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SCIENTIFIC PERSONNEL  
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## SCIENTIFIC PERSONNEL INTERCHANGE

### INTRODUCTION

The federal government has, for a number of years, been concerned with the general level of national R&D effort and in particular industry's level of R&D activity. In response to this concern, the government has introduced a number of R&D initiatives aimed at stimulating industrial R&D effort. These initiatives have taken several forms ranging from general R&D tax incentives to the implementation of specific government policies and programs.

The federal government's Contracting-Out Program, one of these initiatives, has been in effect for several years. This program provides not only for a significant expansion of the research market for private research organizations and consulting companies but also fosters the development of closer interaction between the government and private sectors. This type of program, together with other initiatives following the federal Cabinet's decision in 1978 to further encourage technology transfer between the two sectors, is seen as a mechanism for increasing industry's capacity to respond to national R&D needs as well as to seize new opportunities in high technology fields. The identification of a target of 1.5% of GNP for the national R&D effort is another indication of the government's commitment to increasing scientific and technological capabilities in general.

The government, while recognizing the need for an increased national R&D effort and capacity, has also noted that further efforts must be made to insure that maximum benefit is achieved from both our existing and increasing future expenditures on science. To this end, a number of reviews of existing programs and mechanisms, geared to the transfer of technology from government to industry, have taken place or are presently underway. Within the context of a broad examination of government-industry technology transfer processes (MOSST report - Technology Transfer from Federal Laboratories to Industry), personnel transfer was identified as a valuable component in many instances of successful technology transfers. Consequently, MOSST undertook to examine further the potential for increased personnel exchanges between government and industry, focussing initially on an existing program, the Interchange Canada program, which is administered by the Public Service Commission.

During the course of the study it was concluded that there would be difficulties in employing Interchange Canada or some potential subprogram, in many of those cases where technology transfer was the *raison d'être* of the desired interchange. Accordingly, the study was expanded to look at other existing and possible new mechanisms for the interchange of personnel and any impediments that might exist to their implementation, and also to examine the increased use of existing mechanisms for technology transfer as alternatives to such interchanges

#### PURPOSE

The object of this study is to examine the adequacy of existing mechanisms for the interchange of personnel between the public and private sectors in a technology transfer context and thereby determine if there is need for new interchange mechanisms that are more effective and flexible.

#### METHODOLOGY

The project commenced, in the fall of 1980, with discussions between MOSST and the Interchange Canada Office of the Public Service Commission. These discussions led to an agreement between the two organizations whereby the Interchange Canada Office would collaborate with the Ministry in an assessment of the need to develop a new or expanded program under Interchange Canada.

It was also agreed that both client groups for such an initiative would have to be canvassed, namely the appropriate federal government departments and private sector companies. Due to obvious limitations, it was decided that the most appropriate method of canvassing the private industry clientele was through their industrial associations.

The major science departments were contacted and sounded out as to their views on the use of "personnel interchange" as an instrument for achieving technology transfer. (A list of those departments contacted is contained in Appendix A). The departments were also asked to suggest those industrial associations which represent the companies that would form the nucleus of each department's clientele.

As well, sixteen industrial associations were solicited for their opinions as to the value of such a mechanism in helping to further technology transfer. (A list of Associations contacted is contained in Appendix B. A copy of the MOSST letter soliciting their comments is contained



in Appendix C). Of the sixteen associations contacted, five provided detailed comment on the proposal, the remainder responded in more general terms.

As discussion progressed with federal government departments and industrial representatives on the potential use of personnel exchange programs in fostering technology transfer, it became evident that the personnel exchange mechanism could most usefully be examined within the wider context (beyond the Interchange Canada program) of alternative mechanisms for technology transfer. Consequently, the scope of the study was broadened to encompass these alternative mechanisms.

#### PERSONNEL INTERCHANGE OPTIONS

##### Interchange Canada Program

Interchange Canada, originating in 1971, was initially established as an executive education program to promote closer relations between the federal public service and the business sector through the exchange of executive personnel. These temporary work assignments were meant: to develop greater understanding and co-operation between participating organizations in the public and private sectors; to broaden the experience of participants through work in other organizational environments; and to facilitate the diffusion of knowledge among professionals in the two sectors. Later, the program was expanded to include other sectors such as: academia; municipal, provincial and foreign governments; and, more recently, international organizations (U.N., NATO, OECD, etc.).

Prior to 1978, the program was restricted to senior executives. After that date, program practices were altered to better reflect changing government policy and MOSST recommendations aimed at enhancing the government-industry interface. The program now provides for the exchange of personnel at the PM 5 (or equivalent) officer level, or higher, and has placed more emphasis on the exchange of information, ideas, skills and technology.

The administration of an interchange agreement is straightforward and done with a minimum of red tape. An individual on interchange continues to receive his or her salary from the home organization, without interruption in either seniority or the benefits that might otherwise have accrued during the period of the assignment. The salary and benefit package is reimbursed by the host organization on a quarterly basis. A federal department, sending an employee on an interchange assignment does not lose the person-year and may use that person-year during the employee's absence.

When a department hosts an individual from the private sector, it must have a person-year or an Executive Complement available, whichever is appropriate. At the completion of the assignment, which normally lasts from one to three years, the individual returns to his or her home department without any loss of tenure. The agreement is in the form of a contract letter that is signed by the individual, the deputy minister, the Chief Executive Officer of the outside organization and by the Director General of the Management Category Programs Branch of the PSC. Each contract letter contains an agreement by the host organization not to offer permanent employment to the individual on assignment either during, or following, the period of assignment.

An interchange assignment may be initiated by a manager, a potential nominee or an outside organization. In all cases, the Interchange Canada Office is to be advised in writing about the job requirements, location and other pertinent data concerning the assignment. This is usually handled by the department's Interchange Canada liaison officer. The Interchange Canada office may identify candidates through internal inventory, through MRIS (Management Resources Information System) or through referrals from contacts both inside and outside the government. Managers may also identify candidates they may wish to consider for interchange. All public servants who are considered for assignment must have a fully satisfactory rating preferably for the past three years. They must also have the support of their departments before accepting an assignment. More specifically, the Deputy Minister must guarantee the employee a position at the same level upon termination of the assignment. Consequently, departments are strongly encouraged to plan carefully for the re-integration of the participant. The usual screening practices are employed by the staffing organization. The Interchange Canada Office, as a final step, prepares an agreement document for the signature of the three parties concerned. (A sample agreement is attached as Appendix D).

An examination of the Interchange Canada program, done by MOSST in 1978, brought out some interesting data concerning the use made of this program by the government and industrial scientific communities in Canada. During the period 1971-77, there was a total of 76 assignments of government personnel to industry. Of this number 15 were judged to be of a scientific nature.<sup>1</sup> In the opposite direction, of a total of 204 assignments, none were deemed to be natural sciences related.

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<sup>1</sup>Personnel from one of the scientific occupational groups within the scientific and professional category.

Between 1978 and 1981, the federal government sent 77 individuals to the industry sector on assignment; of that number five were in scientific (3) or engineering (2) areas. Industry, on the other hand, sponsored 68 assignments to the federal government, including 21 assignments for scientific purposes. These statistics are presented in a summary table below.

<u>INTERCHANGE CANADA PROGRAM</u>			
	<u>1971-77</u>	<u>1978-81</u>	<u>Total</u>
Gov. to Industry			
- scientific	15	5	20
- total	76	77	153
Industry to Gov.			
- scientific	0	21	21
- total	204	68	272

A total of seven federal scientists have recently been on interchanges, the three identified above, plus two who have had assignments with universities and two with international agencies. The three candidates who went with industry stayed, or will be staying, with the host organization after completion of their terms. Although a specific technology transfer function could not be identified in connection with these seven interchanges, the assignments were arranged, in each case, primarily because of the candidate's recognized capability in a specific field. Accordingly, each assignment has been for the purpose of transferring government technical capability (rather than technology) to another sector.

#### DOC Program

The Department of Communications operates its own departmental personnel exchange program designed to meet the needs of both the department and its clientele -- the DOC Industrial Exchange program. Its objective is "to develop and stimulate communication, understanding and working relationships between the Department of Communications and industry/university".<sup>2</sup>

The selection of exchange assignments is aimed at satisfying an operational need while at the same time exposing personnel to working experience in the other sector. The program operates very similarly to the Interchange Canada program in terms of its administrative arrangements.

Under DOC's program, exchanges usually have a one to two year duration and are most often oriented to general technology transfer, though more specific targets and

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<sup>2</sup>Based on discussions with, and written material provided by, the Department of Communications.



assignments of shorter duration are possible. In recent years the number of assignments has averaged six per year with some attempt to maintain a balance between the numbers of outgoing and incoming assignments. These exchanges have tended to involve more senior scientists, usually at the RES 2 or ENG 4 levels, and research managers.

During recent years, this program has provided support for various professors from Canadian universities to spend time with DOC, and for Telesat personnel to work with DOC technical staff in developing applications for the 12-14 gigahertz channels that have been incorporated into the ANIK B communications satellite. In addition, it has allowed departmental personnel to take up assignments with Telesat.

The basic elements of DOC's industrial exchange agreements encompass the following:

- the employee remains on the payroll of the parent organization and is entitled to all salary increases, vacation and sick leave and other fringe benefits while on exchange;
- the parent organization arranges recovery of the salary cost from the host organization;
- possible employee removal expenses may be paid by the host or parent organization or may be shared;
- other expenses during the exchange are borne by the host organization;
- the employee's hours of work, statutory holidays and travelling expenses are governed by the regulations of the host organization;
- participants in the program are subject to the rules and regulations applying to the protection of information and conflict of interest; and
- the employee's performance while on exchange is evaluated by the host organization and provided to the parent organization.

The resource implications of this program, as with the Interchange Canada program, are of two types - dollars and person years, (including Senior Management Complement and Senior Personnel Authority). Briefly stated, when a departmental employee goes to the private sector on an assignment his salary cost is recovered by his home department; the department retains the person year and thus may replace the departing employee for the duration of the assignment; the departing employee is guaranteed an equivalent position (group and level) upon his return. In the case of an employee from the private sector coming to the federal government on an assignment the department must provide the person-year and reimburse the employee's home company for his salary cost.

NRC Incubator Program

The NRC initiated a program in 1979, identified as the Incubator Program, to assist companies with the R&D they require related to their major development activities. Under a formal agreement, the NRC will assist companies by providing laboratory space, support facilities, and technical expertise for a company representative to spend up to three years working at the NRC laboratories. As the company continues to pay the salary and salary-related costs if its employee, the NRC is not faced with any person-year problems. The industry representative becomes a "guest worker" at the NRC for a designated period.

This program was established in response to problems faced by many small, usually high technology companies which can find survival difficult in the Canadian economic environment. In order to become and remain competitive in a field where technology is advancing rapidly, these companies must devote a considerable portion of their expenditures on R&D. The Canadian market is seldom large enough to support the cost of this R&D, and in high risk situations it may be difficult to obtain funding to support the necessary market development, both domestic and export. This program thus fills a gap in the types of assistance provided by the federal government by giving direct technical assistance to the company concerned. Other assistance programs are often not effective for such companies if the companies are not yet sufficiently profitable to take advantage of tax incentives or write-offs, or are too small to afford the specialized equipment and facilities required to keep abreast of changing technologies.

Very little publicity is presently given to the Incubator Program. Accordingly, its availability has become known largely by word of mouth, and contractual arrangements for a specific assignment have usually evolved directly from on-going interaction between the company and NRC scientists. This approach has resulted in a rather informal administrative mechanism for the program. Nevertheless, the NRC considers that an effective screening process is essential in selecting candidates. The success of an assignment, and hence of the program itself, is felt to be very much dependent on the type of person sent by a company to the NRC. The individual must be fully aware of the company's technical capabilities and business activities and also the company's strategy with respect to new product development. In addition, progress reviews of the work should be held, at a senior level, at no more than 6 month intervals.

NRC considers that this program could be adapted to departmental needs but feels that no advantage would be gained in trying to manage the program as a centralized

federal program, as has been done with PILP. If this were done, the program's feature of being an informal, but direct government (NRC) to company interface, would be significantly reduced, if not lost altogether. However, the Incubator Program could be an effective prototype on which to model specific departmental programs.

#### Other Programs

Other departments have developed various working relationships with industry. For example, several of the Agriculture Canada (AC) laboratories, in particular those involved in food technology, work closely with the food processing industry. Industry representatives are regularly located at the AC laboratories to carry out R&D on some topic of interest to the company involved. Agreements are drawn up to cover the period that the company representative is located at the departmental laboratory. On occasion, the transfer of a specific technology will be involved, such as that associated with a piece of equipment - a food blancher, for example - that has been developed by the laboratory and is being turned over to a potential fabricator. The approach followed by AC thus parallels in many respects that followed in NRC's Incubator Program but is described as being even less formal.

The Department of Fisheries and Oceans (DFO) makes laboratory facilities available so that industry representatives can carry out R&D on problems of interest to the industry, and take advantage of resident expertise at these laboratories for guidance and advice in designing and performing the necessary R&D. Arrangements, like those made by AC, are quite informal although contracts are negotiated for each assignment to define the responsibilities and degree of involvement of each party.

In addition, most departments permit, and, in certain instances, foster sabbatical leave, or leave without pay, in order to allow departmental representatives to work in industry, or at a university, for short periods of time. Arrangements for each assignment are made on an ad hoc basis whereby terms and conditions are negotiated specifically to fit the situation. Although not necessarily oriented to technology transfer, such arrangements are frequently made to permit a specific capability or technology to be made available to a company by having the member of the departmental laboratory spend time with the company. The number of personnel involved annually in such arrangements vary widely from less than 10 for one department to about 70 for another.

Departments (AC, EC and DFO are examples) have on a number of occasions allowed laboratory staff to take educational leave in order to obtain additional post-

graduate training. Such arrangements are designed to strengthen the scientific capability of the laboratory so would not be identified as technology transfer mechanisms.

A discussion of the possible role of personnel interchange as an instrument of technology transfer would not be complete without reference to certain additional alternative mechanisms that can be used. This point was made repeatedly during the course of discussions, and in correspondence, with both federal government departments and industrial associations, including individual company representatives. The comments made, while not specifically directed or limited to the interchange proposal, were nonetheless central to the main reason for this study, that of improving the government's existing technology transfer efforts. These comments identified other existing forms of interaction between government and industry whereby technology transfer can occur, or areas where expanded co-operative activities might profitably take place.

Those mentioned were: joint or shared-cost projects, joint government-industry conferences, workshops, open-houses, seminars, departmental newsletters and specialized annual publications; programs providing industrial access to government facilities where no comparable industrial facilities exist; and formal government sponsored programs such as Contracting Out, Unsolicited Proposals, PILP-COPI, and Contracting-In.

Such forms of interaction are already familiar and therefore need no detailed elaboration here; but will be discussed in relation to personnel interchange in the following section.

In addition, the new guidelines for net voting, developed by the Office of the Comptroller General and presently awaiting Cabinet approval, may offer some science managers more flexibility in allocating resources and thus add to their existing capability to respond to increased demands from industry for government assistance.

## DISCUSSION

### Departments

All departments supported the concept of increased interaction with industry. From their perspective, any proposal that would help to foster a better understanding between the two sectors would have merit. This understanding would not only involve the general environment in which the other sector worked, but would also encompass the role that R&D plays within an industrial setting. As well, the cross-fertilization of ideas resulting from such exchanges would improve the national science effort by

expanding and making better use of the existing knowledge base.

Federal R&D activities, however, embrace a spectrum of activities ranging from basic research, oriented specifically to the department's mission, to development activities which could have direct commercial application. There is, thus, a similarly broad range in potential for interfacing with industry by, for example, implementing personnel interchanges. In this regard, departments with regulatory responsibilities, while supporting the concept of personnel interchange, pointed out the potential conflict of interest which may preclude exchanges between certain of their organizational units and some industrial groups. In at least one instance, this matter had previously been discussed between the federal department and its industrial counterpart, and both parties agreed that such a relationship would not be appropriate. In general, most departments, undertaking R&D oriented to their mission, would have few spin-off results that could be transferred to industry for potential commercial development. Nevertheless, certain departmental R&D establishments will have more potential for technology transfer and the related scientific personnel interchange than others. Table 1 provides a preliminary breakdown on this basis and, without attempting to be definitive, identifies those federal R&D activity areas, plus the locations at which they are carried out, that have either led to personnel interchanges in the past, or have the potential to do so.

Table 1 shows that eight departments and three agencies carry out R&D in at least 34 establishments that has been the focus for specific personnel interchanges, or could be in future. The R&D activities include the longer term research that would be of background interest to an industry sector -- expanding or enhancing its technological base; they also include the development of product or process technologies which could be utilized by a company after further development and production engineering. Examples of the first type of activity include research on communications, and mining and mineral processing; and of the second, Telidon, synthetic aperture radars, and the processing of specific mineral ore bodies.

Of the organizations listed in Table 1, DOC and NRC, as previously noted, have well defined personnel interchange programs. Others, like DND and AECL have strong interfaces with their respective industries in their traditional areas of concerns -- interfaces that do not necessarily put a strong emphasis on personnel interchange as a technology transfer mode. Some, however, could usefully consider the advantages of augmenting and formalizing their personnel interchange activities (e.g. CANMET at EMR, and Fisheries and Oceans).

Table 1: Federal R&D Establishments with Effective Interface with Industry

<u>Department</u>	<u>Type of R&amp;D Activity</u>	<u>Location</u>
Communications	Satellite Technology, Communications, Radar	Ottawa
Energy, Mines and Resources	Mining, Extraction Metallurgy, Mineral Processing, Metals Reduction, Coal, Energy, Remote Sensing, Mapping and Surveys	Calgary, Edmonton, Elliot Lake, Ottawa, Quebec
Transport	Telecommunications, Electronics, Transport Development	Ottawa, Montreal
National Defence	Defence Research Environmental Medicine	Suffield, Ralston, Ottawa, Downsview, Valcartier, Dartmouth
Agriculture	Engineering, Food Processing, Tobacco Processing, Hybrid Corn Production	Summerland, Swift Current, Morden, Ottawa, Kentville
Fisheries and Oceans	Oceanography Mariculture Mariculture	Patricia Bay, Victoria, Dartmouth.
Health and Welfare	Food Production	Ottawa
Environment	Forestry, Sensing Techniques	Ottawa
<u>Agency</u>		
National Research Council	Biotechnology, Building Research, Mechanical Electrical Engineering and Electronics, Engineering, Aeronautics, Natural Sciences, Industrial Materials	Saskatoon, Ottawa, Halifax, Montreal, Vancouver.
Atomic Energy of Canada Limited	Power Generation, Commercial Products	Whiteshell, Chalk River, Sheridan Park, Ottawa
Canadian Grain Commission.	Grain Research	Winnipeg



It should be noted that the R&D activity areas, identified in Table 1, in no case, comprise the total R&D effort of the establishment, but, in certain instances, are the predominant ones. Other areas of R&D, such as fish processing technology, and forest regeneration and protection, might also come to be added to this list in the future. In the former case, extension of the ocean resource management zone to 200 miles has resulted in major increases in the total volume of fish for which the government is responsible. This could require a greater involvement of the domestic fish processing industry which would, in turn, necessitate a better interface between this industry and the relevant federal R&D activities. In the latter case, forest management in Canada is currently in a state of transition in that provinces - the forest resource managers - are examining the benefits of having industry assume a greater portion of this management responsibility. This could also lead to an increased level of interaction between the forest industry and federal R&D activities. In another area, all departments are increasing their level of expertise in computer sciences and programming; this could lead to extensive interactions - including personnel interchanges - with industry.

For those departments, with which industrial interchanges would be appropriate, the duration of assignment was frequently identified as a problem. Several departments expressed the view that, in many cases, shorter exchange assignments (less than one year) would be both more attractive and practicable than the minimum one year period presently existing under the Interchange Canada program. In particular, one department expressed interest in exchanges of less than one year whereby industry personnel would be assigned to the department's regional establishments. It was the opinion of a number of departments that some of their establishments are somewhat isolated from the global scientific community, and that visiting scientists would act as stimulants to the regional staff, help them to keep abreast of the latest scientific developments, and thus assist in improving the establishment's programs. Other departments with regional laboratories would also be expected to be interested in such an arrangement, especially if budgetary systems were made flexible enough to provide for non-routine expenditures.

In some federal establishments, resource constraints are considered a limiting factor in any attempt at increasing the number of scientific exchanges between the federal and private sectors. The shortage of trained manpower, in particular, increases significantly the impact of lending out a scientist for a period of one to three years. In other instances, the impact on dollars and person-years of hosting a visiting industrial scientist was thought to be considerable.

Departments with personnel on exchange, especially those operating their own program, such as DOC, may run into imbalances in person-years. This issue could be significant for a small departmental research organization but should not be serious at the program level. Lapsing person-months accumulated over the year due to such factors as staff departures, and delays in staffing, should be sufficient to offset any imbalance. In order to minimize this problem a centralized pool of reserved person-years on a departmental basis may be desirable.

The NRC Incubator Program represents an alternative whereby an industry representative can be located at the NRC for a designated period of time as a "guest worker" under terms of a contract which provides for access to the laboratory and covers use of the NRC laboratory space and facilities. It does not cover the salary of the industry representative who continues to be paid by his company. Under the circumstances person-years are not a factor.

At least two departmental spokesmen stressed the importance of developing strong links between an interchange mechanism and the departments' other technology transfer activities. It was their opinion that the interchange program and the other technology transfer activities should be managed as a coherent set. This combined approach would facilitate the planning process and hopefully help overcome some of the resource constraints. Additionally, such a management approach would further underline for the benefit of participants and potential client industries the importance being attached by management to technology transfer activities within an organization. It would also be expected to reduce the incidents of individual external secondments for reasons other than those intended.

Departmental discussions indicated that considerable use was being made of the major federal technology transfer mechanisms initiated in recent years. Such programs as; the Contracting-Out Program, the Unsolicited Proposals program, and PILP-COPI were some of the key instruments in passing on federal expertise to industry. These programs have the added advantage of providing direct financial support to the companies involved. This financial element is frequently the critical ingredient in making a technology transfer opportunity successful. Prime examples are the records of the Department of Communications and NRC.

A considerable number of less formal methods of government-industry interaction are used by departments to transfer technology or to assist industry in technology development. While they often involve little direct

resource expenditure, these methods are judged by departments to be successful and significant. They include such things as: the loan of personnel for short periods of time; the loan of equipment and other facilities, including ship and aircraft time; responding to both general and specific requests for information and advice; sponsoring or supporting conferences, seminars, and workshops at both the national and regional levels; submitting for publication learned articles, and producing specialized publications and newsletters; and in some cases publicizing future program plans for industry information and comment.

Another popular mechanism to transfer expertise has been the use of joint or shared-cost projects. This approach has several distinct advantages, the principal ones being close interaction of personnel, an agreed objective, and an identifiable commitment of resources.

The use of "contracting in" has also been a helpful means of assisting industry. Subject to the normal provisions with regard to the guidelines on direct competition with industry, several departments have frequently entered into service contracts with private companies to provide such things as equipment rentals and ship and aircraft time in addition to straight service work. This mechanism appears to function reasonably well, especially in those instances where the demand has been predictable. When this has not been the case some departments have either had to absorb the impact of these additional demands within their own resource allocations with subsequent reductions in their own ongoing activities, or else turn down some of industry's requests for assistance. The administrative and resource implications of using the "contracting in" mechanism, are discussed in greater detail in the MOSST report, The Provision of Government S&T Services to Industry. 1981.

Two other methods of technology transfer between government and industry were mentioned by departmental spokesmen. In one case, a department runs its own training course for specialists and this course is open to candidates from the private sector. Another organization has used the "leave without pay" mechanism to permit the temporary transfer of government personnel to a private company for the purpose of assisting in the development of a new technological capacity. This method appears to have been used discriminately and for periods of usually three to six months.

### Industry

Most industrial respondents also agreed in principle that increased exchanges, at the working level, between the two sectors could not help but be of benefit to the overall

climate of our national science effort. Industry perceived considerable advantage in bringing government scientists into their establishments. From their point of view, this exposure would help to make government scientists more sensitive to industry's work environment and hopefully their needs. In this way, government scientists would be in a better position to identify industrial opportunities during the course of their own work and, whenever possible, pursue work having industrial spin-off, if not direct industrial application.

Several spokesmen from industry voiced concern about the general lack of trained scientific manpower in Canada. The effects of these shortages were further magnified by the staffing competition that exists between the two sectors for those trained personnel that are available. This scarcity of scientists and researchers was also seen as a serious constraint on private companies, especially the smaller ones, to "free up" personnel for interchanges with government. Consequently there appeared to be considerable interest within industry in arrangements which would facilitate the flow, if only on a temporary basis, of government scientists to industry, but fewer expectations of personnel flows to the government sector.

There was also some concern, within industry, with regard to the length of the assignments. It was thought that a term of one to three years was unnecessarily confining for some types of exchanges. Shorter term assignments were thought to be more appropriate and in many cases much more attractive. It was further recognized that individual opportunities should properly dictate the length of assignments and that they could expect terms to vary from case to case.

A number of industrial respondents also raised the question of the importance of management's role in successfully implementing a serious exchange program. In their view, the benefits to be derived from individual exchanges must be real and be perceived to be important by both the organization, and the individual proposed for outside assignment. In particular, the individual going on assignment must be assured by management that his stay outside his home organization will not be detrimental to his career development but, in fact, be considered an asset.

Many industry representatives foresaw difficulties in overcoming some of the barriers inherent in the temporary movement of personnel, and in the matching of personnel factors in choosing the most appropriate employees for outside assignments. These obstacles were judged to be very significant in the case of smaller companies or companies having limited R&D capacity. The barriers included such things as relocation costs; housing purchases,

sales, and rentals; salary disparities and cost of living factors; benefits packages; taxes; educational dislocation; performance appraisal and promotion; and position upon return to the home organization. The matching of personnel factors encompassed such considerations as: skills; age; experience; position; and marital status.

Perhaps the single most frequently raised comment by industry dealt with the question of technology transfer opportunities. Aside from a few specific high technology areas, such as space, communications and some ocean related sectors, in which the federal government plays a leading role, industry was less convinced than government of the number of "hard" government-originated opportunities for technology transfer. It was their perception that the bulk of government science expenditures was directed at scientific data gathering in support of its natural resource management responsibilities and related activities, or basic research which is often in support of the same responsibilities. In their view, very little of the government's scientific expenditure is aimed at areas which are of direct interest to industry, and thus the opportunities for rapid technology transfer to industry are limited. Several spokesmen suggested that it would be helpful if government departments were to develop lists of discrete technology transfer opportunities and either publicize them widely throughout the appropriate industrial sector or contact selected companies directly. Departments might make greater use of seminars and workshops, as well as publications, to publicize their industry-oriented R&D activities, especially those carried out by establishments (Table 1) that have good potential for interacting with industry. They felt confident that where "hard" opportunities existed, the industrial sector would respond quickly.

Publicity regarding industry-oriented R&D activities could be handled by the departmental establishment carrying out the work, by the department, or on a government-wide basis. Because of a possible direct interface between the performer of the R&D and the potential user, undoubtedly the greatest impact would result from publicity - in the various forms possible, but especially that involving the use of seminars and workshops - provided by the establishment itself. Nevertheless, this approach could be impractical in the case of certain departments, EMR and AC for example, which have several establishments carrying out R&D activities in related fields. For these situations, departmental identification would provide better coverage, but would lose the advantage of direct contact.

In this regard, it should be noted that the department, or establishment, would have to undertake the initial identification of any R&D results that are considered to be

of potential interest to industry; this could not be done as effectively by someone outside the department. All departments should be encouraged to handle such an identification, as well as subsequent phases of the technology transfer process in a uniform way. This is not necessarily the situation at present, for example, with respect to either the level, or technical orientation or capability, of the responsible officer(s). In addition, an evaluation of the technology would be required to determine what development work is still required before commercialization is possible. Accordingly, while some interdepartmental coordination of these activities is possible through the PILP office at NRC, the basic responsibility for the identification and pursuit of technological opportunities must lie with the departments.

The question of confidentiality of information and security of patent rights was a frequently recurring topic of concern throughout the discussions with industry representatives. This concern, in large part, revolves around the situation where personnel of one federal department might be interacting with several companies working in the same sector, all of whom are in a competitive situation. Some industrial spokesmen correctly pointed out that many companies are already operating under these same conditions, both when they participate in several of the government's industrial incentive programs and when they frequently lose their staff to other competitors. Consequently, this appeared to be a situation with which companies should be capable of coping.

A number of industrial representatives with first-hand experience working with federal departments on scientific matters mentioned the attractiveness of the joint or shared-cost project approach to technology transfer; this is being used to an increasing degree by PILP. Such an approach has a mutually agreed objective, a definite time frame, a commitment of resources by both parties, and a high degree of interaction between personnel. The sharing of resources can take any number of forms, but usually involves some mix of expertise, personnel, dollars, equipment and other facilities, sometimes including ship or aircraft time, etc. Industry generally favors this approach because it focusses on an identifiable product, with a quantifiable cost, within a known time-frame.

As an alternative to the more structured means of interaction, industry spokesmen suggested that greater use be made of some of the less formal mechanisms. Those industries which have already established a close professional working relationship with their federal counterparts have also indicated a high degree of satisfaction with the assistance that they are already receiving. It is their belief that these useful ties should be expanded as far as possible across the broad spectrum of



industrial activity. To this end they have proposed increased initiatives on the part of federal departments to organize or sponsor joint government-industry conferences, workshops, open-houses, seminars etc., on both a national and regional basis as a means of better informing industry of ongoing government activities and possible new industrial opportunities. It was felt that such initiatives would be most helpful to those companies who either did not have offices in Ottawa or near other centres of scientific activity or have had little, if any, previous contact with government agencies. Short newsletters or succinct annual publications devoted to reporting on scientific work underway in government departments were also considered beneficial means of "getting the message out" and thus hopefully stimulating industrial interest to take better advantage of government expertise.

More than a few spokesmen from industry expressed considerable interest in any mechanism which would provide them with greater access to government facilities. Joint or shared-cost projects, previously mentioned, have been one way of increasing this access. Outright loans of equipment, and some "contracting in" situations have also provided access. This assistance was gratefully acknowledged and appreciated especially in some high technology sectors where aircraft and ship time was involved. In instances where no comparable private sector facilities existed, the government's co-operation was seen to be crucial.

#### General

There appears to be a genuine concern, within both sectors, as to the national shortage of skilled manpower. This shortage has two dimensions; supply and size of complement. More than one industry spokesman complained that of the limited number of trained personnel available in Canada, the federal government had a disproportionate share and was offering stiff competition in new recruitments. The supply problem, from the perspective of both sectors, is further exacerbated because of the additional time required to supplement the university training of new recruits by providing them with hands on experience prior to their becoming productive contributors to the organization's R&D efforts. As a generality, both sectors also perceived the size (manpower) of their existing establishments as a significant constraint. The temporary absence of one scientist can often translate within many organizations, into a real staff reduction of twenty to fifty percent. The implications of manpower shortages go beyond the question of numbers by often seriously affecting what a research organization can do and, equally, how it can do it. This limitation was one of the chief reasons why more than a few industrial spokesmen expressed interest in a mechanism which

would provide them with an opportunity to acquire experienced personnel from the federal government, if only on a temporary basis.

The importance of the role that management plays in successful technology transfer was emphasized by several spokesmen in both sectors. On the government side, it is thought that success begins with the identification of technology transfer as an integral element of an organization's objectives. From there, the planning and budgetary system must provide for this activity within the organization's overall operational plans at both the project and program levels. Specifically this would involve budgeting, wherever possible, for sufficient manpower and dollar resources to meet anticipated interaction with industry, of both a formal and informal nature, at the project level. This interaction would encompass such things as the provision of advice, short term visits to or from industry, managing and directing contracting-in or out situations, and write-ups for information dissemination, etc. At the program level, budgeting for more formal, or longer-term interaction is desirable to meet the resource demands stemming from an organization's participation in long-term secondments, joint projects, contracting-in or out projects, publications, and in sponsoring workshops, seminars and conferences, etc. The added focus gained from the identification of technology transfer activities within an organization's operational plans helps underline, for all levels of the organization, the importance of, and commitment to technology transfer--thereby reinforcing the individual's personal commitment and heightening personal motivation.

#### CONCLUSIONS AND RECOMMENDATIONS

Both the government and industry representatives agreed in principle on the usefulness of personnel interchange mechanisms to help foster greater technology transfer from the federal government to the private sector. But at the same time comments were made by both departments and industry spokesmen which would appear to restrict the broad applicability of such mechanisms, at least at the present time.

A formalized, general purpose interchange program such as Interchange Canada or a modified version aimed at providing an "educational experience" is of limited interest to R&D based industry. Only those industrial organizations with large research units, and thus with considerable flexibility in staffing, can afford the luxury of sending a staff member on interchange for a couple of years. Nevertheless, the Interchange Canada program is recognized as an effective instrument for longer term exchanges of a more general, educational nature and this orientation should not be decreased.

Two departments have formalized personnel interchange programs geared primarily to technology transfer -- DOC and NRC. Although most of the other science departments have various informal approaches to personnel interchange, certain of these departments (some of those in Table 1) could usefully consider formalizing or enhancing such personnel interchange activities. These are departments (or establishments within departments) whose activities focus on the enlargement of the technological base of a sector (minerals processing, for example), or lead directly to product or process technologies that can be further developed by industry for commercial production to satisfy markets in government (defence products, traffic control systems), non-government or abroad. The purpose of formalizing such a program within a department would be to increase the visibility and effectiveness of a vital component of the technology transfer process.

Specific interchange programs could be established by a department by utilizing the DOC model and would involve little more than submitting a proposal to Treasury Board, and at this stage, probably also to the appropriate Cabinet Policy Committee. To minimize any problems of person-year imbalances arising from such a program, departments may find that a centralized pool of reserved person-years for the interchange program would be desirable. In addition, the department should take full advantage of the financial and person-year management opportunities offered by the guidelines on net voting have been proposed by the Office of the Comptroller General, but are still awaiting Cabinet approval. Accordingly, there do not appear to be any major impediments to establishing a program similar to that organized by DOC.

If, however, departments have a resident expertise in a specific field and wish to assist industrial firms to develop such a capability, they might consider using the NRC Incubator Program as a model for their own programs. Under such an approach, industry representatives could spend a designated period of time at a departmental laboratory under the terms of a contract which covers use of space and facilities but not salary (the individual would continue to be paid by his company). In this situation, there would be no person-year problems, but reciprocal arrangements to permit a departmental representative to spend time at a company laboratory might prove more difficult to arrange.

Industrial spokesmen were less convinced than were government officials of the number of "hard" government-originated opportunities for technology transfer available to industry. However, this view was less prevalent among the high technology industry sectors, such as space, communications and oceans, in which the

government's existing efforts are both considerable and highly visible. Other industry sectors were more inclined to perceive government science activities as being oriented primarily to supporting the government's responsibilities in natural resource management, to setting and enforcing regulations, and to undertaking basic scientific studies, and less to directly supporting industrial effort, or to carrying out activities of specific interest to industry. In many sectors, this perception is reasonably accurate. Much of the federal government's scientific effort is mission oriented, but in the opinion of departmental representatives, this type of scientific work frequently offers industrial opportunities. In addition, the federal government has, in the last few years, significantly increased its level of R&D activity in several areas which lead to identifiable industrial opportunities.

In the federal government sphere, some departments expend considerable effort disseminating information on their scientific activities. Aside from the requisite annual reports, there is a whole array of information exchange mechanisms available that are being used to varying degrees by government departments. They include such things as: general and specialized publications and newsletters; contributions to professional journals; the sponsorship of workshops, seminars and technical conferences; and formal and informal interactions between organizations and individuals.

Despite these existing federal efforts there still appears to be a need for further improvement in communication between departments and their clientele as underlined by comments from industrial spokesmen, and by some perceptions of possible industrial opportunities held by government officials but frequently not shared by industry. On this latter point industry representatives strongly suggested that government departments be more forceful in publicizing the results of R&D activities of those establishments, such as those identified in Table 1, that have had, or have good potential for an effective interface with industry. This publicity might be achieved either by special publications or through direct contact (through seminars, workshops or meetings, for example) with those companies operating in the relevant field. In this regard, the establishments carrying out the R&D - or the department if more than one establishment is involved - should handle the direct publicity, especially that involving seminars and workshops. In addition, publicity that is compiled on a government-wide basis, on the technological opportunities emerging from intramural government R&D activities would help define the extent to which personnel interchanges are needed and appropriate.

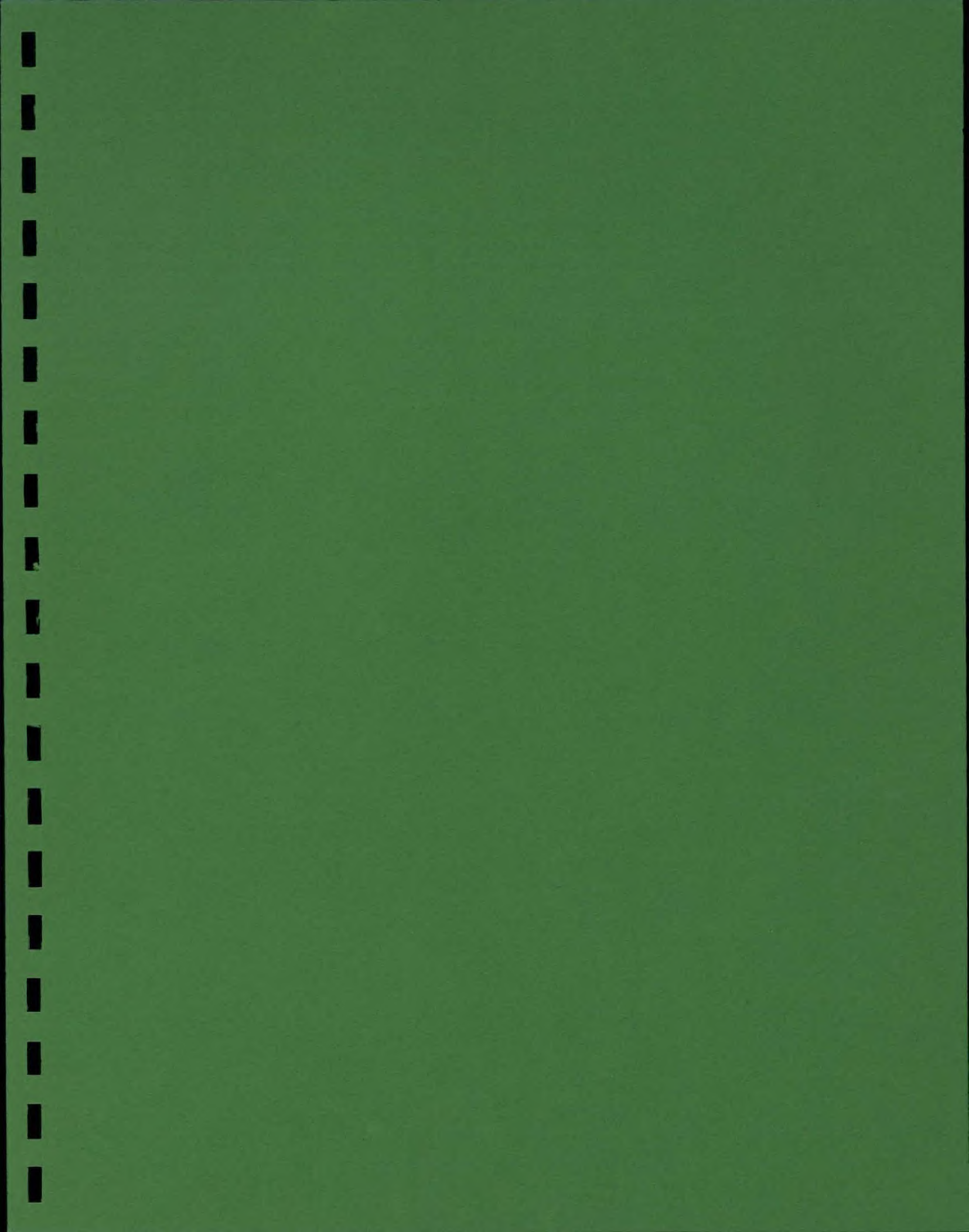
A further advantage in having the R&D establishment handle the publicity is that a more effective contact can be established with the particular industry group concerned. This point was stressed with respect to departments' regional facilities as it was felt that such contact could be beneficial to both the industry and government representatives. Once such a contact is established and mutual interest reached, both parties would then be in position to decide upon the most appropriate mechanism to effect the technology transfer. The use of short-term personnel exchanges was thought by industry to be a viable mechanism under such circumstances. Accordingly, regional industrial liaison officers in the relevant departments should be given the responsibility for identifying technology transfer opportunities, and specifically those that might lead to personnel exchanges.

Based on an examination of inputs obtained from both departments and industry associations, no significant policy changes are considered to be required to bring about a more effective utilization of personnel interchange as a mechanism for enhancing the transfer of technology between the government and industry sectors. Only better, or more widespread, use of existing mechanisms would be needed, and it is therefore recommended that:

1. the Public Service Commission should maintain the Interchange Canada program in its present format, which is oriented to the purpose of personal improvement and career development, but in order to enhance its applicability for improving personal skills in a scientific context, and thereby improving the program's usefulness to scientific personnel, the Commission should consider giving the S&T component of the program greater weight and visibility - in line with the government's emphasis on the importance of science and technology, generally, and of the transfer of technology between sectors, in particular;
2. certain of those departments with establishments undertaking or supporting R&D activities that are explicitly related to industry (e.g. CANMET at EMR and Fisheries and Oceans), including longer term R&D relevant to an industry sector, direct development of new technologies for market, and the provision of services and facilities to industry, should develop, or enhance their own interchange programs oriented specifically to technology transfer - the DOC Industrial Exchange program would be an effective model for those specific departmental programs; and

3. those science-based departments and agencies with significant R&D programs which provide results of potential interest to industry should identify full time, qualified project managers who would have the responsibility of compiling potential projects for technology transfer, categorizing the projects as to their readiness for transfer, identifying the role that personnel interchange should play, and interfacing with PILP to develop the necessary government-wide focus for these transfer projects and to identify prospective industrial clients for further developing and commercializing the technologies. In developing such a focus, the departmental project managers, coordinated by NRC through the PILP program office, should submit annually to MOSST an evaluation of these potential projects for technology transfer showing what action is being pursued, including scientific personnel interchanges, for their exploitation.





SCIENTIFIC PERSONNEL INTERCHANGE

APPENDIX A

Federal Departments and Agencies Consulted

Department of Agriculture  
Department of Communications  
Department of Energy, Mines and Resources  
Department of Environment  
Department of Fisheries and Oceans  
Department of National Health and Welfare  
Department of National Defence  
Ministry of Transport  
National Research Council.

Scientific Personnel Interchange

APPENDIX B

National Industrial Associations Consulted

The Canadian Advanced Technology Association  
The Canadian Chemical Producers' Association  
The Mining Association of Canada  
Canadian shipbuilding and ship Repairing  
Association  
Canadian Steel Industry Research Association  
Air Industries Association of Canada  
Canadian Seed Growers' Association  
Petroleum Association for Conservation of the  
Canadian Environment  
Canadian Food Processors Association  
Canadian Pulp and Paper Association  
The Canadian Manufacturers' Association  
Pharmaceutical Manufacturers Association of Canada  
Canadian Oceans Industries Association.  
The Society of the Plastics Industry of Canada  
Arctic Petroleum Operatos Association  
The Coal Association of Canada

SCIENTIFIC PERSONNEL INTERCHANGE

APPENDIX C

MOSST Letter Soliciting Comments.

March 4, 1981

Dear

Over the past few years, the federal Ministry of State for Science and Technology (MOSST) has been examining ways to encourage technology transfer between laboratories in the public and private sectors. Though there are various methods for exchanging knowledge and expertise between the two sectors, the transfer of personnel is being recognized more and more as one of the most effective mechanisms. The movement of scientific and technical personnel from the place of origin of a technology to the place of its application can occur by means of secondment, temporary transfer or interchange of the employees involved.

MOSST, in conjunction with the Public Service Commission of Canada (PSC), is currently examining the feasibility of establishing an improved or broader mechanism for the interchange of laboratory scientists between the public and private sectors. In this connection, a number of industry associations are being contacted to ascertain the need for such a program, and also to obtain some idea about the most favourable sort of circumstances under which scientific and technical personnel could benefit from each other's experience. It will also be useful to identify the types of impediments which may be encountered in administering such a program.

...2

270 Albert Street  
Ottawa K1A 1A1

270, rue Albert  
Ottawa K1A 1A1

Briefly, the major objective of such a program would be to enhance technology transfer and improve the interface between government and industry through the interchange of scientific and technical personnel between the laboratories of the two sectors. An appropriate program for such an interchange might, we feel, be developed under the aegis of Interchange Canada, which is administered by the Public Service Commission of Canada and has been in operation since 1971. Interchange Canada is now oriented primarily to executives, within and outside the federal public service, and provides them an opportunity to extend their experience beyond the limits of their own sector.

The subsidiary scientific and technical interchange program within Interchange Canada would emphasize the improvement of communications and the exchange of technological know-how and expertise between the public and private sectors. The principal criteria for making assignments under such an interchange program would be that:

- (i) the program should be aimed at "working" scientists, preferably at bench-level laboratory scientists;
- (ii) the interchange should be tied to the organization's program as well as to individual career development;
- (iii) the home organization should fully sponsor the participant by guaranteeing the individual a position at the same or equivalent level upon his or her return; and
- (iv) the duration of the assignment should not normally exceed three years.

We would be thankful if, through the offices of your association, you would be able to provide input to this proposal. In particular, we would like to find out the views of your membership on the need for and usefulness of such a program, the areas in which it might apply, and the most favourable sort of circumstances under which scientific and technical personnel in the two sectors would benefit from each other's experience. I would appreciate it if you could provide us with a contact point in your association. On hearing from you, we will undertake to arrange a meeting

between the relevant officials of your association and the project officers from MOSST and PSC (Mr. Colin Macpherson at 613-996-8304 and Mrs. Sylvie Dufresne at 613-995-1141) for the purpose of discussing this project in greater detail. As we would like to complete our meetings with the industry sector by the end of March, an early response would be greatly appreciated.

Yours sincerely,

D.R. Stephens

MAILING LIST

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Mr. Alex C. Dick  
Manager  
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M5E 1J9

Mr. E.R. Evason  
President  
The Society of the Plastics Industry of Canada  
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Mr. Stan MacKay  
Artic Petroleum Operators Association  
c/o Frontier Planning Department  
Esso Resources of Canada Ltd  
500 - 6th Ave S.W.  
Calgary, Alberta  
T2P 0S1

Mr. Garnet T. Page  
President  
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T2P 0N8

SCIENTIFIC PERSONNEL INTERCHANGE

APPENDIX D

Interchange Canada Sample Agreement



Public Service Commission  
of Canada

Commission de la Fonction publique  
du Canada

Senior Executive Programs  
Branch

Direction générale des programmes  
de la haute direction

SAMPLE AGREEMENT  
(English version)

Interchange Canada  
and International Programs

Échanges Canada  
et Programmes internationaux

Interchange Canada  
Agreement

Protocole d'entente  
Échanges Canada

The following sets out the agreed terms and conditions covering the assignment of Mr. Smith from Associated Industries Limited to the Department of Industry, Trade and Commerce in Ottawa.

It is agreed that Mr. Smith will report for duty on or about June 29, 1981, and that his assignment will be for a period of two (2) years with provision for extension subject to the agreement of all parties or to early termination with three months notice from any of the parties. Mr. Smith will be performing the duties of Director with the Department of Industry, Trade and Commerce.

It is agreed that Mr. Smith will continue to receive his salary and benefits from Associated Industries Limited. The Department of Industry, Trade and Commerce undertakes to reimburse Associated Industries Limited the sum of \$45,000 per annum and to increase this amount by any increase that may become due to Mr. Smith under Associated Industries Limited's salary system, during the period of the assignment. Arrangements for effecting this reimbursement may be made directly between Associated Industries Limited and the Department of Industry, Trade and Commerce through the Director General, Personnel Branch, Department of Industry, Trade and Commerce.

It is agreed that the Department of Industry, Trade and Commerce will pay for the removal expenses for Mr. Smith and his family from Toronto to Ottawa according to the Treasury Board Relocation Directives. Associated Industries Limited will pay for their return to Toronto at the conclusion of the assignment.

It is agreed that within six months of the commencement of this assignment representatives of the Public Service Commission may call upon Mr. Smith and his superiors at the Department of Industry, Trade and Commerce to discuss progress on the assignment and the specific objectives that have been established.

The Department of Industry, Trade and Commerce agrees to supply Associated Industries Limited, on request, with an evaluation of Mr. Smith's performance and with a record, on a regular basis, of all leave taken by him.

It is agreed that the assignment shall be considered to be "employment" for purposes of the Official Secrets Act and Mr. Smith will be bound by Section 4 of that Act regarding wrongful communication of information, etc. It is also agreed that the Conflict of Interest Guidelines shall apply to Mr. Smith and that declaration of actual or potential conflict of interest shall be made prior to the commencement of the assignment.

As required by the regulations governing the Interchange Canada Program, it is agreed that Mr. Smith will return to Associated Industries Limited upon termination of the assignment and that no offer of continuing employment will be made to him by the Department of Industry, Trade and Commerce.

To confirm understanding and acceptance of the terms and conditions of this agreement, all parties have signed in the appropriate spaces below.

\_\_\_\_\_  
President  
Associated Industries Limited

\_\_\_\_\_  
Deputy Minister  
Department of Industry, Trade and  
Commerce

Date: \_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_  
Interchange Participant

\_\_\_\_\_  
J.Y. Ranger  
Director General  
Senior Executive Programs Branch  
Public Service Commission of Canada

Date: \_\_\_\_\_

Date: \_\_\_\_\_

