avoid fragmentation of the domestic market, it may be advantageous to create for Canadian product a single distribution and marketing corporation to serve educational and public broadcasters, the private broadcasters, independent producers, the performing arts and the cultural industries generally.

Distribution systems will also be key. In the absence of a common national marketing and distribution corporation, Canadian producers of programming would need reliable access to effective national and international distribution, the lack of which has persistently plagued several Canadian cultural industries. To achieve this goal, local distributors and retailers will need market information about home video and of information pertaining to anticipated Canadian activities in this area before the technology actually achieves significant consumer acceptance.

There is Canadian programming attractive for Home Video markets but much of it is tied up by contractual barriers. While there are agencies like CBC and NFB etc which now distribute pre-recorded content to the public, their efforts are under-funded and therefore under-promoted. There is a lack of co-ordination and they are not geared to exploit the Home Video market. Moreover, the private sector producers have a backlog of material and a capacity to produce more that should find a market in Home Video. Strength in the international market will be re-inforced by the existence of a strong, national distribution scheme.

A third important consideration is the replication of discs in Canada. There would be economic benefits created from employment and Canadian producers may well need access to domestic manufacturing capability especially for the production of relatively small runs of discs aimed at audiences with special interests.

There appear to be few possibilities for the domestic manufacture of mass market players or even assembly of them. Contacts with Canadian electronic manufacturers showed little or no interest. They no doubt consider there are better alternatives to utilize their capacity and capability.

Three Canadian groups have expressed interest in mastering and replicating videodiscs. Such an investment is doubtless a high risk one because of the demonstrated difficulties in achieving efficient mastering and replication processes. DiscoVision Associates have given up mass replication and given it over to Pioneer in Japan. Only they and RCA have actually succeeded in mass producing discs. Philips, 3M and Sony have still not demonstrated a replication ability beyond small runs in laboratory-like condition. IBM's involvement in DiscoVision Associates replication plant was reported at $116 million cash in 1980 alone.

In summary, there are two basic considerations. The first is the problem of whether there is a fundamental need for one or more "instruments" in the public and/or private sector to undertake the following tasks:

a) distribution and promotion of all Canadian product;

b) acquisition and dissemination of necessary information for Canadian producers; and

c) provision of financial services, equity participation

and/or loans in support of Home Video aspects of production.

This matter will clearly require extensive consultation with governments, agencies private industry and unions.

The second consideration is the need for a definite assessment of the requirement for and feasibility of mastering and replication in Canada.

B. INDUSTRIAL TRAINING & EDUCATIONAL MARKET RESULTS AND CONCLUSIONS

1. Industrial Market

At present, the optical laser videodisc is rapidly gaining a foothold in the A/V training market. The two industrial players in distribution -- the DVA 7820 and the Sony -- are equipped with a microprocessor which permits interactive instruction, random access, branched learning techniques, etc. While these capabilities have not been fully exploited in production to date, a sector of A/V industry is rapidly moving into LV videodisc for corporate use. After careful analysis of previous A/V devices and 1/2" VCR they have concluded that the videodisc is cost benefit effective. The cross-over point seems to be about 150 to 250 units in a corporate videodisc network.

So far, General Motors and Ford have adopted DVA and Sony respectively. Other corporations reported to have made an agreement or are about to conclude one are McDonalds, Burger King and American Motors. The U.S. military will also be a major client.

Where the videodisc appears to be gaining acceptance is in those training applications where there is a high turnover of basically young and unskilled personnel who must be made rapidly competent without undue use of managerial time; or in situations where the introduction of new techniques, procedures etc is predictable and frequent. This training approach assures a high

degree of central control and common standards and it usually obtains good results through quizzes on time cards, etc. which if failed require the learner to repeat the procedure.

Videodisc manufacturers and A/V systems houses do not anticipate the public educational market to be of much interest. Although many experiments have been conducted demonstrating the versatility and effectiveness of the LV videodisc, the industry sees little potential in this market for a long time. This is not because of the technology but because of the school systems. School boards and systems are too decentralized to be able to produce the course-ware economically; they have limited budgets; and there is a resistance to more A/V technology.

Research findings indicate that there are Canadian industry and government needs for the technology. The Department of Employment and Immigration and the Department of National Defense are potential users. All told, the federal government, in a cursory estimate, might beneficially use 2,000 machines. No estimate has been made of the private sector's needs. Canadian branches of U.S. companies for the most part will probably follow the lead of head offices.

The independent production industry in Canada services the industrial and institutional A/V market in Canada -- to the extent of over $500 million -- the largest segment of its business. With the trend by industry to introduce videodisc network systems, the Canadian producer must gain the expertise to produce

and supply the software. At present there is only one or two companies with a "track record" videodisc production.

Since the first main users of videodisc will be the multi-branch multi-national companies, this should be the market our A/V industry attacks. At the very least, it should be expected as in the case of GM of Canada, that Canadian versions of U.S. videodisc productions will be produced because there are at least two distinguishing differences in Canadian needs, -- bilingual content and metric measurements. GM of Canada has found it advantageous to produce completely original content for its 600 dealers and not simply to adapt U.S. designed content. In fact, some of this Canadian made content is rated so highly as to be considered for "reversioning" for the U.S. dealers.

2. Education

The literature revealed that a considerable amount of work is being done in the United States on the educational and training use of videodisc. A wide range of potential applications is being explored from language tracking to instruction for the hearing impaired. However, there does not appear to be any coordination of efforts to achieve a set of national goals nor to prevent a duplication of effort.

Judging from the sample of Canadian institutions contacted during this study, there appears to be a high level of awareness in the education sector of videodisc technology. However, there

was not a similar level of understanding of the full capability of the videodisc player and the implications for instructional use. Nor was there a clear understanding of the differences between the consumer and the educational/industrial models. There is no doubt that for a number of contacts the study sparked considerable interest in learning more about the technology.

Canadian educators have already undertaken several disc based projects. An example is OISE's $1.2 million project to prepare a videodisc learning system using a consumer player and a unique microprocessor with a Telidon terminal.

The majority of respondents clearly articulated the barriers to the acceptance and utilization of discs within institutions. Possibly the responses were indicative of educators previous experiences with the promise of new technologies which fail to reach their potential. Cost too was a major deterrent in view of the current financial situation.

Another serious barrier mentioned was lack of standardization. Education represents a relatively small market which cannot afford the split induced by incompatible hardware and software systems. A third deterrent is competing technologies, particularly videotape. Most educational institutions have substantial holdings in tape and/or film and changing technologies is not a viable option in a period of fiscal restraint.

Finally, many institutions cited a lack of courseware as a

further reason not to invest in videodisc equipment.

With respect to the identification of a role for Canada in terms of the development of hardware, software or courseware, the responses were mixed but there was definitely a sense that Canada could develop software and should develop courseware. Many felt there was a need for some form of leadership and support from the government. Many respondents believe that Canada should become involved in developmental activities to explore the use of videodisc but that resources would not be available within individual institutions to undertake this kind of activity, given the current economic climate.

Another important factor is that instructional designers require special expertise to achieve good results from educational videodiscs. If Canadians are to participate in the educational videodisc marketplace it is crucial that we begin to train people who will be able to exploit the medium to its fullest potential.

The integration of other Canadian strengths into instructional videodisc has not received proper attention. The application of Telidon hardware and software either to integrated instructional systems or as an adjunct to courseware preparation is a good prospect for investigation.

The overview obtained from the review of the literature and the data analysis suggests that there is a role for the federal government or national institutions to support and coordinate

experimentation with and evaluation of videodisc technology for education and training. Without support, educational institutions, which are suffering from fiscal restraint, may be unable to mount projects, or may mount a number of small projects which will not substantially contribute to the body of knowledge or the utilization of the technology. Without some coordination the potential exists for individual operations to work in isolation from one another or to duplicate each other's efforts and thereby waste scarce resources.

C. INFORMATION STORAGE AND RETRIEVAL

1. General

The potential sales of these systems, should they be able to meet their expected performance claims, could be very large in Europe, the United States, Canada and other OECD countries with possible markets in the third world. Systems, probably of a modular nature and custom designed, could meet large scale storage and retrieval requirements in banks, trust companies, insurance companies, governments and archival operations.

A number of large companies are working on storage and retrieval disc systems for large and small scale uses. With the possible exception of RCA, most systems are still in various stages of development. Research indicates that from the level of current commitment, few of these companies can provide a commercial product in less than three years.

There are a number of problems challenging these companies. First, the cost of recording is still relatively expensive. Second, the process must be done off-site. Third, efficient and relatively easy revision and updating capacity has to be developed. Fourth, there is a requirement for digital technology to produce truly high resolution picture quality necessary for good detail in visual content.

Institutions and agencies which wish to make their holdings more accessable to the public, may also need an interface between digital high density storage and the public user perhaps through

telecommunications links to high resolution screens or possibly by videodisc and a TV type screen.

2. Canadian Options

To meet her owns needs, Canada has three choices in this area:

- to buy the technology from foreign manufacturers;

- to induce foreign manufacturers to develop systems in Canada and in so doing to involve Canadian computer and electronics firms;

- to acquire hardware and necessary licenses so that Canadian high technology firms can develop specialized uses which incorporate videodisc hardware.

In the first case, Canada might be able to standardize on certain systems for government use and achieve some economies, but by and large the Canadian market would remain fragmented, and there would be no spin-offs for Canadian industry. As well there would be significant import costs and dependence on foreign sources.

The second option offers Canada the opportunity to develop hardware in Canada. The computer and electronics industry would benefit, and Canada should enjoy some share of export markets. There would, however, likely be a substantial cost to persuade multinationals to set up or licence operations in Canada.

The third option would provide for the incorporation of

videodisc hardware with Canadian high technology expertise and achievement. The second and third options are not mutually exclusive.

CHAPTER VIII

FEDERAL GOVERNMENT VIDEODISC PROJECTS OR APPLICATIONS

A. Introduction

As noted in the preface, this study of videodisc in its three main applications for pre-recorded content delivery, education and training, and information storage and retrieval was of immediate interest to a number of the participants in the study group. Many of these branches, departments, or agencies of the federal government are actively exploring the potential advantages of the technology to their specific concerns. Since these activities illustrate by practical example various present or projected applications of videodisc, this chapter summarizes reports contributed by many of the participants. This summary is neither inclusive of the activities of the study or the federal government in whole. A number of other departments and branches are pursuing initiatives in this area and some have been noted elsewhere in the report.

B. The Canadian Broadcasting Corporation (CBC)

The Corporation has identified three special problem areas or interests where videodisc technology may provide good solutions:

a) archival and operational/archival application;

b) information storage and retrieval applications; and

c) program delivery and sales.

1. Archival and Operational/Archival Application

The CBC produces film video and audio tapes which, after broadcast and other operational use, may go to the Public Archives for permanent storage. Initially, such film and tapes are for immediate operational use that may be re-used in whole or in part as rebroadcasts or as excerpts in new programs. Additionally, existing programs are an important research resource. Such material must be durable and accessible throughout its active life and thereafter should be in good condition for possible transfer to the Archives of Canada. The problem is that the each use of film and tapes results in some deterioration and quality is lost as result of reproducing copies by means of analog technology.

Perfected digital videodisc technology would permit the storage of program masters on non-degradable discs and of subsequent reproduction or direct-to-air playback, without noticeable loss of quality. Additionally, this kind of videodisc

system could permit rapid access to programs maintained in a dense storage medium. However, the adoption of digital videodisc systems will, of necessity, take place in concert with the replacement of analog equipment by digital systems generally; a transitional process some year hence.

Apart from the ease of use, a disc approach would have considerable appeal in terms of durability and, of course, storage density. Shelves in both networks are presently packed with 2" Quad tapes in every regional location of the CBC. It would take approximately six months to find out precisely how many there are, how many of these are in regular operational use, and how many are destined for Archives which are, perhaps, being inappropriately and inadequately stored in the meantime. The density, ease and durability of digital video would represent a quantum increase in quality, efficiency and longevity of these audio and video materials.

2. Information Storage and Retrieval

The CBC also holds huge quantities of operational, research and administrative data and information all of which present problems of storage and access. At least half of the administrative and clerical staff time of the Corporation goes to the management of this material. One estimate of space requirements alone is 10-15% of CBC real estate holdings.

Therefore, a major administrative challenge is to develop a coherent and efficient management information system for all of this data and information with computer interface throughout the Corporation. The videodisc elements of a management information system would not have to be of broadcast quality.

3. Program Delivery

CBC has an important interest in the growth of the retail videodisc market for both consumers and institutions and in the interactive videodisc market for educational and training uses. The English Services Division is studying the creation of a "universal program library" which would have an in-house facility for the production of masters. This library would make available various programs for CBC stations and applicates.

The CBC is also interested in the potential of the Videodisc as a vehicle for further non-broadcast distribution of programs. CBC has delivered program material to the public, to learning institutions, interest groups and public libraries on videotape, audio disc and tape, as well as program transcripts in print. CBC Merchandising is examining the feasibility of distributing programs on videodisc as one of several approaches to generating new sales revenues for the corporation.

C. Consumer and Corporate Affairs (CCA)

The Patent and Trade Mark Documentation and Registration Branch has investigated and leased access to a videodisc/computer system used by the American authorities to record patent designs (some 700,000 international patents on eight discs). The computer capability provides access to description of patented devices and the videodisc element provides pictures of the models, etc. The branch is investigating the possible development of a system to record and access Canadian patent information.

Additionally, Consumer and Corporate Affairs Canada participated in the videodisc project in order to foster the distribution of information regarding this new technology. The department's particular interests with respect to videodisc lies in the areas of product standards, copyright and its relationship to other information technologies (including videotex).

D. Department of National Defence (DND)

DND interest in videodisc technology lies primarily in the field of training with a secondary interest in storage and retrieval. This latter capability is a low priority item until such time as a digital encoded videodisc becomes an economic reality. With its freeze frame, variable motion, electronic address and computer interface capabilities, the videodisc provides a new dimension to conventional learning, remote learning and individual or self-paced instruction.

Early in 1982, DND will start a project to evaluate the applicability of videodisc technology to all aspects of training in the Canadian Forces. The project has five objectives each dependant on the results of all the others:

a. to develop a rationale for the application of videodisc technology to the instructional process in the CF. The introduction of media into a training environment often leads to many questions regarding the usefulness of the particular medium to specific training requirements and therefore the advantages of videodisc in the overall training environment will be subject to careful scrutiny. The result will be a clear definition of the rationale for employing videodisc technology in a particular learning setting whether it be in the formal classroom and/or for on-the-job training;

b. to determine the capabilities of the different levels of videodisc learning systems that would meet the training requirements within the CF. The intent is to determine whether in particular modes videodisc technology with and without microcomputer interface will enhance or provide new learning opportunities not provided by any other delivery system;

c. to develop an approach to the design of instructional materials and techniques for training packages prepared for vidodisc technology. The proposal is to explore in depth various learning techniques in the process of preparing a videodisc and to determine the capabilities of various levels of videodisc technology. User trials employing sample population trainees will be the basis for the evaluation of the interactive techniques for subsequent incorporation into the system;

d. to prepare a videodisc utilizing instructional material to exhibit the advantages of the videodisc approach in the school setting as well as in on-the-job training environments. Utilizing the outcome of the first three objectives, this phase includes the preparation of a videodisc employing all the known techniques to promote learning and explore the capabilities of the disc; and

e. to integrate videodisc with a Computer Assisted Learning (CAL) terminal to exhibit the potential this media mix has to further extend the applications of CAL in the training environment. It is proposed to integrate videodisc with the CAL system in two ways: first, the technical aspects of designing the interface between VDP and terminal and an appropriate touch sensitive panel over the display; second, to determine how best to utilize this new audio/visual dimension when designing CAL courseware.

The pilot project above will determine in large measure future DND activity in videodisc. For example, under objective (d) the use of the videodisc as a medium for instructional delivery presents some unique problems to validation because of the inability to edit discs. This leads developers to seek techniques for testing videodisc material prior to having it mastered. In this regard, the DRAW System (Direct Read After Write) is a particularly attractive development of interest to DND in the future.

In addition, the small size of a VDP is viewed as a desirable innovation which has unique DND applications in the aspect of remote learning in confined quarters (i.e. shipboard application).

The emergence on the instructional scene of videodisc technology has brought to light many questions regarding the most advantageous use of this medium. The Canadian Forces has many

areas where the potential of a properly configured and programmed videodisc learning system could offer solutions to training problems. This project will greatly help to determine answers to Canadian Forces questions about videodisc technology and to chart a course for the future.

E. National Museums Corporation (NMC)

There are potential applications of videodisc technology to the three basic elements of museum activity: exhibits, collections and research. Therefore it is not surprising that some large facilities such as the Library of Congress, The Boston Museum of Fine Arts, The Peabody Museum and the Public Archives of Canada have extensive videodisc projects.

1. Exhibits - Mobile Permanent

The museum community uses mobile exhibits extensively to display examples of the donor facility to a wider public. However, the size of such mobile exhibits is somewhat limited in that a large mobile van display is an expensive endeavour.

Videodisc systems could supplement such an exhibit by providing to the visitor photographic representation of a variety of similar artifacts still in the collections back home especially of those objects which cannot travel because of size, value or fragility.

Static (permanent) exhibits within the museum structure require a great deal of preparation, and must fit within a theme of the exhibit hall. The use of videodiscs at selected locations within the museum can provide additional information to the visitor. On the same equipment a visitor may be allowed to play a learning game, for example, to quiz a visiting student on

information for the exhibit. The flexibility of a videodiscs for exhibit applications is quite remarkable.

2. Collections

There exists within museums many types of collections, which grow each year, such as photography, manuscripts, video-tapes, audio recordings, films, slides, etc. . . . The care and management of these collections becomes more difficult each year. The capacity of a storage-type disc to record 104,000 frames of data enables the curator to place whole collections on one very high speed recall unit. Coupled with the existing mini-computer or National Inventories Program (NIP) computer, the disc becomes a formidable tool to promote more effective, cost efficient management of various collections. Updates and duplicates of information can be effected in the same way as changes of data on the present NIP system.

3. Research

A good museum has the capacity to research, and to a major extent, validate the artifact within the facility's care. The research method must give to the public, both visitor and scholar alike, access to artifacts and documented findings. Research stored on videodisc permits a client rapid access and quality reproduction of acquired information. Visitors could spend much

less time in searching and more time in learning from such an effective system.

Another capacity of videodisc systems is to provide copies with detailed information on holdings to other institutions. In such manner members of the museum community could benefit from immediate access to each other's research, collections, and documentation. This program of information distribution could operate on a cost recovery system or even additional revenues.

During the next few years it is anticipated that museums will begin to take advantage of the potential offered by videodisc systems. However, the process of switching from existing systems will be as a consequence of proof of stability, improved cost effectiveness and reliability. Present projects on videodisc are demonstrating those characteristics.

F. National Library of Canada (NLC)

NLC has acquired a videodisc system which includes a microprocessor computer. This equipment together with a monitor, amplifier, modem, and 5 1/4 inch disc drives is being used in a videodisc demonstration project. This project is to produce a disc to demonstrate the utility of videodisc in the storage and retrieval of materials as well as to provide NLC with primary experience with this technology. The target date for the demonstration disc is in Spring of 1982, and various tests and demonstrations will follow thereafter. The Public Archives are providing technical assistance to this project.

Investigation of videodisc potential is also part of NLC's proposed Bibliographic Communications Network Pilot Project. The latter project is to run over a two year period 1981/82 - 1983/84. The purpose is to test the utility of new telecommunications technology for bibliographic data interchange. New technology in this context includes value-added network services, electronic mail, videotex and videography. Videography is the combination of videodisc and computer/communications technology.

G. National Research Council (NRC)

The Electrical Engineering Division of the National Research Council plans to replace a Carousel Random Access Slide Projector with a videodisc system in support of NRC's Computer Assisted Learning (CAL) programs. The first step will be to transfer the material from the Learning Ability Tests slides to videodisc and subsequent steps should include the recording of archival and index information.

The NRC sees videodisc as a very compact system that provides quick search and access to video and/or audio material which is easily displayed by the NRC's NATAL II authoring language.

H. National Film Board (NFB)

The NFB is preparing to release a number of titles to the public in home video. The Board already has titles available for sale to educational and institutional users on three formats of videotape: U-matic, Beta and VHS. This collection includes the entire active catalogue of Board titles, government sponsored films, Canadian travel films, and some CBC TV productions. Most sound tracks are available in either official language, in several native languages, and some are available in a few foreign languages. The Board expects to release videodisc versions of selected titles when there is a substantial volume of videodisc players in Canada (homes and institutions) and when there is access to disc replication facilities for custom pressing.

The Sponsored Film Division is currently assessing, in company with a number of government departments, the feasibility of videodisc for information distribution and the potential for interactive training or informational applications and uses. Similarly, the Montreal-based production branches are examining a small number of experiments of specialized interactive discs for story-telling and science programs.

The Still Photo Division will also explore the information storage and random access playback capabilities for videodisc technology in an experiment to create a new display and dissemination method for the collection.

I. Public Archives of Canada (PAC)

The Public Archives of Canada has been very active in the development of videodisc technology for information storage and retrieval, specifically for archival applications. The Archives undertook a pilot project in September 1978 that resulted in the production of a demonstration disc and system. The latter included the incorporation of/or interface with computers in order to index, search and recall material on a random access basis.

The Archives has presented numerous demonstrations to other departments and agencies and have provided advice to the House of Commons on a possible project to record on videodiscs, with random access capability, the daily broadcasts of the House. Additionally The Library of Parliament has sought advice on a videodisc system to record the printed Hansard.

Public Archives will continue to determine the requirements of a videodisc system for the whole Archives. This work will include a study to prepare a long range plan to implement such a system. The system's characteristics would include a minimal thirty second delay capability of display after transmission of the call-up order at a reference terminal station and also the capability to produce polaroid prints, 35mm positive or negative slides, or 4 X 5 transparencies of the material shown on the video screen of the terminal.

J. Conclusion

From the above, it is clear that federal government institutions have a strong interest in the education/training and information storage/retrieval applications of the videodisc technologies for their own use. The Canadian Broadcasting Corporation and The National Film Board share these interests of internal information management and archieval storage but are also much concerned with videodiscs (and videocassettes) as potential content delivery systems in terms of reaching audiences and augmenting future revenues. Beyond the archieval and data potential of videodisc, the National Library of Canada, the Public Archives of Canada and the National Museum Corporation are interested in the capabilities of the technology to make their contents more accessible to the general public across the land.

All of this activity suggests some concern with compatible standards in the various applications so that economies of scale and ease of access are preserved.