NATIONAL STRATEGY FOR DEVELOPING ADVANCED COMMUNICATIONS TECHNOLOGY

A NATIONAL STRATEGY FOR DEVELOPING ADVANCED COMMUNICATIONS TECHNOLOGY

1. There is consensus among developed nations on a number of long term strategic technology goals. Three are particularly relevant to DOC. First, the development of networks which can carry voice, video and data communications in digital format - particularly those which are based on fibre optics and involve optical or opto-electronic switching (i.e. broadband integrated services digital networks). Second, the development of new cultural technologies, particularly those that involve video (it is surely significant that there are as many television sets in the world as there are telephones). Third, the development of systems which understand user needs and communicate information (i.e. artificial intelligence or the 'Fifth Generation'). These goals symbolize the most important challenges facing developed nations with respect to the primary constituents of communication systems - carriage and content. DOC's mandate gives it clear title to the first two fields and shared responsibility in the second.

2. At the same time, there is agreement among 'underdeveloped' nations on the strategic need to provide basic communication services to rural and remote areas of the world.

3. These goals are being pursued not for their own sake but because they are seen as essential to economic and social development. They are seen as creating jobs and wealth in their own right and contributing to the growth of all other economic and social sectors. At the same time, they are seen as raising fundamental challenges to established institutions and patterns of socio-economic activity.

4. In the past five years, the industrial superpowers - the United States, Japan and Europe - have launched major national programs to accelerate the development of ISDN, video and fifth generation technologies. In each arena, hundreds of millions of dollars are being spent each year on the development of these technologies.

5. The ITU, through the Maitland Report, has called for a global effort to improve basic communications services in the developing world.

6. Canada's high standing among nations, on both economic and social planes, is founded in no small part on its strength in communications. If we wish to retain this standing, we have no choice but to position ourselves with respect to these developments and other long term challenges/opportunities which may be discovered through domestic and international consultation. A national strategy is required.

7. This strategy must take into account the realities of the Canadian situation: an economy that is small, still largely resource based, relatively open to the United States and the rest of the world while remaining somewhat balkanized within; a society characterized by fragmented institutional arrangements and a relatively low level of integration between business, labour, academic and government elites; a culture whose business wing is not excessively entrepreneurial, whose scientific wing is far too weak, whose artistic wing sees itself as struggling for existence in a hostile environment and whose political wing seeks compromise rather than conviction, as is essential in a federal state; finally, a political agenda which puts the emphasis on fiscal restraint, federal-provincial reconciliation, free trade and job creation.

8. In this situation, a national strategy for developing advanced communications technology might involve the following elements: coalescing government, industry and university R&D around public and governmental needs related to the development of strategic technologies in a way that responds to regional differences and development priorities and involves the creation of significant numbers of new jobs in desirable fields (fibre optic based networks for intelligent buildings, computer assisted translation, new TV technologies and electronic publishing on compact discs are examples of initiatives which may satisfy these criteria); exploiting specific product opportunities among the vast range of possibilities created by new communications technology; rounding out technology lines through

international joint ventures; stressing systems integration, soft and service skills; banding together with countries which, like Canada, must either take what the superpowers are offering or do it their own way; using public policy (laws, regulations, the tax regime) to create an environment which is more encouraging to the development and diffusion of new technologies; and using government purchasing power at the federal and provincial levels to boost Canadian industry.

9. The way in which we act is as important as what we do. Program initiatives should put their primary emphasis on constant interaction between the developers and users of new communications technologies, with the aim of ensuring that Canadians in all regions of the country have the opportunity to participate in this process. This will inevitably focus our strategy on intermediate objectives[1] - on what is practicable and attainable in the next three to five years - instead of on grand, long range visions of the kind pursued by the economic superpowers. Although less glamorous, this approach is appropriate to Canada's resources and capabilities. If properly managed, this strategy may be able to create new jobs and wealth at a much lower per capita cost, in terms of capital and social investment, than the technology driven programs of the superpowers which, in most cases, are not based on dialogue with the people they are intended to benefit.

10. Finally, the way in which the program is perceived by the public is at least as important to its political success as its conceptual foundations. The central theme of this strategy is the innovative development of knowledge and human resource capabilities in advanced technology with attendant creation of quality jobs. Success in this task is essential to achieving our goals for industrial, economic and social development. The strategy therefore parallels and provides a technological analogue to what the Minister is attempting to do in the cultural field.

Technology Policy and Planning Branch
Telecommunications and Informatics Sector
December 12, 1985

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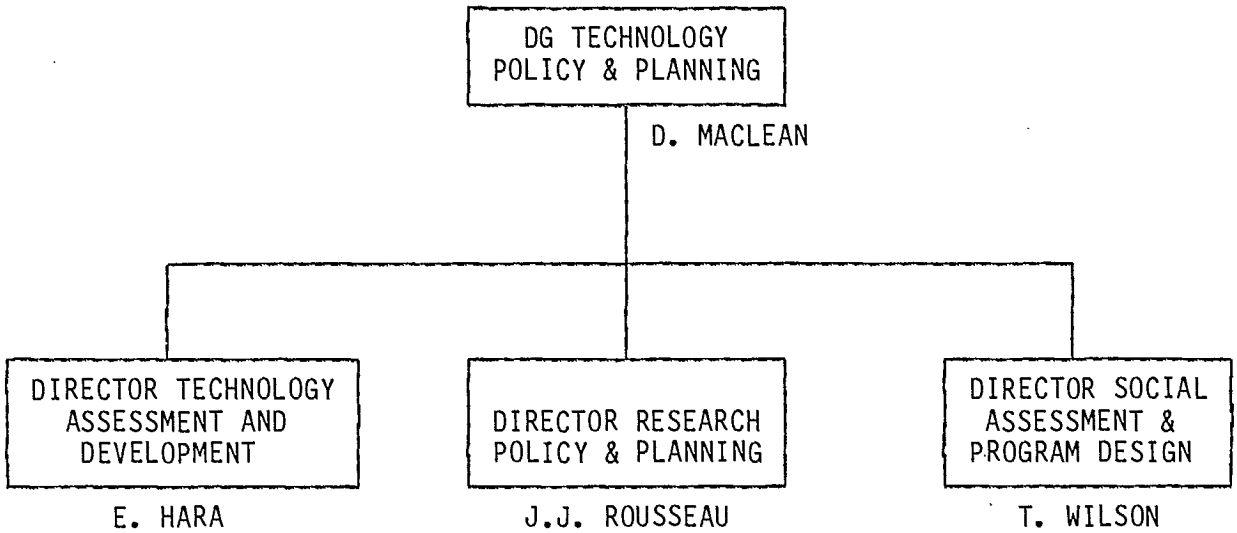
[1]These are sometimes referred to as 'sub-optimal' objectives. In our view, they are optimal.


DG TECHNOLOGY POLICY & PLANNING
D. MACLEAN
DIRECTOR TECHNOLOGY ASSESSMENT AND DEVELOPMENT
E. HARA
DIRECTOR RESEARCH POLICY & PLANNING
J.J. ROUSSEAU
DIRECTOR SOCIAL ASSESSMENT & PROGRAM DESIGN
T. WILSON

TECHNOLOGY POLICY PRIORITIES

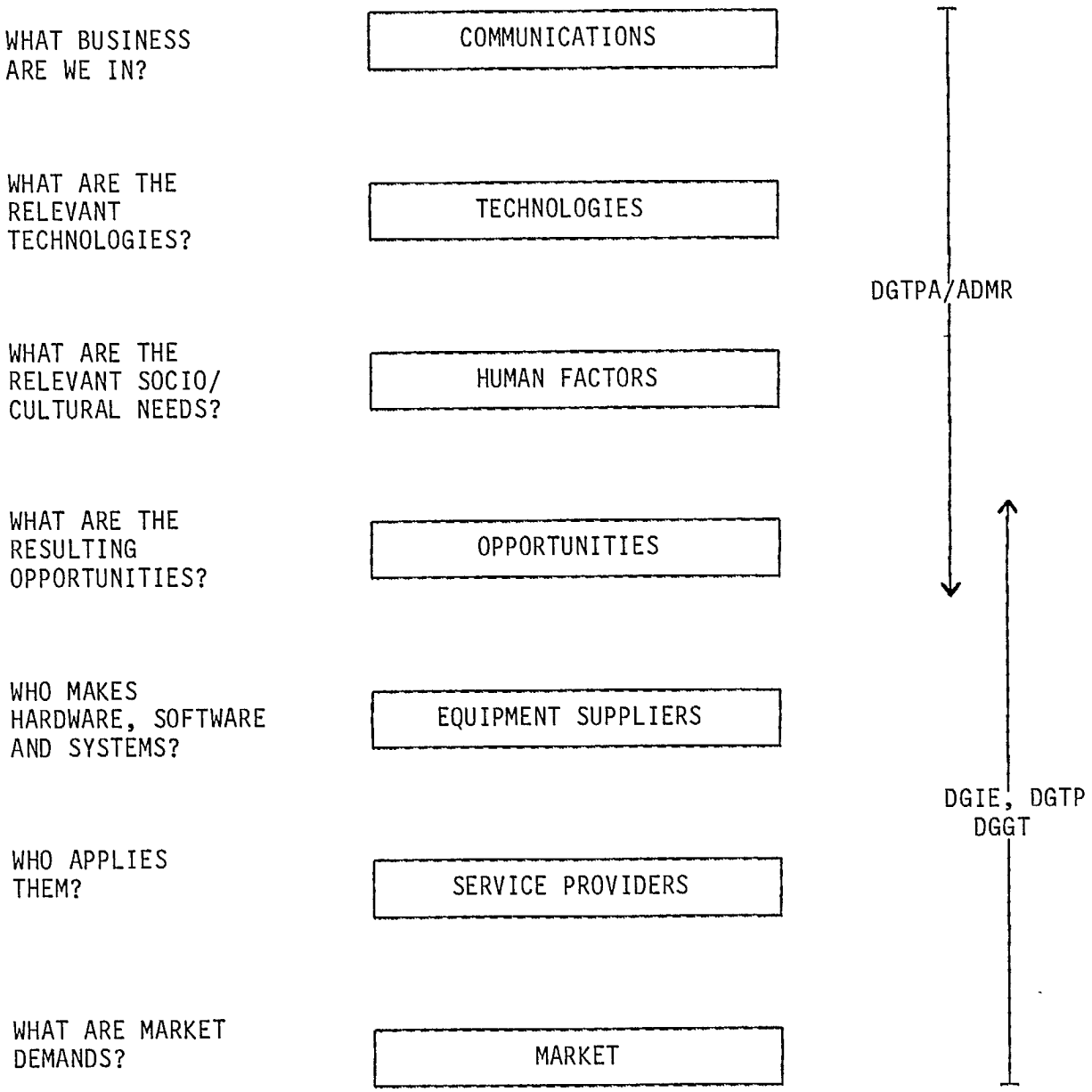
NEW PROGRAM INITIATIVES

- SMART BUILDINGS
- NEW VIDEO TECHNOLOGIES
- COMPUTER ASSISTED TRANSLATION

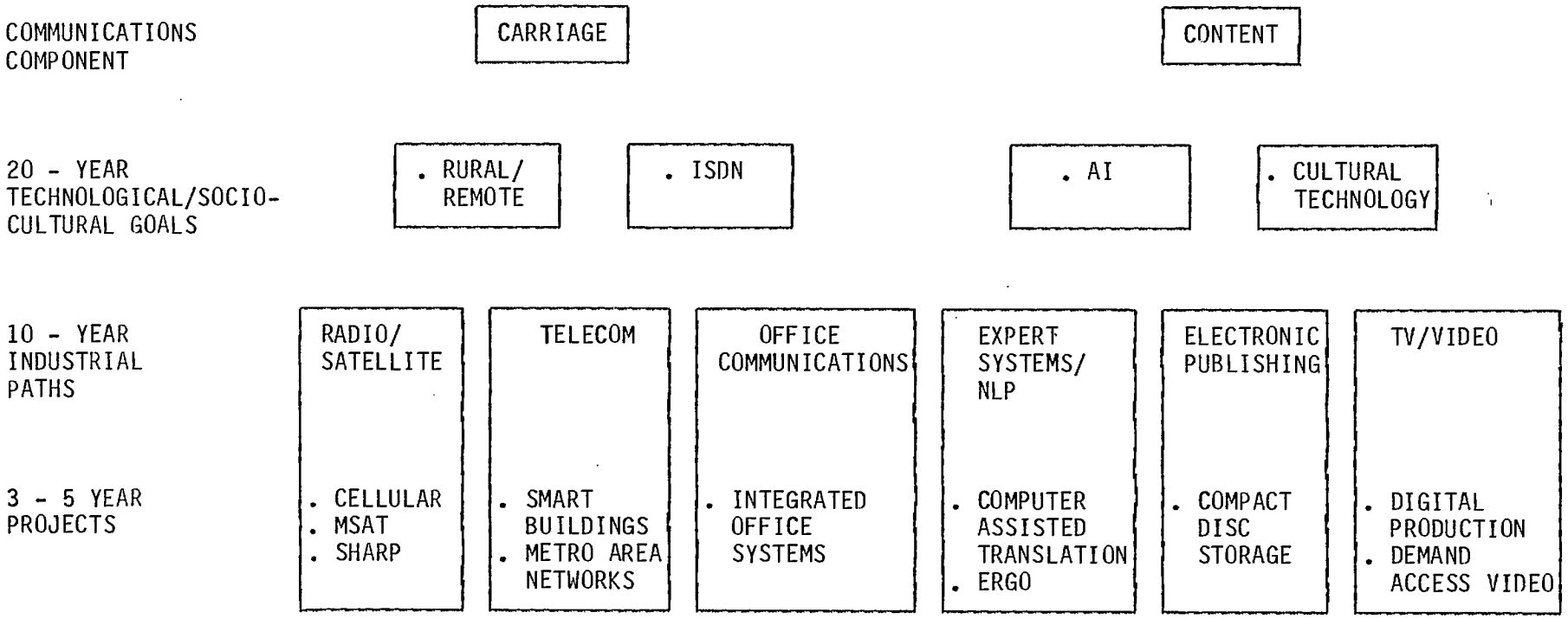
HIGH RISK TECHNOLOGY POLICY

- MAY '85 PLANNING FRAMEWORK
- AUGUST '85 AIDE-MEMOIRE
- DECEMBER '85 NATIONAL STRATEGY PROPOSAL

'KNOWLEDGE PUSH' AND 'MARKET PULL'



TECHNOLOGY POLICY PLANNING FRAMEWORK



THE FOUNDING PRINCIPLES OF KNOWLEDGE PUSH

1. THEOLOGICAL - IF THE MARKET KNEW EVERYTHING THERE WOULD BE NO NEED FOR RESEARCH

2. METAPHYSICAL - TECHNOLOGY IS MORE PREDICTABLE THAN HUMAN AFFAIRS

3. EPISTEMOLOGICAL - EVALUATING THE EXPERIENCE OF USERS PROVIDES A BETTER BASIS FOR DEVELOPING TECHNOLOGY THAN THE DREAMS OF TECHNOLOGISTS OR PHILOSOPHERS

4. ETHICAL - KNOWLEDGE IS A WONDERFUL THING; WHAT MOST PEOPLE NEED IS INTERESTING WORK; IF WE CAN GIVE THEM THE KNOWLEDGE THEY WILL FIND THE WORK

5. PRACTICAL - A PURCHASE ORDER IN THE HAND IS WORTH MORE TO A SUPPLIER THAN HOWEVER MANY GRANTING PROGRAMS AND POLICY FRAMEWORKS WE CAN HIDE IN A BUSH

INDUSTRIAL DEVELOPMENT POLICY AND THE ACTIVITIES OF DGIE

THE DOC MANDATE

- THE GENERAL SCOPE OF THE DOC IN RESPECT TO INDUSTRIAL AND ECONOMIC DEVELOPMENT ACTIVITIES IS SET OUT IN THE DOC ACT. AMONG OTHER DUTIES AND FUNCTIONS, THE MINISTER IS TO:

  A) COORDINATE, PROMOTE AND RECOMMEND NATIONAL POLICIES AND PROGRAMS WITH RESPECT TO COMMUNICATIONS SERVICES FOR CANADA;

  B) PROMOTE THE ESTABLISHMENT, DEVELOPMENT AND EFFICIENCY OF COMMUNICATIONS SYSTEMS AND FACILITIES FOR CANADA;

  C) COMPILE AND KEEP UP TO DATE DETAILED INFORMATION IN RESPECT OF COMMUNICATIONS SYSTEMS AND FACILITIES AND OF TRENDS AND DEVELOPMENTS IN CANADA AND ABROAD RELATIVE TO COMMUNICATION MATTERS.

- OVER THE YEARS THE DEPARTMENT HAS ARGUED THAT THIS MANDATE SHOULD BE BROADLY INTERPRETED TO INCLUDE SO-CALLED TELEMATICS AND INFORMATICS SYSTEMS AND TECHNOLOGIES AS WELL AS TRADITIONAL TELECOMMUNICATIONS AND SPACE. (STATEMENT TO THIS EFFECT HAVE BEEN INCLUDED IN SUCH OFFICIAL DOCUMENTS AS THE MAIN ESTIMATES, AND ANNUAL REPORTS).

THE ARGUMENT FOR AN INDUSTRIAL DEVELOPMENT ROLE

THIS LEGAL MANDATE DOES NOT DESCRIBE HOW THESE DUTIES ARE TO BE CARRIED OUT.

THERE IS, FOR EXAMPLE, NO EXPLICIT REFERENCE TO INDUSTRIAL DEVELOPMENT OR TO INTERNATIONAL MARKETING SUPPORT

THE ARGUMENT FOR THESE FUNCTIONS IS, HOWEVER, FAIRLY STRAIGHT FORWARD:

- THE BENEFITS TO THE CANADIAN ECONOMY AND TO CANADIAN SOCIETY OF MODERN AND EFFICIENT COMMUNICATIONS AND INFORMATION TECHNOLOGIES, PRODUCTS AND SERVICES THROUGH THEIR RAPID DIFFUSION AND UTILIZATION CANNOT BE REALIZED WITHOUT A CANADIAN CAPACITY TO DEVELOP, MANUFACTURE AND MARKET THEM.

THE BASIS OF INDUSTRIAL DEVELOPMENT POLICY IN DOC

EVEN THOUGH OTHER DEPARTMENTS AND AGENCIES HAVE FROM TIME TO TIME CLAIMED EXCLUSIVE JURISDICTION IN THE AREAS OF INDUSTRIAL AND MARKET DEVELOPMENT, DOC WILL ALWAYS HAVE A ROLE TO PLAY.

THIS ROLE, HOWEVER, MUST ALWAYS BE BASED ON THE CORE BUSINESS OF THE DEPARTMENT - THE PROMOTION OF EFFICIENT COMMUNICATIONS SYSTEMS AND FACILITIES FOR THE GENERAL BENEFIT OF CANADA.

INDUSTRIAL DEVELOPMENT AND MARKETING SUPPORT ARE, FOR THIS DEPARTMENT, NOT ENDS TO THEMSELVES BUT MEANS TO ACHIEVING BROADER PUBLIC POLICY OBJECTIVES.

INSTRUMENTS/OPPORTUNITIES

1985-86 FRAMEWORK RE-VISITED

	R&D/APPLICATIONS	REGULATORY POWERS OR POLICY INFLUENCE	SIGNIFICANT GOVERNMENT MARKET	SUPPORT PROGRAMS ($)	DOMESTIC MARKET BASE	EXPORT MARKET
Satellites	X	X		X	X	X
Earth Stations	X	X	X		X	X
Radio	X	X			X	X
Electronic information services	X	X		?	?	?
Office communications	X		X		X	X
Cable TV	X	X				
Spectrum management	X	X	X	X	X	X

THE UNDERLYING THEMES TO DGIE'S WORKPLAN AND PRIORITIES

THERE ARE A NUMBER OF THEMES WHICH RUN THROUGH THE WORKPLAN AND PRIORITIES NOW BEING DEVELOPED BY DGIE FOR NEXT YEAR IN CARRYING OUT POLICY AND PROGRAM ACTIVITIES IN THE AREA OF INDUSTRIAL AND APPLICATIONS DEVELOPMENT.

THESE ARE:

- A FOCUS ON MARKET AND ECONOMIC DEVELOPMENT OPPORTUNITIES FOR CANADIAN-BASED FIRMS WHERE THE DEPARTMENT HAS INSTRUMENTS AVAILABLE TO INTERVENE AND WHERE THESE WILL HAVE A SIGNIFICANT IMPACT WHEN USED;

- THERE WILL BE INCREASED SELECTIVITY AND MORE RIGOUROUS PRIORITY SETTING IN ORDER TO CONCENTRATE THE LIMITED RESOURCES OF THE BRANCH TO MAXIMIZE THE BENEFITS OF INTERVENTION;

- AN INCREASED EMPHASIS ON ENCOURAGING AND FACILITATING THE DIFFUSION OF TECHNOLOGICAL INNOVATION (WHETHER FROM GOVERNMENT LABS TO THE PRIVATE SECTOR OR FROM UNIVERSITIES TO FIRMS OR FROM FIRMS TO BUYERS);

- A DESIRE TO MAKE THE LINKAGES AMONG THE DEPARTMENT'S INSTRUMENTS AND BRANCHES' WORK IN A MEANINGFUL WAY;

- PRIORITY WILL BE GIVEN TO PROJECTS WHERE THERE IS A POSSIBILITY OR A REQUIREMENT TO ESTABLISH PARTNERSHIPS WITH OUTSIDE ORGANIZATIONS EITHER BECAUSE BY DOING SO WE GAIN SUPPORT FOR INITIATIVES OR GET ACCESS TO AVAILABLE FINANCIAL RESOURCES IN THE SYSTEM (E.G., SOS, CEIC, MOSST, DRIE, NRC);

- THE PRIORITIES OF THE BRANCH WILL TAKE ACCOUNT OF THOSE SET BY THE MINISTER AND SENIOR MANAGEMENT AT MONTEBELLO IN AUGUST 1985;

- FINALLY, INCREASED EMPHASIS WILL BE ATTACHED TO EFFECTIVE COMMUNICATION WITH THE MINISTER, THE BUREAUCRATIC SYSTEM AND THE PUBLIC, THE GOALS ACCOMPLISHED AND ACTIVITIES OF THE DEPARTMENT IN THE AREA OF TECHNOLOGICAL, SERVICE AND INDUSTRIAL DEVELOPMENT AND MARKETING SUPPORT.

PREREQUISITES WHICH FLOW FROM THEMES

A NUMBER OF PREREQUISITES REFLECT THE THEMES STATED EARLIER

- THE DESIGN AND ESTABLISHMENT OF A NATIONAL COORDINATED TECHNOLOGY TRANSFER PROGRAM AND OFFICE;

- A COMMUNICATION STRATEGY AND PLAN FOR DEPARTMENTAL INDUSTRIAL DEVELOPMENT AND MARKETING SUPPORT ACTIVITIES;

- AN OVERALL STRATEGY TO USE CURRENT AND PLANNED ERDA'S, BOTH THOSE OF DOC AND OTHER DEPARTMENTS, AS A DELIVERY VEHICLE FOR INDUSTRIAL DEVELOPMENT ACTIVITIES.

- AN ENHANCED LONGER TERM MARKET AND INDUSTRIAL ANALYSIS CAPABILITY AND THE INCORPORATION OF THESE ANALYSES ON AN ONGOING BASIS IN THE DEVELOPMENT STRATEGIES FOR TELECOMMUNICATIONS AND INFORMATICS PRODUCTS AND TECHNOLOGIES;

- ESTABLISH A RIGOUROUS SET OF PRIORITY SETTING CRITERIA TO BE USED ON AN ON-GOING BASIS DURING THE YEAR TO IDENTIFY THE MOST PROMISING PROSPECTS.

THE TARGET TECHNOLOGIES

IT IS TARGETTED TECHNOLOGIES THAT FLESH OUT THE THEMES AND PROGRAM PRE-REQUISITES PREVIOUSLY DESCRIBED.

A GREAT DEAL OF ANALYSIS WAS UNDERTAKEN AND PRESENTED AT THE PLANNING SESSIONS OF THE LAST TWO YEARS.

MUCH OF THIS WORK REMAINS VALID AND IS WORTH REVISITING.

TARGET TECHNOLOGIES:

- SPACE COMMUNICATIONS
- ELECTRONIC INFORMATION SERVICES AND SOFTWARE
- INTEGRATED OFFICE SYSTEMS;
- NEW VIDEO AND IMAGING TECHNOLOGIES;
- BROADBAND NETWORKS;
- SPECTRUM MANAGEMENT SYSTEMS;
- SPECIAL RADIO SERVICES.

SPACE PROGRAM ISSUES IN DOC

1. DO SPACE PROGRAM INDUSTRY AND APPLICATIONS DEVELOPMENT OPPORTUNITIES MEET CRITERIA FOR DOC INVOLVEMENT/INTERVENTION?

   - DO OPPORTUNITIES EXIST
   - DOES DOMESTIC/EXPORT MARKET EXIST
   - DOES DOC HAVE SPECIAL TECHNICAL EXPERTISE
   - WILL DOC INSTRUMENTS HAVE A SIGNIFICANT IMPACT?
   - DOES THIS BUILD ON NATIONAL STRENGTH?

2. DO APPROPRIATE HUMAN RESOURCES AND FACILITIES EXIST WITHIN DOC?

3. DOES THE PRIORITY AND THE WILL EXIST TO PURSUE A CONTINUING VIGOROUS AND SUCCESSFUL SPACE PROGRAM IN DOC, WITH THE NECESSARY CRITICAL LEVEL OF RESOURCES?

4. HOW WILL FEDERAL SPACE PROGRAMS BE MANAGED

DISCUSSION PAPER

A Planning Framework for Proposals Designed to Encourage the development and Application of Advanced Communications Technology

Prepared by:

Technology and Policy
Assessment Branch
Technology and Industry
Sector

May 30, 1985

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Proposed Framework for Supporting the Development and Application of Advanced Communications Technologies

The purpose of this paper is to put forward for discussion a set of principles to guide the department in preparing policy and program proposals designed to support the development and application of advanced communications technologies. These proposals are intended to provide a planning framework for two of the priorities identified in the Minister's March 20, 1985 letter to the Chairman of the Cabinet Committee on Economic Development - high risk technologies and enhanced work environments. Although centred on these thrusts, the proposals flow from the fundamental principles enunciated in his letter and are closely related to his other priorities.

A. The Issue

The main issue addressed in the paper is what principles should underlie any new initiatives proposed by the Department of Communications to support the development and application of advanced communications technology. It is intended to provide a corporate perspective on this issue which concerns other sectors as well as ADMTI.

In the past, the Department has played an active role in the growth of satellite communications, informatics and office automation systems through the Space, Telidon and Office Communications Systems programs. The government has made it very clear that it wants to see the lead in technology development and innovation returned to the private sector. However, the paper suggests that government policies - as enunciated in The Speech from the Throne, the Economic Statement and the Budget, as well as on more specific subjects by the Minister and his colleagues - continue to warrant some measure of direct support to private sector efforts to develop and apply advanced communications technologies, even in the current environment of fiscal restraint, if the following criteria can be satisfied:

- proposed initiatives should be designed to assist private sector concerns in capturing clearly-identified opportunities by helping them overcome significant risks that may have technological, industrial, organizational, economic, social or cultural dimensions;

- they should respond to clearly-identified government and public needs;

- they should involve the coordinated use of various departmental instruments, including R&D assistance, industry and marketing support, applications programs, government procurement, and the creation of a favourable policy, legislative and regulatory climate.

B. Factors

In formulating policy and program proposals to achieve this balance, the following factors should be taken into account:

1. Opportunities and Risks

Advances in a number of fundamental hardware and software technologies for creating, processing, storing, transmitting and displaying information present opportunities for developing and applying powerful new communication systems which could improve the productivity of primary, secondary and tertiary industries, the efficiency of government and public institutions, and the quality of social and cultural life. However, there are risks associated with these technologies, risks which must be overcome if their full potential is to be realized. Some of these risks are technical. Three of these are particularly important:

- the need to build more intelligence and a greater degree of 'user friendliness' into communication systems so that people will be able to work more effectively with ever increasing amounts of information;

- the need to establish communications links between the many incompatible systems that are threatening to turn the 'information age' into the Tower of Babel;

- the need to make effective use of new transmission technologies to deliver services universally, in a cost effective way.

Important business risks for users and suppliers are also associated with the development and application of advanced communication technologies. These risks centre on the relatively low probability of return on resources invested in these technologies, but the very high payoffs that reward success.

Finally, there are a whole series of individual, organizational, economic, social and cultural risks bound up with these technologies. While they promise many benefits in terms of increased productivity and efficiency for existing enterprises as well as new opportunities for economic, social and cultural enrichment, these technologies threaten to disrupt established institutional structures.

2. Government and Public Needs

In addition to their general impact on all elements of our society, the technological developments referred to in the previous section have specific implications for industry and user groups falling within the mandate of the Minister of Communications. Assessments of technological trends, market forces and industrial capabilities have indicated four main areas in which clearly identified government or public needs could provide significant opportunities for the private sector to develop and apply advanced communication technologies but where some measure of government program support or policy encouragement is required. These areas are:

- distribution systems, where the main near term emphasis would be on the development of mobile satellite services, extra-high frequency (EHF) communication satellite systems, and fibre optic networks;

- new broadcasting technologies designed to improve the quality of broadcast programming and give cable subscribers 'on demand' access to video products;

- electronic information systems, such as initiatives to develop and apply machine-assisted translation, provide electronic access to the national museums from all parts of the country, and facilitate the electronic distribution of health care information;

- office communication systems, including policies and programs designed to encourage the application of market ready technologies to achieve demonstrable improvements in public service efficiency and quality, as well as initiatives to promote the development of new technologies which would assist office workers in coping with 'information overload' and promote compatibility between the many different systems that now exist.

3. Government Instruments

In fields where the government decides to attempt to capture the benefits of advanced communications technology for Canada by using its own requirements or public needs as a catalyst, it faces the difficult task of selecting and coordinating the most appropriate instruments for achieving its objectives.

Ultimate success in developing and applying advanced communications technologies in the areas identified above requires the use of many instruments and the involvement of a large number of departments and agencies, both as users of technology and as suppliers of policy and program inputs. Major players include the Department of Finance, which is responsible for setting the government's fiscal framework

and establishing a climate conducive to private sector investment; the Department of Regional Industrial Expansion, which is the principal source of industry support funds; the Department of External Affairs, which has overall responsibility for trade and foreign relations; and the central agencies which collectively manage the internal affairs of the Public Service - the Treasury Board, the Department of Supply and Services, the Department of Public Works, and the Public Service Commission.

Within this galaxy, the role played by the Department of Communications is based on DOC's unique expertise in both the technical and the human aspects of advanced communications systems - an expertise which no other department or agency can provide. In playing this role, the Department also makes use of a unique set of instruments, comprising responsibilities for R&D, applications program management, industry and marketing support, common services planning and procurement, and policy. In sum, this role is seven-fold:

- to establish a clear set of development priorities - reflecting user needs and industrial opportunities - through a program of technology and policy assessment as well as industry and market analysis studies;

- to mobilize the R&D resources of the Communications Research Centre (CRC) and the Canadian Workplace Automation Research Centre (CWARC), in support of these priorities;

- to assist industry and users in developing and applying advanced communications technologies;

- to assist Canadian industry in marketing the resulting products and services;

- to provide the communications infrastructure essential to the application of advanced communications technologies in the federal government through the Government Telecommunications Agency;

- to provide the policy and regulatory climate required to encourage the application and diffusion of advanced communication technology throughout our economy and society;

- to support the development and use of common standards.

By making coordinated use of these instruments, concentrating initially on the many opportunities which arise in the Minister's own portfolio, the Department will be able to provide invaluable support both to users and suppliers of these technologies.

A Planning Framework for Proposals Designed to Encourage the Development and Application of Advanced Communications Technologies

A. Introduction

The purpose of this paper is to put forward for discussion a set of principles to guide the department in preparing policy and program proposals designed to support the development and application of advanced communications technologies. These proposals are intended to provide a planning framework for two of the priorities identified in the Minister's March 20, 1985 letter to the Chairman of the Cabinet Committee on Economic Development - high risk technologies and enhanced work environments. Although centred on these thrusts, the proposals flow from the fundamental principles enunciated in his letter and are closely related to his other priorities.

B. The Issue

The main issue that must be addressed is what principles should underlie any new initiatives proposed by the Department of Communications in order to support the development and application of advanced communications technology.

In Canada, the development and application of communications and information technology is largely the role of the private sector, although a number of federal and provincial crown corporations are also involved. However, there are two areas where the federal government, through the Department of Communications, has historically been directly involved:

- the extension of communication services to remote and underserved areas of the country. The space program has been the principal means of achieving this objective;

- the development of advanced communications technologies, such as Telidon and office communication systems. Essentially, these technologies are a new kind of communications infrastructure. They

combine telecommunications, computer and information management technologies into systems designed to suit a wide range of economic and social needs - at home, in the workplace and in public institutions. To some degree, these systems are being developed outside the traditional telecommunications infrastructure. However, to be truly effective, they must ultimately be connected to it. They therefore represent an important extension of the Minister of Communications' mandate to "promote the establishment, development and efficiency of communications systems and facilities for Canada" (DOC Act).

In the current policy environment - which is dominated by a concern for fiscal restraint, reduced government intervention in the economy, and private sector leadership in research, development and innovation - it might be questioned whether a case can be made for further direct government action aimed at supporting the development and application of communications technologies. On the basis of government policy enunciated in the Speech from the Throne, the Economic Statement of the Minister of Finance, the Budget, the stated priorities of the Minister of Communications, and policy documents prepared by his colleagues, the following grounds appear to justify such action:

- properly introduced, these technologies offer the potential of improving the quality of service to the public - a key objective in the Speech from the Throne and the Budget - as well as internal government efficiency. They therefore provide a basis for either reducing the size of the public service, or for responding to steadily increasing public demands without matching increases in the civil service complement;

- these technologies will impact directly on the responsibilities of the Minister of Communications, particularly on the cultural agencies responsible for producing, distributing and storing information - the CBC, the National Museums and the National Library and Archives. All of these institutions need to make important investments in the next

generation of communications and information technology, if they are to continue to serve the public effectively in a rapidly evolving technological environment. If properly planned and channelled, these investments could be of significant benefit to Canadian companies involved in the research, development and application of new communications technologies;

- in addition, new communication technologies will affect the telecommunications, broadcasting and cultural industries for which he has legislative and regulatory responsibility. They will raise policy issues which the government will be asked to decide, and government decisions will in turn create an environment which will either favour or discourage the development of Canadian industry in these areas;

- because the federal government is the largest single market in the country for communications and information processing systems, whatever action it takes to develop, apply and purchase these technologies will be of critical importance to the growth of Canadian companies which make products or provide services employing these technologies;

- the high risk associated with the development and application of these technologies - which must be balanced against the opportunities they represent - appears to justify some measure of direct government investment, in partnership with the private sector.

The following sections explore these themes in some detail. They suggest that government policy continues to warrant some measure of direct encouragement for the development and application of advanced communications technologies, even in the current environment of fiscal restraint, if the following criteria can be satisfied:

- proposed initiatives should be designed to assist private sector concerns in capturing clearly-identified opportunities by helping them

overcome significant risks which have technological, industrial, organizational, economic, social and cultural dimensions;

- they should respond to clearly-identified public and government needs;

- they should involve the coordinated use of various departmental instruments, including R&D assistance, industry and marketing support, applications programs, government procurement, and the creation of a favourable policy, legislative and regulatory climate.

C. Opportunities and Risks

1. Technology Trends

In examining technology trends, it is useful to distinguish between generic technologies that underlie developments in a large number of areas, and technology applications which are specific to a particular field such as communications.

Insofar as generic technologies are concerned, hardware and software developments in the following areas have important implications for communications applications:

- at the user interface - the point at which information is entered into or retrieved from a communications system - voice recognition and optical scanning technologies are expected to take their place beside the telephone and the keyboard as information input facilities, while high resolution displays, voice synthesis techniques and laser printers improve the quality and accessibility of information output;

- in broadcasting, higher definition cameras, recording equipment and television receivers will significantly improve the quality of broadcast programming and pre-recorded video materials;

- optical disks will provide much greater mass storage capacity than current magnetic memories;

- in the set of disciplines commonly referred to as 'artificial intelligence', research and development programs are beginning to produce hardware and software devices which emulate human intellectual capabilities by employing 'fuzzy logic' instead of rigidly mathematical programming structures, by reasoning about new situations through the application of rules based on a body of knowledge (expert systems), or by replicating mental structures and processes (parallel processing);

- in microelectronics, the speed of microprocessors and the capacity of memory chips will continue to increase, in part through the development of optical and opto-electronic devices, permitting larger and larger amounts of information to be processed in ever smaller units of time;

- all these hardware and software innovations will be supported by the new developments in communications technologies, particularly fibre optics distribution, broadband switching, and new networking technologies.

Taken together, these technologies provide the foundation for more intelligent communications systems. That is to say, systems which are increasingly dependent on software and content, and which transmit, process and store information in ways more closely resembling human communication processes. There are two points which it is particularly important to bear in mind in formulating a policy to promote their development and application:

- while the coming decades will almost certainly see the physical capabilities of new communication technologies gradually approach human dimensions - for example as measured in processing speed or storage capacity - it by no means follows that their ability to emulate human perceptual, intellectual, organizational and cultural

skills will be equally enlarged, or that we will be able to make effective use of these technologies to enhance the quality of our economic and social life. To achieve these goals, we will have to invest these technologies with hardware and software capabilities that increasingly correspond to the higher human faculties, particularly those concerned with representing reality by finding patterns of meaning in the mass of available information. In the 'information age', perhaps the greatest challenge is to cope with information overload;

- as the history of office automation and artificial intelligence illustrate, many advanced technologies will find their initial application in standalone or small scale systems. While accomplishments are in some cases already visible at this level, the real challenge is to evolve beyond this state and to build new communication paths, connecting individuals, groups and larger organizational units. This is an area of high potential risk, because advanced communication systems at this point largely lack the single most important achievement of the traditional telecommunications infrastructure - common standards which make it possible for devices to talk to each other. Until a similar connectivity and interworking is developed for advanced communication technologies, their promise will go unfulfilled. Insofar as business applications are concerned, local area networks - serving work groups, offices, buildings, campuses, factories and farms - are emerging as a logical strategic target for the development of new, more intelligent communication infrastructure. These systems will integrate a number of previously separate functions, such as office automation, telecommunications, security, and energy management. There is already considerable interest in the emergence of "smart buildings". In a similar fashion, the next few years may see the development of smart homes and apartment buildings. As well as providing a possible focus for DOC program activities, it should be a policy objective to ensure that these systems are properly integrated with established communications

infrastructures. If this is not done, key elements of broadcasting and telecommunications policy may be undermined by new forms of technological bypass.

For their significance to be fully appreciated, these technological trends and the two dominant thrusts to which they give rise - towards greater machine intelligence on the one hand and greater integration on the other - need to be mapped against broader economic and social forces.

2. Patterns of Development and Application

Advances in the fundamental hardware and software technologies identified in the previous section for creating, processing, storing, transmitting and displaying information present opportunities for powerful new communication systems which could improve the productivity of primary, secondary and tertiary industries, the efficiency of government and public institutions, and the quality of social and cultural life. However, there are risks associated with these technologies, risks which stand in the way of realizing their full potential. The following model has been developed to illustrate emerging patterns of opportunity and risk, at the technical, industrial, individual, organizational, economic and social level.

a) The Model

The analysis which follows is based on a two-axis model:

- the horizontal axis measures the scale of communication systems on a range from big to small. Communication systems are defined very broadly in the model. They include the facilities and services offered by the various communications media (telecommunications, broadcasting, publishing, etc.) as well as the communications patterns that characterize industry, government, economic and social institutions at the "big systems" end of the scale, in addition to individual and group interaction at the "small systems" end;

- the vertical axis measures the attributes of communication processes, ranging from a dominant or exclusive concern with the carriage of information to a dominant or exclusive concern with content. The technological drive towards greater integration corresponds to the former thrust, and the drive toward greater intelligence to the latter.

From this brief description, it should be obvious that both axes of the model have economic, social and technological dimensions and that these factors are part and parcel of any communication system, whether it be the dedicated, highly visible processes channelled through the media, or the less visible and more intangible communication patterns that underlie our social and economic life.

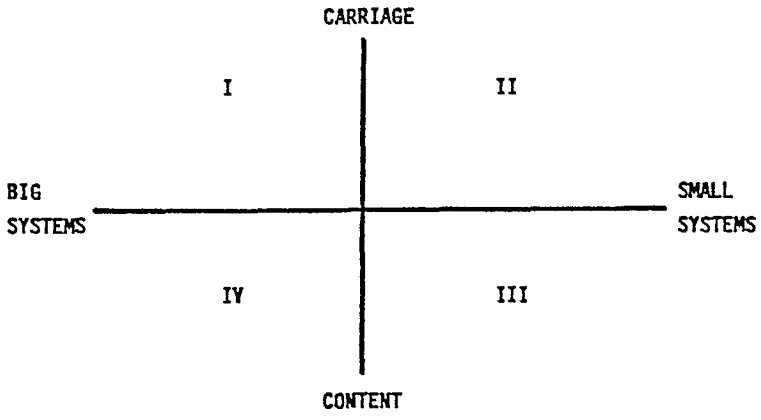


FIGURE 1

b) Economic and Social Trends

The following appear to be the most important long-term trends in the economic and social environment:

- the big systems of our society are undergoing profound structural changes which are typically characterized in the following kinds of terms:

  - industrial restructuring - the progressive shift of traditional primary and secondary economic activities to the developing world, as developed economies increasingly centre around intelligent production processes, the growth of the services sector and a greater dependence on information-related activities;

  - economic renewal - the need to ensure that Canada participates in this process through greater R&D, technology innovation and diffusion, and that the private sector leads in this process;

  - social and cultural revolution - the changes brought to our fundamental social and cultural institutions by these economic transformations particularly those resulting in a redefinition of individual rights and freedoms, the nature of work and employment, requirements for education and training, methods of ensuring an equitable distribution of social benefits, cultural identity and national sovereignty;

  - political reconciliation - the need to reform our political institutions and processes in order to improve our society's ability to respond to the aforementioned trends;

- in the face of these major structural upheavals, small systems are dominated by concerns for individual and small group survival, security and self-expression. In particular, this is reflected in concerns for:

- economic equity - with traditional full-time employment apparently in permanently short supply, what rules will govern the creation, distribution and preservation of wealth in the information society, and what new means can be found to ensure that people have access to a fair share of the economic pie;

- cultural expression - how can the opportunities for self-expression and fulfillment offered by technological change be reconciled with the requirements of economic and social order.

As numerous popular works (e.g. In Pursuit of Excellence, The Next American Frontier) attest, reconciling the competing claims of economic efficiency and human rights is our society's biggest challenge.

c) The Impact of Technology on Communication Processes

To date, technology has had a selective impact on communication processes in advanced industrial societies:

- the main effect of telecommunications and mainframe computer technology has been to improve the efficiency of information carriage, and to set up centralizing forces in big economic and social institutions (quadrant I in the model);

- the main effect of information and microelectronic technology, on the other hand, has been to improve the quality of information content, and to set up democratizing and decentralizing forces in our society (quadrant III in the model).

A number of new technologies are emerging to reinforce these established trends, fill the other quadrants, and establish linkages between them. These developments are illustrated in Figure 2. The convergence of telecommunications, computer and information technologies into advanced

communications systems, which unite these countervailing thrusts toward efficiency and centralization on the one hand, and quality and decentralization efficiency and centralization on the one hand, and quality and decentralization on the other, appears to provide the technological basis for synergistically achieving big and small system goals in Canada's economic and social communication systems. The implications of these patterns for departmental policy are explored at greater length in the Appendices to this document.

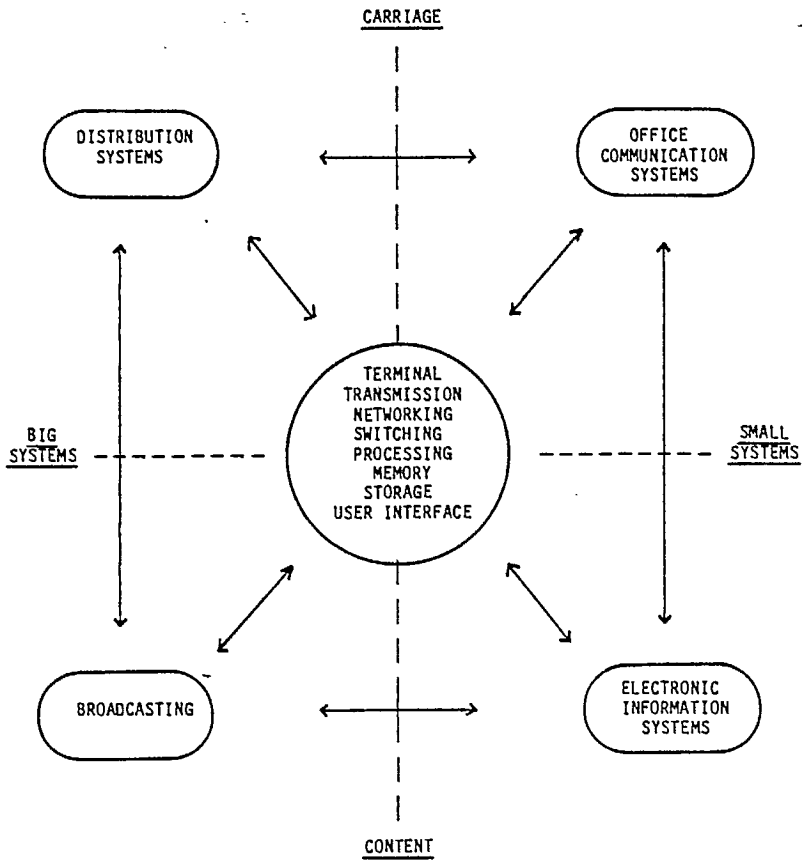


FIGURE 2

3. Industry and User Concerns

The technologies being developed in these various areas may be classified as "high risk" if there is a relatively low probability of return on resources invested in their development and application, but a relatively high payoff if these efforts succeed. High risk may be due to a number of different factors including the inherent difficulty of developing an as yet unavailable technology (e.g. artificial intelligence), and the relatively low probability of successfully commercializing a largely available technology where there is a high degree of competition or where market and human implications are not properly understood (e.g. office automation).

High risk technologies typically exhibit some or all of the following characteristics:

- they involve substantial research and development on technical and human factors;

- there is little likelihood of a short-term return on R&D investment; products based on these technologies are often five or more years away from commercial markets;

- these products tend to have a very short life span in relation to the time required to develop them - in many cases, eighteen months to two years;

- the impetus for developing these technologies generally comes from small- to medium-sized start-up companies rather than from corporate giants;

- these companies are potentially subject to strong international competition, in large part because of massive R&D investments being made by other governments.

D. Government and Public Needs

In addition to their general impact on all elements of our society, the technological developments referred to in the previous section have specific implications for user groups falling within the mandate of the Minister of Communications. Work done to date to assess technology trends, market forces and industrial capabilities have indicated a number of areas where there appear to be clearly defined government or public needs which could provide significant opportunities for the private sector to develop and apply advanced communication technologies but where some measure of government program support or policy encouragement is required. These examples of areas are:

1. Distribution Systems

a) Satellite Communications: Proposals to support the commercial development of a Mobile Satellite (MSAT) System in cooperation with the United States have been studies by Cabinet and are being further developed as part of the strategic plan for Canadian involvement in space. Plans are already underway to develop Extremely-High Frequency (EHF) satellite systems, initially in cooperation with the European Space Agency's L-SAT Program;

b) Fibre Optic Networks: Fibre optic technologies are currently being deployed by telecommunications carriers on international, intercity and trunking routes. As well, they are being applied in some cable systems and private local area networks (see 4(b) below). Fibre optics transmission and the associated opto-electronic and optical switching technologies are expected to be the dominant communications technology over the next ten-twenty years. Canadian industry has considerable strength in this area and there will be many opportunities for the government to promote the development, application and diffusion of this critical technology - using both policy and program instruments - in the government environment and in the private sector.

2. New Broadcasting Technologies

a) Video Technologies: The CBC has estimated that $100M will be needed to acquire new studio equipment for the Toronto consolidation. Canadian industry will require some support to be in a position to compete against Japanese, American and European companies for this very lucrative procurement contract. The market for higher resolution video production, recording and display technologies is particularly important because entertainment applications have historically often led the way in introducing new technologies which ultimately found much wider application;

b) Demand Access Video: Pay television has suffered in competition with videocassette recorders because it cannot offer programs in response to individual demands at specific times. Using new communications systems which combine optical storage with fibre optics distribution, it will be possible to develop "video jukeboxes" containing hundreds of program offerings, and to distribute them on an interactive basis in near real time. This technology could be very important to the future growth and development of the cable and broadcasting industries, and their ability to achieve the cultural policy goals set for them. It also has important implications for program production and copyright policy;

3. Electronic Information Systems

a) Electronic Publishing: This term refers to the interactive distribution or exchange of text and graphic material through electronic means, often although not necessarily in real time. It differs from conventional broadcasting in that content can be manipulated or tailored to meet individual tastes, demands and needs. In a rapidly changing technological environment, the ability of broadcasters, publishers, videotex operators,

to achieve the cultural policy goals which the government has set for them will depend in no small measure on their ability to adopt this technology. One of the goals of policy development and program expenditures in these areas should therefore be to assist Canadian companies in developing the products and services required by these institutions;

b) Machine Assisted Translation: Work is currently underway with the Secretary of State Department to develop a joint program on machine assisted translation. The proposed program would unite the research, development, program management, industry and marketing support and needs analysis capabilities of DOC with the subject matter expertise of SOS. Its fundamental aim would be to improve the productivity and efficiency of the Translation Bureau in meeting the increasingly heavy demands placed on it, without a corresponding rise in resources;

c) Public Information Access Systems: New communications technologies provide a means for more effectively distributing government information to the public. The Department is currently attempting to develop a health care information system in conjunction with the Department of Health and Welfare to more effectively serve the public's need for preventive health care information. To the extent that it succeeds, the program will also lessen the demand for health care services, thereby reducing the call on the public treasury.

4. Office Communication Systems

a) The Application of Available Office Automation Technologies: Office automation technologies are critical to achieving the objectives of restraining the growth of government expenditures and improving the quality of service to the public. These objectives

require coordinated action by a number of players. As the general manager of the public service, the Treasury Board is responsible for setting overall administrative policy for the application of office automation technologies. The Treasury Board Task Force on Informatics has made a series of recommendations on this subject. They are currently being considered at the senior levels of the Board. As the federal government's purchasing agent, the Department of Supply and Services is responsible for pooling departmental requirements and ensuring that they are directed to the benefit of Canadian industry. The Department of Public Works, for its part, is responsible for all aspects of building design, construction and management. The Department of Communications has a critical role to play in support of the efforts being made by these central agencies to promote office automation. This role has two main elements. First, DOC's responsibility for planning and providing government telecommunications means that the Department is responsible for developing the communications infrastructure required to support office automation in the federal government. Second, the expertise which DOC has acquired in the technical, organizational and human aspects of office automation through the OCS program, as well as the research capabilities of the CRC and the CWARC, put the Department in a unique position to advise and assist other departments and agencies in specifying, designing, developing and acquiring office automation systems which meet their needs. Policy and program proposals to carry out these responsibilities are currently being prepared.

b) Local Area Networks: Office automation technology springs from three sources: telecommunications, EDP, and the development of standalone products designed to automate discrete office functions. Currently available technologies seek to integrate these into systems designed to serve specific organizational units. This was the goal of the OCS program. The next stage in this evolutionary process is to extend the range of office functions which are

automated (particularly to include better telecommunications, information gathering, storage and retrieval systems), to enhance the intelligence of the resulting systems and to develop the networks required to connect and extend them to larger organizational units. Local Area Networks (LANs) - which serve work groups, offices, buildings, campuses, factories and farms - are emerging as the central communications infrastructure for achieving these objectives. The construction of the new national museums and the new CBC headquarters could provide Canadian companies with the market required to enter this area, if these projects are accompanied by an appropriate technology development program.

c) Automated Information Storage and Retrieval Systems: As mentioned previously, one of the great challenges in communications will be to develop means of effectively using the large amounts of information made available by the new technologies. The storage capacity of optical discs, which approach that of the human brain, presents a particularly interesting problem. By marrying the document processing capabilities of optical scanners and laser printers, the ability of expert systems to emulate human mental processes, and the storage capacity of optical discs, it will be possible to develop much more efficient storage and retrieval systems than currently exist within the public service. Systems of this kind are particularly needed in the national museums, archives and libraries, as well as in general office applications;

E. Government Instruments

In fields where the government decides to attempt to capture the benefits of advanced communications technology for Canada by using its own requirements or public needs as a catalyst, it faces the difficult task of selecting and coordinating the most appropriate instruments for achieving its objectives.

Ultimate success in developing and applying advanced communications technologies in the areas identified above requires the use of many instruments and the involvement of a large number of departments and agencies, both as users of technology and as suppliers of policy and program inputs. Major players include the Department of Finance, which is responsible for setting the government's fiscal framework and establishing a climate conducive to private sector investment; the Department of Regional Industrial Expansion, which is the principal source of industry support funds; the Department of External Affairs, which has overall responsibility for trade and foreign relations; and the central agencies which collectively manage the internal affairs of the Public Service - the Treasury Board, the Department of Supply and Services, the Department of Public Works, and the Public Service Commission.

Within this galaxy, the role played by the Department of Communications is based on DOC's unique expertise in both the technical and the human aspects of advanced communications systems - an expertise which no other department or agency can provide. In playing this role, the Department also makes use of a unique set of instruments, comprising responsibilities for R&D, applications program management, industry and marketing support, common services planning and procurement, and policy. In sum, this role is seven-fold:

- to establish a clear set of development priorities - reflecting user needs and industrial opportunities - through a program of technology and policy assessment as well as industry and market analysis studies;

- to mobilize the R&D resources of the Communications Research Centre (CRC) and the Canadian Workplace Automation Research Centre (CWARC), in support of these priorities;

- to assist user departments and agencies in developing and applying advanced communications technologies;

- to assist Canadian industry in marketing the resulting products and services;

- to provide the communications infrastructure essential to the application of advanced communications technologies in the federal government through the Government Telecommunications Agency;

- to provide the policy and regulatory climate required to encourage the application and diffusion of advanced communication technology throughout our economy and society;

- to support the development and use of common standards.

By making coordinated use of these instruments, concentrating initially on the many opportunities which arise in the Minister's portfolio, the Department will be able to provide invaluable support to users and suppliers of these technologies.

APPENDIX I

GOVERNMENT AS A CUSTOMER

The four broad areas identified in this paper for policy and program initiatives differ with respect to the principal instruments which the department can use to address them. In two areas - distribution systems and new broadcasting technologies - the major instruments are policy and regulation. In the other two - electronic information systems and office communication systems - the main instruments are government procurement and related industry support measures. The purpose of this appendix is to set out for discussion some of the central features of strategies revolving around government as a customer.

1. Possible Approaches

There are three basic options for promoting the development and application of advanced communications technologies, using government as the 'first customer':

a) Status Quo

A number of positive steps have been taken in the government in past few years to encourage the development and application of advanced communications technology within the government environment, and to extend the resulting benefits to the private sector. A Treasury Board task force has made recommendations on the application of informatics in government departments. The Department of Supply and Services has made advanced communications and information technologies a central focus of its annual strategic procurement plan. Both the Departments of Regional Expansion and External Affairs have placed high technology goods and services at the centre of their program delivery activities. Many departments and agencies are awakening to possible applications within their fields of responsibility. The main danger in simply continuing the status quo is three-fold:

- key players may not awaken in time. The Department of Public Works, the Post office and the Public Service Commission are examples of central government agencies that are probably not yet playing the roles of which they are capable in the development of advanced communications technology;

- if user departments are left entirely to their own devices in developing and applying advanced communications technology, a great deal of inefficient learning and needless redundancy is bound to occur, resulting in lost opportunities for productivity gains and industrial benefits;

- even if central agencies and user departments are fully alert to the benefits of developing and applying these technologies, their efforts may be uncoordinated or at cross purposes if they are not founded on a common information base covering the technical and human aspects of advanced communications technology.

b) A Centralized Program

A natural reaction to the prospect of technological ad hocery or anarchy is to mount a centralized program to address the problem. However, this does not appear to be a practical response to the challenge posed by advanced communications technologies. It is impractical because of the realities of the fiscal environment. More importantly, it is impractical because centralized programs - which often involve long time horizons and large-scale, standardized activities - simply do not work very effectively in highly volatile technological and organizational environments. Experience in Canada and other countries tends to confirm this. The speed with which technical and human parameters are evolving reduces the chances of a successful 'megaproject' approach in a political/public context to virtually zero. There are only two exceptions to this rule. First,

effective technology development is impossible without a sound, technically advanced telecommunications infrastructure. It is therefore vitally important that the role of the Government Telecommunications Agency in planning, providing and coordinating the procurement of government telecommunications be strengthened. Second, it would be most undesirable for other departments and agencies to attempt to duplicate the expertize of the CRC and the CWARC in the technological and human aspects of advanced communications technology.

c) A Decentralized Program

In light of the foregoing considerations, the option which appears to make the most sense is to equip the Department of Communications with the policy mandate and program resources required to support the central agencies and user departments by:

- identifying needs for advanced communications technologies;

- providing R&D assistance in developing products and services which meet their needs;

- managing the application of these technologies in a minimally disruptive fashion;

- evaluating the impact which technology innovations have on human and organizational elements, both within user departments and client groups, and suggesting product or service modifications which may be indicated;

- assisting Canadian industry in marketing products developed for government clients;

- publicizing the lessons learned.

In order to carry out this role effectively, and in particular to help ensure that government applications of advanced technologies are ultimately of benefit to the private sector, it will be necessary for the Department to maintain an up to date database on technology trends as well as industry and market developments.

2. Suggested Guidelines

On the basis of the foregoing analysis, the following framework should guide the formulation of policy and program proposals to promote the development and application of advanced communications technologies by using government as a customer:

a. Policy and program proposals must be consistent with overall government policy. This means that:

- in line with the policy enunciated in the Speech from the Throne and the Economic Statement, their principal objective should be to contribute to fiscal restraint by improving government efficiency and to contribute to national reconciliation by improving the quality of government service to the public;

- following the policy on technology, innovation and industrial development prepared by the Minister of State for Science and Technology and the Minister of Regional Industrial Expansion, they should ensure that leadership in the innovation process is returned to the private sector, that the activities of the Communications Research Centre and the Canadian Workplace Automation Centre respond to the needs of the private sector, and that government procurement - at all levels - is used to support the growth and development of Canadian companies which manufacture or provide advanced communications technologies and services;

- in the spirit of Cabinet's decision on the MSAT program, they must provide an appropriate sharing of risk between the government and the private sector, taking into account the complete range of instruments available to the government, including fiscal and non-fiscal measures.

b. Policy and program proposals must also be consistent with the fundamental strategic principles set out in the Minister's March 20, 1985 letter to the Chairman of the Cabinet Committee on Economic and Regional Development describing his priorities. In line with the principles that cultural activities are increasingly important to all forms of economic activity and that communication systems should be developed to ensure the effective distribution of cultural products, the proposed DOC initiatives should have three principal objectives:

- to encourage the development of intelligent communication systems - i.e. systems embodying hardware and software elements which more closely emulate human intellectual, perceptual, organizational and cultural faculties, improve the quality of content, and enhance the capability of users to deal meaningfully with the ever increasing amounts of information available in electronic form;

- seek to eliminate barriers to communication between different hardware devices, software programs and communications systems by promoting common standards and the development of interfaces.

- to make effective use of new transmission technologies to deliver services in a cost effective way;

c. In order to provide the impetus necessary to successful policy and program implementation, the government should recognize as a matter

of national policy the important contribution which new communications technologies can make to improving the quality of service to the public and the internal efficiency of government. It should accord priority to the development and application of new communications technologies in response to clearly defined government and public needs, in areas where there is a reasonable expectation that industrial and economic benefits will flow to the private sector from government investments. To the extent possible, the private sector should share the risk of developing these technologies with the government in some fair proportion to its capacity to pay and anticipated benefits.

d. The way in which these policy recommendations are implemented should be consistent with the government's desire to transfer the lead in technology development and innovation to the private sector. One way of achieving this objective is to allow government departments to serve as laboratories or test beds within which Canadian companies can develop innovative products or services. Although this would involve some expenditure of new money, the funds required to support small-scale, developmental projects are not large in comparison to the cost of operational systems. Since departments will eventually be making massive expenditures on new systems - for example, the federal government office automation market alone is expected to reach $500M by 1990 - it would seem to be 'penny wise and pound foolish' not to invest some additional resources in development projects designed to give Canadian companies the chance to compete for the large markets that will materialize in Canada and elsewhere;

e. This policy should recognize that it is beyond the financial and human resource capacities of many Canadian firms - particularly the smaller firms which are often the source of product and service innovation - to undertake more than a small part of the R&D required to develop high risk technologies. A significant portion of this

work will therefore have to be done in the departmental laboratories at the CRC and the CWARC, or funded in industry through the DOC research program. However, this is consistent with the government's desire to align the work of federal laboratories more closely with industrial needs;

f. The policy should also recognize that Canadians cannot do everything themselves. Alliances should be encouraged between Canadian firms and foreign companies. Massive investments in these new technologies are being made by giant multinationals as well as by governments in the United States, Japan, France, the United Kingdom and the Federal Republic of Germany. Canadian strategy must concentrate on developing technology only in those niches where we have some clear advantage. More importantly, efforts should be focussed on integrating Canadian and foreign technologies into complete systems and providing them on a turnkey basis;

g. As the OCS program demonstrates, it does little good for government to help industry develop technologies if it is not prepared to purchase the resulting products and services, once they become fully operational and commercially available. Any high risk technology development program with the characteristics described in the preceding paragraphs must therefore be complemented by a program to encourage and assist government departments and agencies in applying developed technologies to their ongoing operations. A high risk communications technology program would therefore have two distinct phases. During the first or developmental phase, Canadian companies would be assisted in developing high risk technologies through a program which mixed support for needs analysis, research, technology development, international technical cooperation, small-scale experimental field trials and evaluation, in selected departments. During the second or applications phase, the resulting systems would be widely applied on an operational basis, with industrial and marketing support to assist companies in reaching beyond the government market;

h. Understanding people's needs and the functioning of organizations is absolutely critical to the development of new technologies, as well as to the application and diffusion of established products or services. This is particularly so as technology begins to exhibit an increasing number of human attributes. These concerns must accordingly have a central place in the strategy. Needs analysis should be the point of departure for both the developmental and applications phases of the program, and a constant point of reference throughout;

i. The provinces must be actively involved in this program, both because they enlarge the available laboratory and eventual market and because their involvement will help ensure equity in the distribution of development efforts;

j. In light of the foregoing, specific policy and program proposals should be developed bearing in mind the following model of DOC's role:

- the Department's fundamental mission is two-fold: to provide the telecommunications infrastructure required to develop advanced communication technologies in government departments and agencies; and to advise and assist central agencies and user departments in formulating and assessing policies and programs for the application of advanced communications technologies;

- in order to carry out this mission effectively, the Department must marshall the research resources of the CRC and CWARC and direct them in support of a clear set of technology priorities based on an assessment of technology trends, user requirements, industrial capabilities, market opportunities, and organizational and human impacts;

- initiatives proposed under this model to encourage the development and application of advanced communications technologies should be small-scale and designed to provide for rapid learning and iteration, in view of the risks inherent in the technological environment and in the organizational and human impacts of these technologies;

- once advanced communications technologies have been developed to a market ready state, the Department should provide advice and assistance to user departments and agencies in analysing their needs, specifying their requirements, procuring hardware, software, and systems, managing the application of these technologies in operational settings, and evaluating the results, which should then be fed forward into the process of developing the next generation of advanced technology;

- the Department should provide support and advice to Canadian companies on marketing products and services developed for government customers;

- the role of the Government Telecommunications Agency in providing the telecommunications infrastructure required to permit the development and application of advanced communications technologies and in facilitating communications between different hardware, software and systems should be recognized and enhanced.

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MARKETS

AND

MARKET TRENDS

PREPARED BY:

THE ECONOMIC DEVELOPMENT DIVISION
OF THE INDUSTRIAL AND ECONOMIC
DEVELOPMENT BRANCH

THE TELECOMMUNICATIONS AND INFORMATICS MARKETS OF THE EARLY 1990s

SOURCES

ADL	:	ARTHUR D. LITTLE
IDC	:	INTERNATIONAL DATA CORPORATION
SLJ	:	STANLEY L. JACOBS RESEARCH INC.
ERC	:	EVANS RESEARCH CORPORATION
INPUT	:	INPUT LTD., ADAPSO ANNUAL REPORT

WORLD TELECOMMUNICATIONS SYSTEMS MARKET

AGR: ANNUAL GROWTH RATE

	85 US $ B	90 US $ B	AGR %	SOURCE
SYSTEMS				
• VOICE COMMUNICATIONS	59.4	85.9	2.7	ADL
• DATA COMMUNICATIONS	12.0	21.8	12.6	
• SATELLITE AND CABLE TV	1.7	2.6	8.7	
• MOBILE RADIO AND PAGING	5.4	6.4	8.2	
TOTAL	79.5	118.5	8.3	

COMMENT(S)

- DATA COMMUNICATIONS IS LEADING GROWTH AREA
- RADIO IS GROWING AT ABOUT THE SAME RATE AS SATELLITE AND CABLE TV BUT CONSTITUTES A BIGGER MARKET

DGIE/DED

WORLD TELECOMMUNICATIONS SYSTEMS MARKET BY MAIN BUYERS

	85 US $ B	90 US $ B	AGR %	SOURCE
MAIN BUYERS				
• MAJOR COMMON CARRIERS	54.8	82.4	8.5	ADL
• OTHER COMMON CARRIERS	6.0	8.8	8.0	
• GOVERNMENTS	5.6	7.9	7.2	
• PRIVATE NETWORKS	13.1	19.4	8.2	
TOTAL	79.5	118.5	8.3	

COMMENT(S)

- PRIVATE NETWORKS CONSTITUTE A RELATIVELY LARGE COMPONENT OF WORLD DEMAND (SECOND LARGEST)
- GROWTH RATE IS EVENLY SPREAD AMONG BUYERS

DGIE/DED

WORLD TELECOMMUNICATIONS SYSTEMS MARKET
BY REGION

	85 US $ B	90 US $ B	AGR %	SOURCE
BY REGION				
• NORTH AMERICA	32.5	45.8	7.1	ADL
• EUROPE	20.1	28.1	7.0	
• ASIA (INC. USSR)	22.9	38.5	11.0	
• REST OF WORLD	4.0	6.1	8.5	
• TOTAL	79.5	118.5	8.3	

COMMENT(S)

- ASIA IS THE LEADING GROWTH AREA
- NORTH AMERICA REMAINS THE LARGEST ACCESSIBLE MARKET

DGIE/DED

WORLD TELECOMMUNICATIONS SERVICES MARKET BY REGION

	85 US $ B	90 US $ B	AGR %	SOURCE
• NORTH AMERICA	78.3	91.7	3.2	ADL
• EUROPE	55.1	73.4	5.9	
• ASIA	30.7	46.3	8.5	
• REST OF WORLD	10.2	15.2	8.4	
• TOTAL	174.3	226.6	5.4	

* WORLDWIDE COMMON CARRIER REVENUES

COMMENT(S)

- NORTH AMERICA IS A MATURED MARKET
- THE THIRD WORLD IS THE LEADING GROWTH AREA

DGIE/DED

NORTH AMERICAN TELECOMMUNICATIONS SYSTEMS MARKET

	85 US $ B	90 US $ B	AGR %	SOURCE
• VOICE COMMUNICATIONS	22.9	31.9	6.9	ADL
• DATA COMMUNICATIONS	5.5	8.6	9.3	
• SATELLITE AND CABLE TV	1.1	1.5	6.3	
• MOBILE RADIO AND PAGING	3.0	3.8	4.8	
TOTAL	32.5	45.8	7.1	
- LANS	0.47	1.07	18.7	ADL
·FIBRE OPTICS	0.045	0.055	4.0	
- WANS				
·FIBRE OPTICS	0.150	0.360	19.0	

CANADIAN TELECOMMUNICATIONS SYSTEMS MARKET

	85 CDN $ B	90 CDN $ B	AGR %	SOURCE
• VOICE COMMUNICATIONS	3.0	4.4	7.9	ADL/ DOC
• DATA COMMUNICATIONS	0.8	1.3	10.1	
• SATELLITE AND CABLE TV	0.13	0.2	8.9	
• MOBILE RADIO AND PAGING	0.4	0.6	8.4	
TOTAL	4.4	6.5	8.1	

DGIE/DED

FREE WORLD INFORMATICS EQUIPMENT MARKET

	85 US $ B	90 US $ B	AGR %	SOURCE
• USA	61.8	97.7	9.6	ADL
• WESTERN EUROPE	29.8	49.3	10.6	
• JAPAN	15.4	26.6	11.6	
• OTHER FREE WORLD	6.0	11.0	12.9	
TOTAL	113.0	184.6	10.3	

COMMENT(S)

- USA ACCOUNTS FOR HALF OF WORLD DEMAND
- THE JAPANESE MARKET IS LARGE AND EXPANDING RAPIDLY

FREE WORLD SOFTWARE MARKET

	85 US $ B	90 US $ B	AGR %	SOURCE
• USA	8.6	23.6	22.0	ADL
• WESTERN EUROPE	2.9	8.3	23.0	
• JAPAN	1.3	3.2	20.0	
• OTHER FREE WORLD	0.5	1.8	29.0	
TOTAL	13.3	36.9	23.0	

COMMENT(S)

- USA IS BY FAR THE LARGEST MARKET (ALMOST 2/3 OF FREE WORLD DEMAND)
- GROWTH RATE IS EVENLY SPREAD AMONG REGIONS
- ESTIMATES INCLUDE SYSTEMS AND APPLICATIONS SOFTWARE PRODUCTS, EXCLUDE AI-BASED SYSTEMS AND CUSTOM SYSTEM DEVELOPMENT

NORTH AMERICAN INFORMATICS SYSTEMS MARKET

	85 $ B	90 $ B	AGR %	SOURCE
- CANADA ($ CDN)				
- NON-INTEGRATED OFFICE SYSTEMS	0.9	0.6	-8.4	SLJ/DOC
- INTEGRATED OFFICE SYSTEMS	0.6	3.4	41.3	SLJ/DOC
- OTHER EDP	2.9	3.7	4.9	ERC/DOC
TOTAL INFORMATICS SYSTEMS	4.4	7.7	13.0	
- US ($ U.S.)				
- NON-INTEGRATED OFFICE SYSTEMS	11.7	3.0	-24.0	ADL
- INTEGRATED OFFICE SYSTEMS	9.3	72.1	50.6	ADL
- OTHER EDP	50.1	66.2	6.0	ADL
TOTAL INFORMATICS SYSTEMS	71.1	141.3	15.0	

COMMENT(S)

- INTEGRATED OFFICE SYSTEMS WILL BE THE LEADING GROWTH AREA, COMPRISING 40-50% OF THE TOTAL MARKET BY 1990
- NON-INTEGRATED OFFICE SYSTEMS WILL CONSTITUTE A DECLINING MARKET, AS THESE SYSTEMS ARE REPLACED BY INTEGRATED SYSTEMS

DGIE/DED

NORTH AMERICAN SOFTWARE MARKET

	85 $ B	90 $ B	AGR %	SOURCE
- CANADA ($ CDN)				
• SYSTEMS SOFTWARE	0.3	0.7	20.8	IDC/DOC
• APPLICATIONS SOFTWARE	0.4	1.0	27.8	IDC/DOC
• A-I BASED SYSTEMS				DOC
- US ($ U.S.)				
• SYSTEMS SOFTWARE	2.9	7.3	20.3	IDC/ADL/ DOC
• APPLICATIONS SOFTWARE	5.7	16.3	23.4	IDC/ADL/ DOC
• A-I BASED SYSTEMS	0.5	11.8	88.0	ADL

COMMENT(S)

- AI APPLICATIONS, PARTICULARLY KNOWLEDGE BASED/EXPERT SYSTEMS AND NATURAL LANGUAGE QUERY SYSTEMS, ARE FORECAST TO BE THE MAJOR GROWTH AREA
- SOFTWARE MARKETS WILL GROW MORE RAPIDLY THAN INFORMATICS EQUIPMENT OR INFORMATICS SERVICES

NORTH AMERICAN INFORMATICS SERVICES MARKET

	85 $ B	90 $ B	AGR %	SOURCE
- CANADA ($ CDN)				
• PROCESSING SERVICES	0.8	0.9	3.8	IDC/DOC
• CUSTOM SYSTEMS DEVELOPMENT	0.2	0.4	10.5	IDC/DOC
• CONSULTING AND PROF. (EXCL. EDUC. & TRG.)	0.1	0.2	12.4	IDC/DOC
- US ($ U.S.)				
• PROCESSING SERVICES	10.8	14.4	5.8	IDC/DOC
• CUSTOM SYSTEMS DEVELOPMENT	5.1	9.3	13.6	INPUT/DOC
• CONSULTING & PROF. (EXCL. EDUC. & TRG.)	5.7	10.6	11.3	IDC/DOC

OPPORTUNITIES

TELECOMMUNICATIONS

- SYSTEMS(S):
  - DATA COMMUNICATIONS
  - WANs AND LANs
- WORLD REGIONS(S):
  - ASIA AND CERTAIN COUNTRIES OF LATIN AMERICA AND AFRICA

INFORMATICS

- SYSTEM(S):
  - INTEGRATED OFFICE
  - SOFTWARE APPLICATIONS
  - ARTIFICIAL INTELLIGENCE
- SERVICE(S):
  - SYSTEMS DEVELOPMENT AND INTEGRATION
  - CONSULTING
- WORLD REGION(S):
  - ALL

Aide-Memoire

High Risk Technologies and Enhanced Work Environments

This aide-memoire provides background information for the Technology and Industry sector presentation at the August 13-15 planning session. It has three purposes:

- to recapitulate the rationale for DOC involvement in the development of high risk technologies and enhanced work environments;
- to establish a set of principles to guide future action based on the lessons drawn from past experience;
- to identify opportunities in the short- to medium-term for developing and applying new technologies.

A. Rationale

The Speech from the Throne, the Economic Statement and the Budget have all indicated the priority which the government attaches to the creation of jobs and new sources of wealth through industrial innovation, as well as to reducing the federal deficit. These priorities are intimately related:

- new jobs can be created and existing industries made more productive and internationally competitive through the development and application of new technologies;
- this will lessen demands on the public purse for income support and increase tax revenues, thereby contributing to deficit reduction;
- at the same time, the cost of government can be reduced and its effectiveness enhanced by the application of new technologies;

- because government is the largest market in the country for some of these technologies, government procurement can substantially assist the development of high technology industries.

The Department of Communications can play an important role in meeting these objectives. Each of its major functions can impact - positively or negatively - on the development and application of new technologies in the private and public sectors:

- if properly harnessed to industrial capabilities and market forces, DOC's research program could support private sector innovation in areas where there are clearly identified public or government needs;

- DOC's responsibility for planning and providing government telecommunications services could be a powerful instrument for improving government efficiency and supporting Canadian industry through coordinated procurement;

- communications and cultural policy can contribute to creating an environment that encourages entrepreneurship and innovation in the development and application of new technologies;

- DOC's responsibility for managing the radio frequency spectrum provides a hands-on means of encouraging the introduction of many new technologies;

- the department's international responsibilities offer an effective means of supporting the international marketing of high risk technologies.

Government priorities have given the Department of Communications a clear challenge: to use its instruments to support industrial innovation on the one hand and increase government efficiency on the other. Two fundamental strategic thrusts are required to respond to this challenge:

- DOC must utilize its instruments to reduce the technological, financial and market risks which confront Canadian firms - particularly small- and medium-sized firms - in the innovation process;

- DOC must become the centre of expertise within the federal government for the application of efficiency-enhancing technologies to government operations.

These thrusts are encapsulated in the two technological priorities which you identified to your Cabinet colleagues in March - high risk technology industry development and enhanced work environments.

B. Lessons

In devising ways of implementing these priorities, much can be learned from the past. At the Montebello presentation, we will focus on four major programs undertaken by the Department to promote the development and application of high risk technologies:

- the space program;

- the Telidon program;

- the Elie-St. Eustache fibre optics field trial;

- the Office Communications Systems program.

1. The Space Program

When DOC was created in 1969, it took over the work on space which had begun in the late 1950s at the Defence Research Telecommunications Establishment of the Department of National Defence. This work had produced a series of outstanding achievements in the 1960s. Canada was the third nation in space with the launch of Alouette 1 in 1962. This was followed by three other

satellites in the Alouette-Isis series, all designed for scientific purposes.

By the middle of 1960s, it was becoming clear that there were many potential practical applications of space technology. In 1967, the government decided to focus its efforts on the application of satellites to telecommunications and resource management. In 1969, it created Telesat to operate a domestic communications satellite system. In 1972, with the launch of Anik I, Canada became the first country in the world to provide commercial communications services with a geostationary satellite.

Under DOC leadership, the government's communications satellite program has evolved through three distinct phases:

- from the late 1960s to the mid 1970s, emphasis was placed on technology development, principally through the Hermes program which ran from 1970 to 1980. The cost of this program was about $70M;

- in the late 1970s, program emphasis shifted to industrial and applications development. The principal means of achieving the government's industrial development objective was the prime contractor policy which was adopted in 1975 and is still in force today. The main vehicle for promoting new applications of satellite technology was the Anik B program which ran from 1978 to 1983 at a cost of $44M;

- in the 1980s, the program has focussed on the commercial development of satellite communications through MSAT. The cost to date of this program is $26M.

In addition to the amounts spent on Hermes, Anik B and MSAT, the government has invested about $80M in the development of the Canadian satellite communications industry. It has also earmarked an additional $90M for cooperation with the European Space Agency on the Olympus Program through to 1990, of which about $60M has been spent to date. In total, the government has

therefore spent about $280M on satellite communications over the past 15 years. On top of the technological achievements noted above, this has generated the following results:

- the achievement, with Telesat's Anik D series, of the objective of supporting the development of a Canadian prime contractor for communication satellites;

- private sector investment of $60M in satellite production and a comparable amount in earth terminal production;

- about 1,000 permanent jobs in the production of communication satellites and 400 jobs in the production of earth terminal equipment;

- 1983 space industry sales of $276M of which 70% was exported, the highest percentage among nations having a space industry. It is also worth noting that Canada is the only country in the world where the value of satellite equipment exports exceeds government expenditures on space.

With respect to satellite utilization, Telesat employs over 400 people and had revenues of $110M in 1984. Its satellites have a total capacity of 108 channels of which 60 are currently being used - 48 by Canadian customers, mostly broadcasters, and 12 by Americans. This ratio of available to occupied channels corresponds almost exactly to the situation in the United States.

In sum, the success of the space program is due to a number of factors among which the following are particularly significant:

- it responded to a clearly identified national need;

- the policy decision to set up Telesat created a market around this need;

- the program took advantage of the R&D capabilities of government laboratories through an ongoing program of technology transfer to industry;

- initiatives to support technology and applications development were generally done in conjunction with users and suppliers of equipment and services;

- federal and provincial government procurement played a significant role in this process;

- the program placed considerable emphasis on international marketing and joint ventures;

- the program evolved as the industry matured, from an early emphasis on technology development to the present concern for commercialization.

The principal problems surrounding the space program have centred on the fact that the policy, regulatory and institutional framework surrounding satellite communications have not always kept pace with technological change. Controversies surrounding such questions as Telesat's appropriate place in the Canadian telecommunications system, the terms and conditions under which satellite capacity could be leased, satellite broadcasting and the ownership of earth stations have added to the risk faced by private investors in satellite goods and services.

2. The Telidon Program

Like the space program, the Telidon program was a major departmental undertaking spanning many years aimed at promoting technology, industry and applications development. It involved the expenditure of significant public funds and generated a great deal of public attention as Canada's first major venture into informatics.

The program, which ran from 1978 to 1985, can be divided into three distinct phases:

- during the first phase, from 1978 to 1981, the main emphasis was on technology development. This was largely done by sponsoring a series of field trials, at least one of which took place in every province. Government investment in this phase was $9M;

- in the second phase, from 1981 to 1983, the emphasis shifted from technology to industry development. Major activities included the Industry Investment Stimulation Program and the effort that was put into securing recognition for Telidon as an international standard. Government investment was $26M;

- during the final phase, from 1983 to 1985, the program emphasized the development of content and applications in the private and public sectors, through the Content Development Program and a number of other initiatives. Government funding was $23M.

In addition, the government invested $7M between 1981 and 1985 in the attempt to develop a broadcast Telidon, or teletext, service on CBC.

In total, the government therefore invested $65M in Telidon. This investment achieved the following results:

- the development of a world class videotex technology which is recognized as the North American standard and one of the three world standards;

- private sector investment estimated at $200M;

- a Canadian videotex industry which currently comprises about 80 firms, provides 750 full time and another 100 part time jobs, did about $30M of business in 1984 and exports over half its production.

The Telidon program's technical achievements were an outstanding success. As the figures cited above indicate, its industrial development activities must also be counted at least a modest success, particularly in the export market where Canadian firms have held their own with their British and French rivals, in spite of the much heavier support provided by the governments of those countries. However, with a few notable exceptions, the program did not succeed in promoting the development of marketable applications in the domestic market.

The principal message which can be drawn from the Telidon program is that in informatics, the Department has so far been more effective in supporting the development of world-class technology than in encouraging its application and diffusion in the domestic market. The conventional wisdom is that in the Telidon program, the Department was pushing a technology that either did not have a market, or not nearly as large a market as the Department believed. Although there is some truth in this view, it is overly simplistic. The Telidon experience also reflects the reality that, too often, new technologies - some of which Canada has developed - have only been adopted in this country after they have been successfully applied elsewhere. This delay between development and application often means the loss of significant industrial benefits - particularly because, over time, the business opportunities involved in applying technology through software, service and content development, training and maintenance far exceed the opportunities provided by hardware development.

A second item of contentional wisdom is that, in future, Canada should refrain from attempting to develop technologies and concentrate on applying and diffusing technologies that are developed elsewhere. Again, while containing a kernel of truth, this proposition is overly simplistic. The opportunities for developing new products based on the fundamental communications and information technologies appear literally unbounded. They are certainly not the preserve of any one nation or set of nations. Indeed, it is apparent that today, there is no such thing as technological sovereignty. All countries involved in technology development import components from the countries where they can be manufactured most cheaply, and international joint ventures to develop technologies are becoming the rule rather than the exception. Canada has no choice but to move with these trends.

Finally, it is equally clear that we are unlikely to compete with the Japanese and the Americans in the production of high-volume, standardized products. However, there are significant opportunities for Canada in integrating these components, through hardware and software development, into new products and systems which respond to our needs - and also have significant off-shore markets.

3. The Elie-St. Eustache and Office Communication Systems Programs

The Elie-St. Eustache local distribution fibre optics field trial and the Office Communications System program were relatively small scale compared to space and Telidon - $10 M and $14 M respectively. Both were very successful in meeting their objectives, which centred on developing technology in Canadian industry. In large part, this was because they involved active partnership and risk sharing with users and suppliers of the technologies:

- in the Elie-St. Eustache trial, the Manitoba Telephone System, other carriers and Northern Telecom all contributed matching funds;

- in the OCS program, Canadian companies were given the opportunity to develop integrated office automation systems using selected government departments as seed beds.

One of the challenges before the department in the next few years is to support the application and diffusion of the technologies that emerged from these programs.

4. Conclusions

If we compare our achievements with those of other countries, it seems clear that Canada could have complemented its technological achievements and developed larger markets for products and services based on new technologies more rapidly if it had adopted more effective strategies for promoting their application and diffusion. Specifically, there appear to have been two main

obstacles which have not yet been successfully addressed:

- the policy, regulatory and institutional framework of the Canadian communications system has not kept pace with technological change. To some degree, this has inhibited private sector investment in new products and services;

- the efforts made by the Department to encourage the development of new technology were not matched by corresponding efforts to develop marketable applications and content.

In addition to the positive elements identified above, the main lessons that can be drawn from past are the following:

- the Department must adopt a stronger market orientation in policy and program development. Greater emphasis needs to be placed on activities such as technology assessment, analysis of user needs and industrial capabilities, market analysis, consultations with industry and the provinces, marketing support, and standards development. As part of this market orientation, the department should continue to emphasize risk sharing with users and suppliers of new technologies;

- the Department needs to do a more effective job of coordinating its industrial development instruments. DOC has two programs which can directly affect the development and application of high risk technology - its research program and its responsibility for planning and managing government telecommunications. Together they provide the base of technical knowledge which enables DOC to assist other government departments in developing and applying new technologies, thereby creating markets which the private sector can exploit. In an era of fiscal restraint, they are likely to be the main program tools for achieving DOC's industrial development objectives. In addition, if appropriately utilized, the Department's policy and regulatory responsibilities can help create

a climate which encourages private sector entrepreneurship, investment and innovation;

- in newly-funded program initiatives, a better balance must be struck between activities aimed at encouraging the development of technology and those aimed at encouraging the development of content and applications.

On the basis of past experience, we have therefore identified five criteria for future DOC action. We intent to propose for your consideration only initiatives which meet all five criteria:

- they must respond to clearly-identified public or government needs;

- there must be significant, demonstrable and attainable domestic and off-shore markets for products and services developed as a result of departmental initiatives;

- there must be demonstrable private sector capability or interest in capturing these markets;

- the technological, industrial or market risks associated with these initiatives must be so high that they preclude private sector action;

- DOC, acting alone or in conjunction with other departments, must have the tools to reduce risk to an acceptable level and to encourage an appropriate level of private sector investment.

C. Opportunities

Over the past year, the work done in the Technology and Industry sector to assess emerging technologies against socio-economic trends, market forces and industrial capabilities has identified four areas where opportunities may arise

to support the development and application of high risk technology. These are:

- distribution systems;
- television technologies;
- electronic information systems;
- office automation.

In each of these areas, there appear to be a number of clearly defined public or government needs that could provide significant opportunities for the private sector to develop or apply advanced communications technology. In three cases - integrated office automation systems, computer-assisted translation, and MSAT - we have completed our analysis, are satisfied that all five criteria are met, and will be presenting policy and program proposals to you at Montebello.

To situate these proposals in context and to provide you with some indication of the scope of possible future initiatives, the following paragraphs briefly describe the four main areas we are exploring and some of the opportunities that may arise in each of them:

1. Distribution Systems

- Satellite Communications: Proposals to support the commercial development of a Mobile Satellite (MSAT) System in cooperation with the United States have been studied by Cabinet and are being further developed as part of the strategic plan for Canadian involvement in space. Plans are already underway to develop Extremely-High Frequency (EHF) satellite systems, initially in cooperation with the European Space Agency's Olympus Program;

- Fibre Optic Networks: Fibre optic technologies are currently being deployed by telecommunications carriers on high traffic volume international, intercity and trunking routes. As well, they are being applied in some cable systems and private local area networks. Fibre optics transmission and the associated opto-electronic and optical switching technologies are expected to become a dominant communications technology over the next ten-twenty years. Canadian industry has considerable strength in this area and there will be many opportunities for the government to promote the development, application and diffusion of this critical technology - using both policy and program instruments - in the government environment and in the private sector.

2. Television Technologies

- New Video Technologies: The CBC has estimated that $200M will be needed to acquire new studio equipment for the Toronto consolidation. Canadian industry will require some support to be in a position to compete against Japanese, American and European companies for this very lucrative procurement contract. The market for higher resolution video production, recording and display technologies is particularly important because entertainment applications have historically often led the way in introducing new technologies which ultimately found much wider application;

- Demand Access Video: Pay television has suffered in competition with videocassette recorders because it cannot offer programs in response to individual demands at specific times. Using new communications systems which combine optical storage with fibre optics distribution, it will be possible to develop "video jukeboxes" containing hundreds of program offerings, and to distribute them on an interactive basis in near real time. This technology could be very important to the future growth and development of the cable, broadcasting and film industries, and their ability to achieve the cultural policy goals set for them.

It also has important implications for program production and copyright policy;

3. Electronic Information Systems

- Computer-Assisted Translation: Work is currently underway with the Secretary of State Department to develop a joint program on machine assisted translation. The proposed program would unite the research, development, program management, industry and marketing support and needs analysis capabilities of DOC with the subject matter expertise of SOS. Its fundamental aim would be to improve the productivity and efficiency of the Translation Bureau in meeting the increasingly heavy demands placed on it, without a corresponding rise in resources;

- Electronic Publishing: This term refers to the interactive distribution or exchange of text and graphic material through electronic means, often although not necessarily in real time. It differs from conventional broadcasting in that content can be manipulated or tailored to meet individual tastes, demands and needs. In a rapidly changing technological environment, the ability of broadcasters, publishers, videotex operators, to achieve the cultural policy goals which the government has set for them will depend in no small measure on their ability to adopt this technology. It will also provide business opportunities for new entrants to the publishing field. One of the goals of policy development and program expenditures in these areas should therefore be to assist Canadian companies in developing the products and services required by these new media;

- Public Access Information Systems: New communications technologies provide a means for more effectively distributing government information to the public. The Department is currently attempting to develop a health care information system in conjunction with the Department of Health and Welfare to more effectively serve the

public's need for preventive health care information. To the extent that it succeeds, the program will also lessen the demand for health care services, thereby reducing the call on the public treasury.

4. Office Communication Systems

- The Application of Integrated Office System Technologies: Office automation technologies are critical to achieving the objectives of restraining the growth of government expenditures and improving the quality of service to the public. These objectives require coordinated action by a number of players. As the general manager of the public service, the Treasury Board is responsible for setting overall administrative policy for the application of office automation technologies. The Treasury Board Task Force on Informatics has made a series of recommendations on this subject. As the federal government's purchasing agent, the Department of Supply and Services is responsible for pooling departmental requirements and ensuring that they are directed to the benefit of Canadian industry. The Department of Public Works, for its part, is responsible for all aspects of building design, construction and management. The Department of Communications has a critical role to play in support of the efforts being made by these central agencies to promote office automation. This role has two main elements. First, DOC's responsibility for planning and providing government telecommunications means that the Department is responsible for developing the communications infrastructure required to support office automation in the federal government. Second, the expertise which DOC has acquired in the technical, organizational and human aspects of office automation through the OCS program, as well as the research capabilities of the CRC and the CWARC, put the Department in a unique position to advise and assist other departments and agencies in specifying, designing, developing and acquiring office automation systems which meet their needs. Policy and program proposals to carry out these

responsibilities are currently being prepared.

- Intelligent Building Local Area Networks: Office automation technology springs from three sources: telecommunications, EDP, and the development of standalone products designed to automate discrete office functions. Currently available technologies seek to integrate these into systems designed to serve specific organizational units. This was the goal of the OCS program. The next stage in this evolutionary process is to extend the range of office functions which are automated (particularly to include better telecommunications, information gathering, storage and retrieval systems), to enhance the intelligence of the resulting systems and to develop the networks required to connect and extend them to larger organizational units. Local Area Networks (LANs) - which serve work groups, offices, buildings, campuses, factories and farms - are emerging as the central communications infrastructure for achieving these objectives. The construction of the new national museums and the new CBC headquarters are example of public projects which could provide Canadian companies with the market required to enter this area, if these projects are accompanied by an appropriate technology development program.

- Automated Information Storage and Retrieval Systems: One of the great challenges in communications will be to develop means of effectively using the large amounts of information made available by the new technologies. The storage capacity of optical discs, presents a particularly interesting problem. By marrying the document processing capabilities of optical scanners and laser printers, the ability of expert systems to emulate human mental processes, and the storage capacity of optical discs, it will be possible to develop much more efficient storage and retrieval systems than currently exist within the public service. Systems of this kind are particularly needed in the national museums, archives and libraries, as well as in general office applications.