# TECHNOLOGY DEVELOPMENT: THE CONTINUING STORY IN CANADA

#### Andrew H. Wilson

Just over three years ago, in June 1984, the government of Canada received the report of its task force on federal policies and programs for technology development (the Wright report). Three months later, this (Liberal) government was defeated in a general election. In its election platform, and during its first months in office, the new (Progressive Conservative) government appeared to favour the kinds of measures and approaches recommended by Wright and his colleagues. Since then the picture has been somewhat confused. On the one hand, there have been changes in policy, budget cuts and some reorganisation affecting federal science departments and agencies. On the other, there have been more programme studies, some programme changes, and increasing emphasis placed on the participation of the private sector in co-operative R & D. This paper looks back to the recommendations of the Wright report and to what has happened to them under the new government. The paper concludes that the report was timely, that it had a positive influence on some of the new government's actions, but, like other similar reports, its impact was diminished by events. The paper also concludes that the Wright report's main thrust — the improved management of federal activities in technology development — has been set back by budget and other cuts and changes.

Keywords: technology policy, technology development, Canada

# INTRODUCTION

The report of the task force on federal policies and programmes for technology development<sup>1</sup> was the principal one of three discussed in a paper published in this journal in June 1985.<sup>2</sup> Its companions — one from the Science Council of Canada and one from the Standing Committee on National Finance of the Senate<sup>3</sup> — were included at that time to show the similarities and differences between the observations and conclusions of contemporary reports covering approximately the same ground. This present paper will, however, deal with only the Wright report since it was the only one of the three

to attract much public attention. It was, in fact, widely hailed in the weeks and months following its publication by individuals, firms and associations in the private sector for having provided the kinds of guidelines needed to make public policy initiatives in support of technology development in Canada more effective.

Wright and his colleagues were asked by the minister for science, technology and economic development in November 1983 to examine the effectiveness of the federal government's efforts to promote technology development in Canada and, in particular, to explore four areas of special concern:

- the effectiveness of the government's industry-support programmes for science, technology and related activities;
- the effectiveness of government procurement of technologyintensive products;
- the effectiveness of the university-industry interface; and
- the effectiveness of the government's intramural scientific and technical activities.

In its report, however, the task force made it clear that it saw its mandate as dealing with technology and not with science. The engineering backgrounds and business experience of the members of the task force helped emphasise this point. They also spoke of 'technology' in an all-inclusive sense and, except for the section of the report on procurement, made no reference to 'high', 'low' or any other kind of it. Technology, they said, should be used to create something useful.

The task force based the ideas it put on record on three principles that it said applied to both government and industry:

- the need for much more intelligent risk-taking;
- the need for much more active enterprise; and
- the need for much better overall management.

The task force saw no reason why all three of these principles could not be applied within the federal government simultaneously. At the same time, it called for better strategies for the allocation of funds to technology development rather than simply for the allocation of more funds. It emphasised the greater effectiveness of demand-driven development over the supply-driven kind. It said that the vast majority of industrial innovations were not so much new as novel adaptations or applications of proven technology. It had serious reservations about the unevenness of the federal government's involvement in the different parts of the innovation chain, and was concerned that the mandates of federal departments and agencies for technology development were no longer clearly enough defined. It was also concerned about the reluctance of federal laboratories to abort or abandon projects of doubtful worth. The best criterion for judging the success or failure of a government programme was the support, or lack of it, shown by its clientele. The task force was deeply conscious of the importance and pervasiveness of the socio-economic problems that could result from technology development, but considered that its own mandate would preclude all but passing references to them. It recommended that others be asked to examine these problems.

The Wright report reached the (Liberal) government in June 1984, just as John Turner became prime minister, appointed a new minister for science and technology, and called a general election for the first week in September. As usually happens, science and technology policy was not a major topic of discussion during the election campaign, nor did it contribute to the incumbent party's defeat or the Progressive Conservative party's victory. The new government of Brian Mulroney took office in mid-September. Tom Siddon — a former university engineering professor and Opposition science critic in the House of Commons — was appointed to the science and technology portfolio and was given a seat on the powerful Treasury Board. He therefore became the first minister to be actively responsible for the implementation of the recommendations of the Wright report. The new government took the report's first recommendation seriously namely, that the process of implementation be initiated immediately. However, as time passed, other problems, other studies and policy decisions diluted this process, and added some confusion to it.

The new government's sympathy for the private sector was more pronounced than that of its predecessor. But like its predecessor, it was having to face up to the problem of the size of the federal deficit. Cuts would have to be applied as a matter of priority, and more results would be required from the expenditure of the remaining dollars. In the months that followed, two other policy matters gained in prominence on the government's agenda — the possibility of a freetrade agreement with the United States, and the need to reach agreement with the provinces on the constitution that would lead to Quebec signing, as the others had done in April 1982. All of these matters absorbed the attention of ministers.

Before dealing with the Wright recommendations in detail, it would be useful to look briefly and chronologically at a number of events and pronouncements that have had some influence on them and on science policy generally at the federal level. Also, a comment should be made that federal and national science policy in Canada are not now necessarily the same thing. Over the last dozen years some provinces have developed policies of their own. The events that unfolded between 1984 and 1987 have led to the beginnings of national policy, of which the federal one is only part, albeit the largest.

# POLICY DEVELOPMENT CHRONOLOGY

Promises made during election campaigns are just promises. Fulfilment after taking office is often quite another matter. Two of those made by the Mulroney Conservatives during the run-up to the 1984 general election are worth noting in the context of policy developments since then. One was that, during their first term in office, they would double all government research and development (R & D) spending and significantly increase private sector spending, with the result that the 'GDP percentage' figure for Canada would rise from around 1.25 to 2.5. The second was that, during the first two years of the mandate, all of the existing R & D programmes would be overhauled along the lines recommended in the Wright report. These two years have passed and only some programmes have been changed. The 2.5 per cent target has been forgotten, except when the Opposition thinks to use it against the government. Meanwhile, the government has not been idle.

Siddon asserted about the time he took office that he favoured a five-point science strategy that would include:

- a doubling of R & D spending;
- the building up of Canada's science and technology capabilities on the basis of existing strengths;
- the devising of better ways to get innovative technologies to market;
- direct government incentives to small research companies; and
- a reorganisation of the entire management of R & D policy.<sup>4</sup>

In late October 1984, Siddon said he was well aware of the problem the government would face in trying to get the private sector to increase its R & D expenditures. He favoured tax incentives, and a larger role for government purchasing in the encouragement of technology development. With regard to the National Research Council, he said a case could be made for a careful re-evaluation of its mandate since the council would be likely to play a larger role in the management and leadership of technology development, although it would not receive significant budget increases.<sup>5</sup>

On 10 October 1984, the minister of finance, Michael Wilson, announced a moratorium on the issuing of the so-called 'quick flip' investments under the scientific research tax credit (SRTC) introduced by the previous government only nine months earlier. Using the quick flip, a company performing R & D and earning tax credits for it could sell these credits to outside investors in exchange for funds that could be applied to the R & D work. Many companies had successfully augmented their R & D funds in this way, but others had abused the system and performed no R & D with the flipped funds. The moratorium was put in place because the rate of abuse had become alarming. Deals already in progress were, however, not affected. On 8 November 1984, Wilson delivered an economic and fiscal statement to the House of Commons. It was also a political statement, but it made clear that the federal deficit was the government's main problem. The minister said that, following a Treasury Board assessment of expenditure reduction and revenue recovery measures, significant deficit-reducing steps would begin in the next fiscal year, and would continue. He said that further recommendations to improve federal programmes and services would undoubtedly come from the Ministerial Task Force on Program Review, set up in September under Deputy Prime Minister Nielsen, and of which he was a member.

Wilson's statement to the House was accompanied by a lengthier document with more details and discussion, including a section on R & D, innovation and technology diffusion. It made mention of the Wright report's recommendations. It also said:

We must establish the appropriate climate for increasing industrial R & D commitments by rationalising the present tax and grant support system. We must examine the array of programmes which has accumulated over the years without a comprehensive strategy. Canada already has some of the most generous incentives supporting R & D in the western world, yet our industrial R & D is forecast to decline in real terms this year. Given our commitment to expenditure restraint, we must seek better use of existing industrial incentives as well as non-fiscal measures to improve the effectiveness and market relevance of Canadian R & D efforts. Simply spending more dollars may not be the answer; indeed, it could be counterproductive if poorly focussed.<sup>6</sup>

Also in November, Siddon was asked for his reaction to the Wright report. He responded:

Very positive. We plan to issue a response early in 1985. Because the private sector seems to be under-investing in R & D, you can't solve that problem by pouring more government resources into government laboratories and assume a catalyst for product demand will bubble forth. As Dr. Wright and his colleagues identify, we have to start with a market driven system of priorities and then consider the necessary supply of fundamental research needed to meet these market expectations.<sup>7</sup>

The promised response was never made public, though its substance was undoubtedly covered in the minister's speeches.

In November 1984 the government tabled the budget cuts it was proposing for its programmes for the next financial year. These cuts were the first of a series that affected the federal laboratories, and the National Research Council especially. Siddon was asked about the NRC, and said: Its traditional role has been to provide support to industry, such as testing laboratories and large scale sophisticated apparatus such as wind tunnels and nuclear accelerators, things unaffordable to individual firms because of the huge capital cost. We've told the NRC that we want its facilities which are quite elaborate and cost the federal government more than \$500 million a year — to be used more effectively in interfacing with industry.<sup>8</sup>

In February 1985, Siddon met with his provincial and territorial counterparts to begin discussions of a national policy for science and technology. A working paper was prepared to aid their deliberations. Its thrust was economic development, and it made a number of references to the Wright report.<sup>9</sup> At this meeting, the ministers agreed that the national policy should have three principal objectives:

- to strengthen private sector innovations;
- to encourage the transfer and application of technology; and
- to develop the long-term competitiveness of Canadian industry by supporting basic scientific research.<sup>10</sup>

Siddon announced in March that the Natural Sciences and Engineering Research Council (NSERC), which is the major university funding agency, would receive an additional \$20 million in its 1984-85 budget, to be used to respond to some of the hundreds of applications for research equipment it had received. NSERC's budget for the year would then be \$312 million. Siddon emphasised that this allocation, in a time of general restraint, showed that the government was serious about supporting research.<sup>11</sup>

Wilson's first budget was presented in late May 1985. Several of his proposals affected federal R & D activities, including general cuts in the public service. Subject to certain 'grandfathering' provisons, the SRTC program was terminated. A few weeks later, Siddon published a small brochure emphasising the positive aspects of the May 1985 budget in order to help overcome the increasing criticism the government was receiving for its handling of science policy.<sup>12</sup> One of the papers that accompanied the first Wilson budget was the initial report of the Nielsen task force on programme review.<sup>13</sup>

In June 1985, a strong rumour arose that the government intended to carry through one of the Nielsen task force recommendations to the effect that the work of the Science Council of Canada would be redirected to focus it more sharply and that the resources available to it would be reduced.<sup>14</sup> In late July the government confirmed its intentions, roughly halving the budget (to \$2.5 million) and the staff. The Council was still free, within the limits of its new resource levels, to pursue its customary think tank activities. Also in June 1985 the Natural Sciences and Engineering Research Council published its second five-year plan. It called for increased funding from the level of \$312 million in 1984-85 to \$703 million (in constant Canadian dollars)

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by 1989-90. The rationale behind this proposed increase was summed up this way:

If economic renewal is, in fact, to be built upon 'R & D, Innovation and Technology Diffusion', then an up-front investment of this magnitude in new talent and new knowledge is an essential prerequisite. The challenge has to be addressed with the same priority and commitment as has been given to energy self-sufficiency. Yet the incremental *five-year* funding sought by this plan to sustain our research capacity in an increasingly demanding technological world is less than that spent on frontier drilling incentives in *any one* of the past years.<sup>15</sup>

The National Research Council also published a new five-year plan in 1985. By this time, the first major restraints on the NRC's programmes and laboratory activities were in place. The plan was therefore modest in its requests for additional funding and staff. The plan emphasised the council's economic and social roles and proposed a series of changes to strengthen these. The document was extensively and defensively detailed and designed to show the government how well the council was adapting to its new circumstances.<sup>16</sup>

Siddon and his provincial and territorial counterparts met for the second time in September 1985 and reviewed progress towards a national science and technology policy. The ministers agreed to convene a representative forum in the spring of 1986 for an open discussion of policy issues. Abruptly, on 20 November 1985, Tom Siddon was replaced in science and technology by a Cabinet newcomer, Frank Oberle. Prior to entering federal politics, Oberle had been in business in central British Columbia and had served as mayor of his town. In Opposition in the House, he had served as critic for mines, forestry and Indian affairs. Since September 1984, he had served as parliamentary secretary to the minister for mines.

Finance Minister Wilson brought down his second budget in February 1986. It included a 2 per cent across the board reduction in federal spending. In the R & D field, the principal measure affected NSERC and its two sister granting councils (for medical and social science research). Their base funding was to be effectively frozen for the next five years, but the government would provide additional funding to match private sector contributions up to a certain limit.

On 11 March 1986, Deputy Prime Minister Nielsen tabled in the House of Commons the 21-volume report of the task force on programme review. The report was organised on the basis of one volume for each of 20 study teams, together with an introductory volume. The package amounted to some 7,000 pages of text. Even before the full report appeared, the government had begun to implement recommendations, and this process has continued. In view of the scope of the subject matter, its complexity and interrelationships, the fact that study team recommendations were not always accepted and task force ones were not always made public, and the fact that Nielsen effectively left politics in the summer of 1986, it will be some time before the full impact of this massive piece of work can be assessed.

Also in March 1986, the House of Commons appointed, for the first time, a standing committee devoted to research, science and technology. Chaired by a former professor of geology, this small committee immediately began taking an active interest in its subject and began talking to people working in the field. The National Science and Technology Policy Forum, which the thirteen ministers had agreed to convene, took place in Winnipeg in June 1986, under the management of the Science Council. Two hundred delegates from industry, labour, the universities and the public sector attended, among them Wright. The Science Council subsequently published proceedings which included summaries of the discussions. The final paragraph of the summary of the concluding plenary session said:

Delegates were unanimous on the need for science and technology to have a more senior status and a more prominent place in the federal decisionmaking process generally. The area is so crucial to Canada's future that it must have a 'champion at the top' to guarantee the emphasis it deserves in the setting of national policies and priorities.<sup>17</sup>

In October 1986, John Polanyi of the University of Toronto won a share of the year's Nobel Prize for chemistry. A rare event for a Canadian scientist, this award helped to highlight the difficulties being experienced by research people in Canada under the Conservative government, and especially those in basic research and in the universities. A good public speaker at any time, Polanyi used the new opportunities well. In particular, he warned that young scientists, especially, would leave the country if money for academic research dried up, as it appeared to be doing. The media also made much of the fact that the section of NRC in which Polanyi had begun the work that led to the prize was being phased out as NRC cut back its activities to meet its new budget and staff levels.

A Throne Speech was also read during October 1986. These speeches are a little like election ones, full of promises. This particular one did, however, make promises which have been kept, or are very likely to be. For example, it promised the establishment of a National Advisory Board for Science and Technology (NABST), with the prime minister in the chair. This promise was kept. It promised a Canadian strategy for science and technology, and this was later unveiled under the title of 'InnovAction'. And it promised a space agency, to draw together various federal activities in this field. At the time of writing (July 1987), the discussion is not about 'if' but 'where'.

In November 1986, in the wake of the concerns raised in government, industry and among the general public about recent budgetary reductions within the National Research Council and the way the council had handled them, Oberle appointed a three-person task group to look into this from the point of view of the possible effects on the health and safety of the public, the relationship of the reductions to the council's five-year plan, and the internal management procedures used within the council for making the reductions. The federal, provincial and territorial ministers met for the third time in December 1986 to discuss the outline of the proposed national science and technology policy. They agreed at this meeting to establish a Council of Science and Technology Ministers, which would play a key role in the implementation of the national policy.

The first meeting of the National Advisory Board (NABST) was held on 16 February 1987, with the prime minister as chairman and Oberle as deputy chairman. Most of the other board members were from industry or the universities. They included Wright and Polanyi. The board's task, in very general terms, is to provide the prime minister with expert advice on national science and technology goals and policies and their application to the Canadian economy. The board will meet three times a year.

On 4 March 1987, Mulroney made a major speech at the University of Waterloo which was devoted to R & D, innovation and science policy. Waterloo is one of Canada's leading engineering and science institutions and Wright is its president. During his address, he covered the recent meeting of NABST, the need for more industrial R & D and technology transfer, the need to watch the level of government spending, and the need to know that government laboratories are effective. Near the end of his address, the prime minister said:

I am fully aware that everyone looks to the federal government as the key barometer, especially since [it] spends about \$4 billion a year on science and technology, by far the biggest commitment in Canada. In contrast, the provinces directly fund less than \$400 million in R & D. Even in Ontario, the federal government funds 38 per cent of all R & D conducted in the province — the province funds about three per cent. The facile approach to our science and technology dilemma is simply to have the federal government spend more borrowed money. Yet as several studies have clearly shown, while we need to spend more on science and technology, such spending by itself is not the answer. The long term answer involves all of us — the federal government, the provinces, the private sector, the universities, the research community, all Canadians.<sup>18</sup>

On 12 March 1987, Canada's first formal national science and technology policy was signed in Vancouver by the thirteen ministers. The one-page document includes a single-paragraph statement which says that the policy has been designed to bring science and technology

fully to bear on the economic, social, cultural and regional development of the country by encouraging co-operation among governments, and between the public, quasi-public and private sectors. As noted above, the Council of Minsters will guide the implementation of the national policy, but their decisions will also need the approval of the Council of First Ministers (the prime minister and the premiers). At Vancouver, the Council of Ministers set up seven working groups, chaired by federal and provincial public servants, to prepare reports on R & D spending, strategic resource technologies, assistance for science and technology, technology transfer, basic research, the social/cultural impact of science and technology, and science and regional development.

Twelve days later, at a conference sponsored by the *Financial Post* in Toronto, Oberle unveiled the Canadian strategy for science and technology. The 'InnovAction' strategy seeks to focus federal science and technology activities and initiatives in five specific areas:

- industrial innovation and technology diffusion;
- strategic technologies (such as microelectronics, biotechnology and advanced industrial materials);
- the management of federal resources;
- human resources; and
- public education.

During his speech in Toronto, the minister explained that 'InnovAction' was a federal initiative designed to operate within the broad parameters of the national policy adopted in Vancouver. In particular, 'InnovAction' had been designed to focus on a 'practical and coherent agenda of science and technology'. In the succeeding months, he and his Cabinet colleagues would be announcing specific actions and programmes.<sup>19</sup>

The three-person task group appointed by Oberle to examine the budget cuts and decisions at the National Research Council reported to the minister in late February. For the purposes of this paper, its contents will be discussed later, in the section on the federal laboratories. On 18 June 1987, Wilson presented his proposals for tax reform to the House of Commons. The minister noted in his speech that firms performing R & D in Canada would continue to benefit, under tax reform, from one of the most favourable regimes in the industrialised world. With the exception of a minor change affecting buildings used for research, the current incentives would not be changed.<sup>20</sup>

# THE WRIGHT REPORT

It could be argued that the Wright report was well timed for the new Mulroney government in September 1984. It provided a starting point.

It was written by private sector people for a government that put more emphasis on this sector, its initiatives and potential, than did the previous one. But the new government quickly found itself between the rock of inadequate support for R & D and the hard place of the size of the federal deficit. The deficit won and, three years later, little new money has been committed to R & D. But, of course, Wright said this would not be needed if the management of the federal policies and programmes for technology development is to be placed on a better footing. The real problem is management.

Over the past three years, the Wright report has been slowly but surely slipping from the scene. The Nielsen task force and the budgets, as well as the policy initiatives of 1987, have been more visible. And Wright had nothing to say, for example, about the SRTC. It was too early to comment. On the other hand, a good many of the Wright recommendations have been acted upon. The sections that follow review these recommendations briefly and then discuss the action taken in the four areas of special concern. They are followed by a very brief note on socio-economic problems and a commentary which summarises the main points in the paper.

#### Support Programmes

The task force discussion centred on four programmes: the technology portion of the industrial and regional development program (IRDP); the defence industry productivity programme (DIPP); the industrial research assistance programme (IRAP); and the programme for industry/laboratory projects (PILP). The first two were the responsibility of the department of regional industrial expansion (DRIE), and the second two of the National Research Council. Tax incentives were also discussed briefly.

The task force praised IRAP and PILP, was critical of IRDP, and had no strong views on DIPP. The main criticisms were in regard to administration and evaluation procedures, overlap and the tendency of bureaucrats to want to minimise risks. The task force also wanted more decisions on applications for assistance to be made locally. It wanted the IRDP programme transferred to NRC and recommended that a ministry (such as science and technology) should thoroughly review the programmes.

These programmes were studied in some depth by the Nielsen task force study teams, which used the Wright report as input information. In the May 1985 report, the Nielsen people drew attention to the problems of overlap, especially IRDP, IRAP and the tax incentive system. Some overlap was also found between IRDP and DIPP. Projects funded under DIPP were to be redirected into the defence field, as had been originally intended. And industry was to be given a stronger voice in general management decisions relating to industrial R & D assistance programmes.

The March 1986 report of the study team on services and subsidies to business reviewed the programmes in greater detail. It concurred with the Wright report regarding the IRDP-IRAP merger, but went further and suggested that PILP should join them. It saw the NRC's industrial development office (IDO) playing a stronger role in the coordination and management of the merged programmes, but suggested that it should have the benefit of the advice of a strong representative group drawn from the programmes' clientele.

The three-way merger of the programmes has now been implemented. The limit for local project assessment and approval has been raised from \$30,000 tp \$100,000. The IDO has recently acquired an advisory board, and adjustments have been made within the DIPP programme to encourage more defence-oriented assistance for projects destined for the domestic market. The elimination of the SRTC programme has already been noted. The Income Tax Act provision allowing for the deduction of qualifying current and capital expenditures on R & D, which has been in place for many years, remains in place. However, adjustments have been made to improve the investment tax credit provisions, and especially for small Canadian firms. A lifetime capital gains tax provision has been added to the personal tax deductions for investors in R & D-performing companies. Most of the changes were made in the May 1985 budget.

The Wright report recommended that the definition of scientific research and development used for tax purposes should be broadened in line with the one used in the United States. Accordingly, the department of national revenue sought advice from the private sector. A new set of technical guidelines was published by the department in early September 1986. However, the experience within the department of abuse of the SRTC programme must have influenced the writers of the guidelines because, when they appeared, industry found them over-restrictive and potentially discouraging to increased R & D. Pressure was applied to the department and, after further work and discussions with industry representatives, it made changes the industry found acceptable. The revised guidelines went into use in early November 1986.

#### Procurement

The Wright task force supported the idea that a peacetime equivalent of the military-industrial complex might stimulate technology development in Canada. In this way, the government's immense purchasing power could be better harnessed to the R & D and innovation chains. The basis for this idea came from the long history of military-inspired innovation and subsequent adaptation of it for peacetime production. It was also intended to help overcome the apparent lack of risk-taking and long-range planning the task force found when studying federal procurement policies and programmes.

Clearly, the task force realised that a peacetime complex would create political problems for the government, but it could not help noticing the innovation-stimulating influence of certain foreign institutions such as the Defense Advanced Research Procurement Agency (DARPA) in the United States. It realised that, in Canada, not all federal souces of procurement 'muscle' had been effectively used. Therefore, it suggested that the mandates of certain Crown corporations and key departments should include assistance in the development of the innovative capabilities of Canadian companies. The task force was also concerned that the 'matching dollar' conditions included as offsets in international procurement deals usually resulted in little benefit for the manufacturing sector of Canadian industry. The Nielsen task force and its study teams recognised the same problems during their work and agreed that industrial output could be greatly increased through directed procurement.

The federal government has taken note of the findings of the two task forces on procurement and has announced a new policy that will link it with long-term industrial and regional benefits. Nothing has been done formally to change the mandates of the departments and Crown corporations. The minister of defence recently tabled a white paper in the House of Commons. It will be some time before the full impact of the procurements that receive approval can be measured. Meanwhile, the pressure for change is being maintained.

The Wright task force commented favourably on two programmes managed by the main federal procurement agency, the department of supply and services. These were the unsolicited proposal (UP) and source development fund (SDF) programmes, both of which were contributing something to more effective government procurement. The task force cautioned, however, that neither should be expanded without first reviewing carefully its relationship to the other industry support programmes. There was, it said, a regrettable tendency for other departments to try to use the SDF and UP programmes as sources of extra funding when their own programme funds had been exhausted. The Nielsen task force made similar observations. It added in its May 1985 report, however, that one important factor in the SDF programme was that it assisted business to demonstrate new technology in an operational setting. And it announced that the government was ending the SDF programme, except for the demonstration feature, which would be incorporated into the UP programme.21

# University-Industry Interface

The universities in Canada are under provincial jurisdiction, but are heavily financed by the federal government. The government has chosen not to follow the funding recommendations included in the second five-year plan of NSERC. By doing this, it appears to have listened to the advice of the Nielsen task force, which said in its May 1985 report, with regard to basic research, that NSERC and the other two granting councils would be asked to concentrate their available resources more effectively on a smaller number of exceptionally able researchers.<sup>22</sup> The Nielsen study team on education and research commented in its report published the following March that NSERC, in its five-year plan, had requested a significant increase in its base budget, but that both the rationale for the increase and the need for fiscal restraint made this request inappropriate. It went on to say:

The upper ranges of the projections in the five-year plan for the increased needs for highly qualified personnel who could be trained with the NSERC grants are probably excessive. The projections are questionable, particularly in this era of economic uncertainty.<sup>23</sup>

Instead, as noted earlier, the government introduced the combination of stable base funding and a system of matching grants dependent on the private sector funds the universities could attract. This technique was clearly designed to shift more of the university research funding load to the private sector and to help with the deficit. At the same time, the government could tell its critics that it was providing extra help to the universities. However, the matching funding did not start until April of 1987 and there are to be limits to it.

The Wright task force identified a number of "crippling restraints" on the ability of the universities to meet the challenges that industry was increasingly making on them. Among these were shrinking revenues, operational inflexibility at the departmental level, and constraints imposed by current federal-provincial financing arrangements (such as the lack of earmarking of transferred funds).

While the task force was high in its praise for NSERC and its programmes in support of university research and researchers, it found a number of deficiencies and disincentives at the universityindustry interface. It recommended, for example, that the federal government pay the full costs of university research funded by grant or contract through any of its agencies, including the full overhead costs. The government should also pay the universities a bonus of 25 per cent for performing industry-financed research, and pay the companies involved an incentive in the form of a 50 per cent tax credit. NSERC, the task force said, should concentrate its resources on funding long-term research, on training research manpower, and on co-ordinating federally-funded university research. It should be the NRC's role to promote the technological capabilities of private sector firms and to provide advice on state-of-the-art technology.

The government has gone only part-way to meeting the Wright recommendations. It has, for example, changed the income tax rules to allow companies to obtain the same credits for universityperformed work as for their own. It has increased the overhead allowance payable to the universities, but not to cover all overheads. But it has not moved on the university bonus or the special industry tax credit.

# Federal Laboratories

This section of the Wright report was the most contentious of the four. The Wright task force gave the federal laboratories no report cards, but it did recognise the excellence of much of their past work. It said, however, that this was being undermined by a growing atmosphere of irrelevance and by an excessively bureaucratic style of management.

The task force said it was satisfied with the general level of funding of the laboratories and disagreed with the view that more money would result in better work. It spelled out the conditions under which the federal government should be doing research and development in its own laboratories, rather than contracting it out to the private sector or the universities, or supporting it with grants or other contributions. The task force championed the 'GOCO' government-owned, contractor-operated - principle and suggested it be extended beyond the single example it found. It noted that the peer review system was inadequate and that industry people were not being consulted to advantage before new laboratories were established. It was particularly critical of the NRC's manufacturing technology laboratory, then being built in Winnipeg, and wanted a second look taken at it.

The task force wanted federal scientists to have access to outside funds, including those from other departments, NSERC and the private sector, in addition to those within the budgets of their own departments. It wanted those research and development people who helped industry, and whose 'normal' work suffered as a result, to get proper recognition. And it wanted more incentives for these people to take their innovative ideas to the marketplace.

The Nielsen reports also had things to say about the federal laboratories. For example, the May 1985 report was particularly concerned about cost recovery by the NRC and by the department of communications. It was concerned about the possibilities for privatising some of NRC's activities and services. It wanted the field of building research examined and the roles and responsibilities of the participating departments and agencies clarified.

The report by the Nielsen study team on subsidies and services to business in March 1986 agreed that all of the federal laboratories should become more client-responsive, and even client-driven, in terms of their general direction and the management of major programmes. It said, for example, that the associate committees advising the NRC research groups had little influence in effecting change in the management of the laboratories. It wanted NRC's industrial development office to provide funds to individual laboratories for either intramural or contracted-out projects.

Since taking office in September 1984, the Mulroney government has done more to change the federal laboratories in Canada than its predecessors did over a very much longer time. But this change has been accomplished amid confusion and the lowering of morale in many of the laboratories, and the process is not yet complete. The changes have been effected through budget cuts, the reallocation of the remaining resources, and the assumption of new tasks in accordance with the government's policies of deficit cutting and having the laboratories conform more closely than was their custom in many cases to the government's own priorities. The process began with the finance minister's economic and fiscal statement early in November 1984. The cuts affected all of the main federal laboratories, and especially the National Research Council.

As noted in a recently published report, the council lost some \$85 million in programmes and 310 person-years of effort in the November cuts, and a further 20 person-years — over a five-year period — in the May 1985 budget. However, despite these and subsequent cuts, and reallocations to the space programme, the NRC still has a staff of 3,000 and a budget of \$400 million. The council also managed to soften the effects of the cuts on employees by offering early retirement to those qualified for it and by reassigning others within the existing divisions or helping them find jobs outside.<sup>24</sup>

NRC's problems received a good deal of political and media coverage and expressions of concern came from many quarters. As noted earlier, Oberle asked a three-person task group to look into the cuts and reallocations. Briefly, the group's report said that these did not endanger the health and safety of Canadians, but that a cost recovery system for work done by NRC for other departments would help sort out priorities in future. The report found that the principles behind the latest five-year plan had been maintained. The criteria used to make reallocation decisions it found to be "reasonable and sensible". and the management procedures followed were satisfactory. But the task group expressed concern about the relationship between the NRC's governing council and the senior management of the laboratories, about the relationship between the governing council and the minister, and about the modern interpretation of the National Research Council Act, which was first passed in 1924 and had hardly changed since then.<sup>25</sup>

In making some general observations at the end of its report, the task group said it was making no claim to have discovered new problems, and was in fact echoing much that had been said in the Wright report. A lot of what the Wright report recommended for the federal laboratories has been seriously considered and some action has been taken, although not always as the task force might have anticipated. The new government policies and deficit-reducing measures have forced departments and agencies to reassess the mandates and objectives of their laboratories. The new levels of funding are less attractive than before, but now, in mid-1987, the government is beginning to let some of them rise again. Morale in the laboratories has not fully recovered and all of the confusion has not disappeared. Wright and his colleagues wanted to see the government take a greater share of the risks of technology development. For the time being at least, research people and their managers may be even more risk-averse because of the continuing uncertainties surrounding jobs and programmes. Not all laboratories have been equally affected; even within the NRC there are differences, with the older programmes naturally being the more vulnerable.

Laboratories now have cost-recovery and business plans. They are developing more links with the private sector, other departments, other levels of government in Canada, and even with other governments. But so far only one of the boards of directors favoured by the task force to bring more client responsiveness to individual laboratories has been established. More are expected soon. No new 'GOCO' laboratories have so far come on stream, but a good deal more attention has been paid to opportunities for contracting out.

As a result of the November 1984 cuts, the NRC's manufacturing technology laboratory — then under construction — was cancelled. However, the decision was later made to complete the building and to operate it as an institute of industrial and manufacturing technology which will rent space to public and private users, under the coordination of the NRC for at least five years. NRC will also supply the core research group and underwrite some of the operating costs. The November cuts also wiped out, in the later planning stage, a cold regions research laboratory approved for Edmonton, Alberta. This proposal has recently been revived by a private group, and could become a 'GOCO' laboratory.

The problems of micromanagement identified in the Wright report have increased over the last three years, as might be expected when a government increases the pressure of its will on its departments. Federal scientists still have no access to NSERC funds and, given NSERC's own funding problems, are most unlikely to have access in the short term at least. However, these two problem areas are exercising the ingenuity of the federal government's research managers and the long term results may be more favourable.

## Human and Social Aspects of Technology

The Wright report acknowledged the importance of this problem area, but said that its mandate and the time available to it did not allow for adequate study. It recommended that this be done elsewhere. Several agencies have, in fact, taken up the challenge. One of those to report recently was the Economic Council of Canada, a federally-funded think tank and the equivalent in economics to the Science Council. From its beginnings in 1963, this council has tackled many of the same issues as its science counterpart, always adding its own logic and interpretation.

The Economic Council's report concluded that, realistically, technological change is a mixed blessing. It will put pressure on labour markets and it will prove costly for many individuals. However, new technologies hold out the promise of rising productivity, higher product quality, greater competitiveness, and increased employment. The council also said:

The task that faces Canadians is to make technology work to their advantage. Canada has numerous examples of firms that are at the leading edge in adopting technology and using it effectively. The problem is that many Canadian organisations — in the private as well as the public sector — lag far behind in this respect. The success stories show that Canadians can do it, but too many managers, employees, educators, and policy makers in this country are not yet on track. Such complacency costs Canadians jobs and incomes as other countries increase their lead.<sup>26</sup>

# COMMENTARY

From many points of view, the Wright report was well timed. It did not help the government that commissioned it, but it was there when the new one took over. The new minister of science had ammunition to shoot with. So did the minister of finance, and so did the task force on programme review. The Wright report was not so well received by the laboratories and the programme managers in its field of fire, with some notable exceptions. That the private sector liked it is not surprising, but underneath this was the hidden fact that the federal science establishment and its principal institutions have always had a fair army of detractors. This has nothing to do with the party in power in Ottawa. The fact that the influence of the Wright report has been declining should not be surprising, especially with a new government in office. This new government has put in place a number of new policy and institutional initiatives which should obviate the need for another Wright-style task force for some time to come. But the problem is, at the present time, one of illusion *versus* reality. Both the national policy and the Canadian strategy were launched with glossy brochures and promises of things to come. Will the NABST board rise above being simply a grousing place where some influential ears are available? More data obviously need to be gathered, and there are still problems to be solved. But will the advice of the Science and Economic Councils not be enough? What will the House committee contribute?

The new government chose to treat its scientific and technological activities like the others when it came to deficit-cutting. But the message that the Wright report gave was not financial. It had to do with the management of the activities, which could be considerably improved, it said. One could speculate that, if the government had simply held the budget line for science and technology and emphasised better management, and had seen to it that this happened, then a lot of the clumsiness and bad feeling that was generated would have been avoided. Laboratories are notoriously tender plants, which may take a decade to produce good results, but which may be destroyed overnight. This is a management fact.

Micromanagement was one of the Wright report's main targets. Its origins go back to the 1960s when the federal Treasury Board began exerting increasing influence, with Cabinet approval, over federal agencies that had been — legally — more or less self governing and which reported to Parliament *through* a minister rather than *to* one. Hindsight will probably justify some of these intrusions, but the fact is that the rules of the game were left unchanged. The Mulroney government has no doubt pushed much harder than its predecessors on the Treasury Board button, and the Nielsen task force review has been more extensive than any earlier one. Perhaps one of the most important outcomes of the Wright-micromanagement connection will be to get the rules straightened out and some of the more harmful impediments to good laboratory and programme management removed.

Finally, the Wright report covered a lot of old ground, in a contemporary way. In other words, the old problems are still around — unsolved. Will they ever be? The same may be said about attitudes, which concerned Wright and his colleagues quite a bit. They are hard to change. It seems that messages must be repeated continuously. For example, Walter Light, one of the three-person NRC task group, wrote not so many years ago:

It is very apparent that Canadians — inside and outside of government — do not, or do not want to, understand that tomorrow's jobs, their continued high standard of living, the health of the economy and the real future security of the country rest upon the success or failure of our technologies, and on our skill to create and develop them faster and better than other countries.<sup>27</sup>

The message is the same today, only the action required is more urgent. Some of the most important of it will be needed from a Cabinet minister who has lower seniority and less influence than most of his colleagues.

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