Energy, Mines and Resources Canada
Canada Centre for Remote Sensing

Énergie, Mines et Ressources Canada
Centre Canadien de Télédétection

THE TRANSFER OF FEDERAL TECHNOLOGY TO THE PROVINCES

J. Cihlar, editor

November 1980

THE TRANSFER OF FEDERAL TECHNOLOGY TO THE PROVINCES

Proceedings of a Workshop,

Ottawa, November 20-21, 1980

J. CIHLAR, editor

Sponsored by

CANADA CENTRE FOR REMOTE SENSING

ENERGY, MINES AND RESOURCES, OTTAWA

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Acknowledgements

This workshop was conceived and organized as a result of discussions of the IACRS Technology Transfer Subcommittee concerned with a remote sensing transfer program. This Subcommittee included representatives of DOA, DOE, IAND, and EMR. Mr. Paul Hession (CCRS) was in charge of local arrangements and arranged for the recording of the entire workshop. Mr. Nee Lee (CCRS) assisted in compiling and editing the final version. Although individual speakers reviewed drafts of their recorded contributions, only minor editing of the discussion was done.

1. INTRODUCTION AND OBJECTIVES

E.A. Godby
Director General
Canada Centre for Remote Sensing
and
J. Cihlar (Chairman)
Head, Applications Development Section
Canada Centre for Remote Sensing

E.A. GODBY: I wish to welcome you to this workshop and thank you all for taking the time to participate.

At CCRS we have, for some years, been involved in the process of getting remote sensing data actually used in resource management information systems. This effort has been partially successful, but we feel new initiative must be taken to make the process more effective and we would like to draw on the experience of others who have been involved in technology transfer activities.

In recognition of this need for more technology transfer efforts, funding for a technology transfer program was included in the LANDSAT-D submission in the ICS 5-year plan. Under the proposal for technology transfer a core group of 12 people, drawn from DOE, DIANA, Agriculture and CCRS would be formed and this group would be responsible for developing a program under which the technology would be incorporated into the decision making process of the province. This submission will be going before Cabinet on November 25, 1980.

It is now necessary to thresh out the details of the proposal. The procedures we intend to follow are

1) As a result of the recommendation of a sub-committee of IACRS, this workshop is being held which will hopefully distill the Federal experience in technology transfer and result in a plan of action. Although at the moment we are discussing this at the Federal level, we have asked Cal Bricker, Head of the Alberta Remote Sensing Centre and Chairman of the IPTASC to listen to the talks and give us his reaction at lunch tomorrow. This will provide immediate feedback.

2) The proposal will then be presented to the next meeting of the IPTASC and hopefully they, with the help of the IACRS sub-committee, will develop a proposal acceptable to both the federal government

agencies and the provinces. The next step of course will be implementation. If approval in principle for our ICS submission is obtained, then the implementation stage is relatively easy. If it is not, then we will use the developed plan as part of next year's ICS submission. In any event, the process of preparing the plan is starting here.

I hope that the participants will find this experience mutually beneficial and I thank you again for coming.

J. CIHLAR: I would like to briefly review some of the thinking behind this workshop. I have been in contact with many of you and you have contributed the material in preparation for the report that has been distributed.

The workshop is called the Transfer of Federal Technology to the Provinces. By technology, we have implied in a broad sense knowledge, skills, hardware, know-how and things that are available or developed at the federal level. They are developed in the context of resource management. The word provinces, in legal sense, includes territories. Therefore, whenever the word "provinces" is used, it does not exclude the territories.

There are essentially three objectives to the workshop:

1) To review the existing and planned programs of the federal government. This will hopefully give us a broad overview of all the different programs that are being worked on. Why are they in existence? How are they working? What are their successes?

2) What are the relevant aspects of these programs in terms of transfer to the provinces? It became obvious when we organized this workshop that there is a relatively small level of transfer to the provinces, but a large amount of transfer to the industry. The second objective will allow us to extract from the existing experience that which is relevant or useful in terms of transfer to the provinces.

3) To develop an approach to technology transfer to the provinces, using remote sensing technology as an example.

A proposal has been distributed to you which we will hopefully be able to discuss tomorrow. While we talk about remote sensing, technology transfer crosses most other kinds of technology. For this reason, the exchange and the results of the workshop should be useful in the context of your individual agencies.

2. CONSERVATION AND RENEWABLE ENERGY BRANCH

C. McNeil
Coordinator - Demonstrations, CREB
Energy, Mines and Resources

Thank you Mr. Chairman, and congratulations on this very good idea of getting together with these people to discuss technology transfer, not only to the provinces, but through the provinces, which is our emphasis in the Conservation and Renewable Energy Branch.

CREB is one of the fastest growing units in the Canadian government. In 1974, it was three man-years and a few thousand dollars. Today it is 113 man-years with over $300 million in programs, particularly through the new energy program. Many of you are familiar with the internal program and the alternate liquid fuels just getting under way. I would like to read into the record the programs that CREB is involved with right now.

In the building area there are diffusion of existing technologies, transfer and spread of technologies, CHIP - and if that isn't enough, super-CHIP -, Arctic Housing Standards and the adoption of energy efficient measures for new housing, municipal energy management, low-cost initiatives in buildings and district heating.

In federal facilities; federal facilities retrofit, federal facilities off-oil and low-cost initiatives.

In industry; national energy audit and seminars, industrial conversion retrofit in the Atlantic provinces, expanded FIRE, including municipal wastes and low-cost initiatives.

In transportation; fuel efficient legislation, low-cost initiatives, propane vehicles' conversion grants.

In renewables; remote communities, wood furnace grants and solar grants.

In the demonstration of new technologies - which I would like to emphasize since it is in the area that I am most familiar with - federal/provincial demonstration agreements, super-energy-efficient home demonstration, Arctic home demonstration, federal fleet propane demonstration and residential solar hot water demonstrations.

In research and development; the on-going R&D program in conservation and a new one in liquid fuels.

The goals of the Conservation Renewable Energy Branch thus include the acceleration of the adoption of energy conservation or renewable energy technologies. In other words, we are in the technology transfer business, although it is not always explicitly recognized. We are and must be a conduit for the facilitation of technology transfer. If we are to achieve our goals, we must work through others.

I would like to focus on the transfer of technologies and of systems applications with the provinces and through the provinces to the end users. I am going to use my privilege as first speaker and state some trite truisms:

1. Technology is transferred by people and the corollary is technology can help people transfer technology.

2. No technology transfer can take place without technological information transfer taking place first. Information transfer is a vital part of technology transfer.

3. Technology is best transferred where everybody gains. Avarice and greed work and we can use them.

To illustrate these throw-away lines, I would like to use the example of the federal provincial demonstration agreements.

Technology transfer is an explicit goal of the demonstration agreements that we developed with the provinces over the last two years. We are expecting expenditures of 113 million federal dollars; approximately 96 million provincial dollars; and approximately 100 million third party dollars. In other words, it is a large and important set of agreements with the provinces that we and the end users feel are important to meet the rapidly changing energy situation. The demonstrations which are administered by the provinces and managed by a joint federal/provincial management committee are very good devices to transfer technology. The technology has perhaps been used off-shore or has been developed in Canada through research and development. There often needs to be a real life, in-the-ground, irrefutable demonstration by people who have credibility with the user group in order for the technology to be effectively transferred.

Inevitably we seek demonstrations with people who are going to use that technology and who are in fact going

to make a dollar from it. In other words, we first try to demonstrate with manufacturers, with industrial associations, with people who can, in their own enlightened self-interest, make the demonstration trigger a massive deployment of that technology. Whenever possible, we want hands-on demonstrations. We want as many people as possible involved in the demonstration project itself. We want participation. We want to have whoever is going to use the technology vitally involved through financial and physical participation.

The fact that the provinces and the federal government are working together is by itself a very valuable technology transfer device and program delivery tool. The provinces are now able to deliver multi-million dollar programs that they perhaps did not have the capability to deliver before. There are a number of advantages to approaching technology transfer through a federal/provincial agreement where the province administers the program.

Trite truism number two leads us to emphasize information transfer, technical information transfer. It is written into the procedures that funding flows for technical information transfer as an integral part of every project. As examples, I would like to tell you about a few projects that we have underway and highlight some of the more significant ones to give you a flavour of how we work.

Under the aegis of the International Energy Agency Housing Tour and through the Builder's Association, the Saskatchewan agreement had fourteen super-energy-efficient homes built in a suburb of Saskatoon. Each contractor was given $7,000.00 to build houses designed to cost about $55.00 a year to heat. These standard size homes were shown to be extremely marketable. The demonstration was not only of energy efficient technology, though they were using some advanced concepts including home heat exchangers and air tight vapour barriers. The essence of this demonstration was to show, that these houses could sell like hot cakes. There are profits to be made for builders who will go out and build thousands of them. We are learning from this experience through wide publicity, tours, seminars, and best of all, word of mouth.

The Department had been involved in geothermal drilling and exploration in the Meager Mountain area for some years. British Columbia proposed - and it was accepted - that B.C. Hydro and the federal/provincial demonstration program would take on the task of proving the

resource. B.C. Hydro would then take over; our only target audience for this demonstration, they have been effectively reached. It is our expectation that a 100 megawatt geothermal plant will result. The use of geothermal energy in the area opens new possibilities as does the use of geothermal energy from sedimentary basins across the Prairies. We are demonstrating that in Regina. Both are the first of their kind in this country.

The Omni gasifier in Hearst, Ontario, a very fine Canadian technology, is being demonstrated not only to Levesque Lumber, the plywood industry, the forest industry and the nation, but internationally. There has been considerable attention given to this unit in France. By putting enough money in, to make it happen, we accelerate the development and spread the use of wood chips and hog fuel as a significant renewable energy resource.

Twenty one percent of British Columbia's energy is produced from hog fuels and from biomass. There is no reason this could not spread across the country. A private small entrepreneur in Fort Providence, N.W.T. came to us and asked us to help him put a wood gasifier into his already existing diesel set up. He generates his own power, and power for a considerable portion of Fort Providence. For very little extra money - we only pay the increment - he is going to create employment for half the town in winter: cutting and chipping wood. It will be gasified, and used to fuel the diesels which drive the generators. What a model for isolated wooded areas using high priced oil!

We have considerable peat resources spread throughout the country. Newfoundland is taking advantage of this. We have, in fact, through the demonstration, created a new industry. There is a consortium including a western oil firm, Memorial University and a number of private concerns. A pulp and paper plant will burn the peat as fuel. The industry will possibly spin off into horticultural peat. We are demonstrating that peat is a viable industrial fuel and the word is being spread by visits to the sites, by articles, and by seminars. We are also videotaping the portions that are relevant. We target who it is that could use the technology and the application and then go after them in a concerted plan of action.

We have also developed a number of information transfer devices including computer systems. The Canadian Energy Projects System, which holds full-text descriptions of significant R&D projects, has the capability of being

not only accessed but updated on-line from anywhere in the country, is almost unique. We are tying into the best technologies being used. We believe that technology can help people transfer technology.

I am very pleased to see Dr. Sutterlin from CANMET here, who will have a chance to share some of the developments in the area of technical information transfer through applied technology which we are using on the federal/provincial program and which, of course, they are applying widely.

I would like to leave you with the idea that the utilization of provincial resources coupled with federal resources is a very good way to transfer to third parties the technology that Canadians must have in order to maintain and increase our position in this world of change.

3. TECHNOLOGY TRANSFER IN THE ATMOSPHERIC ENVIRONMENT SERVICE

W.S. Appleby
AES
Environment Canada

In the Atmospheric Environment Service (AES) most of our technology transfer can be divided into two types. The projects outlined in the document I have just distributed fit into the first category: operational meteorological technology transfer. The other two fit into the research and development technology transfer.

Operational Meteorology Technology Transfer - Interchange Program

A part of our mandate is to advance the understanding of meteorology as it relates to the improvement of the national, social, environmental, and economic conditions. In this area, one of the most relevant types of technology transfer that we get involved in is transferring our expertise to industry.

Approximately three years ago, with the increased activity in off-shore drilling, AES saw an industry which could greatly benefit from site-specific meteorological forecasts. At that time, there was very little in the private sector to support this activity and there was some concern that foreign companies would move in and Canada would be left in a position of having to depend on them.

With this in mind, AES decided to encourage technology transfer of operational meteorology to many of the meteorological consulting firms that existed in Canada. When this policy was made known, AES was approached by several consulting firms who wanted AES to provide expertise at setting up an operational system for them. Most of their problems did not lie in the fact that they did not have meteorological expertise, but in the fact that they did not have expertise at setting up and operating an operational forecast program. The first method tried - and it has probably worked very well - was Executive Interchange. Executive is probably not the best word since what was being exchanged was operational meteorologists at the supervisory level. After a number of these exchanges were in progress it was found that there was some interest by AES employees in moving into the private sector. In some instances, they were uncertain about leaving. AES management considered the situation, and leave without pay was

offered because there are benefits both for AES and for the private sector. First, their knowledge of the AES operation would be transferred to the private sector. In addition, AES would have a line of communication to explain the various types of services it offers. Furthermore when these meteorologists returned to AES, their experience would be very valuable to the organization. For this reason, leave without pay was encouraged. There have also been a few secondments to other government agencies.

Because most meteorologists in Canada come through the AES training system - and until recently this involved a fairly comprehensive in-house course - the Canadian universities have not had the need to teach a very operationally oriented course. Most meteorologists in AES came out of math and physics courses and took the comprehensive nine month AES courses. Therefore, there was a lack of trained meteorologists in the private sector. As a result, AES offered to allow the consultants to place students on the AES course. AES would charge them the incremental cost of training.

The various agencies that have received the operational technology have been private consultants, Government agencies and crown corporations. I refer here to Ontario Hydro, the Alberta Government and private consultants like NORDCO, MEP and MacLaren Merricks.

The hand-out on the transfer of meteorological services technology, which you have been given a copy of, describes how we have been transferring this technology to private meteorological consultants. So far, things have worked very well. The Executive Interchange has been used with NORDCO and MacLaren Merricks as well as others. Leave without pay has been used with MEP. In most of these cases, AES has also transferred their operational software technology to these companies.

The other area in which AES has been involved in technology transfer is research and development. This is mostly done in the Atmospheric Research Directorate. These have involved mission oriented contracting out. The other case is with the contractor actually coming into AES to be involved in the technology transfer.

Again, there have been some scientist interchanges. These have mostly involved the development of either software or of an instrument.

Another example is where AES has developed an internationally recognized instrument to do ozone studies in the upper atmosphere. AES is now looking for a manufacturer to build and market this instrument.

J. CIHLAR: Has AES reorganized or organized in a way to facilitate this? Was it a new program or have you tried to do it with existing resources?

W.S. APPLEBY: I do not think there has really been a need for a reorganization or a new program. AES had to decide in what areas it felt the federal government should be providing meteorological services and what areas it felt private industries should be able to provide services. With AES operating a forecast program, it was very easy to add a small increment to do something for a special user. If AES continued to do that, there would be a requirement, at some point, for resources. More meteorologists would be required and the private sector would not be able to compete. As a result, because of limited resources there was an incentive to encourage the private sector.

Furthermore, AES took the position that if industry does come to AES and wants a service and there is no private group available to do it, AES will try to make sure that the cost recovered is similar to what the private industry would charge. In the long term, the private sector will then be able to move into this area.

Three specific examples of technology transfer at AES are presented below. The first two descriptions were provided by C.B. Adamson.

Name of the Program or Activity:	Development of a Mesoscale Surface Wind Prediction Model - The Small Area Model
Department/Agency:	Forecast Research Division, AES/DOE
Goal of the Technology Transfer:	To enable use by the private sector of the technology in other similar applications.
Mandate:	Carrying out the required research through contracting with the private sector.
Technology being Transferred:	Know-how and software.
Anticipated Outcome:	A model to diagnose mesoscale surface winds as they are affected by terrain, frictional and thermal effects has been developed.
Adopters:	Atmospheric Dynamics Corporation
Procedure for Selecting:	Having specified the requirements for the contract work, the field of companies was surveyed and it was determined that Atmospheric Dynamics Corporation was best qualified to carry out the work. The company had considerable experience in dealing with primitive equations models, a prime requirement of the contract.
Mechanism:	The methodology was developed by Atmospheric Dynamics Corporation under contract with AES and hence no separately identifiable technology transfer phase was necessary.
Technology Transfer Agents:	Forecast Research Division and Atmospheric Dynamics Corporation.
Continuity:	The technology developed has since been used in various other applications, e.g. surface winds required to predict ice motion and motion of oil spills in data-sparse areas.

Use of Technology:	The effectiveness of the technology transfer was evidenced by the number of requests that were received from other government and non-government agencies for the use of the methodology.
Resources Used:	The contract was fully funded by the Federal Government. About 0.5 PY of divisional resource was utilized in addition to the contract funds provided.
Problems:	None.
Illustrative Examples	This contract was a stand-alone contract and as such was not part of any federal program. The contractor has been able to very successfully market the technology developed through this contract.
Comments:	This activity has fulfilled the objective of contracting out research where possible and has also given impetus to the private sector to successfully market the technology.

Name of the Program or Activity:	Satellite Sounding.
Department/Agency:	Aerospace Meteorology Division, AES/DOE
Goal of the Technology Transfer:	To transfer the Aerospace Meteorology Division's TOVS processing methodology and associated physics to MDA to accelerate commerical exploitation by Canadian Industry.
Mandate:	The project is being carried out as part of the COPI program.
Technology being Transferred:	Know-how and software.
Anticipated Outcome:	The company will export a number of TOVS processing systems.
Adopters:	MacDonald Dettwiler and Associates Ltd.
Procedure for Selecting:	Unsolicited Proposal from MDA and references that showed that MDA was probably the most promising candidate.
Mechanism: Phase I	A computer scientist and a meteorologist are participating in the Aerospace Meteorology Division's satellite sounding research program. At the end of six months they will take back to MDA the prototype software developed by the Division.
Phase II	Development of a marketable production TOVS software processing package and delivery of copies of the software description to the Aerospace Meteorology Division.
Technology Transfer Agents:	Aerospace Meteorology Division and MDA scientists.
Continuity:	Continuity will be maintained by the Division using the MDA software package for future research and exchanging updated information with the company.

Use of Technology:	The effectiveness of the technology transfer will be judged on the quality of the resulting TOVS processor and the success of the company in exporting the system.
Resources Used:	The program is funded by the Federal Government. Two people are being provided by the adopter for phase I. The Division utilizes about 2 PY per year on the program.
Problems:	The only significant problem encountered to date was identifying the appropriate federal program for the transfer.
Illustrative Examples:	This is the first project of this type carried out by the Division. To date all technology transfer has been via consultation.
Comments:	The main reasons for doing the program are to accelerate the AES R&D program by adding resources and to assist MDA in developing a commercial processor using AES know-how.

Name of the Program or Activity:	Transfer of Meteorological Services Technology to non-government agencies.
Department/Agency:	Field Services Directorate, AES/DOE
Mandate:	To advance knowledge and understanding of the nature and behaviour of the atmosphere, atmospheric constituents, and atmosphere/water and atmosphere/land interface relationship, in areas which will contribute to the long-term improvement of national, social, environmental and economic conditions.
Goal of the Technology Transfer:	To encourage the establishing of a Canadian private meteorological consultant sector.
Technology being Transferred:	Know-how and software.
Anticipated Outcome:	The company will provide site specific and consultant services to industry.
Adopters:	Private Meteorological Consultants.
Procedure for Selecting:	In general, the companies have approached AES for help in setting up a site specific forecast service or have approached AES personnel.
Mechanism:	The mechanisms that have been used are: 1) Executive Interchange - Interchange Canada. This has been a one way interchange to industry, provincial agencies or a university. 2) Leave without pay - The professional in AES approached has requested permission from AES to go to industry on leave without pay or AES has suggested the employee try this route before moving into the private sector. In some instances, this was the mechanism initiated by AES. 3) Access to AES training courses on an incremental cost recovery basis.

Technology Transfer Agents:	Field Services Directorate/AES Atmospheric Research Directorate/AES.
Continuity:	Continuity will be maintained through their use of AES guidance material and access to AES communications circuits and software.
Use of Technology:	The effectiveness of the technology transfer will be judged on the ability of the private sector to provide an effective consultant service.
Resources Used:	The program is funded by the adopter, however, AES makes software and trained professionals available.
Problems:	No serious problems have been encountered to date.
Illustrative Examples:	NORDCO - An Interchange Canada program was undertaken involving a meteorologist to establish an operational site specific forecast service for the offshore drilling industry. MEP - A meteorologist is working for MEP on leave without pay to participate in the development and management of a weather forecast system and data management system. Alberta Oil Sands Environmental Research Program (AOSERP) - A professional is working in AOSERP through the Interchange Canada mechanism as a research manager. The main areas being studied are likely environmental impacts of air quality.

4. DEPARTMENT OF COMMUNICATIONS

J. Barry
Director
Space Electronics
Communications Research Centre

I would like to talk about ANIK-B communications projects and on one other activity in our Department. This deals with technology transfer to para-provincial organizations having to do with the technology of fiberoptics which we have been in for quite a while.

The ANIK-B Communications Pilot Project is built around the use of the 12/14 GHz frequency bands which has special characteristics as far as the use for our communications goes. Going back to the first generation of satellite communications, which operated in lower frequency bands, they operated at frequencies and wave lengths where there was a strong possibility of interference from local terrestrial services in the same or continuous bands. Therefore, the services that were provided had to be provided by means of receiving antennas that had fair measure of directivity toward the satellites and discriminated against local interference. There were also limitations on the power that this satellite could pour down because of the interference into the terrestrial systems. By virtue of some very good planning, the 12/14 GHz bands do not suffer this technical limitation. On the satellite, you can pour on the coal as far as you want and you will not interfere with any terrestrial services because there are none.

On the other side of the space-earth link, which is the ground station, you can operate with receivers of modest sensitivity because they do not have to discriminate against signals that originate locally on terrestrial systems. This is the virtue of the 12/14 GHz and the thrust of the program is aimed at capitalizing on this class of service.

The goals of the technology transfer are:

1) To get the technology into the hands of people that will be the real users of it.

2) To provide them with initial services for the equipment they have and to work with them.

3) To get feed-back from them on the use of this class of telecommunication services in a real operating environment.

In the ANIK-B communications, which is the present set of experiments, some of the users pay for their satellite time if they can. This is a feature that was introduced with the Hermes satellite. The services are provided, more or less, free of charge by the Department.

4) To develop the knowledge and expertise to better utilize this spectrum.

5) To develop expertise and create awareness among the user institutions. This is really the end object of the exercise.

The agencies that have been involved in this particular program cover a fairly good cross-section of users in the country.

The mandate of the Department is:

1) To coordinate and support development in Canada of space communication facilities and services.

2) To explore and support the development of new applications based on what can be done. In other words, finding clients for new technology.

The technology being transferred is:

1) The knowledge of the capabilities of the 12/14 GHz bands. It is the uniqueness of this particular spectrum situation that we are capitalizing here with low-cost earth terminals.

2) The user experience in use of satellite communications. We have an opportunity here to work at the local level with medical people and educational authorities.

3) The exploration of the parameters of satellite communications. This serves our own requirements as well as the industry that will eventually provide these services.

4) Experience with prototype earth stations.

Under anticipated outcome, there are five:

1) Increased use of telecommunications in this new mode, to either improve the services that are available or provide services where there previously were none.

2) Greater knowledge of the application of tele-education and tele-medicine experiments.

3) Identification of new services in health, education, administration and inter-community communications.

4) Confirmation of the feasibility.

5) To make proper use of the commercial satellites in this country which are provided by TELESAT Canada.

We have a very explicit procedure for selecting organizations be they para-public, commercial, provincial, foreign or otherwise. An open invitation is issued. Then there is a screening process which is conducted. In subjects such as health where there is inter-hospital communication for diagnostic services, we work with the Department of National Health and Welfare. They screen these proposals for us. They have, in the past, provided financial support to some of these experimenters. In the case of a university coupled with a hospital, the people frequently do not have sufficient money or budget to allow them to purchase, not only the terminal which we supply, but auxiliary equipment for coding signals.

National Health and Welfare have been very cooperative with us in providing the financial support especially to some of the universities that work with hospitals. The final selection is made by our Department taking into account our satellite and ground terminal resources and priorities. We presently control or virtually own about 150 earth terminals which are distributed across the country for a variety of services.

The mechanism for accomplishing the project is that you must enter proposals and make certain agreements with the Department as to how the information will be used. You must also promise not to listen in on someone else's transmission as well as agree to a few other administrative regulations.

Every month, we prepare a report in our Department called the ANIK-B Pilot Project which is sent to the Deputy Minister and the Minister. It is available on a distribution basis to government departments that are involved in any way.

The transfer agents are our own staff, contractors and project sponsors. In the case of Health and Welfare I might identify them more properly as co-sponsors.

The continuity is provided, since it began with the Hermes mission in 1976 through the ANIK-B projects we presently have, for the Department who rents the capacity and the satellite and offers it to the users who cannot pay. It recovers from those that can. ANIK-B will go into an extended phase when ANIK-C commercial services are available. At which point the people that are really interested and are able to make a cost effective analysis of how they feel about it will be able to contract with TELESAT Canada for service at the frequencies on ANIK-C. This is a third satellite operating in 12/14 GHz frequency bands.

The use of that technology is described monthly under a formal reporting system that experimenters accept. It is difficult to get an exact statement of resources used because a lot of our scientific staff have been involved in developing these programs. In straight dollar terms, DOC has put in approximately $4 million in the purchase of earth terminals and contracts to service them, plus the transponder lease. This is a fair amount of money to TELESAT Canada. The other federal government departments have put in about 3 million dollars; provincial 1 million dollars; sponsoring agencies 1/3 of 1 million dollars. That adds up to somewhere between 7 and 10 million dollars.

The problem that we face in this undertaking is the usual problem one has of putting state-of-the-art equipment in the field without the proper technical support to maintain it. You run into all sorts of difficulties because people stress the equipment to the limit. The equipment we presently have in the field was made to receive two T.V. channels through one satellite channel. People have found that by changing the modulation and by applying technical tricks they can put three T.V. channels to a satellite transponder channel. With a slight degradation, which people are quite happy to accept, they have three programs.

Difficulties can arise. For example, you may have a project where you are radiating into a cable head end and the experimental equipment is tuned for one particular channel. Someone shuts down the satellite for a while and the thing goes off the air. When the satellite comes back on, the new receiver we have - which is an experimental class of receiver - grabs the wrong picture because the local oscillator does not have enough stability. This is the type of problem we run into where people press whatever instruments they have to the limit. This is something that is always done.

An illustrative example is the Ministry of Education with a pilot project to eleven colleges in British Columbia and the Yukon. As a result of this, the B.C. government formed the Knowledge Network of the West Communciations Authority. They will now purchase services on ANIK-C when it is brought into service by TELESAT in the next two or three years.

I would also like to mention the work we have done in fiberoptics. This has been taken up by at least two provincial telephone authorities. There was some pioneering work done in the laboratories from 1969 onwards, in ordinary terrestrial communications using fiberoptics. Bell Northern is active in the fiberoptics field with Northern Telecom. There is also another company called CANSTAR which is an outgrowth of Canada Wire and Cable. They have worked with Sask Tel and Manitoba Tel to install pilot projects to use fiberoptics in the provincial telephone systems. The contributions of laboratories, apart from starting the discussions and acting as a consultant, have been to provide direct support in certain types of hardware which have been developed at our laboratories and handed over to BNR or to Northern Telecom to manufacture and to provide support measurements on some of the fibers. In our laboratories, we have some special instrumentation for measuring losses and this service is proferred to, for example, Sask Tel when they are concerned about measuring breaks in their optical lines.

The technology transfer is not as direct to the telephone company as is the case of what is going on in ANIK-B because we are really transferring to a company and building up an industry that can sell to any telephone company. Obviously, it can be sold to Bell Canada when the time comes. There is, of course, continuity here. The agents are the Bell Northern and the provincial institutions.

Another example is the Ministry of Transportation and Communications in Ontario. They are presently discussing fiberoptics for communications along Highway 401 because they have a lot of communciation requirements along that highway. This has not gone beyond the discussion stage. Once these things have been demonstrated, the telephone companies usually take them up.

My only comment on the use of technology is that we must assume there is success because only problems get reported. When something goes wrong, someone always contacts the laboratory. And this is a sort of transfer to a provincial agency.

J. CIHLAR: Are there any questions concerning this presentation?

B. BHANEJA: I have two questions. You mentioned the criteria which DOC uses for screening adopters of technology. What sort of criteria would those be? Secondly, I gather that provincial governments and sponsoring agencies make contributions. What are the bases on which these contribution amounts are decided?

J. BARRY: I will take the second question first. The amounts are decided on the basis of what the experimenters can draw out of their organizations. The people at the University of Western Ontario, who are associated with the hospital, have shown a lot of enterprise in working with federal regional hospitals for X-ray diagnostics and a range of other services. They have been able to make their case with Health and Welfare and to the provincial government. Memorial University in Newfoundland made their case to Health and Welfare. Whether or not they received provincial support, I am not certain.

An experimenter, in trying to assemble a scenario to present to the Department so he can get time on the satellite for his experiments, has to show the Department that he can put it together if we give him the ground terminal.

B. BHANEJA: It would mainly be for the interface equipment or field trials?

J. BARRY: That is right. We have, up to now, always handled the transportation of the terminals since they go in and out of places depending on who is active at any particular time. We look after the service of them. We are not obligating or asking people to maintain them at

this point in time. People have to rely on extra staff. For example, at the hospital in Moosonee, people worked extra hours because of the time they had on the satellite. Nurses on the station travelled from one site to another so that they could participate in some of the sessions originating in the University of Western Ontario which were transmitted to the hospital. The same thing stands for the Memorial University undertaking where they were attempting to provide teaching to health units from the university. These resources have to be assembled by the experimenter putting this scenario together.

To answer your first question, there were certain criteria that were more rigid in ANIK-B. They were slightly different. The first set of experiments on the Hermes satellite was: Do you have something interesting to do with the satellite that you could propose to us? Can it be done? Will it prejudice other users who might want time on the satellite? Can you provide us with a believable picture of how you are going to proceed? Will you agree to use a satellite and stop using it when it is being offered to someone else? These were screened by a committee of the Royal Society so that we could have some objectivity and not be accused of favouring our own people. On the ANIK-B, they are more in the nature of pilot projects so they go on for a longer time. There is less of them and they tend to be larger like the experiment in British Columbia where they have the eleven colleges lined up. We have to provide earth terminals for them, or at least rotate a number of earth terminals to them so they can all have a try at this enterprise.

B. BHANEJA: Would the criteria be limited to only scientific aspects or to commercial aspects?

J. BARRY: They are scientific and commercial. In the ANIK-B, there has to be some evidence that this service, if it looks like it will work technically, will be carried on in ANIK-C. This is the problem some of the medical people face, because it is very difficult to buy time on the satellite. It is not cheap. Another economic trade-off has to be made, for example, by Health and Welfare for approved services to the north versus the cost of using this service to do it. The social aspect of it has been very much in the fore on both the Hermes and the ANIK-B. People had to really demonstrate that the use of these services was in fact going to serve some non-economic goal whether it is medical, cultural or educational. These aspects were considered very clearly. They had to be addressed in the applications.

J. CIHLAR: How is DOC organized internally to do this ANIK-B pilot project program?

J. BARRY: We have, in the laboratories at Shirley Bay, a division under a Director named George Davies. His job is to run these missions and run these experimental programs. He carries a budget of his own. He has the use of the satellites insofar as the leasing arrangements at TELESAT provide it. He makes sure that the experimenters get what they need and that the Department gets what it requires back from the experimenters. He runs it as a tight program with support staff and technicians in the field, some of whom are contract staff. We do not provide our own technicians for this, he has a budget to hire technical services from people that can provide it and keep the terminals repaired and keep them moved.

5. DEPARTMENT OF SUPPLY AND SERVICES

P. Samson
Head, SQ Section
Science Centre
Supply and Services

At the Department of Supply and Services, the technology being transferred is knowledge concerning all phases of procurement cycle for R&D requirements, including development and implementation of policies applicable to procurement. The goal is to transfer to the provinces procurement expertise to use in their contracting activities in the R&D field. We have no mandate other than a request from the provinces to use our services and our desire to sell them. The anticipated outcome is:

1) To provide the opportunity to learn, in a most expeditious manner, all phases of the procurement cycle for R&D.

2) To open up and maintain lines of communication for the provision of consulting services in the area of procurement.

3) To ensure best value is obtained for the money spent for procurement of requirements.

4) To make available specialized resources and expertise.

5) To shorten the learning process period.

The adopters are all provincial departments dealing with energy resources. Each province is individually visited and made aware of the available services. The mechanisms used in the technology transfer are in-situ training, seminars and consulting. The transfer agents are a combination of legal, managerial, accounting and procurement expertise.

Continuity in our effort is ensured through continued marketing of services. Whenever possible, "before" and "after" procedures are reviewed.

All resources used in technology transfer are supplied by the Science Centre of DSS.

Two problems encountered are:

1) Apathy of organizations that have not been able to recognize the need for the services because of their lack of experience.

2) Keeping a low profile while effecting technology transfer.

An example of our transfer effort is the in-situ training session with the Saskatchewan Department of Mineral Resources to set up their R&D procurement operation.

The success of the program is dependent on the willingness of the provinces to recognize the benefits of the technology transfer. The marketing of our services must be delicately handled and must always ensure that the provinces keep their decision-making process intact. The technology transfer has an impact on a Provincial-Federal shared-cost program, inasmuch as procurement is an integral function of the program.

6. NATIONAL RESEARCH COUNCIL

W. Coderre
General Manager, PILP
National Research Council

NRC is in the technology transfer business and has been since its inception. It is almost fair to say that NRC was created to transfer technology. That is its reason for being. It was created to be a place where quality science would be carried out in Canada to the economic advantage of Canadian industry. Those of you who know the history of NRC can say there were years and eras in which that seemed to have been forgotten by NRC, but it is definitely not true today.

Through the 1970's in particular, NRC has been very rapidly converting itself from the Ivory Tower that was created after the war to an effective agent for economic transferring of technology to the advantage of Canadian industry. I will spend most of the time I have today describing the PILP program, the Program for Industry/ Laboratory Projects. Before I get to PILP, however, I would like to mention a few other programs at NRC that are in the technology transfer area.

Generally speaking, industry interfaces with engineers and scientists in NRC on a day to day basis. They are available to be called upon at any time. This is a highly difficult enterprise to quantify but it exists and it is extremely valuable to industry.

NRC maintains the considerable expense of national facilities such as the wind-tunnel, the ship tanks, the TRIUMF facilities on the west coast. They are building the Ave Maria (AVMARI), the Arctic Vessel Marine Research Institute on the east coast. These, and many other national facilities, serve the needs of industry and are agents for technology transfer.

As far back as 1948, C.D. Howe created the Technical Information Service (TIS). This currently involves approximately 75 people, either NRC employees or people contracted to NRC, distributed throughout the country, calling on small relatively low-technology industries and helping them to discover what their technological problems are and the solutions for those problems. It is a pro-active, not a reactive, activity. They call on the industries, they visit them and they bring them up to date with technologies that will best suit their needs where

they are today. They also respond to technical enquiries from Canadian companies and, to an increasing extent, from Third World countries.

A very recent program at NRC called "INCUBATOR" is one where a small new Canadian company - that wants to prove that it has a potential business in an area of high technology but simply cannot afford to build the laboratories and facilities and to procure the equipment that it needs to prove that this is a good venture - is invited to NRC to share our facilities, our space, the content of the minds of the NRC engineers and scientists until they have satisfied themselves that their venture is viable. At which point, they leave us and say thank you very much and no money has changed hands. All that by way of background. I would now like to move on to discussion on the PILP program.

PILP was created in 1975 in response to a perceived problem with the question of the transfer of new high technology to the Canadian high technology industrial sector in NRC. The problem was specified this way:

1) Canadian industry needed a "head start" with advanced technology which is faster than was normally taking place.

2) NRC was an available source of "head start" capability and knowledge.

3) NRC has a mandate to assist industry.

Simultaneous analysis of the flow of NRC-generated technology to industry through CPDL revealed the following facts: Canada Patents Development Limited (CPDL) received about 1/10 of its patents from the National Research Council for licensing. (They have the mandate for licensing government technology.) Of the licenses that they ultimately granted to industry, half of them came from those NRC patents. The half-life of that technology on the shelves of CPDL was seven years. Those of you who are involved in high technology industry know that that is too slow. Only half of the transfers that were ultimately affected were transferred after seven years, the other half took longer than seven years. That is not good enough. We must do something more positive about applying federal technology in industry.

The PILP program was thus created (see Figure 1). Its objective is to bring about the application and use in

Canada of the technology that the federal government has generated through the activity of NRC.

In 1978, the COPI program was cloned from the PILP program. Those of you in Communications, Agriculture, Environment, Fisheries and Oceans, and Energy, Mines and Resources are probably familiar with COPI. Some of you are also aware that the Ministry of State for Economic Development has decided, with the noble objective of trying to make access to government programs simpler for industry, to reunite PILP and COPI into one consolidated program as of April 1, 1981.

Allow me to ruminate a little bit about what I think technology transfer is. There are basically two processes involved in technology anywhere in the world today (see Figure 2). The "research cycle" is the sort of cycle that takes place in universities, but it translates equally well to the mission-oriented research of government laboratories. You start with a collection of scientific knowledge; you identify problems of scientific or mission motivation; you do R&D to solve these motivations, and you end up with results. The process then continues merrily along and never has to be involved with industry at all. There is nothing wrong with that. The best place to do mission work is in a mission lab. The best place to do curiosity motivated research is in an Ivory Tower. There is nothing wrong with that.

In industry, on the other hand, they start with the state of the art. They are motivated by profit. They proceed through an innovation activity which is composed of many steps, the most critical of which is the establishment of a market need. They then wind up with new products, methods and processes, and economic growth. There is nothing wrong with that. It is a perfectly logical and legitimate way to run business. These latter people are usually definitely not motivated to interact with the former and so there is the need for a third body of people who are motivated to technology transfer. You will notice that I draw a line from the "collected body of scientific knowledge" into the "new product idea" activity as the more probable points of contact on these two cycles. There is a converse line - a feedback loop - that feeds market needs, back through the same people, to the "unanswered or new scientific questions".

The problems of technological transfer (see Figure 3) are: The famous "barrier to technology transfer" which is a build up of many bricks. The NIH factor is certainly

one of them. The barriers to technology transfer basically derive from the different motivations of the two communities. When you look at it from the perspective of industry, there is a pitfall. The dangers of going into ill-considered risk ventures are pitfalls that derive directly from being taken in by someone who is pushing technology on you. Industry is very leery of that. We need a mechanism for removing the barrier to the degree possible. I submit that mechanism is the people involved in technology transfer which is quite literally a people-driven process. Quite often we also need something to fill in the pit, and nothing fits the pit better than money. PILP is a process whereby people and money are applied to transfer technology.

Who can receive technology from NRC via PILP? (Figure 4) Anyone who proves that they are competent to receive it. That is the key. The objective is to see viable business opportunities get developed in Canada. Someone who does not have the management, marketing or technical skills to make a viable business of the technology is not welcome under PILP.

The projects that are selected are the ones which serve to create business opportunities in Canada. (Figure 5) Because PILP has been defined the way it is, these projects make use of federal expertise. It is not merely the application of the R&D results which are "on the shelf" at NRC. It is the application of the expertise within the heads of the people at NRC. That is a subtle distinction, but a very important one.

Figure 6 illustrates an example of the kinds of technology transfer trouble we have experienced. This is the case where we have given a piece of technology on a program that costs us, in terms of transferring it, $200,000 to $300,000. To carry that program on to the market place will involve the typical investment of ten times that amount. The capital can simply not be raised. We have to be on the lookout for these "successful" technology transfers where the "patient" dies. They always come back for more money and you wind up having to put more money into the company than the economic benefit which justified the original program. Treasury Board frowns on that.

The proposals from industry must be detailed (Figure 7). The proposals for PILP esentially look like the kinds of proposals you would get for the outside contracting program. They must contain their objectives,

their corporate commitments. We do not want the companies whose whole business is going to the government for contracts (Figure 8). We want companies whose business is to make money. We want the greedy ones. We have a cliche in the PILP office: never trust an altruist. I want to see the greed and it must have a detailed cost and schedule.

PILP is not to be confused with the IRAP program where, in essence, the money is contributed to industry to do what they choose to do. NRC makes sure that they have competent R&D establishment people and that the program looks like it has some sensible meaning. We, in PILP, are asking for a detailed work breakdown, priced to task. We are asking for the market prospects. We are asking for a risk analysis.

I would like to illustrate this with a real story. A major Canadian industry came to us and said: "We can use the technology in your laboratory. We can make money with that. In fact, if you give us $500,000, we can guarantee that within six months we can improve our processes" - it was not a product, it was a process improvement type of thing - "so that we will be making $2 million a year within six months". We said: "Are you sure? You can really get four times the investment back within six months?" They said they could, within a year. We told them to take the technology. They asked: "Where is the money?" We told them we were not going to give them any money because there was not enough risk. This program needs risk. If there are no risks, normal commercial venture capital applies. We are in the business of filling in pitfalls. If there are no pitfalls, forget it. Of course, if the risk is completely non-sensible, we cannot justify the wise disposition of Her Majesty's funds. It must be somewhere between the two.

Small business finds some of the rules, terms and conditions, and the details we ask for in the proposal, onerous (see Figure 9). They find that the wall that prevents the swift technology transfer from scientists to scientists is very frustrating. This wall is composed of the Department of Supply and Services, the Industrial Development at NRC and the PILP staff itself. The NRC scientists on the other side of the wall are equally furious with us. But there has to be a modicum of bureaucracy in order to ensure that there is an audit trail so that the program is accountable. We try to keep the wall as low as possible. We try to reach around it and over it, give a hand to the small industries that may not have the

legal advice and the financial advice that they need in order to take advantage of the program. However, there has to be a certain wall, otherwise we cannot defend ourselves against those companies that do not have the ability to run their own businesses.

The Treasury Board and the Ministry of State for Economic Development have agreed, in principle, that PILP is really not in the business of procuring R&D from anybody. We are in the business of giving technology to people. The contract mechanism we have been using, which has been an R&D procurement contract, is an inappropriate mechanism. As of April 1, 1981, we will be in a contribution mode. This means that, since DSS does not have a mandate for contributions, we will use DSS services when they have marketed them and given us value for money. When we don't need them, we won't use them.

Our programs are evaluated against a series of criteria which are based upon economic benefit, quality of the company, commitment of the company, risk - and, as I said before, it has to be high enough - and social and regional benefits of the program (see Figure 10). In PILP, we try to stay away from "the what's in it for NRC mentality?". Since the mandate of NRC is technology transfer to industry, the benefits are immediate and quite direct.

The contract mechanism we use now is a procurement contract through the science procurement office (see Figure 11). If you look into its fundamental purpose and its operating characteristics, it becomes a cooperative agreement between a company and NRC, where the company agrees to carry out the program of work. At the beginning of the project, they have some technology which is an unquantifiable risk to them. At the end of the program, they have a quantifiable risk. That is all we can guarantee. They promise to develop the technology, to manage the program, to commercialize the results - that is a promise we insist on up front - and to continuously report on progress. NRC, on its part, agrees to transfer the technology and to work in collaboration. Before we agree to any proposal, the laboratory administration must sign the commitment of their resources to this technology transfer process.

Finally, there has to be an agreement on the part of NRC to have CPDL arrange to license the NRC background technology. While we are in procurement type contracts, because of DSS 1036, we also have to agree to transfer the foreground technology, which the government owns. In the

contribution mode, the government will not own foreground data and intellectual property.

Some of the terms and conditions and some of the legal requirements are objectionable to some of our clients (see Figure 12). They find that DSS wants to put too many strings on them. We absolutely refuse to elminate some of the strings. Most important is that any recipient of our technology will exploit that technology in Canada with the world product mandate. We can, and do, deal with multinational corporations, but we must insist that the parent of that corporation gives the Canadian unit the world product mandate. If they transfer that technology to anywhere else outside Canada, they must first justify their reasons to us.

Project management at NRC (see Figure 13) essentially consists of forming a project steering committee with a PILP project manager in charge; the scientific advisor from the laboratory, usually the inventor or the engineer who is intimately involved in developing the expertise or technology; a member of the Contract Service Organization of NRC, and a Science Procurement Officer from DSS. The kind of performance that DSS science procurement has been giving to us has been nothing short of phenomenal in the last year.

J. CIHLAR: Is this an internal committee?

W. CODERRE: Yes. These are all NRC people (except for the DSS officer).

J. CIHLAR: Do they oversee the performance of the company?

W. CODERRE: Yes. Obviously, this committee is matched by company personnel. There will have to be a company project manager, company engineers and scientists and company contract administers. Each one has their appropriate interface. In contrast to the science procurement contract - which in some strange way divides the authority between a Scientific Authority and a Science Procurement Officer, each one of them seems to have equivalent authority although in different areas, - we insist that the Project Manager be in charge of the whole process because only he has the responsibility and is being held accountable for the PILP objectives. The scientist does not have the PILP objectives at heart. What he has at heart is seeing his project become something, and, in fact, too often he will try to tell industry how to run its business and the project manager has to bring him back. That is a highly

critical function of a project manager. In NRC, it is a profession. It is a full-time job. This is the way we are currently organized in the office. We are handling approximately 120-130 contracts. This year, we will contribute, through these programs, $9 million.

I have four project managers and I have divided their responsibilities according to technical areas (see Figure 14). One concentrates on the physical science projects, one on the biological and chemical sciences, one on the electronics and the last one on the grab-bag of general engineering.

Finally, post-contracting activity (Figure 15). This involves making sure, to the degree possible, that appropriate licenses are struck with the company. CPDL is not part of NRC anymore, although they have the responsibility and the mandate to negotiate our licenses. We request that the company submit a marketing and business plan, then, if we are satisfied, we ask CPDL to negotiate the license.

For on-going project evaluation, we look to see at the beginning of a PILP program whether or not this is a good project for us and stands a realistic chance for a return-on-the-investment, as measured in sales by the company, of 20/1. This is an arbitrary figure, but it comes from the fact that high technology industries, on the average, invest 5% of their sales in R&D. We arbitrarily say, that if the program takes two years to affect the technology transfer, we will give the company two years to absorb it after that, and start counting sales for five years. Over those five years, we expect to see sales accumulating 20/1 on our original investment. This is not as a result of detailed economic in-depth analysis. It is a very hand-wavy thing, but we want something we can measure.

R. LAWFORD: You mentioned that before PILP got underway, the technology on the shelf had a half-life of seven years. What is the half-life now?

W. CODERRE: We transfer it before it gets to CPDL. I do not know what the statistics in CPDL are now, but what we are transferring now usually does not get to CPDL until it is involved in a transfer project.

R. LAWFORD: Someone must take out a patent somewhere along the line?

W. CODERRE: Yes, true. By getting involved with technology transfer earlier, we can sometimes allow the industry to decide whether or not it is to their best interest to have a patent or to have a corporate secret. More often than not with PILP, we are licensing know-how, not licensing patents. You are pumping the patent or the technology directly into an industry. You are not waiting for industry to discover it in CPDL. That is quite a different process.

R. LAWFORD: Do your laboratories have part of their financial planning and work planning devoted to the technology transfer that might be imposed on them through PILP?

W. CODERRE: The technology transfer cannot be imposed on them by PILP because in the project selection process we cannot go anywhere without the agreement, at every level, of a laboratory authority. When a proposal comes to us unsolicited from industry - which is the preferred approach because otherwise it is technology push - the first thing that we do is assign the appropriate project manager to identify the appropriate source of expertise in NRC. He then does a quick check to see whether or not the project fits the mandate of PILP. If he thinks it does, the project manager writes a one or two page quick analysis form which is sent to me and to a laboratory Director for approval. Only if he gets both our signatures can he proceed with the detailed analysis which goes into things like the economic benefit, the details of their marketing, the management strategy, etc.

Having done the detailed analysis, he writes a request for approval-in-principle. That approval-in-principle form is passed, again, through the Director of the laboratory and through me in parallel. In my case, I check to make sure that he has done all the appropriate homework and has not left anything out. The laboratory Director, at that point, has to commit the resources of his laboratory. We cannot proceed without that commitment. That same form then goes to Vice-President of the Industry Development Office of NRC and to the Senior Vice-President in charge of all the laboratories. We have to have the ongoing full support of the laboratories at every stage. You cannot force someone to be involved in a technology transfer process and still have an effective technology transfer process.

The inverse can also happen when the laboratory thinks "this is a great idea" and they tell us to market

it. We have to come back sometimes and tell them that if they force us to do that, then we are guaranteed to get criticized by Treasury Board because it is a waste of money. To protect ourselves against that, the criteria for evaluating projects were established in consultation with all the laboratory Directors. The weights put on those criteria were the weighted mean of all their opinions.

B. BHANEJA: Through which mechanisms do they become aware of the technology available in NRC laboratories?

W. CODERRE: Because we are more and more in the process of selling what is in the heads of people rather than what is on the shelf of NRC, it is impossible to come up with a meaningful catalogue. We can and do circulate lists of general areas in which NRC is working.

If an industry is being offered an opportunity to, after a very short period of mining or marketing, wind up with $250 or $500 million worth of essentially free money to invest in an opportunity that is important to them. I ask them how much work they would have had to do to generate that much money through their normal sales activities? I think it is much better to arrange with the industry to let them discover opportunities and we help them in every way we can. We help them, but not by catalogue.

P. SUTTERLIN: How do people get to you in the first place?

W. CODERRE: A very important aspect of the program is to advertise and promote it. We work through the Technical Information Service which has approximately 30 people in the field all loaded up with information about us. When it comes to the high technology industry of Canada - that means roughly 1,000 companies - you get to know them pretty fast. The scientists themselves know them. The fact of the matter is, that when we do have a piece of technology that we think is ready for transfer to industry - it still happens quite often - it is usually more difficult to find anybody interested and capable, than it is to decide between several. Identifying recipients is not as big a problem in practice as it sounds academically; but the program is not as well known as it can be and we are working to improve it.

J. CIHLAR: Would you comment on what you mean by importance of people? What skills are being looked for and how does the process work?

W. CODERRE: When I say that technology transfer is a people process, I mean that if you want to effectively transfer technology into industry, you have to have people who know that it is their responsibility to do so. It cannot be a casual activity or a part-time activity. Nor can it be done simply by publishing the results. NRC publishes mountains and mountains of technical papers every year, but very little effective transfer is accomplished through that mechanism. It is a great way of transferring information about the research cycle to the research cycle, but not into the industry.

J. BARRY: Do you have any problems with two companies looking for the same thing? How do you handle the intellectual property business of government on information which is then passed over in secrecy to the first person?

W. CODERRE: We handle competition between companies essentially by weighing their proposals against the criteria. When we are going out to competition, we tell them ahead of time exactly how we will weigh the criteria. We copy the DSS approach. We also reserve the right to transfer the technology to more than one company if that seems appropriate. We do not necessarily have to give it to only one. For example, we are now involved in transferring some technology which involves the use of sulphur and asphalt to make long-lasting pot hole patches. We will probably end up transferring that to approximately seven different companies because that is the kind of industry where nobody ships asphalt patching material all the way across the country.

The second question was: How do we handle the intellectual property ownership problem, the famous DSS 1036? The way we handle that is to promise that we will direct CPDL to license the technology to them. In the contribution mode, they will own the technology, that is, the foreground technology. In order to protect our interest, they will necessarily have to grant to us, as a contract term, the right to that technology for government purposes and the right to transfer it to third parties if in fact our first choice does not perform. They will continue to own it, but someone else will also have the right to it.

J. BARRY: Do you catalogue and offer the reports to anybody?

W. CODERRE: No. They tell us there is a general policy in the government to the effect that whatever the government

owns is available to the public. But our policy is that we are in the business of creating business opportunities for companies. We will treat those business opportunities, company's confidentially, unless we have a good business opportunity for one company to the world at large, and thereby negate the whole purpose of the technology transfer in the first place. On the other hand, we do get involved in some studies which are more generic in nature and which are to benefit the industry as a whole, in those cases we will distribute the reports.

Figure 1

NRC

INDUSTRIAL DEVELOPMENT OFFICE

PROGRAM FOR INDUSTRY/ LABORATORY PROJECTS

OBJECTIVE:

TO BRING ABOUT THE APPLICATION AND USE IN CANADA OF NRC SCIENTIFIC AND ENGINEERING KNOW-HOW HAVING POTENTIAL ECONOMIC AND SOCIAL BENEFITS TO CANADA.

Figure 2


GRADUATES
INTERNATIONAL IDEA EXCHANGE
• STUDENTS AND • MONEY
• PUBLICATION OF RESULTS
• FILING OF PATENTS
R + D ACTIVITY
RESEARCH
COLLECTION OF SCIENTIFIC KNOWLEDGE *
UNANSWERED SCIENTIFIC OR POLICY-BASED QUESTIONS
ENHANCED REPUTATIONS
• POLICIES
• STANDARDS
• CODES
• DESIRE FOR RECOGNITION
• NEED FOR POLICY BACKGROUND INFORMATION
TECHNOLOGY TRANSFER AGENTS
PATENTS
• LABORATORY DEVELOPMENT
• PRODUCT IMPROVEMENT
NEW IDEAS FOR PRODUCTS + PROCESSES
• MARKET NEED
• COMP. THREAT
PROFIT MOTIVE
FEASIBILITY AND PILOT PLANT STUDIES AND TESTS
INNOVATION
** STANDARD METHODS PROCESSES AND PRODUCTS
MARKET AND TECHNOLOGY TRIALS
SCALE UP TO PRODUCTION
NEW PRODUCT + PROCESSES
INDUSTRIAL AND ECONOMIC GROWTH
MARKET FEED BACK
CAPITAL
• SALES
• EXPORTS
JOBS AND INVESTMENT

TECHNOLOGY TRANSFER

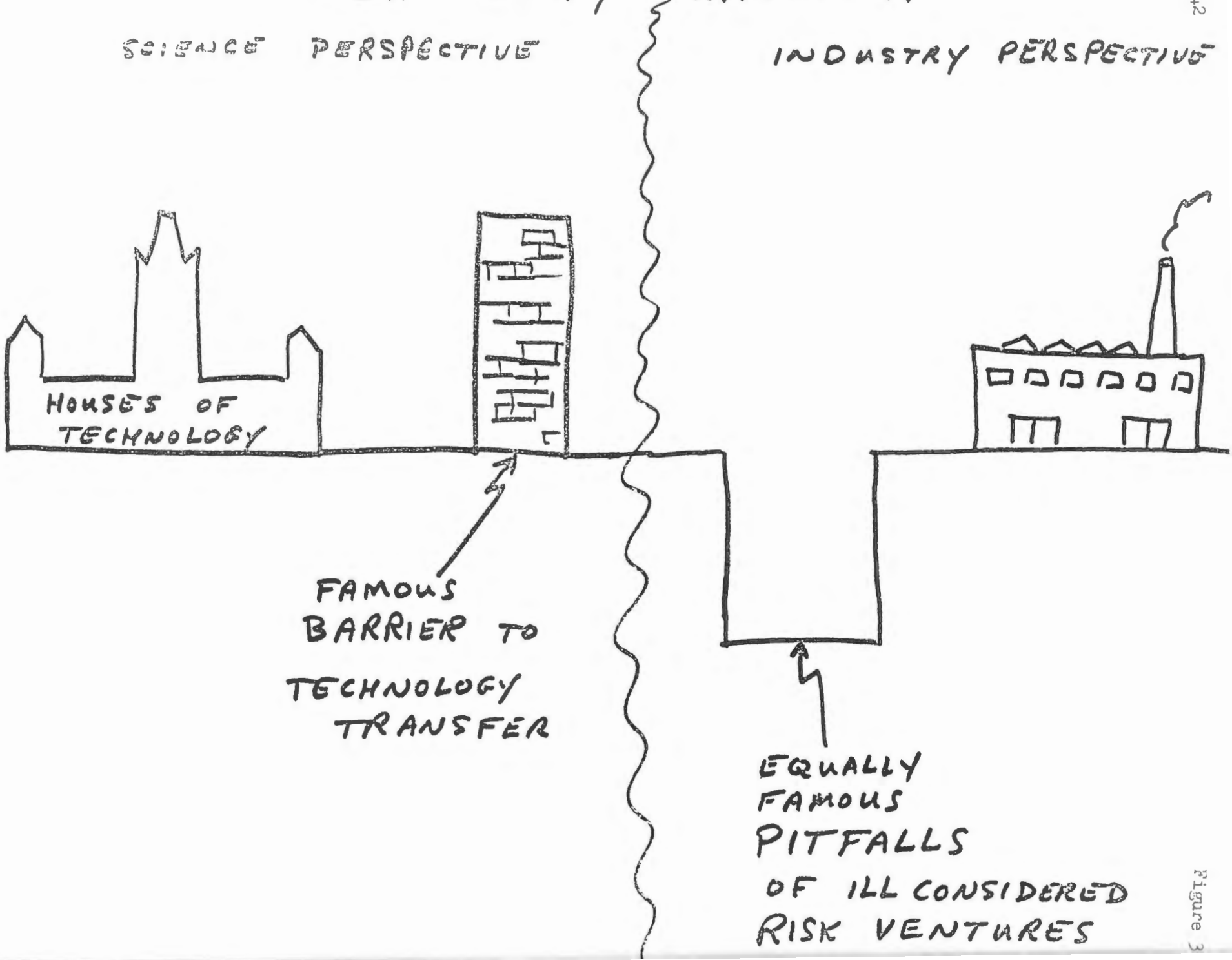


Figure 3

Figure 4

NRC

INDUSTRIAL DEVELOPMENT OFFICE

PILP

1. THE INDUSTRIAL RECIPIENT

— Any company incorporated in Canada with the necessary:

- Management Skills
- Technical Skills
- Marketing Skills
- Financial Stability

to carry a project to successful commercial exploitation.

Figure 5

NRC

INDUSTRIAL DEVELOPMENT OFFICE

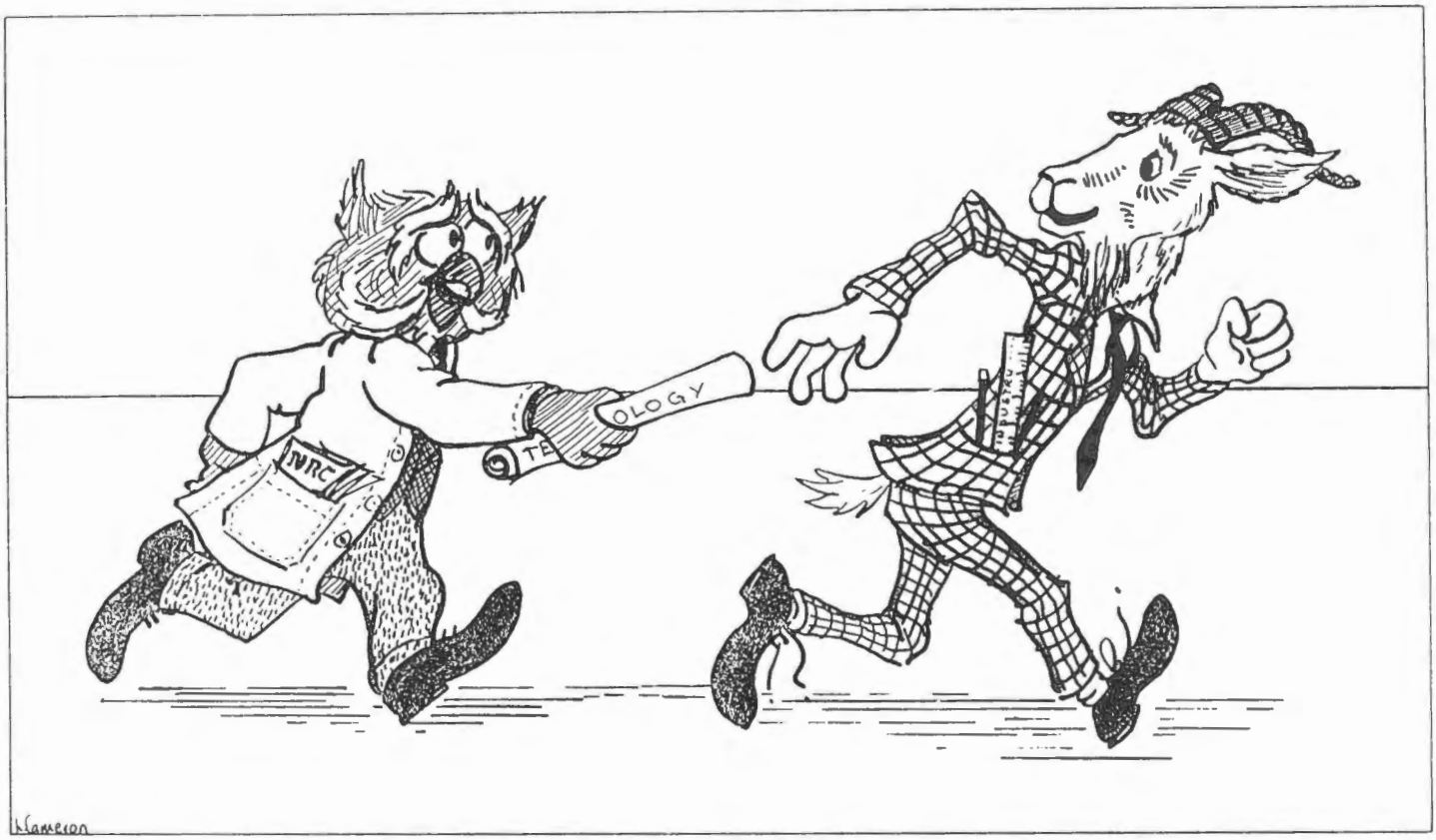
PILP

2. **THE PROJECT**

- ANY PROJECT WHICH SERVES TO BRING ABOUT THE APPLICATION AND USE IN CANADA OF SCIENTIFIC AND ENGINEERING KNOW-HOW HAVING POTENTIAL ECONOMIC AND SOCIAL BENEFITS TO CANADA;

  BY EITHER: THE APLICATION AND EXPLOITATION OF NRC R&D RESULTS AND KNOW-HOW;

  OR: THE JOINT DEVELOPMENT IN COLLABORATION WITH NRC OF THE DESIRED APPLICATION OR KNOW-HOW.


NRC
TE
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H Cameron

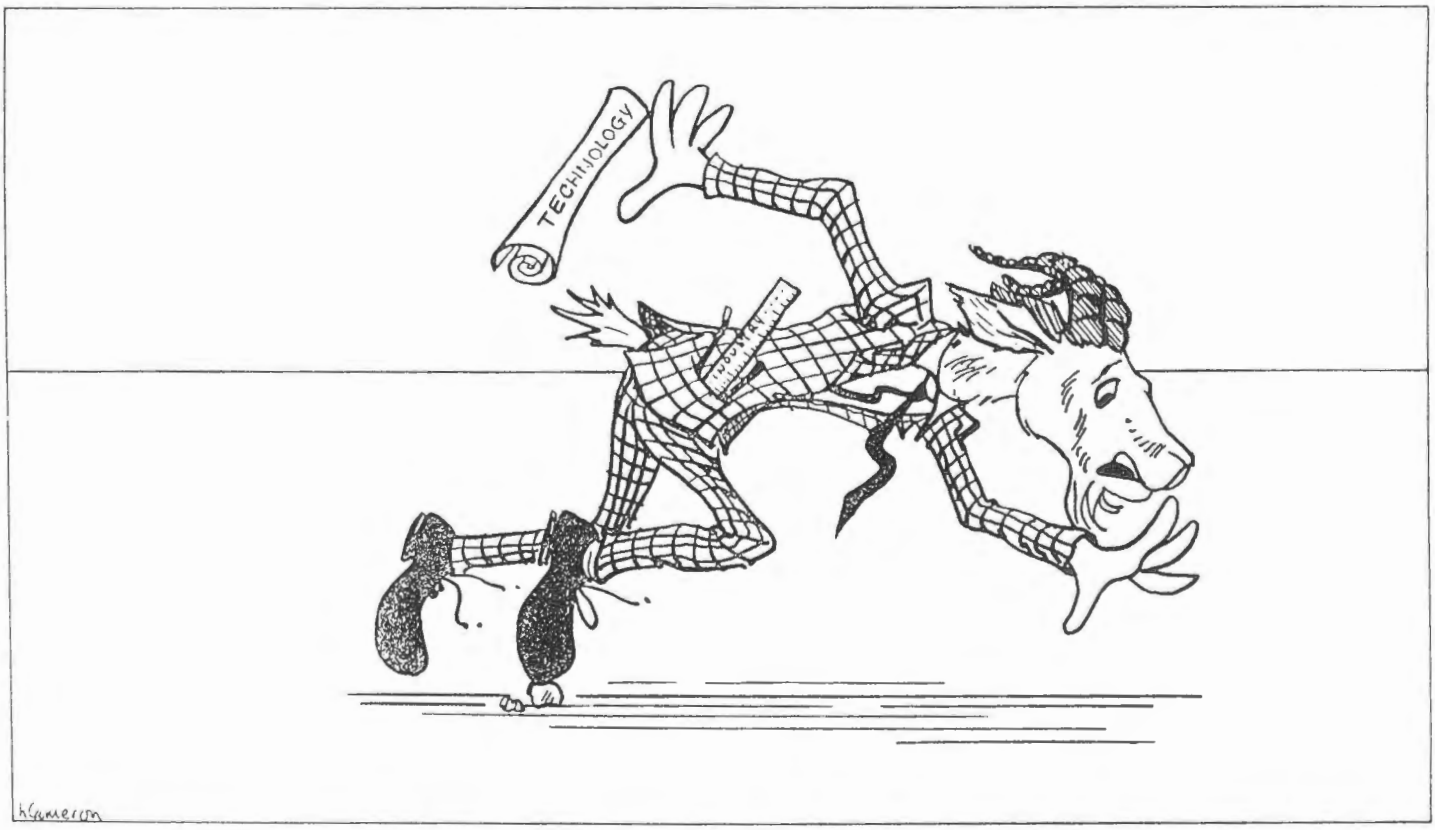

TECHNOLOGY
H Cameron

Figure 7

NRC

INDUSTRIAL DEVELOPMENT OFFICE

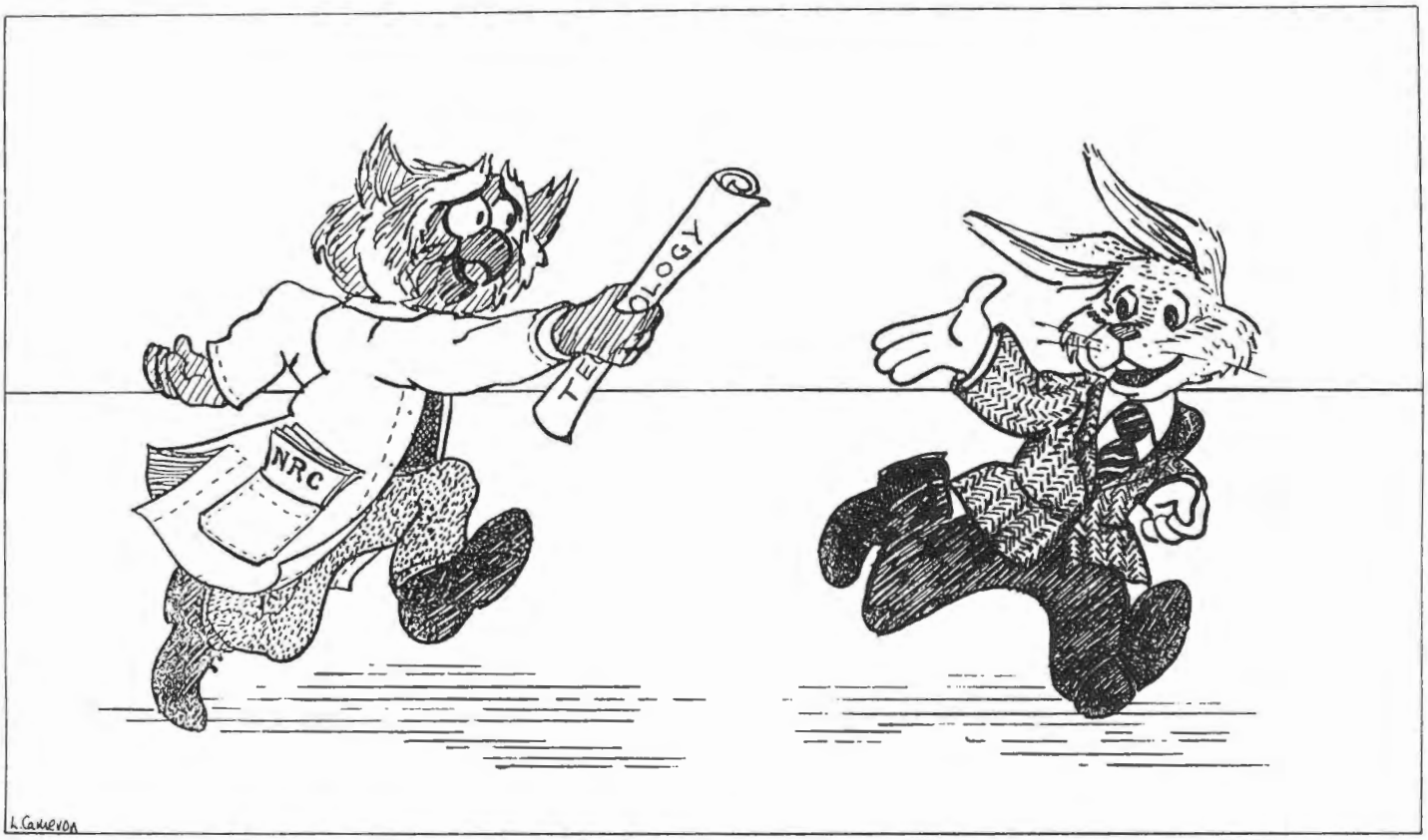
PILP

3. **THE PROPOSAL.**

PROPOSALS MUST INCLUDE:

- OBJECTIVE
- CORPORATE COMMITMENT TO COMMERCIALIZATION
- DETAILED WORK STATEMENT
- COST AND SCHEDULE
- PERSONNEL AND ORGANIZATION
- CORPORATE STABILITY AND TRACK RECORD
- MARKET PROSPECTS AND PLANS
- RISK ANALYSIS

Figure 8



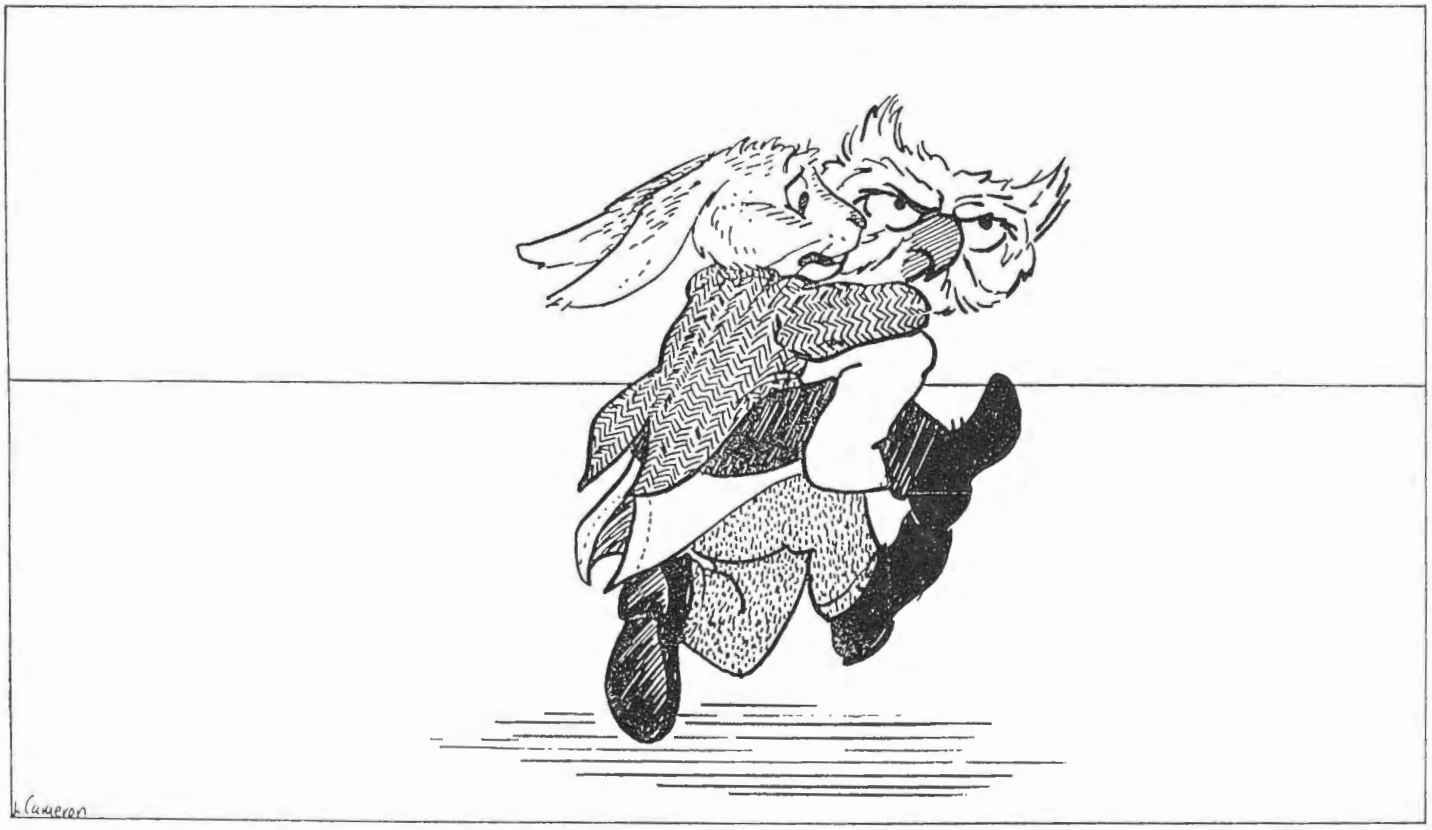


Figure 9

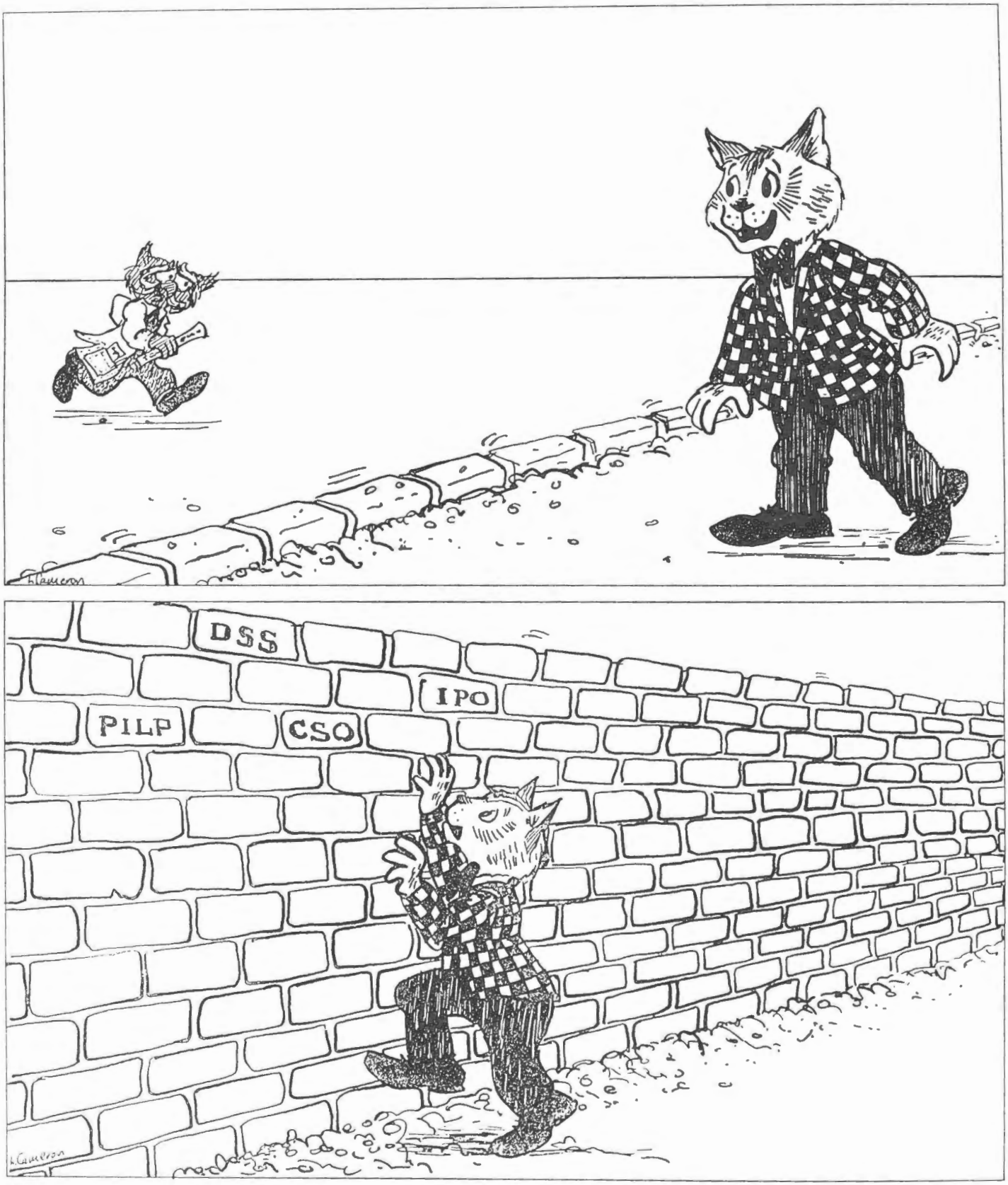


Figure 10

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4. THE COMPETITION

PROJECT PROPOSALS ARE EVALUATED IN TERMS OF:

- ECONOMIC BENEFIT/MARKET POTENTIAL
- COMPANY MANAGEMENT
- COMPANY COMMITMENT
- TECHNICAL RISK/SIGNIFICANCE
- SOCIAL BENEFIT/REGIONAL DEVELOPMENT

Figure 11

NRC
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5. THE CONTRACT

PILP PROJECTS ARE COOPERATIVE AGREEMENTS BETWEEN NRC AND A CANADIAN CORPORATION WHEREIN:

THE COMPANY AGREES TO:

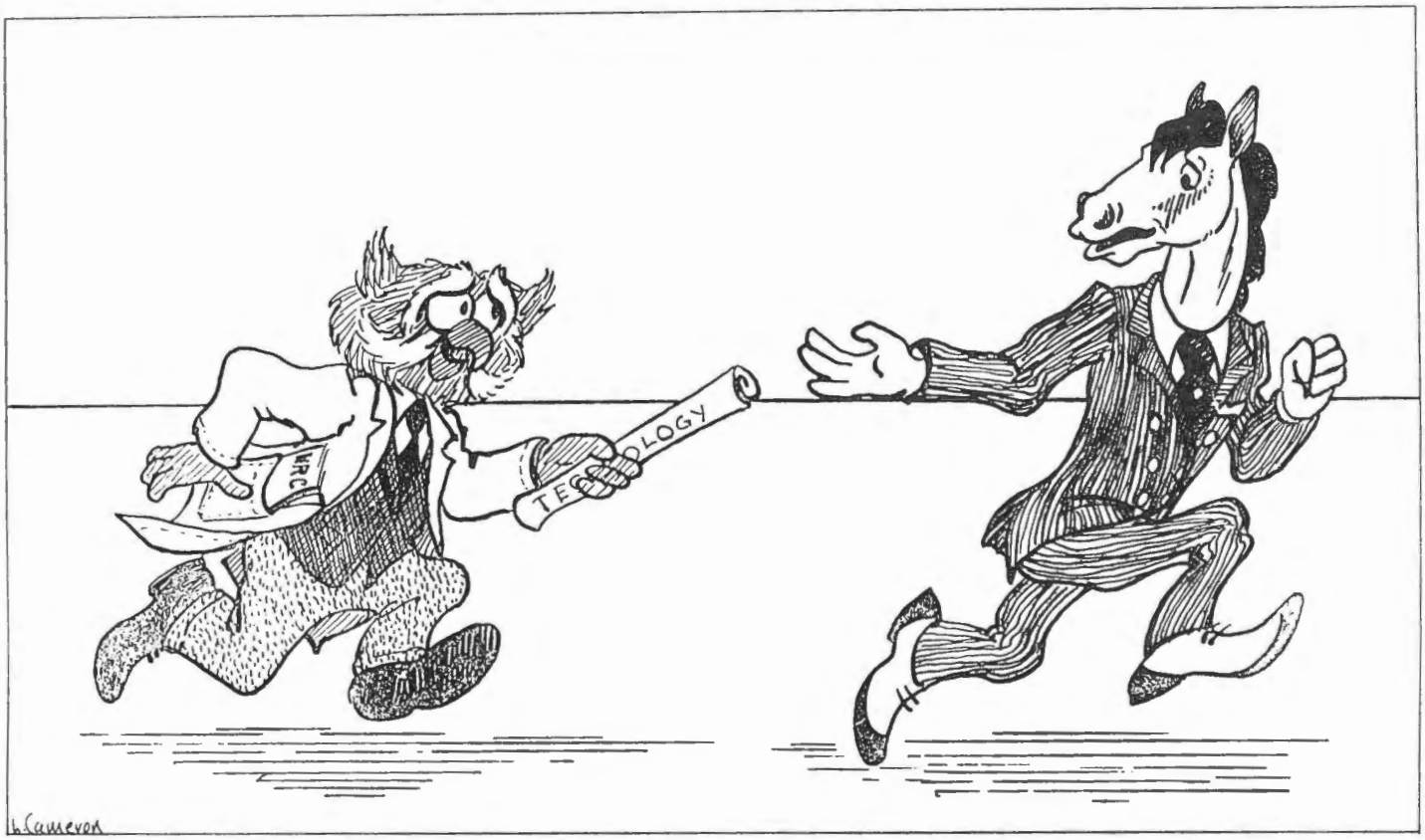
- DEVELOP THE TECHNOLOGY
- MANAGE THE PROJECT
- COMMERCIALIZE THE RESULTS
- REPORT ON PROGRESS

AND:

NRC AGREES TO:

- TRANSFER TECHNOLOGY
- WORK IN COLLABORATION
- LICENCE TECHNOLOGY (VIA CPDL)

Figure 12


NRC
TECHNOLOGY
W. Cameron

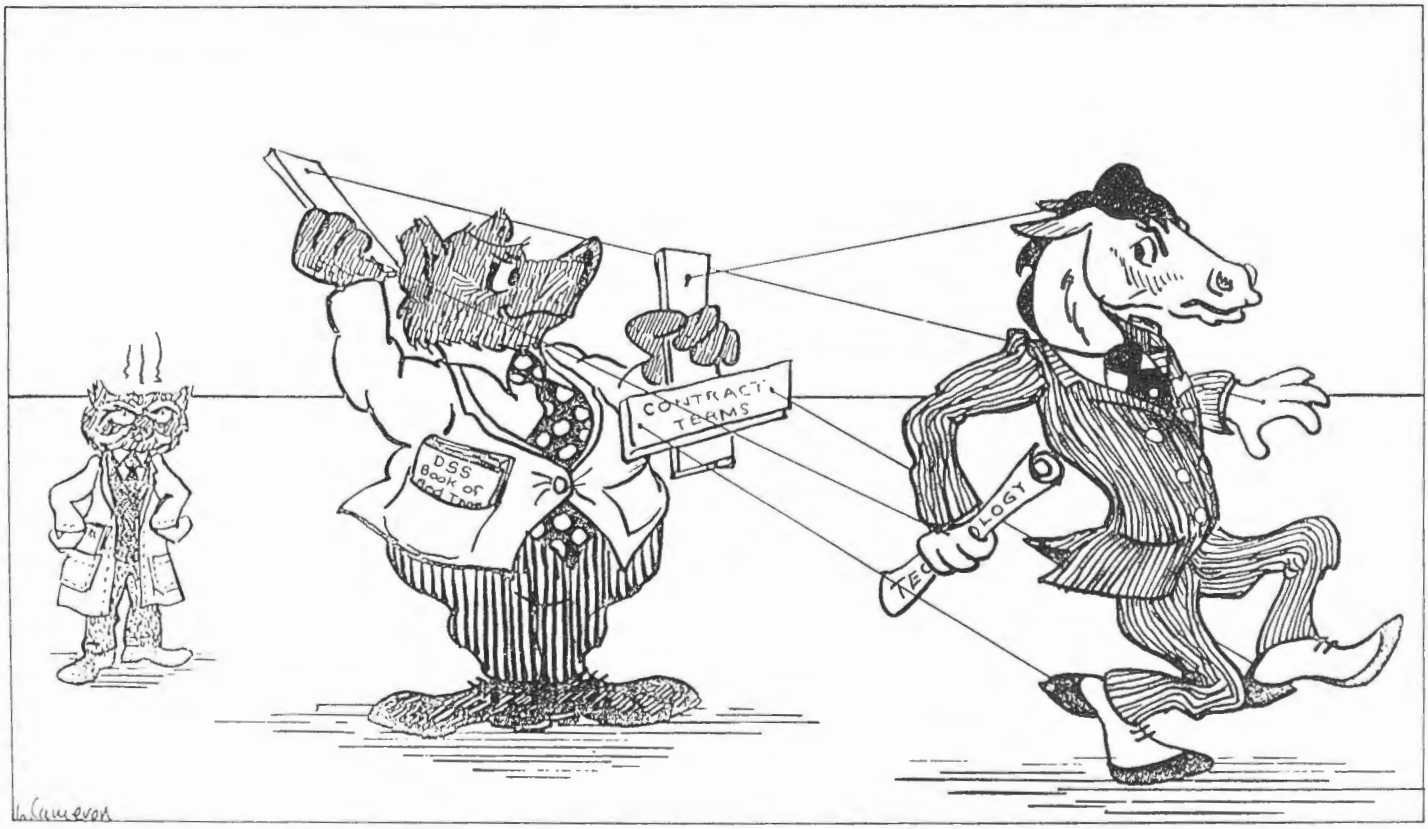

DSS
Book of
Bad Times
CONTRACT
TERMS
TECHNOLOGY
W. Cameron

Figure 13

NRC

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PILP

6. THE PROJECT MANAGEMENT

PILP PROJECT STEERING COMMITTEE

- PROJECT MANAGER
- SCIENTIFIC ADVISOR
- CONTRACT SERVICE OFFICER

Figure 14

NRC

INDUSTRIAL DEVELOPMENT OFFICE

PROGRAM FOR INDUSTRY/LABORATORY PROJECTS

(PILP)

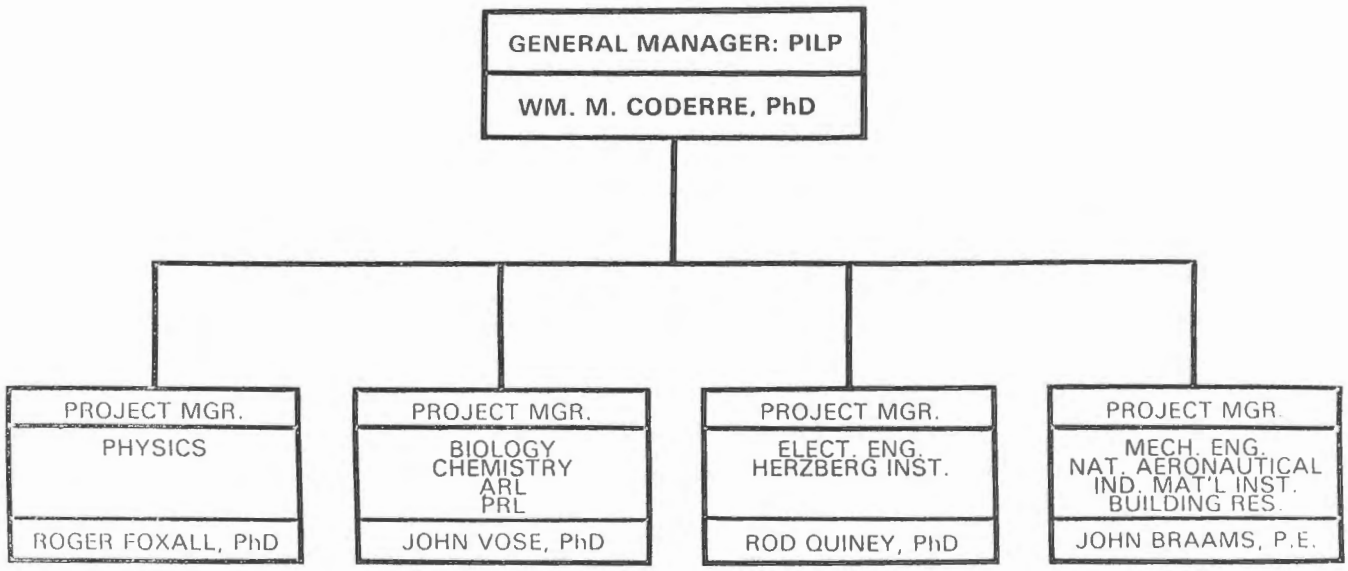

Figure 15

NRC

INDUSTRIAL DEVELOPMENT OFFICE

PILP

7. POST-CONTRACT ACTIVITY

- LICENCING
- PROJECT EVALUATION

1029131

7. CANADA CENTRE FOR REMOTE SENSING

J. Cihlar
Head, Applications Development Section
Canada Centre for Remote Sensing

At CCRS, we are involved in the development and transfer of remote sensing technology. The goal of the transfer program is to enhance the economic and social benefits from the use of remote sensing technology through increasing the rate and extent of its adoption by agencies with resource management responsibilities. These benefits can be economic or social in nature. The mandate for technology transfer follows from CCRS's responsibility to demonstrate practical applications of remote sensing methods. It is thus the proper function of the Centre to support user efforts by providing specialized personnel and facilities, directly or through industrial involvement.

The adopters of remote sensing technology are agencies responsible for the management of Canadian land and water resources. These are most frequently provincial government departments, although federal government agencies and industry also have resource management responsibilities and are therefore potential adopters of remote sensing technology.

In selecting potential adopters, three criteria are applied. First, the agency must have an operational responsibility for resource management. Secondly, the probability of success of applying the technology in the operational environment must be high. Thirdly, the resource management agency must be interested and must be prepared to contribute manpower and other resources as required. Cost benefit studies, the importance of the natural resource in question, and previous work done by the agency are examples of additional criteria applied in selecting potential adopters.

Several mechanisms are employed in the transfer process. From our experience, the most important transfer mechanism is a joint demonstration project. Such a project permits demonstrating to the adopting agency that the technology is effective in their environment and under their operational constraints. Although the amount and type of work carried out by personnel from each agency may vary from one project to another, the objective is to transfer to the resource agency personnel the expertise necessary for successful use of remote sensing data and methods. On-the-job training, as well as more formal

courses and workshops, supplement the demonstration project activities. CCRS scientists are available to the user community across Canada for consultation on remote sensing application problems. They are also directly involved in our technology transfer efforts, including demonstration projects.

There is no formal agreement between CCRS and the cooperating agency concerning follow-on activities. However, there is an understanding that if the remote sensing-based approach proves effective, it will be continued or adopted by the agency.

As for resources for the technology transfer projects, CCRS typically contributes satellite (and sometimes airborne) remotely sensed data, facilities required to analyze the data and to evaluate the derived information, and the time and expenses associated with the participation of the staff. The adopter usually provides ground and other ancillary data, staff time, and travel and other expenses of the agency staff.

In our technology transfer efforts, the following problems are encountered:

1. Identification of key individuals within user agencies at both managerial and technical levels;

2. Identification of resource management problems to which remote sensing techniques can be successfully applied;

3. Inertia and resistance to change of management procedures. Many managers, having done a certain thing in a certain way for a number of years, are reluctant to consider alternate technology.

4. A technology-related problem is the continuity and reliability of remotely sensed data. The LANDSAT program is still considered an experimental program by NASA, although plans are now in place to make the program operational so that data continuity can be guaranteed.

Although CCRS has realized the importance of transferring applications to operational agencies, technology tranfer has not been systematically carried out in the past. Besides responding to user inquiries about remote sensing applications and giving presentations to various groups of potential users, we have conducted technology

transfer primarily in the context of applications development projects. In applications development projects, we usually work with a user agency because we are developing techniques for managing specific resources. Since the user agency is a part of this effort, the transfer of technology takes place in the process. The above approach is very slow in that the transfer occurs only to one agency at a time. In addition, applications developed elsewhere are not a part of this process and their operational use is therefore delayed or not realized. These are problems we are attempting to address in a focussed technology transfer program.

R. LAWFORD: Has it been your experience that there needs to be a focal point within the province for receiving the remote sensing technology in order to ensure effective technology transfer? Would you say that Ontario has been somewhat more effective in absorbing such technologies because they have the OCRS?

J. CIHLAR: It is true that because of OCRS, the technology transfer has taken place at a faster rate than it would have without OCRS. The important part is that there is a group in the province that is actively involved in promoting the technology and its transfer. One specific aspect of remote sensing is that the initial investment can be considerable for a single agency because one needs equipment and support to maintain and operate the equipment. This is much easier to set up through one agency. Once the equipment is available, it can then be used by many others.

8. MINISTRY OF STATE FOR SCIENCE AND TECHNOLOGY

B. Bhaneja
Policy Advisor, Government Projects Division
Government Branch
Ministry of State for Science and Technology

I should begin my discussion with the statement that MOSST, unlike other science departments has no operational programs to run. Our role is essentially that of providing policy advice, of policy development and of policy coordination. One of our primary responsibilities is to assist government departments in developing and maintaining policies and programs in science and technology which are in support of government objectives.

Our first formal encounter with technology transfer took place two years ago when we were involved in the preparation of a Cabinet Submission. The resulting Cabinet Decision gave MOSST the responsibility to assist federal departments and agencies in facilitating a series of measures aimed at enhancing the transfer of technology from federal laboratories to the private sector. In addition to developing this initiative, MOSST in its other studies, has also been examining policy development implications for technology transfer to Canadian provinces and regions as well as to other countries.

The April 1978 government decision entitled "Enhancement of Technology Transfer from Federal Laboratories to Industry" identified several policy measures aimed at the removal of structural impediments to facilitate technology transfer. The measures aimed at federal laboratories included the following:

1) All federal laboratories should include technology transfer among their objectives.

2) Technology transfer should become an integral part of R&D project planning at an early stage.

3) National Research Council's PILP program should be extended to departments. That has been implemented in the form of COPI and it is now going back to NRC as a PILP-COPI consolidation.

4) The federal laboratories should be actively consulted by their departments in any S&T procurement.

In addition, as part of these initiatives, technology transfer was to be formally recognized in the performance appraisal of federal scientists, and the exchange of laboratory scientists between the public and private sector was encouraged and increased. Most of these initiatives were aimed at structural changes.

Over the past two years, MOSST has also been working with science departments in facilitating the implementation of these measures. It is currently involved with the Public Service Commission in the development of a "S&T Personnel Interchange Program" aimed at the exchange of bench-level scientists and technologists between the two sectors. In addition, it is also examining current means for providing S&T services by federal laboratories to those outside the federal government.

In the area of international technology transfer, we have recommended a "twinning" approach to the transfer of technology from federal laboratories to Third World countries.

A "twinning" arrangement is a formal, sustained institutional linkage between a science oriented federal department and an institution with corresponding aims located in a developing country or region. Its primary objective is to assist the developing country's institution to reach a state in which it has generated a self sustaining capacity for action in this field of concern. Ideally, such a link should have the following criteria:

1) It should be long term in nature.

2) It should cover a series of activities such as regular information exchange, provision of training in Canada and in the developing countries, provision of Canadian experts, use of Canadian laboratory facilities, equipment and involvement of the two countries on joint collaborative projects in the developing country.

3) It should be of mutual - although not necessarily - equal benefit.

4) It should provide, if possible, for research to be undertaken in Canada directed towards the solving of problems or priority concerns to the developing partner.

Most of these criteria were based on the practice which we found in our three case studies which were picked from the Department of Agriculture, Energy, Mines and Resources and the Department of Fisheries. The projects were: India/Canada, Dry-lands Projects of Agriculture Canada; CCRS/Peru, Remote Sensing Project of Energy, Mines and Resources; and Thailand's National Inland Fisheries Institute to twinning projects of the Department of Fisheries.

In our report, we identified specific steps to an ideal twinning arrangement and the four stages are:

1) Identification of sectoral needs and priorities and the assessment of the feasibility of meeting them. We identified mechanisms through which that can be done; joint task forces, national development plans, international organizations and feasibility studies.

2) Selection and design of projects aimed at the creation of these sustainable capacities in training, research and services in line with identified needs and priorities. The mechanisms there were supposed to be collaborative project planning, role assignment and division of labour between Canada and other partners.

3) Experimental demonstration phase. The mechanisms were: conducting field trials, tests, surveys and setting up experimental stations.

4) Application and extension phase. The mechanisms were identified as mobilizing resources to train manpower and arrangement for material resources for "extension" of the project activities.

This approach is different from other technology transfer arrangements in that it sought to emphasize the notion of partnership among professionals of both developed and developing countries. It assumed that those who are closest to the point of R&D innovation understand best the problems of its adaptation and application.

With regard to technology transfer from government laboratories to provinces and other levels of government, not much policy research has been done in MOSST. The question of technology transfer to the provinces has been indirectly addressed in our studies, primarily in a study of forestry R&D which we carried out some years ago for

Environment Canada. The study looked at some existing organizational arrangements within the Canadian Forestry Service. We suggested measures concerning increased provincial participation by joint programs, advisory committees, and developing R&D programs for particular forestry research centres. The study also looked at the role of these research centres in assisting DREE and the provincial governments in developing regional/provincial S&T plans, and at the undertaking of joint cost-shared projects with provinces.

No significant approaches have been developed on the subject because the three major problems - which are encountered in technology transfer with Canadian provinces - are the problems of jurisdiction, management orientation of the federal government and the provincial governments, and the varying nature of S&T sophistication within federal, provincial and municipal governments.

In recent years, the emphasis in the federal government has been to try to broaden the specialist orientation of our scientists to include more applied aspects of research. On the provincial side, the major concern has been how to increase the specialization of their scientists who are generally involved in three or four fields at the same time because of the operational nature of their jobs. I must, however, point out that we have been in the process of consulting with provinces on industrial research and development. This has been initiated as a result of the Federal/Provincial Conference of Ministers on Industrial R&D which was convened in November 1978. MOSST was asked to consult bilaterally with each province to identify those research and development goals where there is a legitimate role for governments to play, and to propose a plan of action, taking into consideration provincial priorities, as well as the interests of industries and other parties.

Over the last two years, MOSST has held bilateral consultations with each of the ten provinces on goals and priorities. Detailed discussions were held with the four Atlantic provinces in order to develop an "Action Plan" which forms the first stage of what MOSST expects will be a nationwide exercise. Recommendations resulting from the Atlantic "Action Plan" are now before the Ministers responsible for the Economic Development envelope.

E.A. GODBY: You mentioned the twinning program. We did have such an arrangement with Peru; transferring remote sensing technology and it worked pretty well. It was a very good program. We are quite pleased with it. The

secret was that we had some money provided by CIDA. That was the money we had to work with in order to get this technology transferred into Peru. When it comes to doing it in Canada, we do not have the same money. That is one of the big impediments. Do you have any suggestions?

B. BHANEJA: I would assume that the federal government's attitude would be that the provinces are rich enough to provide part of the money. As far as the Maritime provinces are concerned, DREE has been quite active in providing financial support to them.

E.A. GODBY: This depends upon the level you are working at. One of the problems we have is that if you start looking at a resource management agency, you find that they are probably working full out. They have all the resources committed and they are doing things in a particular way. They will even agree with you that there are benefits to be gained from using remote sensing techniques. This year, they have to invest more money and more people into trying out the techniques and demonstrating them. This is where the catch comes. That is the money you need for the demonstration. Unless that is available, it is a hard road.

L. RAYNES: I have a question for Bill Coderre. As the holder of the federal technology transfer money, would you consider expanding the idea of PILP to include a federal/provincial agreement to increase the effectiveness of the dollar?

W. CODERRE: What I would consider is irrelevant to what the federal government is willing to fund but PILP-COPI is currently structured at industrial development. Insofar as transferring the technology to some other agency furthering industrial development, it is available now. If it is not furthering industrial development and if we broaden the program mandate to include that, we would probably have some new program. It would be a different program. It would no longer be called COPI.

If the money is flowing to a province then it is completely out of our bailiwick. If the money is flowing to industry then we are willing to entertain almost anything, for instance, the transfer of technology from university to industry or the transfer of technology from the Centre National des Etudes Spaciales in France to industry in Canada.

B. BHANEJA: When we are talking about CCRS technology transfer, we are talking about a different kind of technology transfer than industry development per se. The kind of transfer which we are talking about through CCRS remote sensing is more of an information transfer. That sort of transfer is usually used not to develop a product, but to assist in standard setting or regulation development and in the development of resource management systems in provinces. That is a very different kind of product. I would think that in this case, the initiative ought to come from the provinces rather than federal sources.

J. CIHLAR: Are you suggesting that if provinces took initiatives and approached the federal government they might have more success then if CCRS does?

B. BHANEJA: I am saying that the moves have to be made from both sides. It should not be a unilateral federal move.

P. SAMSON: I always thought that there had to be a need and that it had to be identified before you could sell it. I cannot talk in terms of what your problems are but is it not also one of the solutions: to get the money and have people that will get transfer of technology pay for it? If the provinces have a need and you have identified it and sold it, I do not see why they should get it for free.

E.A. GODBY: That is not always the case. We had an aerial hydrography project which was to measure the water depth in shallow water areas. If you look at all the uncharted areas in Canada, you will find that the benefits of being able to do this from an aircraft are tremendous. We did the preliminary research and it was successful, but getting that transferred was a problem. We did not have the money to do it nor did the Canadian Hydrographic Service. The secret is that we got the money from the DSS unsolicited proposals. Regardless of what the benefits were, if we had not had that extra money, we would not have done it. The benefits were great, but there were also risks in terms of a company leaping in and investing some millions in order to be able to set themselves up to do that.

P. SAMSON: We seem to understand that the money that was needed was to keep on developing the project, not to turn it over. It must not be something like they have at NRC because then it would appear that if you had unsolicited proposal funds, the transfer of technology was done to the company doing some more research work. Somewhere a distinction has to be made as to what stage you call it transfer of technology.

E.A. GODBY: There is no question that there are a lot of steps in the process, but the initial steps are the inexpensive ones. It is the next step, where you want to actually install prototype equipment and an aircraft and do a complete demonstration survey, that really convinces everybody that this is the way to go. The key to getting this business done successfully is to have money to draw on.

J. McINTYRE: I take it then that the money was actually to build that first prototype with the actual demonstration. This still raises some question as to how far the research was actually taken. I have trouble believing that we are talking about something that is that mysterious or that esoteric. Did it really require demonstration for the customer to perceive the value of it?

E.A. GODBY: Yes. It required a demonstration to actually show that in a real life situation you could, on the basis of the original R&D test, put together a package that could meet the accuracy requirements of the Canadian Hydrographic Service. Once you have done that, you have established that you can, in fact, use this technique to meet the Service's accuracy requirements and you also have established what the whole activity costs.

J. McINTYRE: One of the reasons I asked the question was because I had the perception that this actual demonstration point becomes the cross-over point between sender and receiver in a technology transfer. The better we can understand the actual financial involvements with various ways of demonstration, the better we will be able to understand the inputs and outputs of the actual process.

W. CODERRE: It has been our experience at NRC that the timing of technology transfer is perhaps one of the most critical parameters. If you allow a piece of technology to stay in the laboratory too long, a perceived product in the mind of the scientist is created and an industry has to un-invent it or de-engineer it to make it useful for them. If you transfer it too soon then it is quite difficult to get industry interested in it. That is a continuing problem that people involved in the technology transfer processes have to be on top of, identifying when to transfer. The point at which the first practical prototype is made tends to be just about the right place. In fact, most of our money tends to be spent building first practical prototypes.

N. SMITH: We have not touched on these various phases in technology development and it is indeed very important to identify the correct phase at which successful technology transfer will take place. In our experience, it is true that demonstration can cost you ten times as much as the original idea. You can produce a neat little device that will do all sorts of good things in the laboratories, but it is an extremely hard job to engineer it into something useful for industry. It is an even bigger job to convince industry that it is worth having. We found the most successsful way of transferring the technology is to involve industry in the demonstration stage. There are all sorts of ways you can do it: you can talk contracts, you can talk staff attachments, you can talk joint projects. It is important to keep in mind the various phases of development. We find that the most effective technology transfer is during this demonstration stage.

C. BRICKER: I have listened to so many people today talking about the success of technology transfer. Surely, it was not as easy as that. Surely, they were not lined up at the gate waiting for this new breakthrough. From the time that you have it developed, how do you get it out to these people? The most important person in remote sensing program is the user or potential user. How do we get this technology transferred to those people?

9. CANADA CENTRE FOR MINERAL AND ENERGY TECHNOLOGY

P. Sutterlin
Head, Technical Inquiry
CANMET

There are three types of research and development going on at Canada Centre for Mineral and Energy Technology (CANMET): in-house R&D, contracted-out R&D and joint R&D projects with industry. The focus is on the areas of mining, mineral processing, metallurgy and energy technology. The objective of the activity is to transfer the results of this R&D to industry, and therefore parallels that already outlined for the National Research Council. CANMET projects are designed to concentrate on areas of high risk technology which industry may be reluctant to initiate on their own.

Every person at CANMET is considered to be in the business of transferring technology from CANMET to both the public and private sectors. This applies particularly to the scientists, engineers and technicians in the laboratories who are actually doing the research and development work. Within CANMET, the Technology Information Division plays an important role in insuring not only that CANMET scientists have an adequate information resource base, but that the results of CANMET R&D are made easily and widely accessible. It is this role which I would like to outline in a bit more detail.

The Technology Information Division comprises three units which work in close conjunction with one another. The CANMET Library houses the largest single collection of information resources dealing with mineral, metallurgy and energy technology in the country. Our library attempts to maintain this resource as part of the informal National Science and Technology Information Dissemination Network. There is a full on-going program of internal circulation of current journals and loans of monographs as well as inter-library loans and borrowings. In addition, the Library staff responds directly to inquiries of a general nature. The Publications Section of the Division performs editing, transcription, layout and, where required, translation services and arranges for the printing of CANMET Report Series and Laboratory Division reports.

The Technical Inquiries Section of the Division is responsible for responding to inquiries of a technical nature as well as for a technical documentation activity.

This is, in a sense, a marketing function designed to keep the Canadian mineral and energy technology industries aware of developing R&D within CANMET as well as pertinent developments elsewhere. Technology Information Officers of the Section, all of whom are scientists or engineers, respond to approximately 2,000 inquiries per year which involve some analysis or interpretation. That this service is available has been made known through an internally-produced brochure distributed to 2,500 individuals, as well as through advertisements placed in a few technical and scientific journals.

The CANMET Report series makes up our senior reports, and are distributed by Supply and Services Canada and by CANMET itself. There are also reports which originate in the Laboratory Divisions which, although listed in CANMET's annual Catalogue of Publications, were never too widely circulated. Even though many of these reports contain only preliminary or interim results, it was noted by many industry personnel that the information contained in them was often of value to those outside CANMET. Neither were the reports submitted by contractors widely circulated. These Divisional and Contract reports were held in open file in the CANMET Library. Since the middle of July, 1979, a list of these reports (and including the CANMET Report Series reports) is circulated to a clientele of 2,500 individuals and institutions every two months. Soon after the distribution of the first "Open File List", we were inundated with requests for copies of the reports. This led us to enter into a contractual arrangement with a private sector organization which microfilms the reports and makes them available, directly to the customer, in either microfiche or hard copy form.

To further publicize CANMET's activities through the CANMET Divisional and Contract reports, we recently set up a three-way arrangement with Chemical Abstracts Service (the generators of the Chemical Abstracts computer-processable database), our private sector reports distributor and ourselves. The reports distributor has agreed to supply to Chemical Abstracts Service a microfiche copy of any CANMET report (free of charge) to be included in the Chemical Abstracts database, in return for which Chemical Abstracts Service will indicate the private sector vendor as the source for microfiche or hard copy of the reports. CANMET will supply an Open File List to Chemical Abstracts Service.

CANMET has been involved in the generation of a computer-processable bibliography database dealing with

mining technology since 1973. Retrieval of information from this file was done in-house using a set of computer programs designed specifically to manage this file, called MINTEC. It was pointed out that industrial organizations, for reasons of confidentiality, would be better served if this file were made available to them without a government agency acting as an intermediary in performing the retrievals. For this and other reasons, MINTEC is now available directly on-line through QL Systems Limited in Kingston, Ontario. The development of a similar file (MINPROC) in the area of mineral processing is in progress. In addition, we contribute material to the International Energy Agency's Coal Technology Database, which should be available through CAN/OLE (the Canadian Institute for Scientific and Technical Information) early in 1981.

Technology Information Officers of CANMET are also involved, together with CANMET scientists, in the preparation of what are best described as "State-of-the-Art" reviews - a compilation of the most recent information on certain specific topics. These are issued in the CANMET Report Series.

10. ATOMIC ENERGY OF CANADA LIMITED RESEARCH COMPANY

N. Smith
Assistant to General Manager
Commercial Operations
Atomic Energy of Canada Ltd.

What I am going to say refers specifically to Chalk River Nuclear Laboratories which is a major R&D laboratory of Atomic Energy of Canada Limited (AECL). I would hope, however, that this will reflect the interests and the perception of AECL as to what we are all about.

We have had little experience with transfer of technology to provincial agencies, unless you consider Ontario Hydro a provincial agency. Both ourselves and Hydro are one step removed from direct government control, although we are obviously government agencies of a type.

The problems of technology transfer and the rewards are similar regardless of the agency. We recognized, very early, the importance of technology transfer, partly because Ontario Hydro, in the early days, made a very strong commitment to nuclear power. We worked in cooperation with them for many years. This meant a strong involvement with Canadian manufacturing industry. We were dealing with the problems of getting a major high technology product into the marketplace.

Important points I think should be made are:

1) It needs considerable initiative by all parties to make technology transfer work. It will not "just happen."

2) We have to market the technology. A reference was made to technical reports just sitting there with nobody reading them. You have to get out and make sure that the people making the decisions will read these reports.

The government came to us and said that we should be getting more of a dollar return on our R&D investments. With that in mind, we formally set up a Commercial Operations group at Chalk River one and a half years ago.

Our prime mandate in commercial operations is to sell the technology, the know-how, the expertise,

and the specialized facilities at Chalk River to industry or to anyone else who wants to buy it. This meant that we had to get into marketing and it is quite interesting to see the spin-off from this activity. As we get into this, more and more people, particularly people outside the nuclear industry, are now becoming aware of our laboratories, who we are, what we can do and what we can offer.

It is also worth noting at this point that in a research laboratory like Chalk River, there is a long standing tradition of scientific freedom. We found that in making contact with outside groups - once you can break down the initial resistance - the effect is very positive on the staff in the laboratory. It is nice to know that somebody other than government feels that what you are doing is worthwhile, and might even be prepared to support you and pay you.

3) A third important point to ensure the success of the transfer is that you have to identify early on and agree on what your common goals are. Having established that, you must work in complete cooperation to achieve these goals.

4) It is also important to relate the technology to the real world. If you can do this, if you can relate it to the real world and if you can identify and agree on the common goals, it helps enormously in identifying the nature of the transfer, the direction of the transfer and the timing of the transfer.

5) Traditionally, the scientist sees two stages to a high technology development. He sees the laboratory stage and the commercialization stage. It is very important to recognize, however, that there are far more stages than these.

We found that stage two is usually the best time to involve your second party following demonstration of feasibility in the laboratory. We find that by getting the participation, the involvement, and the commitment from industry or other agencies, there is some hope of success. Industry has a hard-nose perception. It is important for us to keep that in mind at all times; identify your market.

6) It is also important to identify the areas of responsibility. You have to identify who is going to make this transfer work. On the same theme, we found it is very useful to establish cross-links between the two organizations at the appropriate level. We are talking about people when we talk about technology transfer. They have to communicate. They have to be able to understand each other. We must establish links between the project managers, the engineers, the scientists, the legal experts and the marketing people.

7) The final important point is that we measure success of technology transfer simply by the presence of a viable industry, or whether that technology is being independently exploited. To achieve that success generally needs far more support than the initial effort of transferring the technology. In other words, you can draw up a plan, but transferring a particular remote sensing technology to an agency, giving it to them and training them in it, may not be enough. There has to be a continuing relationship all the way through to full exploitation.

The role of Atomic Energy is to carry out research and development in peaceful applications of nuclear energy for the maximum benefit of Canada. The major objective is to develop nuclear technology and transfer it to Canadian industry so it can be put to use. It is not really surprising that with that role and that major objective, we recognized the importance of technology transfer. We were, in the early days and to a lesser extent today, given the dollars to do it. We were given a budget to contract out to industry. Because of the nature of the game we are in, this meant that our staff, scientists and engineers, recognized very early on the importance of cooperation with utility and manufacturing industry.

A point to bear in mind when we are talking about joint projects, R&D contracting or attachment of staff is that not only is the agency introduced to the technology very early on in the development so that it can make a useful contribution itself, but it also forms the nucleus of an effective team in that industry. That is very important. You have to have a team that is viable, critical and that can expand. The R&D contract helps them to set up that team and grow from there.

I mentioned a few minutes ago, the importance of continuing cooperation right the way through to commercial exploitation. We have now put in place a number of licensing agreements. These are considered at the stage when we are looking at full commercial exploitation. We license a company to practice a technology, which may be an instrument or a general technology. There may be royalties involved. What is important is that through that licensing agreement, Chalk River will guarantee continued R&D support and assistance to that group all the way through to exploitation. If problems arise, it helps enormously to have that continuing back-up.

Two of the major considerations are:

1) It requires major initiatives to make technology transfer happen, and

2) It needs cooperative involvement and commitment towards a common goal and identification of responsibility.

J. BARRY: Do you provide the licensing agreement to the licensee, the technical support in the laboratory, the fabrication of parts, and the parts, free of charge?

M. SMITH: We are not in the manufacturing business and that is one of the reasons we try to get our technology into industry. We are an R&D organization. That is what we employ our staff to do. The support we give to a licensing agreement is obviously negotiable. We would, for instance, offer free of charge full consultation that is necessary to bring that product on to line. If it is a question of further development or product improvement - provided the market is viable - we would be looking for a commercial contract from that manufacturer to develop the product.

J. BARRY: In the case of a detector or something like that, would you loan the person spare crystals or manufacture some annular ring or something of special material that you might have in your machine shop free of charge just to help him get going?

N. SMITH: You may be talking about stage two here of doing the pilot demonstration before getting the whole product on-line. Yes, we would be offering our facilities. We would be offering our equipment to get the operation going.

J. BARRY: Many times without cost? There is no transferring of money involved. You are just supporting your own product and his company?

N. SMITH: Yes.

B. BHANEJA: You show CRNL's contract expenditures over the last five years. There is a decline in the industrial contract expenditure from 1975 to 1980 and there is an increase in the university contract expenditures. Is it due to any particular policy within AECL?

N. SMITH: The general answer is that we have been under pressure from the federal government for our dollars over the last five years. We have had budget freezes and we are attempting to maintain the laboratories at their current level of expertise and strength. To do that in real dollars, means you have to cut down on your gravy items. I am afraid that R&D contracts is one of your gravy items. That is why the industrial contracts are declining.

The university contracts are expressed in dollars of the year. There is an escalation built in here. We have, at Chalk River, two main groups:

1) The applied research group which consists of engineers, designers and scientists. This is the group that has been most closely associated with the technology transfer, and

2) The research group which consists of physics, health sciences and chemistry. They traditionally issue contracts to universities. We have been continuing that general contractual support of universities at about the same level.

B. BHANEJA: What sort of percentage would a contract research be of your total R&D budget? Is most of the work done inside or outside the laboratories?

N. SMITH: It is a relatively small proportion, approximately two or three percent. Back in 1975 it would have been a higher percentage.

11. DEPARTMENT OF REGIONAL ECONOMIC EXPANSION

N.A. Williams
Manager, Program Implementation
Department of Regional Economic Expansion
Fredericton, New Brunswick

The technology transfer program I am going to describe is one of the six programs that are embodied in the Canada-New Brunswick Agricultural Resources Development Agreement that was signed in March 1978. This is a subsidiary agreement to the "General Development Agreement" of 1974 between Canada and New Brunswick.

Under the sub-agreement, Canada and the province agreed that greater economic benefits could be obtained from the agricultural sector by a process of stimulation of planned development activities both on and off the farm in the context of planned agricultural commodity goals. The agreement is administered by a Management Committe comprising an equal number of representatives of Canada and the province who are appointed by their respective ministers. The province is responsible for the implementation of the agreement under the general supervision of the Committee. The Department of Regional Economic Expansion administers the federal inputs. Thus, our mandate to be involved in the technology transfer is provided.

In general, the goal of the technology transfer program is to increase the efficiency of agricultural production, improve producer returns, encourage greater value-added activities by testing and demonstrating to primary producers new crops and new technologies for the marketing and the processing of their products. This is done in cooperation with the private sector. It is in conformity with agreed commodity strategies. These commodity strategies were set up for potatoes, fruit and vegetables, livestock and livestock feed and a "general" category. They are designed to overcome the constraints to each of the development goals of each commodity. The Management Committee reviews and revamps these strategies every year.

Specifically, the goals are:

1) To introduce new technology into New Brunswick to fully test, evaluate, and effectively communicate the results;

2) To introduce technology to primary producers through: a) on-farm demonstrations of a

semi-commercial nature; b) small on-farm demonstrations of new techniques and crops by farm management specialists; c) significant demonstrations of advanced methods of shipping, packaging and presenting the agricultural products for sale;

3) To introduce new technology to processors through the demonstration and testing of advanced methods of preparing agricultural products for the consumer market.

The technology that is being transferred is both hardware and know-how, whichever is better suited to address the need for improved technology, as determined by:

1) The constraints imposed by existing or currently used technology;

2) The existence of identified problems that are acting as constraints where the ideas presented in the project appear to offer a reasonable solution;

3) Lack of knowledge of existing technology, and;

4) A positive opportunity for utilization of a different technology appears.

Hopefully, the outcome of the program will be to increase the efficiency of agricultural production, improve the return to the producer, and get greater "value added" to their activities.

The transfer is made through the New Brunswick Department of Agriculture to the farmers of New Brunswick. Projects for funding can be originated by:

1) Professional or technical staff of the New Brunswick Department of Agriculture or Agriculture Canada;

2) Farm organizations, including commodity groups, marketing boards and general organizations;

3) Individual farmers;

4) Agri-business, including farm supply and food processors, and;

5) Anybody else.

Because this is a program under a joint federal/provincial agreement, selection procedures are rather complex. The agreement is administered by a Management Committee. The province is responsible for implementation of the program under the supervision of that Committee.

The Management Committee has struck a sub-committee to oversee the technology transfer program, has approved guidelines for them to work under, and set a financial limit of $10,000 for them to use, on their own authority without coming back to the main Committee.

The Technology Transfer Committee carries out the selection of projects. The projects to be considered include the following categories:

1) Testing, evaluation and adoption of new and existing technology;

2) Demonstration and communication of new or known technology, and;

3) Assessment of acceptance and success of new and existing technology.

A project is reviewed by the appropriate branch of the New Brunswick Department of Agriculture. It is then forwarded to the Technology Transfer Committee. If it is within their delegated authority of $10,000, and if it is within the guidelines, they approve it and away it goes. If it is over their delegated authority they then bring it to the Management Committee with a recommendation.

The guideline stipulates that all project applications be fully documented to include the following:

1) A literature review and an assessement of the need for the project in New Brusnwick;

2) A report on testing and evaluation in other areas and why further testing is necessary before field demonstrations are needed in New Brunswick;

3) A preliminary analysis of the anticipated benefits to the agricultural industry;

4) The proposed location of the project, participants, and arrangements with farmers and other cooperators;

5) A proposed budget by fiscal years;

6) How the results will be communicated, and;

7) How the results will be evaluated.

To select from various projects that meet all those requirements, the projects will be evaluated on the basis of cost in relation to potential benefits as determined by the cost of continuing the present system and the potential benefits of the new technology in terms of increased volume or efficiency of production.

In nearly all cases, the projects are demonstrations or trials and evaluations which involve some amount of training or knowledge gained. In most cases, the farmer or the organization initiating the project carries it out with the help of specialists from the New Brunswick Department of Agriculture. Occasionally they call upon consultants from Agriculture Canada, industry or universities. Again, as far as the federal government is concerned, the province is the implementing agent.

The initiator of a project other than the New Brunswick Department of Agriculture or Agriculture Canada, has to enter into a legal contract with the New Brunswick Department of Agriculture, which describes the life of the project, the financial, manpower and resource involvement of all the parties, the disposal of any assets, and the requirement to make the results of the projects known to other farmers. These terms include:

1) A statement of objectives;

2) A statement of the work to be performed;

3) A statement of the resources to be employed in carrying out the work.

4) A requirement for submission of progress reports;

5) A requirement to complete the project within the specified time;

6) A requirement to submit a final report stating everything that was carried on, the total costs, the recommendations, evaluation of how it worked.

7) An agreement to work with the appointed representative of the provincial Department of Agriculture;

8) An agreement to permit pre-arranged visits by others to view the project. This is a rather important one. It is a one shot deal on one farm so that the rest of the farmers in the province can come and see if it suits their needs;

9) A section detailing the cost-sharing arrangements for materials, manpower, equipment, and other resources, and limiting the financial responsibilities of the contracting parties;

10) Acceptance of liabilities for actions or results occurring as a result of project activities;

11) A statement of the share of the costs to be applied as compensation for adverse effects arising from the project including loss of revenue;

12) A statement exempting the New Brunswick Department of Agriculture and Rural Development from all costs other than those specified arising from claims for compensation for adverse effects;

13) An equitable basis for the disposal of revenue.

Projects carried out by the New Brunswick Department of Agriculture or Agriculture Canada do not require this contract. We share in all direct costs such as the services of technicians and other casual employees engaged specifically to conduct the project during the period covered by the project; the costs of all materials and equipment; the cost of renting or leasing equipment; the rental of the buildings; the compensation for agreed damages and/or losses of income, as stipulated in the contract between the cooperative farmer and New Brunswick Department of Agriculture and Rural Development, as approved by the Committee and; the miscellaneous costs.

In every case, all material and equipment acquired and wholly paid for from the project funding become assets of the Crown. These assets shall normally be disposed of in the manner provided in the statutes for the disposal of Crown assets, except where these fixed assets become an integral part of land or buildings, they may be transferred to the cooperating farmers at an agreed cost.

Each project proposal outlines the criteria to be used in evaluating the project, and gives an indication of acceptable levels of performance, including the extent of adoption of the technology. This varies from project to project and is used to evaluate the individual project. As well, the whole program is evaluated each year by the Management Committee to ascertain its effectiveness in overcoming the deficiencies that are outlined in each commodity strategy.

Project funding is shared 80% federal and 20% provincial. Most of the professional input is provincial but they will call upon university, industry or federal people if necessary. In some projects, the farmer makes labour and equipment inputs.

We have not had any major problems with this program to date. It has been running since 1978.

To show you the size of the projects we are talking about, here are some examples:

1) Trial and evaluation of a potato vine puller. It is only going to cost $2,300 to try this;

2) Trial and evaluation of the use of plastic mulch on vegetable crops, $10,000. This was really an offshoot of one of the human resources development programs. Under that program, we paid to send half a dozen farmers to Florida;

3) Dairy waste utilization. This is a method of handling manure to get it in the fields in the proper form without losing all the useful ingredients;

4) Application of meteorological data to fruit production. Again, this is only costing us $3,000.

The total funds in the whole agreement are $34.6 million over a period of five years. The Technology Transfer Program accounts for $2,250,000. At the present time, we have over 80 projects underway. They are worth approximately $1 million in total. Some are completed and some are still in progress.

Now, a brief comment on our workshop to date.

Yesterday, I heard it remarked, several times, that technology must be sold to the industry, that industry must

be made to see they could make a dollar if it were adopted, but that there seemed to be a gap between the technology design and its usage, with no money or means to demonstrate the technology.

The difference between the little projects I have described is that these points have already been settled. The federal government, the province, and the industry have, through the agreement, been sold, or have sold themselves, that to increase the return from agriculture they must overcome constraints to development they themselves have identified.

They have agreed that a technology transfer program is necessary to overcome these constraints to increase returns, and have set up an amount of $2,250,000 for the demonstration and evaluation of the transfer program. The technical people of the government, and the farmers, work the projects out together.

While this is not a very high form of technology, and while financially, most of our projects are less than $5,000 with some ranging up to $90,000, the system works. It may be that similar steps need to be taken for some of the more sophisticated programs as well.

L. CARLSON: In your case, the emphasis seems to come from the eventual adopter. In many of the other cases, it comes from the actual one who has something to transfer. It is different than some of the technology transfer programs we have been talking about.

N.A. WILLIAMS: Yes, it is different, but it seems to be the demonstration phase that you are having problems with. You have the technology that someone needs but is not willing to take the risk. These people have identified constraints. They know that they have to overcome them somehow. They are not sure what they need but they know they need some new technology.

L. CARLSON: Do you have a group of people who keep up to date on the new different innovations that are coming along? If people come up with a question, do you have the back-up information?

N.A. WILLIAMS: Our department does not, but the provincial department does. If they do not know the answer they always try to find out.

J. CIHLAR: You made a comment about the need for the agreement which is where the backing comes from. There was a need for the technology transfer. How was the case made? What actually convinced New Brunswick and Canada that there was a need for this program?

N.A. WILLIAMS: New Brunswick convinced themselves by running a two year study on what they had to do to upgrade agriculture. They did this in conjunction with the federal department. Before that, there was another agreement with Agriculture and our Department. It was on a different basis where we gave them money and they did certain things with it. We did not go into the type of information required in this newer agreement which calls for a new strategy which is upgraded every year.

There is another program for farm development where the farmer has to put together a five year farm development plan of his own farm. This calls for some training in human resource development and book-keeping. We pay for that and send them off to courses under program one.

Our program six is implementation where we help fund the experts that the province does not have. This is on a descending scale. The first year we had a lot of money but then it dropped down. These people are being taken on as staff of the provincial department. They are not disappearing, they are being absorbed into it.

EXAMPLES OF TECHNOLOGY TRANSFER PROJECTS

POTATOES:

- Evaluation of a seed planter
- Data collection - pests
- Central potato storage
- Seed warming
- Seed production demonstration
- Feeding cull potatoes to beef cattle

FRUIT & VEGETABLES:

- Fiddlehead cultivation
- Blueberry pest management
- Strawberry fumigation
- Evaluation of a precision vegetable seeder
- Black light insect traps for cornborers

LIVESTOCK & LIVESTOCK FEED:

- Grain production management
- Soybean trials
- Cereal grain trials
- Predator electric sheep fence
- Equi-potential barn floors

GENERAL:

- Weather forecasts for vegetable growers
- Soil "K" values
- Potato monoculture practices
- Chisel plow trials

12. CANADIAN FORESTRY SERVICE

L. Carlson
Forestry Advisor
Canadian Forestry Service

Our technology transfer programs are not really defined as such and we do not have a particular group called the technology transfer section.

Our transfer is mainly in ideas and software with a minimum of technology transfer in hardware. The agency that is doing the transfer is the Department of the Environment, Canadian Forestry Service and more specifically the Petawawa National Forestry Institute. The place of action is in south western Quebec.

The goals for the technology transfer are quite straightforward. They are:

1) To demonstrate the role of modern forest fire control methods to the Canadian forest fire control communities and;

2) To complete development of fire control technologies under operational conditions.

Our mandate to do such work is a little bit vague. It is stated in the Forestry Development and Research Act, which provides for the Minister to provide for the conduct of research relating to protection and gives him the authority to undertake related activities. We have stretched related activities to include technology transfer. As I said, it is a relatively weak mandate because technology transfer is not specifically mentioned. It is implied.

The technology being transferred in this particular project was:

1) Computer technology;

2) Remote sensing technology; and

3) Management science.

The anticipated outcomes are:

1) The adaptation of developed technology to the operating environment;

2) The demonstration of technology to other Canadian forest fire control agencies. In other words, we are using the set-up that is at Maniwaki as a model for others to see;

3) The exportation of Canadian technology and;

4) The identification of problems and refinement of the technology, i.e. continual development.

The main adoptor is "La Societe de la conservation d'Outaouais". They are the only one at the present time but there is a potential for other Canadian forest fire control groups and for foreign forest control agencies to become adopters as well.

The procedures for selecting who you conduct technology transfer with are:

1) Select a leader in the forest fire control field;

2) Select an agency that has a high level of technological competence in that field;

3) Select an agency that has a good attitude which is one that sees the usefulness of the technology that you want to transfer and;

4) Select an agency that has the desire to cooperate in technology transfer and understand that there will be mutual benefits from that technology transfer.

The mechanisms for the transfer in that particular program are:

1) Demonstration projects where a field organization can provide feedback;

2) The technology is introduced as a parallel system, not a replacing system, to the existing adopter program. The idea is that if you replace one system you also replace all the parts and the people that are in that system. You will find that the adopter agency will not gain in competence at all levels because the people that have been involved have been displaced;

3) A training program should be there but there should be no big training programs to involve everybody at one time. In other words, do not unduly raise the expectations of the agency and finally do not displace staff; and

4) Pass a law that the technology has to be used, for example, a law to keep the current forest inventories, that will require the use of new technology. In other words, you cannot keep it current unless you have that particular technology. It is an assiduous way of doing it, but it is probably the most effective way of ensuring that technology is transferred.

The technology transfer agents are:

1) The researchers and engineers who developed or are developing the technology. They need to take this technology to the field and then babysit it until final acceptance by the adopter; and

2) The adopter should participate with the researchers in technology development. There should be no middle man as it lessens the chance of researcher and adopter to understand each other's problems.

A lot of people try to transfer technology by having a special liaison group that transfers technology or information. In other words, the liaison person receives information from research and passes it on to be accepted. This is a poor way of transferring the technology.

The adopter agency should be able to continue development of the technology when the original developer is no longer around. They should have the technical competence to do it.

As for the use of technology, the proof is in the pudding. The Societe now relies on the new technology. Effectiveness of the computerized fire control systems is shown by the demand for the technology by other agencies. In this particular case, the demand is now becoming worldwide. Foreign agencies are coming to see the set-up at Maniwaki.

There are no formal agreements and the cooperation works 60-40% both ways. Formal agreements tend to leave the parties expecting too much from each other, or very

carefully lining out what each other should do and then laying blame if is does not get done.

One real problem is the underestimation of the involvement of the researchers or the engineers transferring the technology. The lack of control by researchers on the internal activities of the adopter is a natural one which does create some problems. Conflict of personalities even at the lowest level, can destroy the technology transfer. In other words, one of those people who is going to be displaced by dropping the system on him can foul up the whole system, either by not pulling his share of the load or by slowing down the process by which the communication is handled.

Finally, the federal government internal activities and central agency policies have conflicted with the technology transfer programs in general. There are the activities, in the last four years, of the Zero A-base review and Zero Base budgeting that demand that we have fewer ties with the provincial agencies. There is also a reduction in budget and man-years over that period of time in our service which then cuts the efficiency of technology transfer.

The illustrative example I have been talking about is the Maniwaki set-up. Essentially, the things that are done there are the transferring of computer technology, deployment of fire fighting equipment, a system of fire detection, integration of weather information, and decision making process. This is helped by use of models on rate of fire spread. What this technology does is quite simple. The forest fire control group operates in the same way as the city fire department.

Technology transfer is necessary because of the large gap between research technology and the potential users' understanding of the technology. That is the biggest gap and some of the hardest fights we have had in transferring technology is in promoting ideas as a result of research and not having a particular piece of hardware associated with them.

I have four other illustrative examples and they are: large scale photography, aerial ignition system, tree growth modelling and fire weather index. We have spent 50% of our time in the transfer of large scale photography and 25% of the cost of transferring the fire weather index system technology. This started in 1925 and we are still transferring technology related to it. The point being

made is that technology transfer is always going on and will continue for the period of time of use of that technology by the industry or by the provinces.

N. SMITH: We have faced the mechanism about passing a law to transfer this technology in our exploitation. We are into non-destructive testing and every now and then we come up with what we think is an excellent technique of checking out some of these drums, pipes, etc. If we are commercially hard-nosed, we go after the licensing agencies and get them to build it in to all these certification rules. However, we do not really want to do that. If we cannot sell the advantages to the agencies that should be exploiting it, it is not really playing fair to sell it to an agency that probably does not know what is going on anyway. I do not feel that this is a very good way of incorporating technology transfer.

L. CARLSON: I only used that as an example because British Columbia decided that they have to be up to date on their forestry inventory. In their presentation, they say that the minister has to report on the state of the forest for the province every year. That is a tall order when you talk about inventory. You do not get that just by looking at a few maps and doing it very quickly. Most inventories are not done every year. They are done every five or ten years. In order to be up to date from one year to the other, you are going to have to use some types of equipment just to get the information. The only type of equipment you are going to have will be through satellite imagery, mapping capabilities, and digital information. Although they did not say you have to use that technology, the law itself makes it mandatory to use it.

N. SMITH: If a government feels strongly enough that technology is essential, they should be putting the dollars in rather than passing a law.

L. CARLSON: They did.

13. DEPARTMENT OF AGRICULTURE

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Agriculture Canada
Research Branch

This report summarizes the role of technology transfer in Agriculture Canada including procedures now in place and plans for the extension of existing, or development of new, technology transfer mechanisms. The views expressed are those of the authors, although latest available information and departmental policy were used in preparing the manuscript. This report, which has been prepared for the proceedings of the Workshop, is broader in scope than the presentation made at the Workshop.

Introduction

Agriculture Canada obtained its mandate for scientific research in agriculture from the following five acts:

- British North America Act (1867)
- Department of Agriculture Act (1886)
- Act Respecting Contagious Diseases of Animals (1886) New - Animal Diseases and Protection Act (1977)
- Experimental Farm Stations Act (1977)
- Canada Grains Act (1930).

None of these defined adequately the role of federal and provincial agencies in the areas of agricultural research, education and extension.

One of the reasons for the establishment of the Canadian Agricultural Services Coordinating Committee (CASCC) in 1964 was to review governmental and institutional services affecting the general welfare of Canadian agriculture, including their coordination and adequacy. It was agreed that the provinces were primarily responsible for extension while the federal government would cover the major load in agricultural research. This Committee under the chairmanship of the federal Deputy Minister of Agriculture is composed of the provincial Deputy Ministers of Agriculture, the Deans of Agriculture and Veterinary

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Medicine Faculties at the universities, several senior federal officers, and representatives of certain national agricultural organizations. CASCC established in 1974 the Canadian Agricultural Research Council (CARC) to advise on the state and needs of the national program of agricultural research and development. CARC has representation from all agencies involved with agricultural research and development. Similarly, the General Services Section of CASCC was formed in 1976 to review and report on the non-R&D related recommendations.

The provincial/regional Agricultural Services Coordinating Committees and the seven Canada Committees (with their Expert Committees) provide CASCC with the necessary technical input and feedback for the effective coordination of the total effort toward providing agricultural services in Canada.

CASCC and all of its committees are purely advisory in function and do not exert any line control over the various agencies represented on them, although line managers may draw upon the recommendations of CASCC in planning resource utilization and research programs.

Agriculture Canada's Role

Technology transfer in agriculture is concerned with the application of research results for the benefit of producers or user agencies in Canada and abroad. Sometimes a saleable product is handed over from the research and development phase to the operational or commercial mode. More often new techniques or concepts, which have the potential for improving agricultural production, management practices and economics of farming, are the subject of such transfer. For this reason and because farmers have always preferred a person-to-person approach of information exchange, agricultural technology transfer in Canada is people-oriented and quite different from the transfer systems typical of the other sectors.

The Research Branch of Agriculture Canada has a long history of effective agricultural technology transfer involving provincial departments and institutes, universities and producers. The Branch conducts about one half of the agricultural research and development in Canada. It also cooperates with universities and industry by supporting research that augments the Branch goals and objectives. Currently some $6 million are spent annually on contracted research. The Branch is organized to solve current and anticipated problems in the many soil and

climate zones of Canada. Branch headquarters are located at the Central Experimental Farm, Ottawa. The program of research is carried out at 47 stations and experimental farms across the country.

In 1980, the Branch was reorganized into four regions (Atlantic, Quebec, Ontario and Western) and an Institutes and Program Coordination Directorate. This reorganization has moved the research function of the Department closer to the production and marketing branches and has highlighted the importance of research and development in relation to provincial/regional needs and international responsibilities. The aims of the Research Branch fully support Agriculture Canada's objectives for a strategy of agricultural development and the Government's food strategy for Canada.

The Department's position on technology transfer can be summarized as follows:

a) Technology transfer is one of the main objectives in Agriculture Canada research and development programs.

b) There is no mandate problem in the transfer of agricultural findings to the agricultural industry.

c) The primary route of technology transfer in Agriculture Canada is through provincial extension departments to the industry - the farmer.

d) Engineering and food processing technology is transferred to Canadian companies via contract and support programs.

e) Agriculture Canada scientists are encouraged to transfer technological findings and information. This activity is one of the six criteria used in rating scientists in the department.

f) Agriculture Canada supports the transfer of scientists between government and industry laboratories to encourage exchange of information and ideas.

Existing Mechanisms for Technology Transfer

1. To the Scientific Community: by scientific publication (>1000/year), technical bulletins, monographs, work planning meetings, scientific

conferences. This is the initial stage of technology transfer and is a source of information to extension workers and industry.

2. To the Producer: by way of printed materials and audio-visual methods. Some of these are bulletins, research reports, news releases, farmer recommendation bulletins, Canadex for extension workers, demonstrations (field plots, field days, exhibits), radio, T.V., films, direct contact between farm and research workers. Many of these activities are carried out jointly with the provinces, universities and industry, or with their full knowledge of the activity.

3. To Industry: by provision of technical expertise for development of processes and equipment, data interpretation and general trouble shooting; the commercial development of new strains and varieties of plants and animals is often based on information from Agriculture Canada laboratories; by contract programs such as the New Crop Development Fund, DREAM, etc; by exhibits; and by publications such as the Lighter. Industry representatives attend many departmental meetings concerned with research planning and development.

4. To other Government Agencies: by transfer of technical information in support of regulatory/legislative functions (carcass grading, pesticides, environmental issues, land issues, fertilizer regulations); as liaison experts for programs in other Departments (NRC, IT&C, Health and Welfare, Fisheries and Environment); and by patents (Canadian Patents and Development Limited).

5. To the General Public: by provision of data for translation into regulatory standards to protect the consumer, and producer (food safety and quality, fertilizer recommendations and regulations, pesticide recommendations and regulations); by means of a food advisory service (cooking procedures, recipes, nutritional value and cost of food); through the Information Services by publication of bulletins, films, radio and TV scripts, etc.; and by displays, and test plots and gardens at most Research Stations across Canada.

6. International Aid Programs: by participation in and management of CIDA-sponsored projects (India,

Tanzania, Sri Lanka, etc.); by participation in international agency programs relating to the environment, waste management, pesticide regulations, food programs, crop information system development; and by attendance at and participation in international society meetings and international symposia on agricultural and food production.

Agriculture Canada Plans for Technology Transfer

1. Maintenance of Existing Technology Transfer Mechanisms:
Agriculture Canada places a high priority on maintenance of the existing programs which have been developed to serve the needs of Canadians - consumers, producers, and those in the processing, distribution and retailing (PDR) sector. The programs will continue to evolve in response to new demands. Better coordination of federal government programs of interest and concern to agriculture would improve the transfer of technology to industry.

Agriculture Canada should be the lead agency in coordination of these programs.

2. Exploitation of New Communications Technologies:
Agriculture Canada is studying the Department of Communications Videotex system as a means to transfer new technology to the farm community. Examples of such programs are CANFARM's farm management programs, the Michigan State University's Telplan and the University of Nebraska's AGNET.

The technology now exists for a farmer to dial a code on an instrument resembling a touch-tone telephone and hand set or to punch in a request on a keyboard for information. Such information can be tailored to meet his precise requirements with allowances made for variables such as weather forecasts, and can be displayed on his television screen. Data obtained from the system could be printed out in hard copy, recorded on magnetic tape for future use, or manipulated to meet his special requirements.

It will take approximately two years to develop software for such a service. The rationale for such a service is based on the projection that the North American personal computer market will total $3.5 billion by 1982, and that personal computers will

be "the most important consumer product of the decade."

3. New Technology Program:
This initiative by Agriculture Canada will be made available through DREE as part of the federal government's ecomonic initiatives. $7.5 million has been allocated for 1979-80. Agriculture Canada research laboratories are involved in this technology transfer program, and the scientist is encouraged to take his laboratory findings and to become involved in the field demonstrations.

4. Co-operative Projects with Industry (COPI):
This program (formerly PILP) permits the transfer of technology developed in Agriculture Canada laboratories to industry. The fund for 1978 is $400,000, and candidate programs have been selected and are being put in place at the present time.

5. R&D Program in PDR Sector:
Agriculture Canada is coordinating a program to improve the efficiency of the Canadian food processing, distribution and retailing system. The program is the result of a MOSST initiative and has a planned funding of $700 K. Several departments will be involved in development of the program.

6. Farm Development Division:
It is proposed to form a Farm Development Division in Agriculture Canada that will concentrate on closing the gap between available and new technical and economic information from research and related activities, and the information required at the farm level for making sound management decisions and for long-term farm planning. This will include information and advice to senior department and other government officials on the farm management implications of departmental policies and programs.

7. CanFarm:
Agriculture Canada has transferred the CanFarm service for farmers to a major farm organization. The three main services provided by CanFarm are: Farm records (14000 farmers enrolled); Data bank (stores and retrieves data from the record system for education, extension research, and policy purposes); and Farm planning (provides information for making farm management decisions in areas of feed formulation, financial planning and machinery management).

8. Proposed Expansion of Technical Services to Processing, Distributing and Retailing Sector: This initiative now under consideration in Agriculture Canada is to stimulate collaborative research between industry and government laboratories. This development will lead directly to enhancement of technological transfer from Agriculture Canada laboratories to industry.

Conclusions

1. Agricultural information transfer is an important ongoing objective of Agriculture Canada. Its procedures are effective, are well received by producers of agricultural and food products, and involve provincial extension workers as well as departmental staff.

2. There is a free international exchange of scientific agricultural information through the world's scientific literature. This is unimpeded by restrictions such as patents and is scrutinized, tested and modified for agricultural use by all segments of the agricultural community in Canada.

3. The importance of foreign technology is of less importance in agriculture than in many industries because foreign agricultural practices must be significantly modified and adapted to Canadian climatic and soil conditions, and foreign seed varieties and animal breeds are often unsuited to Canadian conditions.

4. In the more industrialized aspects of agriculture, such as engineering and food processing, active programs of contracted-out research are assisting in the transfer of technology.

14. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

J. Cihlar
Head, Applications Development Section
Canada Centre for Remote Sensing

The National Aeronautics and Space Administration (NASA) developed a remote sensing technology transfer program to overcome the low use of remote sensing methods by agencies outside of the R&D sphere. It was an attempt to derive benefits from investments in space technology. We have discussed this program, called Regional Applications Program, with NASA personnel before preparing this report. However, I should note that the report has not been reviewed by NASA and therefore may not be fully accurate in all cases.

In 1977, NASA established three Regional Applications Centres with a responsibility for transferring remote sensing technology to state and local governments. The goal of the program is to establish baseline capability for remote sensing data analysis in the user community. This is achieved by giving user agencies a low cost, low risk opportunity to assess the value of information derived from remotely sensed data. The emphasis is placed on satellite data and methods. The "low risk, low cost" qualifiers are considered to be very important and affect the way in which the program is structured.

The anticipated outcome of the program is stand-alone digital capability to analyze satellite data in each state and expertise in interpreting and using results of such analysis. It is assumed that the participants know how to do certain kinds of visual analysis. The new technology to be transferred is digital analysis which is very powerful, which has been shown to produce good results, and which is not available to the state agencies. Since only digital analysis of satellite data is seen as "new, unproven" technology, the emphasis in demonstration projects is placed on this component.

To date, state government agencies responsible for resource management have been the primary adopters. It is envisioned that in the near future, smaller administrative results such as communities and municipalities and perhaps industries will also become potential adopters. Any agency that expresses interest in assessing the usefulness of information derived from satellite data is eligible to

become involved in the program on a first come first serve basis. Should the level of interest exceed available resources, cooperative activities are scheduled at a later time.

Several mechanisms are used in the technology transfer program.

1) User liaison and awareness. This is done in a systematic fashion by approaching each state and establishing a key contact within the state at a political or a senior management level. They attempt to make the state government aware of the potential of remote sensing through examples from other states and through presentations from other states where the technology is actually being used;

2) Training in remote sensing. The primary emphasis is on digital analysis of satellite data and training in project planning;

3) Demonstration projects. A demonstration project is a short duration effort of one year or less which addresses a specific problem and is approved by the cooperating agency and by NASA. Each project has a description which specifies what is to be done, when, with what accuracy, who will do it, what will be the outcome, and what each agency will contribute. Several projects are usually conducted simultaneously by several agencies but not necessarily in the same geographic area of the state. The project is designed so that results are meaningful to the state government with respect to problems of preferably current concern to the state. The projects need not provide results of immediate operational use as in most cases they are executed in parallel with the traditional procedures. In practice, results of many demonstration projects are immediately used by the resource agencies involved;

4) Assistance in establishing in-house facilities. In particular, software transfer and necessary modifications are provided for the cooperating state agencies.

5) Universities. Universities are funded under two NASA programs. In one program, remote sensing courses are prepared and taught by professors under contract to NASA. It is hoped that these courses then become a part of the basic curriculum for

University students and that resource specialists knowledgeable in remote sensing will thus enter the job market. The second program provides grants to University professors or laboratories to develop and demonstrate practical applications of remotely sensed data to problems of interest to state agencies.

The technology transfer agents are NASA employees. It is considered essential that the transfer agents have no "loyalty conflict."

Once the remote sensing approach is successfully demonstrated, the key state agency is encouraged to establish its own facilities for analyzing remotely sensed data. Assistance is provided in designing such facility, in converting and installing software, and in making the facility operational. Also, a continuing liaison is maintained with states where the effort has decelerated, where personnel or priority changes resulted in temporary interruption, where the initial demonstration effort was not successful, etc. There is no formal commitment to follow-on at the beginning of the transfer program. Rather, the parties involved assume that if the results are successful, the program will maintain or increase its momentum.

The accuracy of the results is evaluated by comparison with data obtained using the traditional methods. Effectiveness of the entire program is assessed by evaluating the progress in establishing remote sensing data analysis capability and in the use of satellite data by individual states. NASA covers all expenses associated with the participation of its staff and with remote sensing aspects of the transfer effort: travel, training, data, computer time, etc. Individual participating states contribute:

i) a state coordinator (or a coordinating committee);

ii) means to maintain awareness of the program and its progress (e.g. regular meetings of representatives of user agencies);

iii) time of agency employees allocated to the project(s); and

iv) ground and other data as appropriate. The general rule is that no transfer of funds takes

place. One demonstration project costs NASA $40 K (including contract support) and 0.25 PY of civil service staff time.

This approach to technology transfer has proven very successful to date. Whereas in 1977 less than five states were involved in comprehensive satellite data evaluation and technology transfer programs, the participation has now increased to over 33 states. Many states now have an established facility for analyzing remotely sensed data. Remote sensing methods also contributed to increased use of geobased information systems for resource planning and management.

15. ROLE OF INDUSTRY

J. Barry
Director, Space Electronics
Communications Research Centre

I do not purport to speak for industry and industry's role in technology transfer on a broad scale because I am simply not competent to deal with a subject as broad as that. I will, however, speak about one subject that I was involved with which involved the transfer of technology from the federal level to a provincial organization.

This had to do with the contract I conducted when I was on the Executive Interchange. It was to use aerial thermography techniques to study heat loss from flat-roof and public buildings. This was a contract which the company I was with accepted in 1977 and it had two objectives:

1) To study the application of this technology to heat loss and flat-roof buildings; and

2) To transfer the technology to some para-public institution in the Maritimes who could take the technology and see that it got used.

I will simply describe the project and you can draw your own conclusions as to whether or not it was successful.

It was a contract whereby the Canada Centre for Remote Sensing took flight trials over several Maritime cities; in Nova Scotia and in Prince Edward Island. The purpose of the contract was to pull together a team of people with experts from the company to which I was temporarily assigned, experts from the Ontario Centre for Remote Sensing in Toronto, experts from CCRS and non-experts from the Maritimes, the latter being the object of this technology transfer. We chose as a partner the Nova Scotia Research Foundation which has a good reputation in the Maritimes. Before the contract was even underway, we were asked if a consultant to the Department of Industry and Commerce in P.E.I. could join us at no cost to us so he could learn. We were happy to accept another team member.

The flight trials were done in due course and the data was taken. Some of the data was pretty good and some was not so good because of special conditions required for

acquiring good data. We got the analysis and the interpretation of the results underway and we interviewed a lot of people who were owners of the buildings for which we had the data. We told them that their roof was in good shape or that they had potential heat loss leaks. Because of the limitations of the contract, we were not able to get any of these analyses done in Halifax and we limited our study, principally, to buildings in Charlottetown. The interesting thing is that the man who joined us from P.E.I. as a paid consultant to the P.E.I. Department of Industry, was a very energetic person and worked hard with us. He and the Nova Scotia Research Foundation both ended up with the technology.

The Nova Scotia Research Foundation were only able to analyze roofs of buildings where they were reasonably assured that the analysis would be paid for. An added difficulty was the fact that some of the data over Halifax was not of very good quality because the weather was not quite right. They consequently were able to absorb the technology but developing a paying clientele has been a slow process.

We did not undertake originally to transfer technology to the P.E.I. government, but because their consultant was a lively person, was interested in the subject, and the P.E.I. government was prepared to allocate the funds to support him, they ran a high-profile program.

The other element for the success of the P.E.I. program is that P.E.I. is a smaller place; you can get more visibility for a subject in P.E.I. than you can in Nova Scotia for the same amount of work. The government complex is smaller and there are fewer people to talk to.

The Nova Scotia Research Foundation really did not have the follow-up funding that they needed to carry their message one step further. There was a link missing somewhere.

J. THIE: This certainly allows us to have a bit of discussion on the topic. Some of the other speakers may be able to highlight some of the roles of industry they have experienced overseas where the industry can play a greater role than it has been playing so far. I understand that in Dr. Barry's case much of the initiative came from the Canada Centre for Remote Sensing in its effort.

J. BARRY: Our company was also interested in the subject. The President of the company knew about the programs that

went on in remote sensing. He knew there was an opportunity. He had information about the Enersave program and the desire to use whatever technology is available to assist in energy conservation. This was one of the tools in this whole subject. We had a follow-up contract which we initiated ourselves to study particular technical features of it, but there was not much technology transfer there.

J. THIE: Could you recommend the best way that industry should be involved in technology transfer?

J. BARRY: I would like to make one observation. In technology transfer to the province, a consultant that can get in and get out is not a bad way of doing it. As a company, we did not have a vested interest in continuing to provide this program delivery at a local level. Our goal was to create a new resource in the Maritimes using someone else's funds. In that particular case, we as a third party were quite useful. It might not have gone nearly as well if we had tried to contract directly with the Maritimes. It could have been done, but they would not have known how to respond.

There are other types of technology that get transferred where consultancy is not the proper way to do it.

C. McNEIL: What evaluation was done of the Nova Scotia and P.E.I. experience? Is there an evaluation of the technology transfer that has taken place and of the results?

J. BARRY: No. What I am describing here is my own observations after the fact and the fact that we also went down and did a second experiment in Charlottetown to check out part of the technology. I also did a survey a year ago on who was doing what with aerial thermography across the country. I found that there is some activity in Nova Scotia, but it is a fairly low level on a proportional basis compared to what goes on in Prince Edward Island.

C. McNEIL: Can you tie the P.E.I. thermographic results to energy savings taking place now as a direct result? This becomes a very powerful incentive to broadcast the technology.

J. BARRY: My observation is that the thermography program is one string in your bow in the energy conservation program. It sensitizes people when they see thermographs of their own homes or it sensitizes para-public institutions who see heat loss pictures of their roofs to do

something about it. I do not know how often you can prove that a thermography presentation really triggered something that was not likely to happen anyhow.

C. McNEIL: It would be very interesting to us at Conservation Renewable Energy Branch if we could get a pretty definitive assessment of the success of thermography in that particular situation.

J. BARRY: Ways have been suggested for doing this - have another set of over-flights and compare the roofs (which are obviously cooler the second time around) with what was the case before and then to make a cross comparison with the people we had spoken to. I am not sure just how many people we actually triggered.

C. McNEIL: How do you get those quantitative results? I really do not think that there is going to be much of a federal or provincial level thrust for that technology.

J. BARRY: There are better examples of the technology. B.C. Hydro has done a lot of work in promoting this. They are paying for these flights and analysis. They have a very large and energetic program. They have a wealth of data on problems they have solved.

J. CIHLAR: To answer your specific question. There are two extensive provincial programs; one in B.C. and one in Ontario, on exactly the same subject. They are provincially paid.

C. McNEIL: I am aware of them, but they have not been tied to specific energy savings on a global basis. Until they are, you are not going to get the support for anything more than what is already going on. It is still a scientific curiosity until you can actually pin that down. It is a good public relations tool, but we would like to see it as much more.

J. CIHLAR: The only answer to that is that in B.C. and Ontario they consider it sufficient to make substantial investments into technology. They do not consider it a scientific curiosity, otherwise they would not invest in it.

C. McNEIL: Not relatively, not compared to the amount that Ontario Hydro or B.C. Hydro is spending. It is a public relations tool.

C. BRICKER: Along the same line, I agree. We had a project in Alberta utilizing a private company that did the

thermography as well as the gas company that supplied two towns about the size of 5,000 people. We were involved in it and made up beautiful demonstration thermography enlargements and took them down to the local town halls. They all looked at it and there was no follow-up that I know of, but they certainly became aware of the fact that there is a so-called energy shortage. Curiosity was possibly the best word for it there.

C. McNEIL: For successful technology transfer, there has to be a follow up that can show decision makers specific results so that they can get behind the technology and it can become an expected practice rather than a curiosity. I am not suggesting that aerial IR is that, but it could be so much more. It could be used in a much more concerted way if the follow up and the evaluations are done and people can agree that this was a direct tie to the end goal of the particular program. Without that, all the excellent work done previously is for nothing.

R. BAKER: When we talk about transfer of technology, it may sometimes depend on the point of view of the agency involved. CCRS has been quite active in the aerial thermography business and our purpose in transferring the technology of aerial heat mapping might not be quite what Enersave's purpose is. Theirs is a better purpose. Their purpose is to save the country money, to conserve resources and to make a better way of heating and insulating buildings. CCRS is promoting remote sensing and if along the way that does something useful then we promote remote sensing for this useful purpose.

In the aerial thermography mapping project, we did not quite have the resources to go to the end and find out whether we could establish a program across the country that would save money, insulate buildings and improve the cost benefits. We did, however, start the project. We flew the original thermography mapping flights locally and over places like Halifax and Charlottetown. From the point of view of Canada Centre for Remote Sensing a certain part of this technology has now been transferred. The part that has been transferred is worth emphasizing, from our point of view that has been done. Originally, we were the only ones in the country that could gather the data. After some of it was gathered, an interest was stimulated in several places including Ontario. Private companies came into the act and had contracts. The current status of the situation is that there is one private company that has gone out, bought all the same kind of equipment that we were using - hundreds of thousands of dollars worth of flying equipment

- and now tells us they have all the contracts they can possibly find. Their equipment is now used up and they are asking to lease Canada Centre for Remote Sensing equipment to do future flights. In a narrow sense, the transfer of technology to industry, where industry is now promoting it and presumably making money from it and producing some benefits, has happened. As far as CCRS is concerned we tend to drop out of these projects and let them roll. Are we saving energy in the country? I mention this only to highlight that the person who is transferring the technology will have something to say when he thinks the transfer is completed.

J. THIE: The way I see it, industry has all these transfer agents doing it for us or as a receiver. I would like to think that all of you here must have built up a fair amount of experience with the role of industry in this sense. Have they been satisfactory in the technology transfer role and have they been satisfactory in the receiving end role? Are there ways and means that we can improve the efficiency of that system?

W. CODERRE: From the industrial perspective, technology transfer becomes a very intimate part of an equivalent decision process to new product, new service and new process introduction within an industry. Conventional wisdom shows that whenever an industry is trying to accept technology, to transfer technology in or to get involved in a new process or a new product, the technical risk involved is usually not a particularly significant factor. The tendency, over the broad range of government programs involved in technology transfer, is to concentrate almost exclusively on the technical risk through research contracts and development contracts. The government is allowed to fund technological investigations. It is highly important, if we are concerned with the overall success of technology transfer, that our programs be funded in such a way that we can fund programs addressed to commercial risk. This means that we should be funding industry to carry out market research. The market research should be carried out by those who have to live with the results of that market research study, not by the government.

The one thing that we can do at the PILP program is to fund them to do market research studies. It is generally said that these market factors are much more significant in terms of ultimate success than the technological factors.

C. McNEIL: I agree with what Dr. Coderre has just said. The essence is that so often we do the difficult superbly and just do not package it. We do not follow through with the market assessment that is going to make the decision makers in industry or in other governments sit up and take notice. I think this is a very important point that we can all learn from.

W. CODERRE: I appreciate your support, but have to disagree that market research is easy.

C. McNEIL: It is not easy, but it is not conceived of as being difficult. It has to be done. Both have to be done.

J. THIE: I would like to pursue this because esentially you are saying that marketing research should be part of the technology transfer program. It may not be an intricate part of most federal government programs, but it seems to be part of yours. How did you achieve that to get it included? How can others follow those steps to enlarge their programs? How do you get the money?

W. CODERRE: I am not sure how other people accomplish it, but what we have done with our program was to keep its objective up front. The program objective is to see that a successful business opportunity exists at the end of our activity. Keeping that objective in mind, if it appears obvious that commercial risks will have to be addressed, then we fund them. We do not ask anybody's permission to do that.

It was my understanding, when I was in industry trying to sell research contracts to the government, that we could never charge the government for market research. We could only charge the government for technological programs. How we are doing it is that we are simply doing it.

J. THIE: Maybe the most important part is that there is a precedent for us to pursue this in our own organizations.

C. McNEIL: It is a decision of the Provincial and Federal Management Committees to include federal/provincial demonstrations. If you can get the general concept accepted, cash does flow towards it.

C. BRICKER: Is it important in every project to build a sure profit? I do not think so. The first air photograph was taken in Canada in 1883 and people are still not using their photography. I have never yet seen a report done on

the cost-benefit of the use of black and white photography. It is being used by those that wish to use it. It is not being used by those that do not wish to do it. Does that mean that we should have been out of the business years ago? Just because you do not show a profit, it does not mean that it is not good.

16. ROLE OF UNIVERSITIES

Pierre L. Bourgault
Vice Rector, Administration
University of Ottawa

Universities are quite different from government departmentss in that many government departments are involved in developing technology as a primary function. They have a mandate to implement. They, therefore, may find themselves with a package of technology that may be fully developed and which they want to transfer.

Universities are not in the game of developing technology, certainly not in developing complete technological packages. Universities tend to be more concerned with doing research to advance disciplines and to advance knowledge in general. They are not, therefore, a primary source of technology and they have little technology to transfer in the way that we look at it here today.

It is useful to think of the development of technology in three steps. The first being the research and development that can lead you as far as prototypes, inventions, know-how and design parameters. The second is taking the prototype or invention through design and engineering stages which convert a technologically feasible object into a commercially viable product. The third step is the actual production and sale. Universities engage in activities related to the first step but they are ill equipped to carry an innovation through the second and third steps.

Innovation also requires marketing and promotion - depending on what field you are in - where you must make people aware that the technology is available and in some way convince them of its benefits. This activity also provides the return flow of information which identifies properly the users' needs so that you can build it into the product or the service that you are developing or engineering. It is only then that you have the technology which is ready for commercialization.

In some instances, we may feel we have a technology because we have a good idea, and we try to "transfer" that "technology". What we are doing at that stage is trying to get someone else to pick up the idea after stage one and assume the task of developing the technology the remainder of the way to commercialization. In government circles and in university circles, there is a great underestimation of

the amount of effort that is needed to do that remaining step. There is a tendency in universities to think of industry as not understanding the importance of the discoveries that they (the universities) have made. In fact, industry is often cool to a new idea because it has a better appreciation of just how much work is left to be done in development, engineering and marketing.

In the overall process of innovation, idea generation is frequently the easier part of the work. It takes a great deal of skills to bring a product into a form where the price is right, it meets the customers' need and has all of those design parameters that make it a commercially viable product. This facet of innovation is tremendously costly and it requires a combination of many skills. If we consider innovation in that sense, then universities really are not in that game at all. They do some of the R&D at the front end and can be providers of basic information but they seldom have a complete technology to transfer.

Turning now to the relative effort which is placed on R&D versus the other activities in the innovation process. It has been conventional wisdom that R&D is the smaller part, or the component that costs the least, in the process. A study that was done by Statistics Canada a few years ago, where the breakdown of expenditures between research, marketing, design, engineering, manufacturing start-up and capital was examined, revealed some surprises. R&D expenditures, while smaller in absolute terms and small relative to what is done in other countries, are relatively large compared to other activities required for innovation. This study was done within Canadian firms. More than half of the R&D done in Canada is done within these firms. If you examine the data on the basis of total annual expenditures by category, you would find that R&D accounted for 54% of the total innovation activities; marketing 2%; design engineering 13%; industrial engineering 5%; manufacturing-start up and capital 18%. If you do it by selected projects, the R&D percentage is a little lower at 46%; design engineering still comes out at 13% and; marketing at 2%. Data for a country like the United States show a much larger percentage in design and engineering, approximately half or an equal amount to R&D. To attain a similar ratio in Canada, we would have to increase design engineering by nearly a factor of four. There is a weakness here, not so much relative to transfer of technology but rather to the development of technology.

Universities see their functions or their roles as two primary ones; the production of highly trained manpower and research. Moreover, the research which is done in universities is oriented to the support of the teaching function and to the training of graduate students. University research is discipline-oriented as opposed to being product- or service-oriented. The solution of a social or an economic problem is seldom done through a single discipline, it requires a multi-disciplinary approach. This limits the universities' ability to serve as broad generators of new technology. They are organized by disciplines; they structure their teaching by discipline, they conduct their research that way. That is the best way to arrange knowledge from a teaching point of view and consequently one should not expect universities to depart too radically from that.

Universities of Canada have been pretty good at developing highly qualified people. Our product is as good as anywhere in the world, certainly from the point of view of training. From the point of view of attitude of graduates, I think we could improve. Many of our PhD's, when they first graduate, tend to want to continue their PhD thesis rather than tackle the more mundane problems that face us. By and large, however, universities have done a good job. We are producing the generators of technology and the carriers of technology because it is through people that you will transfer and conduct.

The largest number of highly trained researchers in Canada is still in the universities. There are more PhD's in universities than in industry and government combined. Surely that resource could be tapped more than we are now tapping it and without attempting to convert universities into centres for commercial development of new products and services. I see a couple of ways of doing this. University engineers and scientists get involved to some degree in consulting. This has many benefits. They can contribute to technology development and by coming into contact with industry, academics conversely become more aware of industry needs and they become familiar with the technologies developed by industry. Through that mechanism, they can convey to their students - on a shorter time cycle - awareness of new industrial technologies. It also allows them to orient their research into areas more relevant to industrial needs.

Another general weakness in the Canadian industrial structure is that there are relatively fewer corporate laboratories in large firms as compared to the United

States. The large successful technology oriented firms in the U.S. tend to have corporate laboratories that serve as generators of new ideas leading into the operating divisions or branches. They develop prototypes, ideas, patents and know-how. Normally, they do not get involved in the engineering development which is done in the larger firms at the branch level. In other words, they engage mainly in what I described earlier as stage I in the innovation process. Since we have less of that activity within Canadian industry, universities can play a role in helping to compensate for that weakness, through the mechanism of consulting or academics spending part-time in industry.

When I was Dean of Engineering at Sherbrooke, we permitted professors to teach four consecutive terms. This gave them two consecutive terms without teaching responsibility (eight months) which many of them used to work in a firm. We considered this beneficial from many points of view. It was good for the university in that it brought us awareness of real problems thus contributing to teaching. It was good for the firm in that it brought them some highly qualified people with new ideas which many could not have afforded to hire on a full-time basis.

Turning now to some of the difficulties faced by our universities. The growth of funding in Ontario universities has been approximately 5 to 7% per year over the past few years. This has led to a decline since 1970-71 in the level of funding of about 11% in constant dollars. Ontario has a Council for University Affairs, OCUA (Ontario Council for University Affairs) which has been set up as an advisory body to the government on the financing of universities. Two years ago, this independent body of advisors produced a report entitled "System on the Brink." They were speaking of the system of Ontario universities and saying that it was on the brink of major difficulties. This year, their report has essentially the same tone. Unfortunately the Government of Ontario is not as concerned. The OCUA feels that parts of the system are in danger of collapse. A concern is in the shift that has occurred in the way the dollars are spent. Salaries have continued to go up and the proportion going to salaries has increased to the point where there is not enough left in other budget items to maintain efficiency and flexibility. In the case of our university, salaries have reached 80% of the total budget leaving very little flexibility to do some of the other things that we would like to do and that includes such worthwhile projects as "technology transfer".

J. THIE: In essence, you are saying that we should not have too much hope on the accomplishments of the universities with regard to technology transfer in the future. I have been more optimistic, particularly when I think of all the academics that are surrounding us looking for small contracts. Many of the academics have developed small private companies spinning off from their own interest.

How essential are the universities in the present structure of technology transfer? Is it detrimental to our operation that they function as they should? Can it be improved? You seem to emphasize very much the hard technology, the things that can be built and designed. Doesn't the university play a more significant role in the transfer of some technology know-how to companies and provinces?

P. BOURGAULT: In areas such as medicine and agriculture, universities can really develop a complete technology. In areas of services such as remote sensing, where there is that commercialization phase that must be gone through before that technology can be transferred, this is something that universities cannot deal with. It is not just related to the hard goods producing, but to many of the service activities as well.

B. BHANEJA: You mentioned two problems of technology transfer:

1) the multi-dimensional aspect of technology development from research to the other end; and

2) scarce resources.

In view of those two things, it seems that there is increasing need of cooperation between university, government and industry. From the university point of view, has any effort been made to identify opportunities for cooperation among these three sectors in terms of multi-dimensional projects as well as developing some new organizational arrangements where the three sectors could work together on laboratories research centres?

P. BOURGAULT: There is no doubt that universities are looking increasingly at working closely with either government or industry. There is increasing involvement in research which comes through the contract. One example of a three-way cooperation is SECORE. This is the institute in St. John's in which there is cooperation between local industry, Memorial University and the Newfoundland government.

B. BHANEJA: Were the universities responsive to that idea?

P. BOURGAULT: Yes. Universities are responsive to almost anything that would provide them with more opportunities to do research and provide them with more funds. There is also a great change in attitude from the day when I was a graduate student. We used to find pride in saying that the work being done had no visible application, but was just pure research done for the intellectual satisfaction. This is not so today. Particularly, among young professors, there is a great wish to be relevant and to contribute to the social and economic objectives of the country.

W. CODERRE: I thought it would be appropriate to mention some programs that relate to the interaction between university and industry that are being run by the National Science and Engineering Council. The strategics grant program lends itself quite readily to university initiatives where they have a program that they believe is going to be ultimately of significant interest to economic development and even more particularly the program known as PRAI (Project Research of Application to Industry).

In the PRAI program, the university professor must obtain the blessing of an industry spokesman willing to say that that research program is relevant to industry. Then, the university person can get funding to do that program. In the continuing evolution of the PILP program at NRC, we are very actively interested in extending our programs so that we would also pay industry to adapt and exploit the technology of universities in the same way that we are currently paying industry to adapt and exploit the technology of government laboratory. That is another mechanism we can hopefully look forward to in the future.

A month or two ago, I had a call from the President of an industrial company who was trying very hard to take advantage of the expertise in the university where he lived, but could not get the university to agree to work with him and forego their right to publish the results of the program. From his perspective, publishing would be disastrous since his competition would then have all the advantages he had. From the university's perspective, not publishing meant that they would not get the promotions and stature increases that they expected from their efforts. Is that a continuing problem? What can be done about it?

P. BOURGAULT: It is a continuing problem. The promotion system in universities remains partly dependent on success at publication. There is a tendency for the reviewing professors to look almost exclusively at publications although in principle research reports can also be assessed to measure research performance for promotions, in exactly the same way but without going through the publications route. However, this is a problem and I am not sure how to get around it completely.

C. McNEIL: Memorial University is the project manager of a million dollar industrial peat burning project. They have a multi-discipline team that is running the project for the province and ourselves. That is not only to be commended, but should be used as a model for other universities in other areas.

P. BOURGAULT: This certainly does not conform to the picture I have outlined. I am glad to see that it does happen. Universities can get into that, but it has not been their tradition.

W. BAIER: You mentioned that in universities, the number of scientists is greater than in industry and federal departments. If you break it up in disciplines, it does not always apply. The type of research which is being done at universities and in federal departments is sometimes different, particularly in agriculture. The universities are more interested in seeing short term research projects which fit in with their training education process. This is quite understandable, but in agriculture the projects are often of longer nature. There should be no competition. There should be a supplement of long-term, medium-term and short-term research.

J. BARRY: I cannot help wondering why universities are not agents of the transfer. Universities know what goes on in provincial agricultural research institutes because they know what is going on in the provinces. Do they not make that connection? Does it just happen and nobody even takes note of it?

P. BOURGAULT: Universities can very much act as agents. I felt that universities were not good at putting together technology packages of their own to peddle and transfer. As agents they can be effective. They can do this in their role as consultants. University professors are frequently consultants and this is to be encouraged. They can also do this through their teaching.

J. BARRY: I was not referring to the agency. I was thinking of the workshop which is transfer to provinces, not to companies. It seems to me there was a role of the type you described. They know what is going on in provincial/federal technology laboratories.

J. CIHLAR: Dr. Bourgault mentioned that universities are not in the business of preparing packages, but if you consider package from condensed knowledge or soft technology, I do not see why the universities could not be. In fact, the program in the United States is very much oriented in this direction where the soft technology is a package of how to do a certain thing. This involves research and then packaging it into several procedures. Once this is available, it can be transferred to many end users.

P. BOURGAULT: What specific areas would this cover?

J. CIHLAR: It is concerned with remote sensing. It describes data, procedures to analyze the data and specifies the final product that provides the required information.

J. THIE: This is a very interesting issue and I find it very sad that in Canada the federal government, the universities and the private industry have such a hard time getting together into research and technology transfer. In my own field, it is particularly sad to see that because Canada has probably the largest number of leading experts in the field of spatial data handling and in the field of information. There is no coordination whatsoever of the research efforts in the cooperation with industry. Commercial packages are not only developed in Canada, they are developed abroad. They are being sold to Canadian forest companies and engineering firms. Millions of dollars are wasted in going outside the border because of our organizational inefficiency. It is very unfortunate and I do not see a change appearing over a short period of time.

17. LEGAL ASPECTS

J.G. McCallum
EMR Legal Services

SOURCES OF INTELLECTUAL PROPERTY

1. Prior Intellectual Property of Another Person

- before exploiting it, must have agreement of that person
- note carefully our exploitation and confidentiality to owner.

2. Canada Research

(a) Departmental Research:
- Canada has full rights

(b) for Outsider on Cost Recovery Basis:
- Outsider has some right, depending on contract between Canada and the Outsider. An awkward area because Public Servants Invention Act may apply and there is sometimes no contract. The work may be unauthorized by any statute, and not approved by Treasury Board or Governor in Council.

- get help of Legal Services to sort out ownership.

3. Independent contractor

- Sharing of intellectual property set out (hopefully in the contract. There are many options to consider:
  - Canada owns
  - shared ownership
  - contractor owns
- in each case it is necessary to decide:
  - licensing and sublicensing rights;
  - exclusivity;
  - royalties or royalty-free;
  - residual rights such as return to Canada if
    - (i) insufficient exploitation in Canada or in world, or
    - (ii) if rights go offshore;
  - prior, special, arising, and future technology;
  - reports and their copyright;

- restrictions on use of copyright (e.g. delay of publishing) so as not to destroy intellectual property; and
- confidentiality.

- note balance between incentive/reward to contractor and Canada's duty for public good.

4. Statutory

(a) Copyright Act, S.11: ownership (sometimes) to Canada.
(b) Patent Act, S.19: use by Canada, royalty to owner.
(c) Public Servants Inventions Act: Canada owns if done by civil servant.

5. Caution Concerning Publication

- assess carefully whether publication will destroy intellectual property, regardless of the source of the property.

EXPLOITATION

1. Categories

(a) Direct Agreements by the Originating Department
(b) Transfer to CPDL
(c) Use of Another Agent
  (i) Private
  (ii) Provincial Government

2. Procedures

(a) Special Category of Public Servants Inventions:
- If at least in part by a public servant, an invention may be dealt with by the appropriate Minister under the Public Servants Intervention Act:
  - patent application (s. 6)
  - Minister may waive, abandon, or transfer invention (s. 8) (Except for DND and AECB cases, in S. 20 & 22 of Patent Act).
  - transfer to Canada Minister or agency (e.g. CPDL)

(b) Other than Public Servants Invention:
- cannot use PSI Act

- must use s. 52 of Financial Administration Act
  - Governor in Council approval, or under regulations of Governor in Council, upon recommendation of Treasury Board that involves an order in Council, upon recommendation of Treasury Board that involves an order in council with the proposed agreement with the transferee attached
  - the agreement has heavy doses of technology, policy, and legalities - start early.

TRANSFER to PROVINCE

1. Categories

   (a) for Use by Province
   (b) for Province to License
   (c) Directly to Licensee with Help of Province

2. Procedures

   (a) Agreement with Province establishing:
      - parties;
      - management committee and funding; undertakings of all parties; disputes; termination;
      - terms of license as discussed under "Independent Contractor".
   (b) Agreement with Licensee (possibly).

3. Legal Services

   - Note the wide spectrum of choices, depending upon the facts in each case. Impossible to set out a formula, so I encourage early and constant involvement of Legal Services to help in the identification and choice of policy alternatives, to draft and negotiate the agreements, to prepare the orders in council, and to execute a final agreement.

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18. THE INTERPROVINCIAL TERRITORIAL ADVISORY SUBCOMMITTEE AND THE ALBERTA REMOTE SENSING CENTER

Cal D. Bricker
Director, Alberta Remote Sensing Center

Thank you Mr. Godby for the introduction and invitation to say a few words on behalf of the Interprovincial Territorial Advisory Subcommittee (IPTASC) of the Canadian Advisory Committee on Remote Sensing and the Alberta Remote Sensing Center, Alberta Environment.

Guest speakers as listed in the program sounded pretty formal and impressive. I am not really a guest speaker. I paid my own way. My talk will be short and informal as I was asked to base it on the presentations and discussions in the workshop to date. Many points that I intended to cover have been, I am glad to say, fully discussed, and you'll be glad to hear, require no further comment.

As Chairman of IPTASC and actively engaged for many years in remote sensing in Alberta I have, I believe, a feel, for what the provinces and territorial members of the committee think about technology transfer from the Federal Government to the provinces. This important subject will be the main subject of future IPTASC meetings and I hope this workshop will provide a method of transfer so that the provinces may better utilize the science of remote sensing. I have many ideas and suggestions but no sure-fire method to ensure the transfer of federal technology - research and development results from the Canada Centre for Remote Sensing, and other agencies - to the provinces. Provincial users must be recipients, be they in provincial government departments, private industry, educational institutions or the private sector. I came to the workshop to learn and if asked, and I have been, to present my views. Hopefully they may be of some value.

At the Alberta Remote Sensing Center we are service-oriented. Our role is to provide assistance and advice in remote sensing to Albertans. Many persons and agencies from other provinces not having a similar agency use our Center. As we do not carry out R&D, I sometimes have the impression that technology transfer refers only to the transfer of a $120,000 black box with its wonders to perform. Just as important as equipment is the transfer of information, education if you will, on an eye-ball to eye-ball basis. An example of this is the some 10,000 persons who have visited our Center in the past five years. A visitor is one person who may spend only a few minutes

obtaining information or the scientist who spends all day using our equipment. Our education program, although we are not educators in the formal sense, sponsors symposia, courses and lectures. An annual remote sensing course, the only one of its kind in Canada, has been conducted the past eight years. Many universities, colleges and technical schools have tours of the Center and staff lectures incorporated in various course curricula. We also travel the province lecturing at schools. After a visit to an elementary school we received a hand-printed thank you letter from a student, "Thank you for the remote sensing and the infrared trees. My Dad did not believe me. But my mother believes me." Well, we got two out of three, anyway. Education is an important part of technology transfer.

Our Center promotes technology transfer by initiating and funding demonstration projects to assess potential applications of remote sensing. We have for a number of years provided funds to universities, colleges, and private industry to carry out projects in agriculture, forestry, engineering, wildlife habitat and other fields. The results are disseminated to anyone interested.

The 1980 project, Application of Remote Sensing Data to Rangeland Inspection is an example of a cooperative study to transfer technology. It is based on the fact that millions of acres of rangeland must be continuously monitored by range inspectors from vehicles and on foot to establish carrying capacity for cattle grazing. As Mr. Godby mentioned, this project - based on Landsat - is being cooperatively funded and carried out by CCRS, Alberta Remote Sensing Center, Alberta Energy and Natural Resources and the University of Calgary. The end product will allow Albertans and others to use a new application of remote sensing. An interesting spin-off of this project is what I call reverse technology transfer, from the field to R&D. CCRS scientists visiting Alberta learned not to put their pants inside western boots. Strictly drugstore cowboy - all boots and no cows.

An essential point in technology transfer from CCRS to the provinces is that there should be one contact point in each province. When there are provincial centres they should be the contact or coordinating agency. I speak for Alberta, but other provincial centers should be involved if they wish.

Another point, technology transfer is best carried out on a one-to-one person basis with the users actively involved - people process.

The technology being transferred should be of the real world, practical not theoretical and useable today - not ten years down the road.

A point raised in this meeting will, I hope, be discussed further this afternoon. Should federal funding and participation in technology transfer be to those provinces showing little interest, or to those actively engaged in remote sensing?

A "wall" to more extensive use of remote sensing in government are the managers who fail to move with the times. Some, after a number of years of employment, a large staff and a large budget, show little interest in new techniques. Education in remote sensing of employees entering the work force is slowly overcoming this problem. The final solution may possibly be time and retirement.

In conclusion a few important points - there are no doubt others - from the provincial viewpoint. There is a need to transfer federal technology to the provinces. The transfer is to be carried out from CCRS through and in cooperation with provincial centers. The technology transferred should be of practical value and useable at the user level. Results of demonstration projects and R&D outputs should be widely disseminated. More education in remote sensing is required. In cooperative demonstration projects among federal and provincial agencies, the provinces should be involved at the planning stage as they best understand the local conditions. I emphasize the fact that those in the field best understand the local conditions.

Two hunters from Edmonton were hunting for bear in the foothills. After an unsuccessful morning they stopped for lunch. Halfway through coffee a large bear came around the corner between them and their guns. The hunters scrambled for safety, one up a tree and the other into a cave a short distance away. The bear snarled and clawed at the treed hunter who climbed higher. The bear then went to the cave and snarled and clawed at the entrance before ambling off. As soon as the entrance was bear-free the hunter in the cave came running out only to be chased back inside. The bear would leave, the hunter in cave emerge and the bear would chase him back inside. In frustration the treed hunter yelled down, "Why don't you stay in that cave until

the bear goes away?" To which the beleaguered hunter answered, "You don't understand the local conditions, there's another bear in this cave!!"

Thank you for the invitation to attend this workshop and the opportunity to present a provincial view.

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19. PROPOSAL FOR REMOTE SENSING TECHNOLOGY TRANSFER IN CANADA

J. Cihlar
Head, Applications Development Section
Canada Centre for Remote Sensing

E.A. GODBY: We consider the technology transfer process in remote sensing a special problem and we would like to address this as a main-line activity for us. It should be useful as an example of problems and potential solutions in technology transfer for the rest of you.

As far as remote sensing is concerned, we now have a lot going on, but I would call it a grab-bag of technology transfer processes. We do have a computer-based information system called RESORS and it is accessible by the agencies such as Alberta Remote Sensing Center. We have a User Assistance and Marketing Unit which is at the service of people coming in and asking for help in the remote sensing business. We have an Applications Development Section which works with the users to develop applications. We have the Canadian Advisory Committee on Remote Sensing which has approximately twelve discipline-oriented groups and lets us know what is happening in remote sensing in Canada and provides recommendations for improving the program. Part of that is the Interprovincial Territorial Advisory Subcommittee. There are also provincial remote sensing centres in Alberta, Manitoba, Ontario and Quebec which are all part of this technology transfer process. In addition, we have representation in all other provinces. However, we still feel that there are gaps and shortcomings in this process.

The technology transfer process has to be recognized as a legitimate activity in its own right and as a component of the total remote sensing program. Letting the technology diffuse is not very effective. It is extremely slow. I think it is an activity that must be funded. As far as remote sensing is concerned, it must be interdisciplinary. At the federal level, that means that you have to have more than one department involved. There has to be an interagency cooperation at the federal level. It certainly has to have the blessing and the active support of the provinces concerned and there has to be some way that we can evaluate the performance of the process and improve it.

Josef Cihlar has come up with a proposal for a technology transfer program. He will present this to you as something that we could discuss to see if you feel it is

adequate, if it needs to be modified and how. Rick Lawford also has done some thinking on the factors involved in successful technology transfer and he will present those to us.

J. CIHLAR: The proposal I will present here is a result of numerous discussions and of considerable background work at CCRS and which also involved personnel from the Departments of Environment, Agriculture, and Indian and Northern Affairs. In the most recent version, I have attempted to incorporate experiences from the NASA technology transfer program and from CCRS applications development, user liaison, and technology transfer activities. The proposal addresses transfer to the provinces who have major responsibilities for resource management in Canada.

The objective of remote sensing technology transfer is to establish regular and effective use of remote sensing technology for resource management by the provinces. The anticipated outcome is the regular use of remote sensing data and methods for resource management decisions and operations in each province and an infrastructure to support this use.

The following items are critical elements of the proposal (see also Figure 1).

1. Identification of Interested Provinces

An "interested" province is defined as one that is not fully satisfied with information currently available for resource management and that would incorporate remote sensing methods into regular operation if the performance of these methods is satisfactorily demonstrated in terms of accuracy, timeliness, reliability and usefulness. The province would also make the investment necessary to render remote sensing useful in the operational environment.

An important consideration is that the federal government should not appear to favor one province over another. The provinces to be approached should have resource management problems suitable to satellite remote sensing. It is recommended that interested provinces should be identified through the Interprovincial Territorial Advisory Subcomittee (IPTASC) of CACRS, and that priorities for selection among provinces, if required, should be set in cooperation with IPTASC.

2. Federal Government makes a Case for Incorporating Remote Sensing into Operational Use

To "make a case", one must show that remote sensing would be useful for problems and issues of concern to the provinces. The presentation should be made to a group assembled with the assistance of the provincial IPTASC representatives. It should include senior resource managers and individuals responsible for approving and allocating manpower and financial resources. It must be realized that the establishment of a centre or facilities does not guarantee that operational use of technology will result; some form of technology transfer (e.g. demonstration projects) will still be required.

3. Development of the Demonstration Program Plan

The plan should include several demonstration projects dealing with different natural resources (agriculture, forestry, etc.). The projects to be chosen should address current resource problems in the province and only proven remote sensing methods will be used. Proposed organization and required resources from both the federal and provincial governments should be included in the plan. In addition, the role of industry and university should be clearly defined. Finally, the plan should facilitate the establishment of critical mass of expertise in the province. The plan should be approved by all participants.

4. Federal Structure

The structure employed must permit utilization of R&D results in the transfer program and the feedback of problems to R&D. It must facilitate effective decision making, fast response to timely issues, flexibility, liaison with provincial counterparts, and administrative accountability.

The federal departments proposing the program are EMR, DOE, DOA and DIAND. A new Technology Transfer office (TTO) will be established to manage and coordinate all activities under the transfer program. The TTO will be placed administratively under CCRS Applications Division and will be staffed by the participating federal departments.

5. Provincial Structure

A parallel provincial structure should be established to facilitate communication within the province, and to provide a single point of contact for the federal employees involved in the program. It could consist of a Lead Agency and a Provincial Steering Committee which already exist in most provinces. A Remote Sensing Coordinator would be responsible for coordinating the efforts of the recipient agencies and for maintaining awareness and liaison with the agencies.

6. Federal Manpower and Financial Resources

The federal group involved in the program must be capable of providing remote sensing technology input to demonstration projects covering an entire province or portions of several provinces. The group must have systems support, software support, and applications expertise; the first two could be provided by industry. In view of the nature of the demonstration projects and the functions of the proposed TTO, the following positions are required:-

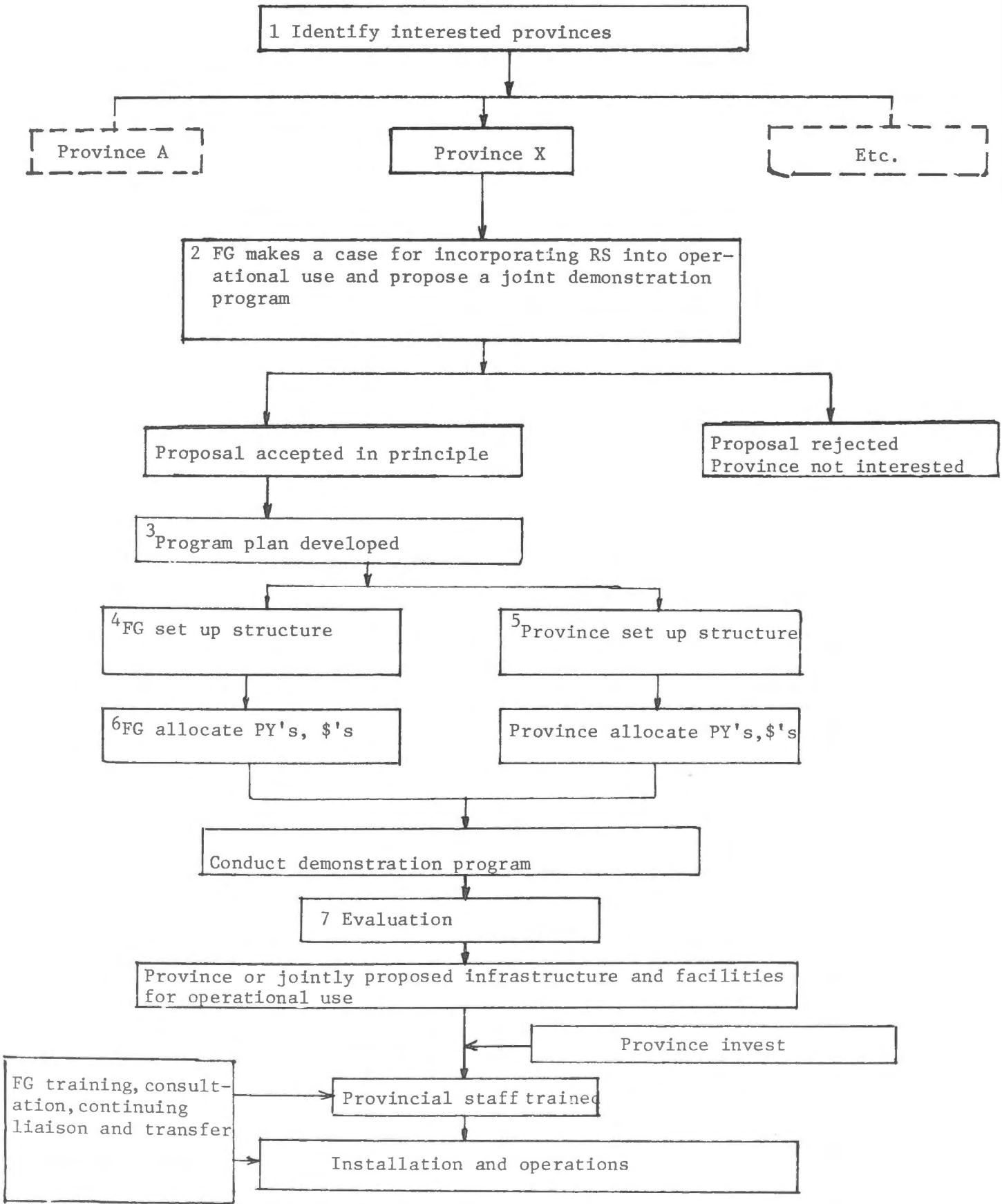
(a) Head; (b) Information Systems specialist; (c) Forester; (d) Hydrologist; (e) Geographer; (f) Agronomist; (g) Geoscientist; (h) Northern Environment specialist; (i) Systems Engineers; (j) Technicians; (k) Secretary.

According to U.S. experience, one demonstration project costs $40 K on the average. This includes all costs and overhead except for salaries of federal employees.

7. Evaluation and Continuity

The perception of success or failure of the demonstration program (from the provincial perspective) will decide whether follow-on takes place. The final decision whether or not to adopt the new technology into operational procedures rests with the province. To achieve the goal of the transfer program, assurance of continuing support is necessary. In the U.S. experience, follow-on results from the enthusiasm of people involved and their confidence in the data. An important question that must be addressed is - Which criteria should be used to evaluate the program, and by whom?

Figure 1. PROPOSAL FOR REMOTE SENSING TECHNOLOGY TRANSFER IN CANADA



20. THOUGHTS ON TECHNOLOGY TRANSFER

R.G. Lawford
Science Policy Advisor, Policy Directorate
Corporate Planning Group, Environment Canada

Introduction

The following presentation summarizes a number of important factors which should be considered in the process of technology transfer. They are based on my personal experiences working in a regional office of the Department of the Environment (in the Atmospheric Environment Service); on discussions with other government personnel regarding technology transfer processes and recent departmental submissions to MOSST.

The Technology Transfer Process

In considering the transfer of technology to provincial resource managers, we can develop a model such as the one shown in Figure 1. First, someone has to develop the concepts and do the basic research necessary to understand the physical basis for the technology. Normally, this research would be carried out at Universities. The federal level of government would be the most likely level to provide support for these research initiatives. Once the concepts are developed and validated, hardware and software must be developed. Subsequently, data sets will also be generated. This important component of a remote sensing program often requires elaborate and expensive equipment.

For a national remote sensing program, it would be anticipated that when expensive equipment is required, such as major satellite receiving stations, only one would be purchased. Ideally this equipment would be located centrally and then provide data sets to all the satellite offices and resource managers in each province or region.

Another group would be charged with the responsibility of developing applications and interpretation techniques. The interface between the resource manager and the remote sensing expert would develop most effectively when this applications group interacted with provincial resource managers.

Unfortunately, a technology barrier appears to exist where the interface should be. Can we break through the barrier? If so, what is the most effective way for breaking through? Furthermore, how can we ensure that

there is adequate feedback from the resource managers or users to the group that is providing the applications and interpretations expertise?

Factors Affecting the Rate of Technology Transfer

As Table 1 shows, there are a number of factors referred to in this paper as "A" factors which work against technology transfer. Technology transfer results in change. We are all creatures of habit, and even more so if we happen to be managers in a government institution. Change disrupts procedures, programs and people. Often managers feel comfortable with the existing procedures. Managers have people on staff and they do not want to disrupt the lives of their staff because it may mean disruption to their own lives if they have to handle grievances. Change costs money. There is a risk that the change may lead to a dependence on an unreliable or inadequate system. It is critical for the manager who is going to rely on a new device or procedure to have complete confidence in it.

On the other hand, there are factors, which we shall call "B" factors (Table 2), that work to promote change. A manager will accept change if that change is going to give him more information than he normally has and thereby allow him to do his job more effectively. The manager may also want to keep up with other offices or provinces that are using the new technology and benefiting from it. Often the more senior levels of management may wish to replace people with technology because of the constraints on person-year use. In addition, they will also be expected to replace old outdated procedures by more cost-effective ones.

Shifting the Balance to Favour Technology Transfer

The rate at which technology transfer or change will take place, will be accelerated when we increase the "B" factors and/or we decrease the "A" factors. How can we go about it in the case of remote sensing?

First, we can educate both the provincial resource managers and the more senior managers regarding the value and the products from remote sensing. If we successfully educate the senior decision makers, we will create a climate which will encourage them to implement new remote sensing techniques. On the other hand, if remote sensing is presented to them as a black box, they will have no in-depth appreciation for the benefits it can provide.

During the early stages of the development of demonstration projects, it will be necessary to provide money to the provincial governments. This will ensure that they are not wasting money on something that will eventually be of no use to them. The provincial resource managers must also have assurances that servicing will be provided on an on-going basis for the system once it has been put in place. It is not sufficient for the federal government to put on a demonstration project and then pull out three years later expecting the province to continue using the technology without supplying them with a source for updates or modifications to the system. Furthermore, the accuracy of the information that remote sensing is able to provide must be fully documented to raise the confidence of the provincial resource manager with regards to the remote sensing technology.

To reduce the "A" factors, it will also be necessary to give the resource manager time to accommodate change. Do not expect him to implement a new procedure in the next six months which is going to result in twenty people being laid off. He needs to have two to three years so that he can move those people to other parts of the organization.

To increase the "B" factors, we should carry out test projects and demonstration projects on real resource management problems, preferably with a token financial commitment from the provincial resource manager. In that way, the resource manager will feel more moral commitment to using the technique since he has invested in it. We can let the managers see how real resource management problems can be solved by letting him participate in workshops where he gets hands-on experience with remote sensing data and in applying data to real resource management problems. In discussing applications, it is useful to select success stories where actual successful operational systems are being used by other provinces or other agencies. This will stimulate the provincial resource manager to identify more closely with the opportunity.

The provincial resource manager should also have access to a mechanism whereby he can influence the priorities for R&D in applications and interpretation. Besides giving the provincial representatives a sense of involvement, it also leaves them with an added degree of commitment to applying the results of the R&D. This sense of ownership by provincial resource managers is enhanced if they become involved in joint projects.

To ensure that a regional group developing the applications has maximum effectiveness, it is essential to have experts trained in the resource management disciplines that are important to the province. For example, if you are dealing with oceanography or ocean applications and you are placing an expert in oceanography for projects, locate him on the east or west coast rather than in Manitoba. If he is located in B.C. or the Maritimes, he can have a one-to-one interaction with oceanographers in the province. It is best to take someone who knows the paradigms of the user and have him communicate with the user. You have to have somebody that will be able to communicate in terms of the problems that the client has and in language commonly used by the client.

It is very important to build bridges to the provincial resource managers. This is best achieved by decentralizing the applications groups, so that the persons in the applications group have almost daily contact with the resource managers whom they are trying to influence and understand. However, the experts must also have access to the best hardware, data, the best technical and scientific advice in remote sensing and in the resource sciences in order to be effective in their roles. Otherwise, they will be transferring information that is out of date. In addition, some of the experts must have a comprehensive knowledge of the province that they are concerned with.

To fully staff an applications office in a region or a province, the following two types of experts are required:

1) Experts in the resource science who can determine how remote sensing can best be applied in that particular resource field;

2) Experts on the variety of influences affecting remote sensing imagery in a given region or province.

These two sorts of expertise should be combined in a single office. In my opinion, the federal contribution should be the discipline-specific expertise while the provincial contribution should be the province-specific expertise. In that way, the results of successful pilot projects can be generalized to other areas in a given province by a provincial or regional expert.

The experts who are involved in technology transfer must be fully committed to this activity. One of the problems which occasionally occurs in DOE laboratories is that some managers, who say that technology transfer is good, are not willing to set aside any research activities to carry out the technology transfer. They claim that until they obtain more resources over and above the resources for research, their technology transfer activities will be limited to publishing in the open scientific literature.

In addition, some of the experts must, to some extent, be trainers and salesmen. They have to be missionaries for remote sensing and thereby stimulate interest in remote sensing. The size of the application units should exceed the critical mass necessary to have good interaction between the individual experts working in the group. If it does not exceed that limit you cannot get as heavily involved in interchanges with other user agencies, provincial resource managers or training programs.

Experience of DOE in Technology Transfer

The Department of the Environment has had considerable experience in transferring technologies to provincial agencies. This experience has shown that the most effective means for technology transfer have been:

- Joint federal/provincial projects (usually carried out at regional centres); - Operational techniques developed for and tested in provincial offices;

- Workshops and seminars for users and potential users in which successes are emphasized;

- Demonstration projects;

- "Vulgarized" technical summaries;

- Provision of facilities; specialized data; consulting services at regional institutes.

One final word of caution based on my own personal observations of successful technology transfer programs (as well as unsuccessful ones):

Be sure the first three transfers are likely to be potential winners before transferring them. Failure to successfully transfer technologies on the first two or three attempts will lower the credibility given by the province to future initiatives and proposals.

In summary, I believe that it is important that the technology transfer program designed for transferring remote sensing techniques to provincial resource managers give full consideration to the strategic and tactical elements outlined above. The two key elements of a successful plan are effective communications with provincial resource managers and decentralized applications units (at a regional or provincial level) of sufficient size to carry out applied province- and resource-specific research and to maintain training programs and up-to-date information on applications.

Table 1

"A" Factors or Factors Which Work Against Change and Against Technology Transfer

- Change is perceived to disrupt procedures, programs and people;

- Change costs money;

- There is a finite risk that change may lead to dependence on an unreliable or inadequate system.

Table 2

"B" Factors or Factors Which Promote Change or Technology Transfer

- Provincial resource manager can obtain information not normally available to him;

- Provincial manager may get "turned-on" by the technology;

- Provincial manager wants to keep up with the "Jones";

- In periods of fiscal restraint, the resource manager's boss wants to replace people with technology and old procedures by more cost-effective ones.

21. DISCUSSION

J. McINTYRE: That was an extremely interesting display of the problems, the mechanism and the details. I was going to try to turn it to a more general topic just for a moment and it has to do with the indentification of those things which one might wish to transfer.

We think of remote sensing transfer to provinces as a rather distinct or clear cut problem. I should think that we would also want to identify the provinces' interest. These two come together to identify those things which might indeed be transferred. It might not necessarily be for reasons that are entirely on the part of the receiver. They might be for reasons that are entirely on the part of the sender, or they might be for mutual reasons. These things come together to identify opportunities for transfer. I was trying to make a case for mission-oriented research which is another way of addressing the question that has come up repeatedly.

The question could be: Whose economics, yours or mine? They are not necessarily the same, because I value things differently than you do. We say he has a need over there, he may not perceive it. If I can sell him on that, you have a transfer. You can say I have a need which, if I can convince him of certain things, he will begin to honour for me. It might be that I can get a resource management need on the part of the nation honoured because the person whom you want to use it enjoys a cost savings for things he is doing. You get these intermixed motivations which require an enlightened understanding on both ends. You have to have a careful and clear understanding of your own goals which are not just to invent hardware or to do good research. There are goals of government and there are goals of department. These have to be understood so that they can be matched with the goals of the various receptors to whom you would effect transfer. It is not just the provinces, it is some agency within a province. They too have provincial goals and subgoals of the agencies in the provinces. It becomes very complicated and certainly not just a linear one to one equation.

The identification of opportunities is not at all obvious. We may be passing up all kinds of real opportunities to achieve our goals, whatever they might be. From the Department of Environment's point of view, we can do a great deal of research intended to support regulations. In the course of that, there will be opportunities for transfer for various reasons. It might be inventing gadgets to

do our thing for which someone else might perceive a market and therefore a manufacture or commercial opportunity - commercial transfer. Would that be recognized necessarily in the course of doing your daily work? Maybe, maybe not. Function of attitudes, function of basic ideas, function of somebody watching and monitoring a system are all different things coming together to detect opportunity.

I want to make one other point and it is to reinforce one that has been made frequently during our discussion. It has to do with the value of personal contact. Here is an article entitled "Analysis of Utilization Differences for Scientific and Technical Information." It is meant to advise a librarian as to how material can be filed so different people can find it. It indicates that there are at least two kinds of motivation here. There are people looking for economic commercial opportunity and there are researchers simply looking for background material and answers to their questions. The questions that get asked of the librarian are quite different even though they focus on the same kind of information. One person might find his information, the other person might not. One of the conclusions is that useful information transfer occurs most often toward the start of applied research project before the end to basic research project.

Information sources are relatively more likely to be written for basic research projects and to be oral for applied research projects. We talk to each other and that effects real information exchange between the person who is generating information for information sake and the person who is looking for information because he has an idea he needs to change and information will help him change.

The last point made is that basic research information exchange often takes place beyond the organization through reprints and conference proceedings. The applied researcher on the other hand, should be encouraged to participate in technical seminars within the organization although often beyond his immediate project field. Again, it is just a way of keeping the tentacles out and keeping the communication lines open beyond what would be normal. All it means is that the notion of technology transfer calls for extension. It calls for going through the normal boundaries we put around ourselves from time to time. It calls for doing that with a kind of attitude. The attitude would be: he has his goals, I have mine, let us see if we can match them up in some way. Mutual understanding becomes a part of it.

J. THIE: My comment is not exactly the same, but somewhat similar. I sometimes have the feeling that we, in the federal government, are trying to transfer second hand research. If you look at the mission orientation of a federal organization, it is obviously different than that in a provincial organization. We are not supposed to carry out research for the provinces. It also relates to the concern I have with the discussion today. We talk about a federal technology transfer program to the provinces with no provinces in participation. They should be, in my feeling, the key to the whole approach and program.

I often have the feeling that even in the field of remote sensing we try to transfer something that the province does not want. The resource manager who does not think he needs it at this time, wants something different. But what he wants is not in the immediate interest for us to transfer. It may relate to the satellite remote sensing, the use of digital analysis systems, etc. We can go out of our way with a lot of money in transferring that technology but it may be that the provinces are not ripe for it, or that the technology is not right for real application use yet. In a sense, we are not listening, we are not doing a market survey of what essentially is required in the resource management process and what the organization can handle right now. Unfortunately, I have the feeling that this is the greatest conflict right now. The present approach in remote sensing still is related to the sale of hard technology and fairly sophisticated technology in areas where implications or benefits are minimal to the provincial government.

Has anyone here had a reasonably significant experience in federal and provincial government operations? Are we just a group of federal servants that are looking at it differently?

N. SMITH: I said, during my talk, that I did not see the transfer of technology as being dependent on the receptor. The problems and rewards are the same whether you are talking about provincial organization or industry.

Since we went commercial at Chalk River, we started thinking about things in a slightly different way. We now bring in approximately 20-25% of our budget from commercial work. We are now starting to think of the federal government as simply another customer. Everything we do at Chalk River has to be sold to a customer. I am being very commercial. I am being very hard-nosed. The bottom line is dollars count. We have to sell it to somebody and if we

cannot sell it to industry, the federal government or a provincial agency might have different priorities. I agree that there are roles that the federal government should play in all sorts of areas that you cannot expect industry to pick up, and it is very important in the national interest that they do. You have to sell it to them as a customer. This might be one of the ways around addressing who should pay for this sort of work. You have to convince someone to because if you cannot convince anyone with all the different perceptions and goals, you are wasting your time.

J. THIE: Part of selling is market research and developing the right products. That should be our major effort and if I look at our experience in remote sensing, I have some doubt that we are actually doing that. We are just trying to adapt the technology to certain clients.

E.A. GODBY: In terms of why aren't the provinces here, the fact is that we have to start somewhere. We want to involve the whole world, but we have to decide how to go about doing that.

I have an experience that I want to relate concerning the business of selling the technology and not doing the right things. I think it is very significant because we sometimes do seem presumptuous.

We had a meeting in Alberta where we had all the rangeland managers and the researchers at the Alberta Remote Sensing Centre. We sat around for a whole day talking about applying remote sensing to rangeland. I came away feeling that in ten years time we could come back and have exactly the same meeting. The managers either did not really know what remote sensing could do or they expected unrealistic things. They wanted remote sensing to come in and do their jobs. That is what they wanted. They wanted to measure biomass; they wanted remote sensing to do that. They need specie compositions; they wanted remote sensing to do that too. We cannot do that. Does that mean that remote sensing is no good? I looked at it and said here is an image that shows the rangeland. It shows that this range is different from that range. It shows that in this part of the range there are different conditions. I do not believe that that is not useful to the rangeland managers. We went through three iterations of enhancing the product so that it brought out the interesting things. It was very successful. It really worked because they found that it was useful. When they are doing what they normally do, they can now extend this to their whole area of interest. That is a very simple product and it worked.

One problem we had was to get the range manager to be the project leader. He insisted that CCRS be the project manager and we insisted that we would not. He said he did not know a thing about remote sensing. We said that since he had 30 years experience in rangeland management it would be easier for him to learn how to interpret images than for us to learn to manage range. After a real battle, we got him to accept the project management role because he is the one that has to write the report and he is the one that has to say whether it is useful or not. It starts out that you are being presumptuous in feeling that you have a product that really could be useful if applied properly. In this particular case, it did work and it was successful.

What approach should we have taken? If we go and ask them what they want, they tell us they want to measure species composition. We tell them that from a satellite we cannot tell how many blades of grass there are. We cannot do it. They say: Does that mean it is not useful? The answer is: No. There are uses, but they are different from what the range manager thinks they are.

W. BAIER: You put your finger on a problem which I mentioned this morning but identified differently.

We know that remote sensing can make a useful contribution in identifying the client or the user. In that case, I take the example of crop information systems. We believe that there is something which remote sensing can do for this system, but the resource managers are not aware and are not convinced of that potential. That is why Rick Lawford put so much emphasis in his demonstration of increasing the B factor by educating the resource managers. What do you do? Either you give up if they think it is no good, or you struggle year after year through each budget and hope for the best. You hope for a breakthrough or you hope for one of your success stories. A final decision or a policy decision will not be made at that time. They just shy away from making a major policy decision. That is my problem. Similar to rangeland, I do believe that there is something in it, but I cannot prove it. Do we go ahead and use whatever we can get out of our limited resources with the help of CCRS and hope that with time a new breakthrough will occur so that our efforts will justify it? Or, do we give up and make the decision not to proceed with this effort? Who takes responsibility for that decision?

J. BARRY: The time to give up is when you give the photographs to the rangeland people. You have to convince the person to try the technique if you believe in it. In the

final analysis, you have to accept his judgment that in its present form it is not useful to him until you can do something better with it.

E.A. GODBY: That is true. You have to go a certain distance. It is not good enough just to ask him what he wants.

J. CIHLAR: The satellite remote sensing technology is fairly recent. In the last ten years, a lot of R&D had to be done. A lot of original R&D was not done by asking the manager who was doing the field work what he wanted. It was done on the basis of scientists getting together and thinking ahead on what information this technology could provide. There was some potential benefits identified usually related to large areas, frequent coverage, and so on. These were the best leads available at the time.

We have now made certain progress and there are methods that have been developed. By matching what has been done with what the managers need, we identify the opportunities. In this specific case of rangeland, it is an application that came from such brain-storming. Now that we have gone a certain distance and have talked to the range managers, we have feed-back on ideas that we need to pursue further.

C. BRICKER: I think that one of the successes is that we did not have any problems. We did not have any with the managers. We got down to the working level of the people who were actually doing this. Instead of showing them fancy pictures and telling them that it was going to do everything for them, we got them involved in how these fancy pictures came around, how we got them, how they were processed and what they meant. They became a part of this team. We got them involved as part of the team instead of telling them that it was the greatest thing that had ever happened. That is one of the ways to go about some of this transfer.

J. McINTYRE: Mr. Thie said that marketing was part of selling. Actually, selling is part of marketing. Selling is a small sub-set of marketing. We have been talking about marketing which is a refined understanding of not only your own problems and your own capabilities, but the problems and capabilities of the potential receivers that you might have. It is marketing.

B. BHANEJA: Rick Lawford presented a very good model of the technology transfer system between federal government and provinces. It shows that in spite of some parallels between technology transfer systems with industry there are definite differences in federal/provincial technology transfer systems. The major component is the infrastructure building effort and it is very difficult to put any money on that sort of thing. I would like to make that qualitative difference when we are thinking about technology transfer system and technology transfer to provinces. It will be useful to use Rick Lawford's model as a background to any discussion on technology transfer to provinces.

On a micro-level, there are two aspects. One aspect is technology transfer of a piece of hardware and the other one is how it would be used. These two things have to be looked at differently.

J. CIHLAR: When we talk about technology transfer to the resource management groups, we are really considering the transfer of the capability for using the data or the capability of obtaining information through remote sensing. To the extent that it requires hardware, the hardware will be part of the infrastructure. It may not necessarily require hardware. The hardware transfer is not an inherent part of the process. It may or may not be required, although it seems that on the basis of what remote sensing is and how it is being used, digitial analysis is quite essential. One may use the latest technology differently than the researchers would, but a powerful technology may still be needed.

L. CARLSON: When we talk about transferring the technology to resource managers, which one have you picked out to transfer it to? Is this such an encompassing technology transfer program that it is going to gather the whole works into one?

Thinking of them all together may create a lot of confusion on how to approach it and on what you are prepared to do in your technology transfer program. If you concentrate on one resource and try to transfer that particular technology to the workers in the particular resource field or resource managers in that field, it might be more effective because in the provincial situation they are not isolated from the other resource managers. You may be clouding up the issue by trying to bring all the resources into one.

J. CIHLAR: That is a very good question. Based on our experience and experience elsewhere, one needs to put together a certain critical mass of effort to have a continuing use. This includes a sufficiently large number of people who are involved in the program. Otherwise, people tend to leave or move around quite rapidly. In fact, when we go back in two to three years, we find only 60-70% of the people that were working in remote sensing at the time. Only through having a certain critical mass can one have continuing effort. The question is: How do you build up this critical mass in the province? One answer may be that a large resource management agency can provide this critical mass. Alternatively, one may have to build up a level of effort by working with several agencies within the province.

L. CARLSON: I can understand that you need a lot of people to operate a centre for remote sensing, but often a particular group like that becomes self-serving and does things to promote remote sensing. Their interest is not so much in resource management as it is in remote sensing technologies. If you put one of those in each province you might find that you are cloning CCRS in each province and still have a group that is interested in the tools and the technology but not necessarily one that is directly interested in the resource management.

J. CIHLAR: When I say critical mass or critical effort, I am speaking of the level in these resource management agencies. For example, the Alberta Centre, or the Ontario Centre have no mandate to do resource management. The critical mass must exist at these resource management agencies. You have to have people who are using these techniques, who are trained and who are doing it on a continuing basis. Unless you have such continuing high effort in these resource management agencies, you will not have continuing use.

J. THIE: My comment is that if you have a significant application, there is no problem. For example, if you look at the forest inventory in B.C., they must spend millions a year just to inventory their forest. They could easily afford up to six man-years using satellite and airborne remote sensing. The critical mass is there if you have a realistic application.

One of your questions is: How can we, at the federal level, identify the most opportune applications for which we should transfer technology? For that, you have to know what kind of environmental information is most

critical in the decision making at the provincial level, not at the federal level. We have to balance the amount of money that is being spent on forestry inventories versus weather forecasting, etc. You probably should analyze what the technology of remote sensing can do to each of those.

The way I understand our technology proposal, is that we get a program planning office that would do that, that would look, balance, evaluate and therefore increase the efficiency of future research.

J. CIHLAR: We have already done something like this in Manitoba. There was a contract to do a comparison study of information needs in the province. It is recognized that this has to be a predecessor to a larger scale program within the province.

B. BHANEJA: The problem seems to be that before the application stage, provinces need to be educated or made aware of this particular technology.

Josef Cihlar spoke about a NASA model. I thought it was not a bad idea to develop three regional centres for remote sensing. Has that thought been considered? If that kind of centre is developed, one can envelop universities and provincial governments on a tripartite basis.

Some years ago, there was talk about a Maritime energy corporation. We have models like that within the country where provincial governments got together with federal assistance to try to establish an organizational entity along those lines.

W. BAIER: Mr. Chairman, you referred to the proposal by the Interdepartmental Committee on Space which is going to Cabinet. I was wondering how this proposal will affect or be used and about the problems which we obviously have with technology transfer. How can we, in the user agencies, exploit or link with this proposal? How would you say I can use it to have a B factor, to convince managers that we should go along with that approach? Can you give me some advice on how I can use the proposal?

E.A. GODBY: I did mention this briefly in talking about the integrated submission of the Interdepartmental Committee on Space. In considering the LANDSAT proposal, we did put a component in there that was for technology transfer. This is a proposal by which there would be a core group. It starts off with four people from Environment, Agriculture, Indian and Northern Affairs and CCRS.

Their initial job would be to do some of the planning and some of the things we have been talking about here. That group would then build up to about twelve and would include people who are competent in software and who would work with provincial agencies. You contribute by having your minister support the proposal.

If we are able to get approval for that program, it would mean that it is a funded program. A lot of our troubles would then disappear and we would have the elements of a technology transfer program that would be interdepartmental. The first stage is to get it approved.

J. THIE: I had always looked at this program planning office as a coordination office, an office that would coordinate the technology transfer in the various departments and that would not necessarily be the sole manager of remote sensing projects.

You stated that we should only be concerned with resource management programs related to satellite remote sensing. In forestry, it may be altimetry. In large scale photography, it may be a realistic area to induce technology transfer that would be part of a multi-stage sampling approach. I do not see this proposal as a funnel for all remote sensing technology transfer activities. I see it more as a way to coordinate our efforts.

E.A. GODBY: The way things came about was that we got the subcommittee of our Interagency Committee together and they were responsible for putting forward the proposal. How it exactly operates has not been worked out and that is the reason we are here today.

Everybody agreed that some kind of technology transfer program was necessary and we needed to have some funding for that. The most effective way of going about that had not been decided and so it was a result of having to respond with a well thought out plan to gain approval of that program which stimulated the putting together of this workshop.

J. BARRY: It seems to me that there is one element in here that is illustrated in the function that Cal Bricker and Bill Coderre have. In fact, there is a broker between the person that is inventing the technology and the person that may eventually wish to use it or find use for it. People like Cal Bricker is a broker with no vested interest in seeing this thing happen other than to make something good happen that satisfies both parties. Cal Bricker is a broker. He can do R & D himself. Bill Coderre is a broker between the scientists at NRC who are doing these great things. There is a function that is necessary, not because they are not interested enough to do the research, but because it is a necessary function that gives credibility to what goes back and forth. It is not always the case. CCRS, I am sure, has dealt directly with a user and it has been very successful.

P. SUTTERLIN: I am sure there will not be any opposition to the fact that the most effective mechanism of technology transfer is the face to face encounter between one scientist and another. It has been our experience that there is a decreasing probability that a researcher in a federal government laboratory is able to directly transfer the results of his research and development to his counterpart in the provincial, industrial or university laboratory. This is due primary to the ever increasing volume of information available to a researcher even when working in a fairly restricted field.

To keep abreast, a researcher would have to spend an unacceptable portion of his time in identifying, retrieving, examining and assessing information much of which is either marginally applicable or entirely irrelevant. Alternately, the researcher would have to become sufficiently familiar with the modern information techniques which are available to him, most of which are computer based and dependent on modern communication technology in order to maintain an awareness of what is going on in his field. This is a task which most researchers have neither the time nor the inclination to do. The person charged with this has generally been the librarian. However, the library staff might be ill-equipped to handle these responsibilities. The person charged with this task must be a subject matter specialist who knows where the information is available, where to obtain it and how to prepare it for use.

Marketing, again, assumes more than a superficial understanding of the technological changes which are affecting the information systems functions. Mr. Lawford

brought out a very good point that we must have information specialists who are committed to technology and information transfer as much as the subject specialists who are also agents. The information specialists and the subject specialists are vital in this technology transfer process. It should be recognized that they should be committed to this activity.

P. GIMBARZEVSKY: Regarding this technology transfer, I feel that we will have better success if a request is generated by the user. People are somehow very suspicious if something is given to them. In our limited experience with Canada Land Inventory, we had this technology transfer and there was a very good cooperation between provincial and federal agencies. The federal agencies provided know-how, techniques and training. Provincial agencies took over after that. With recent technology transfers, especially with LANDSAT, we might be going too fast for people to accept it. In addition, this technology was not always adequate for the use that people wanted. I witnessed one case when they tried to sell LANDSAT technology to a big pulp and paper organization. We could show them where the land and water are, we could show them where the various forests and non-forested areas are. If we can give them more they might accept it, otherwise they are not interested. In this case, we have not done enough R & D work and we have not pressed it in enough cases to make it attractive for the people. They would rather go to a federal agency and ask for technology transfer than having us go to them trying to sell them something.

E. A. GODBY: You are right that quite often technology is oversold. One of the things that we have recognized is that very often we have not been clear about what exactly we can and cannot do. It is a very serious problem and it comes back to the point about trying to sell people things that they do not want. I agree with this too. We are continually faced with the problem that you feel presumptuous, but you feel that you have a product that would be useful provided it is used in the right way. We have found that if we take the immediate response of the particular resource manager, we would run away. But if you persist, develop the product and put it in his hands, it becomes useful. We also had this experience. There is a balancing act between not overselling and yet not being completely discouraged. I do not completely buy the idea that you have to sit there and wait for somebody to come and approach you. That could take a long long time.

J. THIE: We may be trying to take too big a step because we all talk about technology transfer, how good it is and how good it should be. There is not that much disagreement on how it should be done. What we are dealing with is how, in the federal government, we are going to organize ourselves to make that organizational step as easy as possible.

The technology transfer program came about because of the fact that remote sensing is not implemented effectively across Canada. It is partly because federal government or agencies are not set up to transfer technology. It is also partly because the provinces are not set up to do that. In many cases, organizational problems reflect themselves in not enough resources, not enough coordination, etc.

I feel that we have proposed a technology transfer office with one objective which is to get a better handle on our federal government remote sensing operations. One of the problems we have in the federal government is that remote sensing is a tool. Our resources and budgeting are not based on tools but on activities. We talk about development of forest inventory techniques. Remote sensing may be a sub-element of that.

As a result of that, we have great difficulty in coordinating our federal programs even within our organization. It is dispersed and if we do not have enough weight or cannot get enough weight, we do not get the resources to transfer technology. I always looked at the program planning office as an organization that would lift remote sensing out of its subordinate role in a department, highlight it, recommend and advise certain departments how to go about or how to increase its funding. That is a very important aspect of the whole set-up. In my perception, it is as important or even more important than having the program planning office develop their own demonstration projects and programs.

N. SMITH: I would like to add a few words on the role of brokers and it is also related to what you have just said. As commercial offices in the operation at Chalk River, we are acting as brokers. The job is to find out what it is you are selling, what it is you have to sell and to find out if there is anybody out there that wants to use it. In doing that, we found that it is important that the commercial office be technically oriented. It is important to have someone standing back looking at what they are doing, knowing what is going on in the outside world and hopefully

putting two and two together. Potentially, this is a very effective way of identifying those items of technology that might be transferable.

In AECL, we will continue to be, in the foreseable future, strictly a line management organization based on technical disciplines. We have branches of mechanical engineering and branches of chemists. It is a discipline-oriented organization. However, one of our strengths in selling ourselves and in spreading technology is the multi-discipline approach. It is our ability to put all the different areas together to bring a project home to fruition. To do that you have to work across these boundaries. This sort of operation can do it. If you are doing contract jobs involving all sorts of branches, the commercial officer is the person who has to get in there and make sure he is getting the effort from the various groups of management. You can do it. There is an important role to be played both in identifying the technology and in organizing the management to deliver it.

J. C. HENEIN: I felt that perhaps we should indicate some of the things we are trying to do and where we have problems. Certainly, we should do more in the area of packaging of applications. What we have to offer to the user is really not that clear. There are cases where we can fairly confidently tell the user what we can do. For instance, we can show clearcuts and we can mark forest roads. That is something that is packaged and clearly documented and that is one area where we should do more work in. We can see how we can do that. It is mostly a matter of using resources and people to package what has already been done. Incidentally, it requires individuals which are less scientists and more engineers or systems analysts. Their challenge in life is to apply the research as opposed to the research itself. There is a problem which ideally could be resolved by having more people. If you could hire the right type of people that would be helpful.

The second problem area which we recognize we have is data reliability. As was pointed out again in Rick Lawford;s presentation, one of the reasons is that the people responsible for operational systems have a responsibility and they have to have a reliable system to work with. If the system breaks down, they are in trouble. It is quite understandable that there is no way they are going to leave secure demonstrated systems and have a system which is not very reliable. In this area, we should produce the data more reliably. In the case of satellite

problems, we should envisage things like an airborne backup because it may be that cloud cover is our biggest enemy and it is something that is uncontrollable except through that other medium.

The really interesting area is the bridge to the user and we can break that down in several steps. The first step is to sympathize and understand the user problem and discover the match between his operational requirements and what you have to offer. It is not always obvious. Sometimes the user may not be aware of what is available. On the other hand, we are aware of what is available but we do not know what is wanted. It is a long process to discover the match. It has to be done in a living situation. This is where we have personnel problems because we cannot see the world from Ottawa. What it means is that we have to decentralize, and send people to the users to work with them. We must not try to tell them something but we must try to learn from them and make the bridge. If in the process we discover a change agent in the user organization, we will be very lucky and we will probably be able to get somewhere. To achieve this, we have to hire the right type of people who would be more knowledgeable in the discipline and would be willing to decentralize to go work with the user and to travel. That may not be so simple to solve because it involves people and organizational problems.

Finally, when it comes to the funding of demonstration projects, this is again where we seem to have a gap in Canada. We have R & D organizations, excellent ones who can do R & D. Then you turn around and talk to different groups who have an operational responsiblity and who are not allowed to spend money on research. There is this gap in the middle from R & D to operations which should be bridged by demonstrations, but nobody wants to pay for it. CCRS does not have too many resources. There is a limitation there and once the success stories develop we can then publicize them fairly easily.

The central problem is in the area of the people moving out to the users so as to understand the users' problems and the problem of demonstration projects. These are two of the areas where we have real problems.

J.I. SNEDDON: It seems to me that we are dealing with a current generation of resource managers who have a limited awareness of what remote sensing technology can do for them.

In the long term, are we satisfied that we are doing enough at the educational level? You addressed the fact about getting to universities and to high schools and creating an awareness so that the future generation of resource managers are going to be aware of the benefits. They are not going to be hung up on this unknown quantity.

It seems to me that we should be looking at getting over this wall in terms of how to reach the resource managers and show them the benefits of remote sensing and how it is going to help them in their day to day decision making and problem solving. They cannot afford to send scarce manpower resources out to learn this technology which they do not know the benefits of. We are putting enough money into universities in order to create a broad base of awareness of the value of satellite remote sensing.

J. CIHLAR: We identified this as one of the serious problems in technology transfer. What people try to do now in remote sensing is to offer training courses and workshops to get across the bare minimum of knowledge to do certain things. That is probably the short term solution, but the longer term solution certainly is in educational institutions.

We feel rather strongly that research managers have to acquire their remote sensing expertise at the universities. However since Canadian universities are largely under provincial jurisdiction, the question becomes: Who is going to affect the program at universities to put more emphasis on education in remote sensing? Some universities in Ontario are now under such a serious budget squeeze that they have no elbow room for new programs. How can they be more effective in this direction?

W. BAIER: I do not think that you can expect us to develop recommendations for that group because we would mainly be talking to ourselves. If you can get a very strong recommendation from next year's meeting involving the provinces on the proposal and on technology transfer in general, it would be very helpful to user agencies. What do you think about recommendation in support of that proposal?

E. A. GODBY: That is the whole objective of the exercise. it seems that if we are talking about the technology transfer process, the objective is to have this technology incorporated, one way or other, into the information systems of the resources managers which are not entirely in

the provinces but mainly in the provinces. We have to have strong provincial input and recommendations. This is what we hope will come out of this next meeting in January. We hope this is the first step in the process of sifting through the experiences of the federal government agencies as a means of coming up with a reasonable proposal that we can go over with the provincial representatives and come up with a plan. That is the objective. I do not know whether or not we are pinpointing the problem we have. We have proposed an organization which would start with four representatives from four government departments who will be responsible for assessing the situation, developing a plan of action, stimulating demonstrtation projects, making some kind of agreement with one province or another and getting these demonstration projects going and funded, hopefuly in cooperation with the provinces, and monitoring their success.

We are wondering whether the group here feels that this is the proper way to go about it, whether it is an adequate way and whether it fills in a hole in the total technology transfer process as we see it.

J. THIE: The people that have been involved in drafting this proposal in its original concept have all agreed that it is useful as proposed so far. As I have been involved in it myself, I will not criticize it. I have more comments regarding the way it would operate.

Some of the discussion this afternoon has indicated that the type of approach that should be taken is the broker approach integration, not only integration within departments because that is still lacking in many situations since there are not that many official remote sensing coordinators, but also integration between departmental programs on remote sensing technology transfer. One of the major tasks should be the preparation of a federal technology transfer plan related to remote sensing. It should be a plan which looks at interesting on-going activities as well as desirable activities. It should be planned with a budget fitting into the normal five year planning cycle of the federal government. It should establish its opportunities. For those opportunities that are primarily of interest to disciplinary departments, the mission department should be the lead agency. For those projects or opportunities where integration of effort is more desirable, the technology transfer office should be the catalyst and the province involved should be the lead agency. I would recognize it as two distinct efforts. That is my feeling even though the technology transfer

office should be there to help raise the issue in the department. There are projects in which various departments are involved and the technology transfer office should play the coordination role and take a lead.

R. LAWFORD: If three different agencies within a given province are going to want remote sensing information and hardware, does that mean that they will get three sets of hardware in order to allow each agency to have equipment?

J. THIE: I was thinking it was their problem because they would have to pay for the hardware. Are we expected, as a federal government agency, to give it to them? Some integration is desirable there, but that will come by itself. The technology transfer office will not only have an opportunity to integrate federal departmental activities but also to encourage the local initiatives. It is not our responsibility to integrate that. It is the responsibility of the government. Obviously, we are not going to give them free interpretation advice. I am personally against giving them any interpretation advice.

J. CIHLAR: The task that we are addressing is technology transfer to the provincial agencies. That is the objective and if that is not accomplished this transfer process will fail. If for some reason within the province, the organization is not quite proper and the process fails, the job is not done. This means that there has to be a coordination effort within the province to ensure that the organization is right and that the transfer process will succeed.

Part of the coordination effort will be to agree on how the facilities are going to be set up. It is clearly beyond the means of most provinces to have several remote sensing facilities. It is much easier for the province to agree to have the facilities in one agency and to allow access by others. It is the job of the transfer office to assist provinces in organizing themselves in a way that will facilitate acceptance of remote sensing.

N. SMITH: I am a little nervous when I hear recommendations to put four federal people sitting around a table, saying wise things to each other with no reference to the province. One of the bottom lines in our experience is the total cooperation and agreement on the goals of the technology transfer. If you do not have that you do not have cooperation between both parties and therefore you have problems.

If the technology transfer committee is going to be made up of people from the federal government, forget it, it is not going to work. If you are really sure and you have identified the agencies as the people you want to transfer this technology to, you should get them on the technology transfer committee right from the word go. If you cannot, you do not have a technology transfer. If they want to succeed, get them involved right from the beginning.

E. A. GODBY: In the proposal put forward by Josef Cihlar, there was a group set up which consisted of both federal and provincial people. There was no intention to attempt to conduct this kind of activity at the federal level alone. I agree that it is impossible.

J. THIE: I want to emphasize the point you are suggesting. I am not sure whether we have actually dealt with that issue. How do you get a provincial man representing provincial interests on a committee like this, on an operation or a unit like this? Would Alberta or Ontario be prepared to second one? I do not think it works that way. The only way we can assure that is if we make two or three man-years available at federal government expense and have interchanged people in there from a centre for one or two years. I think that is the way you can deal with that issue because otherwise we cannot get a provincial employee in a federal position.

E. A. GODBY: It is an interesting concept.

J. C. HENEIN: I suspect these four people will indeed have to spend a lot of time away from Ottawa. It may be that they would have to be away and would not be able to show us the results for at least a year. They would have to appoint someone to this program planning office who would be willing to relocate themselves in a number of provinces. Unfortunately, we do not have enough people so there would have to be some pre-selection on a visiting basis. They would have to go and work there in order to understand the problems and they would not be able to formulate a plan before having discovered the change agents, the real issues, the match, etc. That is not going to be done overnight. It could be that they will spend at least a year and then come back and formulate the plans.

J. THIE: Spend the year with whom and where?

J. C. HENEIN: In the province. You have in a province, two or three resources and sometimes only one is major. You could say that in B. C., there is only forest but it is not really true. You have forest and you have hydro-power. If you want to deal with those two, you have to go and spend time with the departments in charge of these two resources.

An interesting thing is the role of the provincial centre in this process. The way one might see this is that the provincial centre is just as much an intermediary as we at CCRS are. We are in the same position. Neither of us is an end user. The way we see it is as a triangular relationship where the foremost is the end user. In this case - to continue the example of B. C. - I would say the B. C. Forest Department and B. C. Hydro. That is one end of the triangle. It should be the senior end, the more important end of the triangle. Somewhere down below there should be the federal government pushing this technology up. The third summit of the triangle is the provincial centre which can help a great deal in many ways. They can guide us as to where to begin and what to see from their own knowledge of the resources in the province. They can help a lot with logistics and physical arrangements. They can help a lot, as they have, in organizing seminars and can help disseminate the success stories when they happen, and in case of failure, what lessons were learned.

To answer your specific question of with whom we deal with, we deal with the end user and we team up with the provincial centre in doing so.

J. THIE: Why would you train a federal man to get that expertise? Why do you not get a provincial man to sit at your committee? It would be a lot faster, a lot better and you would get your technology transfer at the same time.

J.C. HENEIN: There is no objection to this in principle. It might have been wrong assumption on my part that the fountain of knowledge is in Ottawa, but I meant that you need someone who knows the technology and someone who knows the resource. There is no objection, if that can be arranged in any way, - of a provincial person being appointed to this office. In fact, that would be ideal.

J. THIE: The irony of the whole situation is that everybody thinks it is ideal but do not know how to do it. Are we prepared to put up a couple of man-years for it? In the federal government, we are not because we think it is the provincial responsibility to do that. Is the province

prepared to do it? No. We are stuck and that is what we are continuously faced with in this technology transfer program.

C. BRICKER: I cannot see having a federal govenment employee out in the provinces doing business and telling them how to study their natural resources. This is one thing we have gone through for years now. All the know-how does not reside in Ottawa in spite of what they think down here. It would be better to get something organized in the provinces in cooperation, and not to have someone tell us what to do. This is one of the problems we have been having.

E. A. GODBY: What is one of the problems you have been having?

C. BRICKER: One of the problems we have been having for a number of years is that people from Ottawa are coming out there to tell us this. Provincial involvement, know-how and cooperation are far better than sending somebody out there, setting themselves up as a representative of CCRS or the federal government and telling us how to do remote sensing. We want to get provincial centres set up, run by provincial people in cooperation with you.

E. A. GODBY: That is certainly what is intended.

J. BARRY: You have to get rid of this "stay away, I do not want to get swayed" attitude. You need an intermediary person.

E. A. GODBY: My own feeling is that it is absolutely inconceivable that anything would be done in the province of Alberta without Cal Bricker's complete support and cooperation. If anything else is coming across, it certainly is not what was intended by anything that has been presented to now.

J. C. HENEIN: Has the mechanism of exchange programs been envisaged at all? The picture that seems to emerge is that only the province knows what it needs. The thing to do would be to present the information to the provincial resource managers and let them choose what they feel is acceptable and useable.

In order to break this barrier, why not bring the representative from the province and have him participate with the federal representative to exchange programs and ideas. I am just putting forward the suggestion that these

exchange programs might be considered as a way to solve these problems.

E. A. GODBY: We did give an example of a technology program. It was probably a learning experience in getting some of the remote sensing products used in a range management context. That did involve a lot of cooperation. We were the ones who had to produce the products. We had to give special priority to providing a real time service. This meant that we had to get the data, translate it into tapes, get it down to Ottawa, produce the products and get them out to the rangeland people in time. It did not mean that we had to identify a need. We had to identify an approach. We had to decide what the federal government, through CCRS, did and what the environmental people did. As a matter of fact, we conducted a very successful project. The only problem is that it strained us to the limit. We really feel that that kind of cooperative effort ought to be a bit more routine than it is and in each case we would want to play the role that we can play best. As I say in this case, it was providing a product, working with the prople in the field to see whether it was good or not, deciding if it can be improved and turning out an improved product. That is the way I see it working except that right now we are very limited both in terms of manpower and funding to do that kind of thing.

J. I. SNEDDON: Are the Alberta Centre for Remote Sensing and the Ontario Centre for Remote sensing achieving what they would like to see happening in terms of technology transfer?

E. A. GODBY: As Cal Bricker has told you, they were obviously doing an extremely good job, but what we would like to see is more actual demonstration projects such as the rangeland project that we worked with Cal on. The problem is that it was not possible for Cal to do that alone. It required certain things of the people who were able to produce the data. It required that we gave special priority to it, that we used our image analysis system to produce the products, that we provided some funding and that we provide some people. In that sense, the only way that that could happen was with a cooperative effort. It was not possible for us to do it alone and it was not possible for Cal to do it alone. In order to do the demonstration, it required the combined efforts of three organizations and that is why we did it. That is quite often the case.

R. LAWFORD: I had the good fortune of taking a tour of the Ontario Centre for Remote Sensing and the indication there was that the provincial people could actually carry out applications with the expertise they had in-house and not have to rely on the federal government. I do not know if that is an appropriate way of doing this. I would like your comment on it.

E. A. GODBY: It is very appropriate and the extent to which a province is self-sufficient in this is all to the good. Of course, the Ontario Centre works in a much different way than the Alberta Centre. They are all autonomous and they all work in their own particular ways. They eventually do take on projects, and they actually charge for their services. They get funding for their salaries alone. The rest of the jobs they get have to be funded by whomever they do the job for. It imposes quite a discipline on them and they are very successful.

The way we support them is by trying to provide the products they need in a timely and reliable fashion. It is also possible that we could work out, again, a demonstration project with them where there are particlar needs that they have that we could fill in order to help them, whether it is in priortiy in getting data or special products that they may not be able to produce themselves.

J. I. SNEDDON: Further to that, should we be looking toward establishing more of these types of centres across the country, providing support with federal man-years to help them get established, or providing financial support to establish these centres?

E. A. GODBY: The idea of providing financial support does not go. When we first set up CCRS, we had in our original plans money to support the establishment of remote sensing centres in the provinces. That was agreed to in principle and was finally turned down on the basis that when you do that kind of thing you tend to change the priorities of the provincial governments. Their attitude is if you have some money to throw around, give it to us and we will decide what to spend it on. It may not be a remote sensing centre. We did not have any success in that. I do not think that we would get anywhere in trying to get money to support remote sensing centres, but we do support that concept any way we possibly can other than by providing actual cash.

L. CARLSON: We seem to find a bit of problem in that the province manages the resource and we develop the technology and it is difficult to get the two together. It has been said before, but what would be wrong with going to an area where we actually manage the resource and do a pretty large demonstration? For example, in the Northwest Territories we are involved in the direct management of the resources. It may be an excellent technology transfer to that region and it could be a show case of something that we have and that the manager has control over. If you are going to a province the key man in the province should be the one who runs the project.

E. A. GODBY: I would entirely agree with you on that. As a matter of fact, I did mention in the particular project that we had with Alberta that that is the way it worked, but it was a fight to get the rangeland manager to take on the project. He wanted CCRS to do it and we would not. I entirely agree that that is the proper way to do it. As for implementing federally supported programs in the Northwest Territories and the Yukon, that is certainly another possiblity. I do not think that we would rule it out nor would we limit this office from supporting such demonstration projects.

J. CIHLAR: We have put forward a proposal that have recommendations and questions of rather specific nature and we have touched on some of them in the discussion but we have not really pinned them down.

W. BAIER: Have we come up with a strong conclusion about this technology transfer problem? I would suggest that after one and a half days we have had quite a discussion on the fact that more attention should be paid and more effort awarded to support this proposal which is going to Cabinet. I am worried that we have not done enough homework so that this will be accepted. Would you go along with a strong conclusion?

E.A. GODBY: If you would like to state your conclusion, perhaps we could see if there is a general agreement on your statement that there has to be much more technology transfer effort put forward and that we have to have more discussion on the ways that this could be carried out. Although we do not, at the moment, have the common elements of everybody's feeling on this, I hope that we will be able to do this in going over the transcript of the meeting.

I thank you all for attending this workshop. The meeting is now adjourned.

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