CANADA

Report of the
National Advisory Board
on Science and Technology

GOVERNMENT PROCUREMENT COMMITTEE

Presented to the
Prime Minister of Canada

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Government Procurement Committee Report

February 1988

The views expressed in this paper are those of the authors and do not necessarily correspond to the views or policies of the Government of Canada.

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1.0 OVERVIEW

1.1 Mandate

The mandate of the Government Procurement Committee is to recommend to the Prime Minister how the government can more effectively focus its procurement efforts to encourage and promote industrial development and innovation.

1.2 Introduction

The policy initiatives in this report deal with recommended changes to the government acquisition process for procuring high technology capital goods and services. The report does not deal with other government policies or programs that support R&D such as:

a) industry support programs sponsored by the Department of Industry, Science and Technology and the National Research Council;

b) funding support to university research through various government granting agencies; and

c) the role and contribution of federal laboratories.

These programs will continue to influence federal R&D initiatives. This committee has not examined the merits of these activities, but has concentrated its efforts on optimizing the leverage of government procurement in promoting industrial development and technical innovation.

We have confined our attention to how best to manage the procurement of goods and services by government operational departments to maximize industrial development in Canada.

1.3 Background

Public procurement in Canada can be of immense importance in creating strong industrial capabilities. In 1984 public sector purchasing in Canada amounted to $73.4 billion or 16 per cent of the GDP. The federal government accounted for approximately 13 per cent of all public sector spending. The importance of public procurement has long been recognized by government policy-makers. One of the reasons for centralizing federal procurement in SSC was to improve the use of government purchasing power to obtain the best value for the taxpayers' money. The stated mandate of SSC is to obtain the best value for money through acquiring and providing, in the most economical manner, goods and services required by departments and agencies taking into account the contribution of procurement to the realization of national objectives.

To highlight the potential influence of procurement on technological and industrial development, the 12 departments and agencies that will spend 96 per cent of the federal government's 1987-88 budget for acquiring machinery and equipment are listed below.

National Defence	$ 2 391 587 000
Transport	365 437 000
R.C.M.P.	57 339 000
External Affairs	51 052 000
Environment	49 089 000
Fisheries and Oceans	45 531 000
National Research Council	40 261 000
Agriculture	31 893 000
Energy, Mines and Resources	31 528 000
National Revenue - Taxation	25 056 000
National Revenue - Customs and Excise	25 056 000
Public Works	24 181 000
Total:	$ 3 138 010 000

The total federal government machinery and equipment capital expenditure for 1987-88 is estimated at $3.24 billion. The DND expenditure amounts to 74 per cent of the total. DND and MOT account for about 85 per cent of all spending. Clearly, significant industrial development leverage is available in the annual requirements of these two departments. Furthermore, the industrial sectors that specialize in the goods and services required by other departments can also benefit from an effective procurement program.

1.4 The Existing Procurement System

The federal procurement system has made a significant contribution to technical innovation and industrial activity in Canada. Many policies and initiatives contribute significantly to industrial development in Canada, such as:

a) preference that Canadian sources 'buy' rather than 'make';

b) the Unsolicited Proposal Program; and

c) industrial benefits that emphasize Canadian content and long-term quality offsets.

Under the present system, there have been some remarkable successes where government procurement has resulted in industrial innovation. These successes were basically the result of a few imaginative government managers working in partnership with creative industrial entrepreneurs to harness the innovative capabilities of Canadian industry. The government needs to build on these successes. Examples of some of them are described below.

1.4.1 Aircraft Training Simulators and Systems

A federal government contract for the flight simulator on the CF-100 aircraft and contracts for other military aircraft simulators have greatly contributed to the emergence of CAE Electronics as a world leader in the development and production of commercial and military flight simulators. Additional federal government R&D support has led to the development of a new Fiber Optic Helmet-Mounted Display Visual System, which has considerable export market potential.

1.4.2 Laser Technology

Lumonics Research Inc. is an excellent example of government programs that promote technology diffusion and innovation of marketable technology. The company was formed in 1971 to exploit laser technology developed in a government laboratory. It received a licence from Canadian Patents and Development Ltd. Through ensuring financial assistance from government industry support programs and contracts, it has become a world leader in pulsed gas laser technology. Lumonics recognized the market potential of the technology, sought its transfer to its facility and developed a new product for a new market.

1.4.3 Space Instruments and Satellite Components

A series of small R&D contracts from 1974-78 and a follow-on production contract have enabled Canadian Astronautics Ltd., Ottawa to grow from a three-person operation to become a significant Canadian and international supplier for space instruments and satellite components.

1.5 Current Budget Constraints

Pressure on federal expenditures and budgets over the years has resulted in departmental capital budget levels that are usually not sufficient to replace obsolete and worn out operating equipment. There has been pressure on senior managers to use scarce capital funds effectively to obtain the maximum operational return. This has mainly fostered procurement of 'off-the-shelf' systems and equipment. If the required systems or equipment are available in Canada, the purchase is made from Canadian industry. If the only developed systems are foreign, as is usually the case given the high technology systems and equipment requirements of many federal departments, procurement is made abroad, or licenced production is arranged. Under these conditions, SSC and other interested departments attempt to obtain economic and other benefits by negotiating offsets or technology transfer in the procurement contract or the licence agreement.

Although offsets will undoubtedly continue to be necessary and useful in procurement, they do not provide an adequate basis for developing world-class technology-based products for both Canadian and export markets.

For many years, Canadian industry has competed with firms from the United States and Europe where fully funded R&D in defence and other high technology fields is government policy. The benefits of this policy, including the commercial spin-offs, provide a considerable commercial advantage to our international competitors. For example, the U.S. Department of Defense Research, Development and Engineering budget for 1988 is US$47 billion (about CDN$63 billion), the majority of which is for contracted R&D. Comparatively, this would amount to a Canadian defence R&D budget of $6 billion - the actual amount for 1987-88 is $133 million. Moreover, when consideration is given to the R&D contracted by NASA, the U.S. Department of Energy and other U.S. departments and agencies, Canadian industry, as far as funded R&D is concerned, is attempting to compete internationally with both hands tied behind its back.

A serious move to increase the level of government-contracted R&D for the Canadian government's capital equipment requirements is a long-standing need that must be addressed if government procurement is to make an additional contribution to technical innovation and industrial development in Canada.

2.0 RECOMMENDATIONS

The committee recommendations are discussed below. Appendix A relates the recommended procurement influences on technical innovation to the capital equipment acquisition cycle.

2.1 Basic Policy Issue

2.1.2 Government Procurement Mandate

The government procurement mandate, which includes "value for money procurement" and "the contribution of procurement to national objectives," should be expanded for all departments and agencies to include the government's goals regarding research, the development of new technology and products, and building an industrial infrastructure and knowledge base in Canada.

In day-to-day practice, the government's operational departments and SSC frequently interpret "value for money" as the lowest acquisition cost. Consequently, procurement planning and implementation does not take into account the larger value to Canada of an investment in Canadian product development and source establishment. The proposed amendment to the procurement mandate should provide a clearer definition of "value for money."

2.2 Developing Canadian Industrial Capability

2.2.1 Contracting R&D Work to the Private Sector

Federal government departments, agencies and Crown corporations should be required to accelerate implementation of the government's policy to use the private sector more for government R&D work. Consideration should also be given to selecting certain government research and test facilities for management and operation by the private sector.

Although contracting out government R&D work has been a policy for several years, less than 10 per cent of the government's total R&D effort is currently performed in the private sector. The current level of private sector participation must be increased to optimize and exploit the commercial opportunities.

The government should review its procedures and practices for contracting out. It should also develop guidelines and a program to ensure higher levels of private sector involvement. This should include setting targets and schedules for improved performance and a planned annual percentage reduction in the use of government laboratories.

Private sector operation (not ownership) of government-owned research and test facilities should be initiated to improve efficiency and optimize the industrial and technological spin-off. Government-owned facilities that could be candidates or are being considered include:

a) the NRC National Aeronautics and Test Establishment in Ottawa, which performs wind tunnel and other testing for the aerospace and aircraft industry; and

b) the David Florida Laboratory at Shirley's Bay, which tests satellite and space hardware.

2.2.2 Total Systems Packages

Procurement contracts for R&D work and high technology systems should be structured and awarded through a 'total systems approach'.

Procurement contracts for government technological requirements are often awarded in small individual packages to various companies. Consequently, no single firm has the opportunity to acquire all the expertise necessary to develop and produce world-class products for the international market place.

Specifications for government requirements for new systems and technologies should be prepared using functional and performance criteria. The successful contractor should have the freedom to develop the most effective R&D approach to meet the performance criteria for the system or product. The government has other objectives for small business and regional development that also need to be addressed. These important initiatives can be achieved by introducing factors such as contract requirements for a 'total systems' prime contractor. These goals could then be met through subcontracts to small business and the regions. However, the technical integrity and knowledge of the total system would remain with the prime contractor.

The result of the 'total systems contracting' approach will be more cost-effective R&D, leading to products that meet the needs of the world market place.

2.2.3 Mission-oriented R&D

The mandate and budget of operational departments should be expanded to include a responsibility to initiate mission-oriented R&D through contracts with industry. This would put Canadian industry in a position to provide products and services to support departmental operations and to enhance their own technological and industrial capabilities.

The basic concept of this recommendation is that government departments, agencies and Crown corporations should assume responsibility for the technological and industrial development of the industrial sectors that support their operations. The most effective way to support technical innovation is through the involvement of industry in meeting specific operational needs.

The approach may vary somewhat, depending on the industrial sector. However, the policy recommendation has wide application:

a) Resource Development

Industries such as agriculture, fisheries and forestry products need R&D support from government departments. It is essential that industrial R&D be carried out under contract in close collaboration with the appropriate government departments. Some departments carry this out efficiently; others do not.

b) Industrial Products

Departments more generally involved in developing products that can produce significant industrial spin-offs include Communications, Transport and National Defence. Therefore, mission-oriented R&D should be an integral part of their mandate.

Innovation is a process that encompasses everything from research to the introduction of new or better products and services. Most experts agree this is most successful when aimed at specific needs or demands. Intellectual property acquired during the process can usually be adapted by the innovators as spin-offs to help satisfy other needs and markets.

In 1984 the Task Force on Federal Policies and Programs for Technology Development endorsed this philosophy. It stated that "the federal government's involvement in technology development must be redefined to maximize the market's 'pull' on the innovation process." The federal government has major capital goods demands that represent a significant portion of the Canadian market place. Using these demands to involve Canadian industry in developing innovative solutions should be the most effective government approach to the promotion of industrial innovation.

This approach will require operational departments to recognize and accept the new mandate. It will require them to give greater emphasis to 'buy' rather than

'make', and involve the private sector at the earliest planning stages. Early investment in industry for research, development, demonstrations, facilities, tests and evaluations will be necessary to ensure that Canada has the capabilities and know-how to satisfy future operational requirements.

This recommendation is aimed at allowing operational departments to acquire high-quality Canadian products and services and at the same time promote industrial innovation focused on real demands with considerable spin-off potential. It also provides other significant benefits by creating secure sources of supply in Canada and enhancing the Canadian industrial base.

2.2.4 Planning

Operational departments should prepare 10- to 15-year plans for their capital equipment requirements. The plans should address the contribution of mission-oriented R&D to future operational needs and comment on their benefits to industry.

Providing the responsibility and funding to operational departments is not enough. Future operational requirements must be identified and current R&D purchases must be matched to these future requirements. This planning should involve industry in the development of technologies and associated products before they are required. The product development lead time would also put the companies under contract in a position to develop other markets from the technological spin-off. In planning to meet operational requirements, early consultation with industry will provide realistic timing and a better understanding of the most appropriate technical solutions to operational needs.

2.2.5 Financing

A new and dedicated budget allotment should be established in operational departments. It should include existing R&D funds and be augmented by new funds. The objective should be to have this protected allotment grow to 10 per cent of the capital budget within three years. The implementation will cost approximately $150 million per year - about 3.6 per cent of the government's current S&T budget.

The innovation cycle is long and time-consuming. Moving from identification of an operational need through system and product development, test, evaluation and acceptance takes several years. Unless long-term government policy and funds are committed, the easy way out will be to continue to buy the best foreign solution.

This particular budget allotment must be dedicated and protected (a separate planning element) to ensure that R&D funds are secure and not diverted to shorter-term objectives during austerity periods.

2.3 Canadian Sourcing

2.3.1 Transfer of Technology

Technology transfer on major international procurement projects should involve Canadian firms, preferably through joint venture arrangements. Guidelines to identify the technology areas of most interest and value to Canadian industry should be developed and used by the procurement planning committees and government negotiators. Proposal solicitation documents, including RFPs for licenced production in Canada, should specify the critical technology transfers that are mandatory requirements.

Not all federal government requirements will be satisfied by Canadian-developed technology and sources. The approach for major purchases involving foreign technology should be to obtain the highest quality technological benefits practical. The most important requirements should be identified and made mandatory. The most effective method of transferring the technology and ensuring its exploitation is through a joint venture or technological partnership. A Canadian firm, selected by government, can negotiate a better agreement with a potential foreign partner to gain access to the foreign technology than government can achieve alone. Such a firm would be chosen for its proven capability to undertake development and exploitation of the project.

A significant additional advantage of the joint venture approach is that technology acquired is available to Canadian firms to perform life-cycle maintenance and support the operational system for its service life. The dollar value of life-cycle support work can be two to three times the capital acquisition cost.

2.3.2 Sourcing and Risk-Taking

a) **Directed Sourcing**

If a reasonable Canadian source has been developed specifically to meet a departmental operational requirement, then competition should not be solicited until at least the first procurement of that product or product type occurs.

Government planning to meet operational requirements through mission-oriented R&D contracts will often result in the establishment of a single Canadian source. To obtain a return on its prior investment, and so that operational departments acquire their equipment needs as originally planned, at least the initial production order should be directed to the newly developed Canadian source.

b) **Government Procurement Policy**

Government procurement policy should support some risk-taking in contracting technology development and follow-on production to Canadian companies.

State-of-the-art R&D work leading to success in the innovation process requires some risk. Under the proposed mandate for operational departments, there may be failures. However, the benefits to be derived from the successes will far outweigh the cost of a few failures. Therefore, the government should recognize and authorize reasonable risk-taking in sourcing new technology and products from Canadian industry.

c) **Long-Term Agreements**

The government should use long-term supply agreements to develop sources in Canada for products and services that are not available domestically.

Long-term supply agreements should be institutionalized and encouraged. Companies involved with the government in an R&D program would commit company funding to R&D in areas where a new product is to be developed. As a first step, such R&D should be developed for a product that the government intends to purchase. Once a proper technical solution has been found and an acceptable product has been developed, the government should commit to buying the firm's product through a long-term supply agreement to underwrite development costs and to develop economic spin-offs in related sectors.

2.3.3 Offshore Procurement

Supply requirements that are consistently bought abroad should be systematically reviewed by SSC, DRIE and the user department, and Canadian sources established where warranted.

Government departments and agencies obtain some goods that could be produced competitively in Canada. However, foreign competitors have already written off their non-recurring costs. The government and Canadian industry would benefit if the government established a Canadian source for these goods.

2.4 Exploiting Canadian Technological Capabilities

2.4.1 Intellectual Property

Intellectual property resulting from fully funded government contracts with Canadian industry should become the joint property of the developer and the federal government. For shared-funding R&D contracts, Canadian industry should retain title to intellectual property and the government should have the royalty-free right to use the data for its own operational and maintenance purposes only.

The private sector has been concerned for some time that the government's policy to retain ownership of technology developed under government contracts is an impediment to commercial exploitation of the technology.

Government officials point out that government-owned technology is made available to any company that requests it. This is not generally understood by industry and a policy change and communications program should be initiated to solve this problem.

Such a change in government policy and contract terms and conditions could provide industry with the unconstrained use of the intellectual property developed.

2.4.2 Recovery of Independent R&D (IRD) Costs

Government contract policy for negotiated contracts should allow recovery of company expenditure on IRD either in allowable costs or as additional profit.

The current profit policy provides additional profit for R&D in the specific contract in which the R&D is performed. This excellent practice should continue. The present recommendation encourages and supports industry to invest its own money in R&D. The government's long-term objective is to increase the level of national expenditures on R&D to 2.5 per cent of the GNP. To encourage industry and provide incentive, government-negotiated contracts for goods and services should allow additional IRD costs in overhead or an additional element of contract profit. This profit should be at the same percentage level as the company is currently spending on independent R&D expressed as a percentage of total company cost of sales.

2.5 Organizational Issues

2.5.1 The Role of the Department of Industry, Science and Technology (DIST)

The newly created Department of Industry, Science and Technology should have monitoring and management responsibilities for the use of procurement as an instrument for industrial development by other departments.

DIST should monitor and report on the costs and benefits associated with the procurement activities of operational departments and SSC. This would ensure that procurement, while satisfying operational needs, also stimulates the development of Canadian expertise and industrial infrastructure. Furthermore, DIST should manage a program of R&D support for products and services that are not associated with government procurement requirements. Rather, they would have strategic application to commercial markets.

2.5.2 Federal-Provincial Cooperative Procurement

The federal government should initiate a cooperative procurement program with the provincial governments and other public jurisdictions.

Significant opportunities for Canadian industrial development can be realized through cooperative procurement programs between the various levels of government. A recent example of such an initiative is the Federal-Provincial Water Bomber Project.

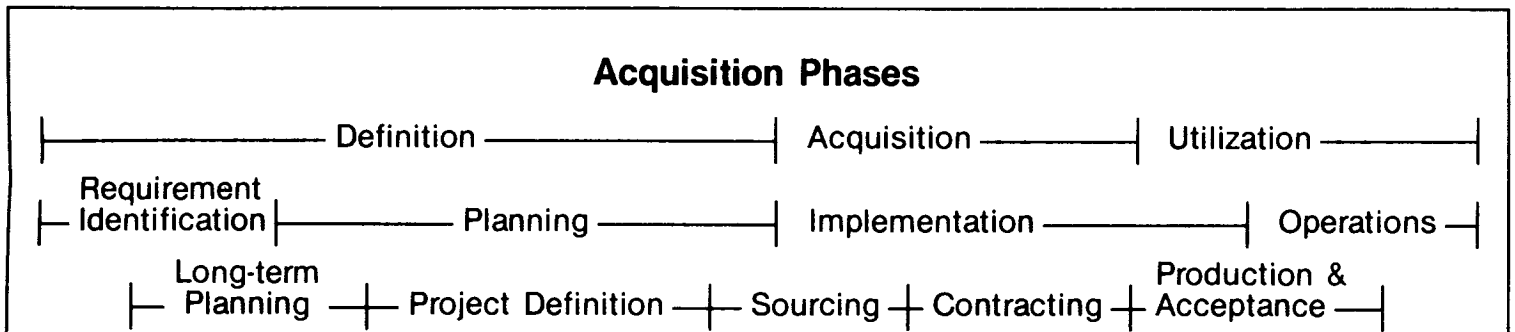
There is currently significant potential in the field of health care. A program of cooperation with the provinces should be implemented to develop products that can be used in the various health-care facilities throughout Canada. A great opportunity is available in Canada for developing and manufacturing medical equipment, appliances and instruments.

3.0 CONCLUSION

Implementation of the committee's recommendations will contribute significantly to Canadian industrial development and technical innovation. Appendix B provides examples of the recommendations' effect on selected procurement projects. It is recommended that the committee be provided with an ongoing mandate to monitor implementation of the recommendations and to work with SSC, DIST and other affected departments to ensure the approach and schedule corresponds to the government's objectives.

APPENDIX A

CAPITAL EQUIPMENT LIFE CYCLE



Procurement Influences to Foster Technical Innovation in Canadian Industry

- Contracting R&D to the private sector (B.1)
- Mission-oriented R&D contracts awarded (B.3-5)
- Federal/ provincial cooperative procurement (E.2)
- Utilization of mission-oriented R&D (B.3-5)
- Technology transfer (C.1)
- Total systems packages (B.2)
- Directed sourcing (C.2a)
- Risk taking (C.2b)
- Long-term agreements (C.2c)
- Offshore procurement (C.3)
- Intellectual property (D.1)
- Recovery of independent R&D (IRD) (D.2)

APPENDIX B

IMPACT OF REPORT RECOMMENDATIONS ON SELECTED HIGH TECHNOLOGY PROCUREMENT PROJECTS

B.1 New Training Aircraft

An example of the application of this report's recommendations would be the DND future requirement for an advanced training aircraft to replace the current Tutor and CF5 aircraft. The new aircraft will be required operationally in the late 1990s and production should start in 1993-94. This schedule would permit implementation of a range of recommendations, including long-term planning and mission-oriented R&D.

At first, government and industry planners should determine whether an aircraft designed and developed in Canada can be a cost-effective and economically viable program. If it is, the project planning and preliminary development work should begin soon. If not, then planning for mission-oriented R&D work on the major systems and sub-systems should commence in the next year or two. The sub-system areas to be considered would include:

a) the latest technological developments in engines;

b) heads-up display;

c) a smart monitoring system for airframe structure, engines and other on-board systems;

d) communications systems; and

e) navigational systems.

Design, development and production of the major sub-systems and system integration, final assembly and flight test of the aircraft should be contracted to Canadian industry.

Implementation of this project will result in a major technology transfer to the airframe manufacturer and sub-systems and equipment manufacturers. It will also provide a timely transfusion of state-of-the-art technology to these manufacturers leading to commercial and defence export opportunities.

If this project follows the report's recommendations for long-term planning, mission-oriented R&D, transfer of technology, total systems packages, sourcing in Canada and intellectual property, then it could serve as an excellent example of using government procurement to contribute to industrial development and technical innovation in Canada.

B.2 The Nuclear-Propelled Submarine Project

This will be the most expensive defence project ever undertaken by the government of Canada. It will basically be an 'off-the-shelf' foreign-designed submarine. This factor, along with the relatively tight deadline, will not permit implementation of the committee's recommendation on mission-oriented R&D. Furthermore, because the parts of the submarine are so interrelated with the whole, there is not likely to be much opportunity for use of Canadian technologically developed equipment. Canadian firms will mainly be 'building to print' equipment designed in another country. This situation could be viewed as offering little opportunity for Canadian technological enhancement, but historic examples suggest the contrary.

An example is the F104 Aircraft Program. These aircraft were built several years ago by Canadair under a licence agreement with the Lockheed Corporation in the United States using drawings and technology acquired from Lockheed. Nevertheless, the technology transfer to Canadair provided knowledge in high performance aircraft design that has contributed significantly to its capability to design and manufacture its own proprietary aircraft and aerospace products.

The F104 program also provided state-of-the-art experience through government and export contracts to CAE as a simulator manufacturer. Litton Industries of Canada was established partly through technology related to the inertial navigation system on the F104.

Potential opportunities do exist in the submarine project - nuclear-powered submarines are outfitted in the same way as conventional submarines except for the propulsion area. This has as its base a nuclear plant, which produces heat that generates steam.

For on-board systems and equipment, the submarine will have a variety of state-of-the-art technology and systems. These include passive and active sonar; acoustic processor; communication, command and control (c^3); infrared; optics; radar; navigation; fire control; missile; torpedo and other systems relating to propulsion, depth control and safety.

All these systems are foreign-designed and built. 'Build to print' in Canada is an option for companies that can meet the demanding quality and cost requirements. It may be acceptable in some cases to build for form, fit and function if a Canadian product already exists that will fit and perform without greatly changing the submarine design. There may be other opportunities; for example, the Canadian navy may require a totally different system to replace one or more systems in the foreign design.

All equipment in this 'off-the-shelf' project is manufactured according to high standards, tolerances and quality. Canadian companies can meet those requirements, but additional costs will be required in some cases to fulfil unusually exacting demands.

The opportunities for technology transfer will be available to companies involved in constructing, building and integrating the submarines and its sub-systems and equipment, including the nuclear reactor and propulsion system. The technology transfer to Canadian industry will result from in-depth exposure to the state-of-the-art design and also to the manufacturing and testing procedures and processes that are unique to this system.

The opportunity for Canadian mission-oriented R&D work on this project is limited. However, implementation of the report's recommendations for transfer of technology, total systems packages and sourcing in Canada should result in a major technology spin-off to Canada, leading to future opportunities in both commercial and export markets.