FINAL EVALUATION REPORT

Canada/Newfoundland Ocean Research and Development Subsidiary Agreement

(NORDCO)

January 1979

CAPTAIN 17

NORDCO LIMITED

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January 11, 1979

CONFIDENTIAL

NORDCO EVALUATION

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Mr. A. Williamson,
Department of Regional Economic Expansion,
Ashley Building,
St. John's, Newfoundland.

Dear Andy:

Enclosed please find a copy of the Final Evaluation Report for your personal use only.

Please accept my sincere gratitude for your efforts in assisting with the completion of this report. I trust that it will be well received by the Management Committee.

Yours truly,

Dick

D.E. GILL,
Director of Administration

DEG/mlb

Encl.

H.H. Williamson

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NORDCO

Submitted to: Ocean Research and Development Management Committee

Submitted by: Evaluation Committee

Date: January, 1979

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PREFACE

This report is the second and final volume of a detailed evaluation of NORDCO's performance and impact over the last four years. The evaluation has been prepared by a sub-committee consisting of:

D.E. Gill	-	NORDCO (Chairman)
I. Palmer	-	Dept. of Industrial Development
M. Staple	-	Cabinet Secretariat
A.H. Williamson	-	DREE

Volume 1 consisted of a discussion of the background leading up to the formation of NORDCO, the form and growth of the corporate structure, a review of representative NORDCO projects, the firm's financial history and tentative conclusions.

Volume 2 comprises the evaluation of NORDCO. Specifically, the firm's attainment of the objectives and compliance with the strategy outlined in the agreement are assessed. In addition, the agreement suggested specific evaluation criteria against which the performance of NORDCO is to be assessed. This has been covered in Chapter 3. In a formal sense the first three chapters complete the agreement evaluation requirements. It was never formally documented that NORDCO was to be self-sufficient within the first

five years of operation, nor was it clear that it was to continue as a Provincial Crown Corporation indefinitely. This has been a concern throughout the evaluation process. Therefore, the final chapters deal with the question of NORDCO's future based on its past performance, and current and future prospects. The conclusions and recommendations of this report cover both the assessment of NORDCO's performance in meeting the sub-agreement objectives and suggest future options and prospects for the company. In extending the evaluation mandate to cover these future issues it is the Evaluation Committee's hope that the evaluation of NORDCO's past performance will clearly contribute to the future direction of the company.

The Evaluation Committee acknowledges the excellent co-operation provided by the management and staff of NORDCO in preparing this report.

January 10, 1979

St. John's, Newfoundland

1. INTRODUCTION

In 1973, the Committee on Ocean Science and Technology brought forward the conception of a Newfoundland Ocean Research and Development Corporation. In some quarters, this was a time of increasing expectations for marine activity in Newfoundland and based on the exploration off the Newfoundland and Labrador coasts, by analogy with the North Sea, great commercial and industrial benefits were foreseen from offshore oil and gas. The committee also dealt with opportunities for development in both the fishery and marine transportation. The deep sea and mid-water fishing industry was expected to generate a steady annual demand for trawlers and large longliners, and the fragmented and unsophisticated state of the inshore industry was ripe for a great infusion of technological development. The growth of traffic associated with mineral and petroleum exploitation in the eastern Arctic was expected to open up, increasing shipping business to Newfoundland, where there was already a base of experience, and to create a demand for marshalling and transshipping freight for the Arctic at a point close to the limits of the sea ice.

Supported by these expectations, then, the Committee concluded that the main job of the new company should be the development of new technology, and the broad field to

which this technology was to be applied was clearly related to the ocean and to ice. However, although the report envisaged some of the specific needs and applications for new technology, the customers who were to bring their requests for assistance to Nordco's door were not identified.

The development of new technology generally takes place either during the solution of practical engineering problems or as a fortuitous spin-off from some more open-ended research which itself demands a subsequent development engineering phase. The ingredients, therefore that Nordco needed were, on the one hand a true research capability of some stature and on the other hand, a practical development engineering arm - together with the necessary operational and support facilities.

Originally, three roles were intended for NORDCO. The first was to perform the role of a consultant firm in the field of off-shore oil and gas technology development, fisheries technology development and marine industry. Secondly, it was intended that it act as a catalyst in encouraging the formation of local companies to capitalize on the opportunities which were perceived as being imminent related to oceans resources development. Thirdly, it was envisaged that NORDCO would act as an R & D organization which would conduct research utilizing in-house funds or

more desirably Federal and Provincial Government funds. Such open ended research would cover off matters related to ice, fisheries technology development, oceanography, and all other fields of research relevant to cold oceans resource development.

At some point in the early days of NORDCO's formation it was accepted, but never documented, that NORDCO should become self-supporting by the end of its first five-year term. The company then quickly emphasized the role of a consulting engineering concern, and consequently placed a much greater emphasis on the hunt for business and with marketing and expanding its own capability. Thus, among the three intended roles of NORDCO - the consultant, the catalyst and the R & D company - the last two became very much subordinated.

For a number of reasons oil and gas exploration activity by the private sector took a serious decline between 1974 and 1979. In this period of depressed markets NORDCO continued to function, building staff and conducting basic in-house research. This activity did serve to keep alive interest in the technology of ocean resource development in the province and with the oil companies. The 1979 market situation looks promising with a number of major oil companies establishing offices in the Province. NORDCO pulled work

into Newfoundland that otherwise would not have been done here, and its existence, although a perceived irritant to competitors, has also been a factor in impelling certain of them to move into this market. NORDCO has demonstrated that work on the specific problems of the north-east coast can and should be done by local companies.

Work is available

Quantitatively, the work for a company - or companies such as NORDCO - is available in the region. The oil exploration scene seems set to show considerable activity off Newfoundland and Labrador and in the Eastern Arctic for at least 3 years to come with a high probability that there will be development and production somewhere in these regions over the next 15 years. Commercial shipping into the Eastern Arctic will also increase and during this time, if there are new industrial installations at Goose Bay, shipping into Lake Melville will increase also. There will be an increase in Government sponsored environmental, oceanographic and hydrographic work in these waters both with respect to hydrocarbon development and to the development of the fishery. There will be a concern eventually to exploit the offshore Labrador fishery and it is clear that there must be a large effort in the development of fisheries technology to keep the Newfoundland fishery competitive.

2. AGREEMENT OBJECTIVES AND STRATEGY

The objectives of the Agreement are to stimulate the development of marine technology within the Province, "to foster the establishment of marine ice related industries and to ensure that the Newfoundland business community becomes fully involved in marine resource development in the adjacent ice-congested waters". The objectives outlined above are to be realized through the strategies employed by NORDCO and by involvement in projects that will give NORDCO prominence and recognition on a high technological level in subjects related to ice research.

2.1 The Strategies

The specific strategies have been defined in the Agreement, they are as follows:

NORDCO will -

Catalyst A. establish itself as an internationally recognized centre of northern oceans' resources exploitation and ice related expertise;

R+D B. undertake projects in the nature of applied research and technology development related to northern oceans' resources exploration, development, transport and processing;

Catalyst C. promote the commercial utilization of knowledge and technological advances developed by itself;

Catalyst

D. encourage participation by the private sector and promote provincial and Canadian capabilities in technology, services, manufacturing and in other fields related to cold oceans' resources exploitation;

Catalyst

E. act as a catalyst in providing technological assistance to Canadian marine-oriented firms wishing to expand, especially those operating in ice-infested water;

Consultant

F. undertake joint ventures or other mutual arrangements with local organizations and firms as well as other Canadian firms and foreign firms as required, to obtain and utilize the most effective technologies and up-to-date information available;

Consultant

G. initiate projects in response to requests from other organizations and (on its own initiative) where the corporation considers there will be potentially marketable and beneficial results for Newfoundland.

These strategies can further be defined or associated with the three perceived roles for NORDCO. Strategies A, C, D and E are seen to relate to NORDCO as catalyst. Strategy B reflects NORDCO's role in research and development and strategies F and G are clearly associated with NORDCO as commercial consultant.

Table I gives a summary of projects undertaken as related to the above listed strategies.

TABLE I

Analysis of Projects by Agreement Strategy

Strategy	Number of Projects	In House Projects	Contracts	Proposals	Total	%
A.	6	73,643	7,982		81,625	3.1
B.	41	191,778	353,620	33,406	578,804	20.0
C.	9	60,791	7,982		68,773	2.3
D.	16	162,225	99,972	826	263,023	9.0
E.	11	70,826	22,506		93,332	3.2
Consultants F.	32	255,098	417,262	24,637	696,997	24.0
Consultants G.	52	180,926	852,332	80,520	1,113,778	38.4
		$995,287	$1,761,656	$139,389	$2,896,332	100%

While it is recognized that the assignment of projects to the various strategies is difficult because of the considerable overlap in their interpretations, it is evident from the Table that there has been considerably more emphasis placed on certain strategies and their related roles. Specifically strategies F and G related to NORDCO's role as a commercial consultant have received 62.4% of project expenditures. Strategy B relating to NORDCO's role as an R & D organization received 20% of project expenditures and strategies A, C, D and E accounted for the remaining 17.6% for NORDCO's role as catalyst.

The foregoing reinforces the observation that relatively greater emphasis has been placed on commercially oriented activities as opposed to NORDCO's roles as catalyst and R & D organization.

2.2 Project Examples by Strategy

Strategy A — Nordco will establish itself as an internationally recognized centre of northern oceans' resources exploitation and ice related expertise.

There are very few projects of note which were specifically related to Strategy A, however a number of projects such as the Shoe Cove Satellite Station, and Hydroball projects have contributed to the recognition of NORDCO on an international scale. Additionally

attendance at certain international conferences and exhibitions such as the First International Conference and Workshop on Iceberg Utilization, Ames Iowa, U.S.A., and the International Oil Pollution Prevention Conference and Exhibition, Hamburg, Germany, where technical papers were delivered by NORDCO scientists have added greatly to NORDCO's credibility.

It is not always possible to relate dollar return to the fact that you are getting international exposure, however occasionally a few such exposures do result in direct contracts. For example, the paper delivered at the abovementioned iceberg conference held in Ames, Iowa by a NORDCO scientist resulted in a large contract from an oil company drilling off the coast of Labrador. This project will see the innovative use of submersibles for measuring the bottom profiles of icebergs off the Labrador coast.

Strategy B Nordco will undertake projects in the nature of applied research and technology development related to northern oceans' resources exploration, development, transport and processing.

Most of the research and development projects undertaken by NORDCO concerned ice and icebergs. The emphasis on the research was the development of a knowledge base of ice characteristics and the dynamics of ice movement. Ultimately this information

base will be used for the development of technologies allowing industry to work in northern waters on a year round basis. Certain research activities such as the iceberg towing and tracking projects have made the initial steps in the development of the appropriate technologies.

Other R & D projects have been carried out in-house and have led directly to commercial contracts and as such have served not only in terms of developing ideas but also in terms of developing manpower capability to actually acquire and carry out contract R & D projects. One such example of this would be the work carried out on the Loran-C project. It should be noted that pursuit of this strategy by NORDCO represents a certain cost to the organization that cannot always be recovered from future contracts. It is not clear that NORDCO has developed an adequate in-house screening process to insure that R & D work undertaken without contract will in fact ultimately be needed by industry.

Strategy C — Nordco will promote the commercial utilization of knowledge and technological advances developed by itself.

The number of projects undertaken which directly relate to this strategy are few. One explanation is that here we are looking at the commercial utilization of innovative technologies

which typically take a long time to develop and are usually very costly. Another is that NORDCO being a young organization did not have the necessary scientific and engineering skills for the creation and development of innovative technologies.

Therefore NORDCO is incapable of launching a number of these high cost, long term return projects. As these types of projects typically represent a drain on the firms resources it is questionable whether this strategy is attainable given current demands on the firm. Attempts to develop new technologies such as in the Hydroball, the Fish Baiting Machine or the Ice Penetration Device have not reached fruition. However, a successful example is the development of an oil spill computer model which is being successfully marketed by the firm.

Strategy D — Nordco will encourage participation by the private sector and promote provincial and Canadian capabilities in technology, services, manufacturing and in other fields related to cold oceans' resources exploitation.

Since its inception NORDCO has been active in encouraging private sector participation. These activities have taken the form of organizing seminars for consultants, assisting with the establishment of the Newfoundland Ocean Industries

Association and further with the formation of joint ventures such as Geonautics Limited. In the fisheries NORDCO trained and hired under parttime contract a local net maker. This particular contract has not only provided the individual with new skills but also has provided him with a base from which to establish a new business. These examples are not great in number but are at least an indication of the companies efforts to promote provincial and Canadian involvement in these areas.

Strategy E — Nordco will act as a catalyst in providing technological assistance to Canadian marine-oriented firms wishing to expand, especially those operating in ice-infested water.

The activity related to this strategy has again been relatively insignificant in terms of the percentage of total project expenditures. However this is not the only indicator. NORDCO has acted somewhat as a catalyst with a number of local firms such as ICE Limited, Remotec Limited and Northland Associates Limited where NORDCO has assisted these firms both in proposal preparation and in the actual carrying out of contracts. The Fisheries Division through the process of technological transfer was able to assist Provincial Rigging and Supplies Limited by introducing tc

them a new product which they are now manufacturing and marketing.

Strategy F — Nordco will undertake joint ventures or other mutual arrangements with local organizations and firms as well as other Canadian firms and foreign firms as requried, to obtain and utilize the most effective technologies and uptodate information available.

Approximately 24% of total project expenditures are related to this strategy. A review of projects indicates that NORDCO has participated in joint ventures and other mutual working arrangements with local and foreign firms. This involvement included the preparation of proposals and the carrying out of a number of projects such as The Ship In Ice Project with C-Core, The Bridport Inlet Ice Management Study with Acres Consulting Limited, and with Chimo Shipping Limited and other firms in the formation of Geonautics Limited. This latter joint venture is bringing to the Newfoundland scene new technological skills complementary to the types of marine related industrial services currently being provided by NORDCO and CHIMO.

The benefits to NORDCO of involvement in these types of arrangement have not always exceeded the costs incurred. For example, The Ship In Ice Study represents a large investment while the benefits from the project in terms of staff training, field experience and equipment testing do not appear to have been justified.

Strategy G — Nordco will initiate projects in response to requests from other organizations and (on its own initiative) where the corporation considers there will be potentially marketable and beneficial results for Newfoundland.

The largest portion of project expenditures incurred are related to this strategy representing some 38% of the total. This underlines NORDCO's emphasis on commercial activity. Over the period under review most of the projects undertaken related to the offshore oil and gas sector.

In addition to projects undertaken upon request from clients there were a large number of unsolicited proposals generated, many of which were unsuccessful. Poor market conditions during this period undoubtedly were a major contributing factor.

While NORDCO has been successful in winning a number of contracts, revenue from this source has not exceeded

operational costs. The low number of remunerative contracts have been largely a result of depressed market conditions and the high operational costs reflect the inordinately high costs attributable to proposal preparation, staff build-up and training.

Although the major concentration of NORDCO's efforts to date has been in compliance to this strategy the result has been a net financial drain to the firm in the short run.

3. Agreement Evaluation Requirements

The section of the Canada/Newfoundland Ocean Research and Development Agreement pertaining to Evaluation (Section 9) specifies certain components to be included in an evaluation. The first, an assessment of NORDCO's operations with regard to the stated objectives and strategy of the agreement has been dealt with in the previous section. The second requirement relates to "an evaluation within the context of the objectives and strategy of this Agreement with respect to the general economic and socio-economic development of Newfoundland and shall consider the impact and costs, particularly in relation to:

A. the extent to which it would support or encourage other activities which will create or maintain employment;

B. the extent to which it would broaden the range of economic opportunities in Newfoundland;

C. the extent to which it would contribute to the stabilization of, or increase in, income levels in Newfoundland; and,

D. its effects on the environment".

It is this second requirement that will be dealt with in this chapter.

NORDCO was conceived and formed at a time when there was great optimism in both the fishery and offshore oil and gas areas. However, the 45 months of NORDCO's existence did not see the general growth and activity hoped for in these areas. The fishery had a serious down turn and the 200 mile limit was declared later than expected. For a number of reasons the offshore oil/gas activity has been slower to materialize than conditions in 1974 suggested. Put simply, NORDCO was conceived as a research and technical service industry and its formation was predicated on a number of events taking place coincidentally. These events have been slow in occurring, consequently, the take-off of NORDCO did not take place as hoped for.

3.1 Performance Evaluation

The following section will consider NORDCO's performance related specifically to the evaluation requirements.

A. The extent to which it would support or encourage other activities which will create or maintain employment;

NORDCO currently directly employs 75 people, of which 38 are professionals. This group provides a basic talent pool providing "on site" expertise for the development of ocean resources. This service can be seen as a basic

mechanism for capitalizing on the development opportunities as related to the availability of ocean resources. In short, NORDCO doesn't create development opportunities, but acts as a catalyst in drawing development activity into the Newfoundland scene. This to a limited extent, NORDCO has done. It is not reasonable to speculate whether more could have been done given the circumstances of the time. Therefore, this review shall list some of the activities encouraging employment creating opportunities outside of NORDCO.

The company has been directly involved in the establishment of several associated and complementary companies. The major effort has been with Geonautics Limited. Geonautics was formed in 1978 in association with Huntec (70) Limited, Golder Associates Limited, Chimo Shipping LImited, R.M. Hardy Associates Limited and Marinav Corporation. This firm provides a local expertise in geophysical sea-bottom and sub-bottom surveys, seabed profiling, offshore geotechnical investigations, sea-bottom engineering classification and bedrock mapping. The combined resources of the member firms provides Canada's largest capability in the marine geotechnical field. This firm has recently established its offices in St. John's.

In addition to this specific joint venture NORDCO has, by sub-contracting and equipment purchase, directly encouraged

and assisted several other firms. Two such cases are ICE Limited, a local company which NORDCO sub-contracts for ice studies and Provincial Rigging and Supplies Limited, a local net-maker who NORDCO has assisted through technology transfer and contracts for the building of 4-panel trawls. It is believed that NORDCO's involvement has provided a foot-hold for this individual to establish a viable business.

Two, so far unsuccessful, attempts were made to assist local inventors in the development of innovative equipment. Mr. Don Andrews the inventor of a trawl line baiting machine for the inshore fishery was given assistance in the design, construction and testing of a prototype for which he holds a patent. The possibilities for the ultimate development and production of this device are as yet uncertain but a definite worldwide market exists if certain technical difficulties are overcome.

Resource Development Consultants Limited were assisted in a similar manner in the development of their ice penetration device. A prototype was constructed by NORDCO and later tested in the field. Unfortunately, this device is of use mainly as a scientific instrument and has a very limited market.

In 1976 NORDCO sponsored a Marine Consultant's Seminar which was attended by 110 representatives of local businesses and government. The purpose of this seminar was to provide a forum to discuss future development prospects in ocean research consulting. Understandably, the local engineering community has been slow to increase their involvement in marine related activities given the depressed market conditions. Only with a dramatic increase in offshore exploration activity and the resultant demands for consulting services can a substantial local involvement be anticipated.

More recently NORDCO provided asssistance in the establishment of the Newfoundland Ocean Industries Association.

A major project announced recently by the National Research Council will see the construction of a $50 million ICE Tank and related facilities on the campus of Memorial University in St. John's. The facility scheduled for completion in 1981 will employ upwards of 50 people at least half of which will be supplied under contract by local consulting firms. NORDCO was instrumental in NRC's decision to locate this facility in Newfoundland and in fact was named in the submission to Treasury Board when approval for the facility was being sought by NRC. It is hoped that NORDCO will be able to send 6 to 10 professional engineers and scientists to participate in a 2 year training program

at the NRC facilities in Ottawa, starting April 1979. These personnel will be paid for under contract by NRC and are expected to return to St. John's when construction is completed on the NRC Tank at the University Campus.

Notwithstanding these efforts there has been some concern expressed that NORDCO may be in a position to compete unfairly with local consulting firms (as a result of the government subsidization) retarding private business development. This has quite possibly been the case in some areas, however, no attempts have been made here to enumerate such cases. Balancing this argument is that there are a number of contract areas that would not have been developed in the Province had not a government subsidized operation existed.

In summary, NORDCO has not had, to this point, a significant impact in supporting or encouraging other activities which create or maintain employment. Apart from direct employment NORDCO has encouraged and participated in some expansion of new industry. With future projects it is possible that other industries both service (consulting) and manufacturing (fishing gear) may emerge. However, it is hard to directly relate present activity and accomplishments in that area, to the costs incurred. The current definable benefits do not appear to exceed the costs.

B. The extent to which it would broaden the range of economic opportunities in Newfoundland.

It is perhaps obvious that technology contributes significantly toward economic growth and an improved standard of living. However, the innovative process is a long one and measuring the related economic impact in the short run is indeed a difficult task. NORDCO has made a considerable investment in in-house R & D programs and under contract to clients has carried out R & D projects of direct advantage to the Province.

The economic opportunities related to ocean resources development will be a function of the availability of resources as well as the "value" of the resource at any point in time. The question of "value" will be answered in terms of the characteristics of the resource (quality, quantity) and the development cost in relation to the market value. The service NORDCO has provided has been related to providing information fundamental to the establishment of the development costs of the ocean resources as well as the contributions to the technology of development. It is in this latter area that NORDCO stands the greatest chance of broadening the range of economic opportunities in the Province.

Essentially, the present definition of ocean resource potential includes the fishery and offshore oil and gas.

NORDCO's contribution to the realization of these opportunities are, as indicated, information pertinent to the development cost and technological advancement. The projects undertaken by NORDCO related to oil/gas development have served to build a general data base on ocean and atmospheric conditions as well as answering specific questions. The former activity could be represented by the Ship In Ice study and the Seasat operation, the latter by the Concrete Platform Study. The general information activities serve to create a pool of knowledge and local expertise that could conceivably accelerate the realization of the economic opportunities.

However, it is in the area of technological development that NORDCO will likely make the most tangible contribution to broadening the range of economic opportunities. Development of the ocean resources will require technological innovation. NORDCO represents one possibility for developing unique technological solutions to specific ocean resource development problems. The impact may be the fostering of local industry versus the purchase of off-the-shelf solutions.

These potential impacts have not clearly materialized at this point in time. Therefore, it is premature to suggest that the current operation of the company has significantly broadened the range of economic opportunities

in the Province, yet, it is possible to say that the potential appears to be there.

c. The extent to which it would contribute to the stabilization of, or increase in, income levels in Newfoundland.

The presence of NORDCO has had some direct economic impact on the Province. The Interim Evaluation Report showed a cash flow to March 31, 1978, of $4.4 million in contract revenue. It is estimated that $3.5 million of this has been spent in Newfoundland in the form of company employee salaries, and purchase of local goods and services. The firm employs 75 people with an average salary of $17,000 per annum. The purchase of goods and services includes such things as local equipment and the rental of fishermen's boats for research. In short, the dollar impact is significant in size and distribution throughout the Province.

The existence and growth of the company has directly provided a number of high income employment opportunities in the Province. While the actual number of these NORDCO positions is insignificant in terms of the total provincial labour force, it is none-the-less important that such opportunities for income advancement and the further development of a "professional class" takes place. There is no

readily available multiplier to measure the impact of these higher income positions through the local economy but coupled with the company purchase of goods and services, it is a contributing factor to the overall growth of the provincial economy.

Again, it is not possible to provide a detailed and quantified assessment of the impact of NORDCO on the provincial economy and to adequately weigh it against the costs incurred. However, it is believed that given current prospects in both oil and gas and the fishery that taken over time the benefit/cost ratio would be positive.

D. Effects on the Environment

While the previous sections deal most specifically with the impact of NORDCO on the social and economic environment, this section will focus on the physical environment.

NORDCO's major contribution to environmental concerns must be related to the building of data bases and local expertise on the marine environment. In this regard NORDCO is becoming recognized as possessing a high degree of expertise on northern, ice-infested waters. This increasing level of knowledge will likely position NORDCO to be invaluable in designing environmentally appropriate technology for northern ocean research and development as well as being

able to react quickly to the future environmental problems such as oil spills.

As in the earlier sections it is difficult to fully assess the impact of NORDCO in this area. It is only possible to observe that the direct corporate impact on the environment will be proportional to the degree of understanding of the environment. It is clear that NORDCO is building this understanding, time will tell if the cost borne in the process (in house research and the maintenance of a nucleus of scientists and engineers and physical plant) will be justified in future impacts.

4. COMPARISON WITH OTHER RESEARCH ORGANIZATIONS

In order to assess the firm's performance it is thought appropriate to look at how other somewhat similar organizations function. There is no doubt that to date NORDCO has functioned very much more like a provincial research organization than a private firm. However, it is unique among other provincial research organizations in that its research activities are focused purely on ocean related industrial and resource development operations. There is another major difference related to the funding of these operations in that there is a much greater emphasis placed on NORDCO to become independently self sufficient through commercial contracts, while most provincial research organizations are satisfied to obtain between 50 to 75% of their necessary funding from commercial activities. With these two exceptions thereafter there is little significant difference in the mandates of NORDCO or provincial research organizations.

Of course there has been a major difference between NORDCO and private consulting firms where profit is the primary motivation and where investments in research and development and the maintenance of highly skilled scientists and engineers and sophisticated plant and equipment are undertaken only when the marketplace has shown a total ability to support such services through commercial contracts.

While it is ultimately possible for NORDCO to structure its operations along the lines of a private commercial organization certainly it could not successfully have done so, over the initial three years of its existance. The demand for local marine consulting services over the past few years was much too small for any private organization of similar size to have survived without substantial government financial support. It can therefore be said that NORDCO has had a somewhat unnatural growth over this period when compared with private industry.

In that NORDCO has to date operated more like a provincial research organization the following information was obtained for purposes of comparison.

4.1 Nova Scotia Research Foundation

The Nova Scotia Research Foundation (NSRF) was established thirty-two years ago to maintain an R & D capability both to assist Nova Scotia industry in the solution of current technical problems and to stimulate it to take advantage of new technological opportunities. NSRF's income is derived from two sources, a grant from the Province of Nova Scotia and contract R & D revenues. In addition the cost of all capital facilities (offices, laboratories, etc.) have been funded by the Provincial and/or Federal Governments. For example NSRF received a $1.7 million grant from the

predecessor to DREE (The Atlantic Development Council) to construct its 45,000 sq. ft. building to house its offices and laboratories. The land for this building was provided by the Provincial Government. In addition, it has a pilot plant on its ten acre site which was funded totally by its Provincial Government under a "winter works program". Current plans to obtain industrial space in the new ocean industries industrial park in Dartmouth are again to be funded by Government. Each year NSRF negotiates with its Provincial Department of Industry for a grant to cover its operations costs. This grant for the past few years has represented approximately one-third of overall income net of grants for capital assets and in 1978/79 will amount to $1 million.

This operations grant is used for the following purposes:-

A. to provide service to the many companies who need, but cannot afford, technological assistance;

B. to undertake R & D on new technological possibilities which hold particular promise;

C. to maintain a nucleus of scientists and engineers and physical plant able to respond to developing needs.

Apart from these government grants NSRF has for the past seven years concentrated on obtaining a greater

percentage of its revenues from commercial R & D contracts. The five year target at the outset was to obtain fifty percent (50%) of their required funding from contracts. Currently they receive approximately sixty percent (60%) of revenues from industrial contracts. This of course is exclusive of grants received for physical plant and facilities which have a current book value of approximately $3 million.

NSRF has approximately 100 personnel. It is the feeling of NSRF's board of directors that its current crown corporation status is desirable, permitting the organization the opportunity to balance its activities between service to the business community and commercial contracts. To go private they feel would mean that too many essential services to the business community would fall by the wayside because of insufficient funding.

To illustrate NSRF as is the nature of all research organizations, is fraught with extraordinarily high overheads (in excess of 140%) a burden which few if any private consulting organizations could absorb under commercial contracts.

4.2 Ontario Research Foundation

The Ontario Research Foundation (ORF) was founded 50 years ago with a similar mandate to that of NSRF. In that

over 50% of Canada's manufacturing capacity is located in Ontario it stands to reason that ORF should be the largest provincial research organization in Canada and currently employs more than 300 personnel.

ORF's revenues are derived from two sources, a performance grant from the Ontario Government and R & D contracts. Up until 1975 the Ontario Government gave ORF a performance grant based on income earned from Canadian industry and was used for the development of ORF's technical capabilities to serve industry. An additional amount was also received from the Province which was specifically for fixed asset purchases.

Commencing in April 1975, the Province of Ontario replaced both of these grants with one contribution, the allocation of which is left to the Ontario Research Foundation. The only constraint placed on the use of this grant is that it not be used to subsidize rates charged to clients of ORF.

In 1977 the Provincial performance grant amounted to approximately $3 million and represented approximately 1/3 of total revenues. Capital facilities including laboratories, offices and equipment are paid for out of the provincial grant solely. The balance of grant funds is used to carry

out research programs and projects which are undertaken between commercial contracts. ORF refers to this as work to fall back on rather than a subsidy to commercial clients.

ORF like NSRF has an overhead rate that hovers around 140% which they consider normal for a research and technical service organization. They would not consider going private for this reason and the fact that they would not be able to provide the proper level of services to the community. To quote L.J. van Monsjou, the Treasurer of ORF "this is not a commercially viable operation because of overheads associated with the need to keep abreast of new and expensive technology."

4.3 Summary

The foregoing information on two other provincial research organizations and the data reproduced in Table 2 provide useful comparisons for NORDCO's evaluation to date.

It is quite evident that these other organizations have operated with a much clearer mandate. They have over a number of decades been able to establish their main technological thrusts at an unhurried pace thus permitting them to acquire the necessary resources and develope the necessary skills in support of the industrial communities

TABLE 2

COMPARATIVE TABLE OF
OPERATIONS OF RESEARCH ORGANIZATIONS

	Ontario Foundation (50 yrs old) 1976-77	Nova Scotia Research Foundation (33 yrs old) 1976-77	NORDCO Limited 1977-78
Staff:-			
Total	300	93	51
Operational	200	58	39
Support	100	35	12
Fixed Assets - book value	$9,400,000	$2,900,000	$717,000
Revenues			
Commercial Contracts	$ 7,300,000	$1,400,000	$ 617,000
Grants	2,900,000	750,000	1,400,000
Total	$10,200,000	$2,150,000	$ 2,017,000*
Operating Costs	$10,300,000	$2,300,000	$ 1,800,000
Overhead Rate	140%	140%	160%**
Charge out Rate	2.4 x payroll cost	2.5 x payroll cost	2.2 x payroll cost
No. of commercial contracts	1520	618	22
Avg. value of contracts	$4,900	$2,300	$28,000
Age of organization (years)	49	29	3
Office & Laboratory	Over 100,000 sq. ft. (owned)	50,000 sq. ft (owned)	13,000 sq. ft. (rented)

*NORDCO's revenues exceed operating costs because of grants received in that year for the purchase of capital equipment which cost approximately $396,000.

**NORDCO's overhead is higher due mainly to personnel recruitment costs of approximately $52,000 and annual rent paid for office and warehouse space of $82,000. Because ORF and NSRF do not pay rent they have a proportionately lower overhead rate.

they serve. Neither of these organizations have had to take a leading role in the establishment of resource based industires in their respective Provinces, rather they are set up to provide a much broader set of support services ranging from advistoy services in the fields of business management and marketing through to specialized engineering and most importantly an R & D capability for technological innovation. NORDCO in terms of the services it provides is much smaller and is focused on marine technology and industry purely.

In terms of the business community being served NORDCO both by definition and location is again much smaller. The number of clients served by ORF and NSRF number in the hundreds and are representative of much larger resource based and secondary manufacturing industries in their respective Provinces. NORDCO's clients on average, may individually represent much larger firms but to date are few in number being drawn mainly from the offshore oil and gas industry and governments. This also illustrates why NORDCO's individual contracts on average are for a much larger value than those of either ORF or NSRF. While the great majority of contracts carried out by NORDCO are of direct advantage to the Province many are carried out for firms and government organizations outside Newfoundland.

The cost of operations for each of these organizations as seen through the respective overhead rates and the size of government assistance through grants is in proportion considering the size, maturity, mandate and location of each. IN terms of facilities, NORDCO lags far behind because of its youth and the need over the initial years to use its funding in support of operations in the face of adverse market conditions. Funding which had originally been allocated for facilities (offices, laboratories and warehouse) had to be redirected. In an effort to cut costs NORDCO has had to move premises 3 times in 3 years and is currently in need of additional space and improved laboratory and warehouse facilities, all of which is currently being rented on short term leases.

While each of these organizations have been established to provide service to the community the only free service that is provided is a Technical Information Service which is underwritten by the National Research Council. NORDCO is not a part of the National Research Council's program but NORDCO does through its participation and substantial sponsorship of the Ocean Engineering Information Center located at Memorial University make a significant contribution to the provision of free technical information services to the local community. In addition, NORDCO has organized,

participated in and underwritten the cost of a number of seminars for the local marine consulting firms.

Other than the above all 3 organizations charge their clients for services performed in line with the approved scale of fees established by their respective Provincial Professional Engineers Associations.

NORDCO's participation in joint ventures is not shared by these other organizations who do not have as an objective the catalytic role in fostering the establishment of new industry.

No information is available on the investment of these organizations on in-house research, however an analysis of the financial information given suggests the expenditures of the three organizations is in proportion.

The major difference between NORDCO and these other two organizations apart from the range of like activities pre-established in the respective mandates is that NORDCO is to perform many of the typical provincial research organization functions but additionally it is to foster the establishment of new industry and in the process become self-sufficient from revenues received under commercial contracts.

5. CURRENT AND FUTURE PROJECT ACTIVITY

Project activity within the firm is handled through its three (3) operating divisions. Information on the level of activity currently ongoing within these divisions is summarized in Table 3 and elaborated on hereunder.

5.1 Operations Division

The operations division currently employs 18 persons. Current contracts are valued at $610,000 while in-house projects costing in the range of $47,000 are also currently underway. Emphasis on the operations division is clearly on commercial contracts, a substantial portion with the oil companies for weather forecasting services. Future earnings potential looks good with $650,000 of proposals under consideration by commercial clients and various Government funding agencies, with another $550,000 of projects not yet advanced to the proposal stage.

The Division is currently made up of four units, The Environmental Forecasting Unit, The Engineering Unit, The Shoe Cove Station, and The Geoscience Surveys Unit. Until recently the Technical Services and Support Unit, now reporting to the Director of Administration and Corporate Planning, was also included in the operations division. This latter unit was spun off to the Administration Division so that it would be better able to serve all divisions of the Corporation.

TABLE 3

PROJECT STATUS SUMMARY

Division	Current Number of Active Projects	Major Type of Project In-HOuse/ Contract	Funding by Source Fed. Govt/ Prov. Govt/ Industry	Project Initiative Solicited/ Unsolicited	Value of Current Contracts
FISHERIES	In Place 6 Proposal 6 Thought 2	In House 8 Contract 5	Fed. Gov't 6 Prov. Gov't 2 Industry 2	Solicited 2 Unsolicited 7	$188,000
OPERATIONS	In Place 12 Proposal 2 Thought 2	In house 4 Contract 12	Fed. Gov't 4 Prov. Gov;t 1 Industry 8	Solicited 7 Unsolicited 3	610,000
OCEAN RESEARCH	In Place 14 Proposal 4 Thought -	In House 3 Contract 13	Fed. Gov't 3 Prov. Gov't 1 Industry 9	Solicited 11 Unsolicited 3	1,060,000

Division	Cost of In-House Projects	Future Earning Potential # Proposals/ Estimated Value	# Thoughts/ Estimated Value
FISHERIES	$ 209,000	$ 95,000	$295,000
OPERATIONS	47,000	650,000	550,000
OCEAN RESEARCH	31,000	65,000	-

The Environmental Forecasting Unit is primarily involved in developing a data base, facilities, expertise, and techniques in weather forecasting in waters extending from offshore Newfoundland and Labrador to the Eastern Arctic. This area of work offers considerable potential for the future, particularly in the next three to five years as drilling resumes offshore. The oil companies have expressed keen interest in this service and it remains now for NORDCO to develop expertise in the practice of weather forecasting to a level acceptable to the oil industry.

The Engineering Section of the operations division offers engineering expertise to all divisions of the company. Areas of recent involvement include an evaluation of Loran-C as a navigational aid for offshore Eastern Canada, and a Marine Transportation Study realted to Bridport Inlet on Melville Island.

The Shoe Cove Station functions within the operations division while providing an information base for the other divisions of the company. The Station enables NORDCO the capability to offer area specific weather forecasts, compile continuous data on ice movements, and provide high resolution imagery. It represents a vital component in enabling NORDCO to carry out its mandate as it transcends practically all of the activities in which NORDCO is involved.

The Geoscience Surveys Unit has expanded its scope to develop enhanced capability in marine surveys and seafloor mapping. The formation of Geonautics Limited was an important step in this process. Plans for the future are aimed at establishing a locally recognized competence to conduct coastal hydrographic surveys to national standards. Future clients for such work are the Provincial and Federal Governments.

5.2 Fisheries Division

The Fisheries Division is currently made up of 7 professionals. Current contracts total $188,000 and on-going in-house projects have an estimated cost of $209,000. It is clear that at present the Fisheries Division is primarily functioning on in-house contracts. However, the future earning potential looks promising with 5 proposals currently being considered by funding agencies with a total value of $95,000 and a further estimated $295,000 worth of potential contracts not yet in the proposal stage.

The current primary clients for fisheries proposals are the federal and provincial governments. It is apparent that the fishing industry is not presently investing in fisheries research, at least through NORDCO. The evaluation committees assessment of the market for future fisheries research is that the government will continue to

be primary investors in Research and Development in the fisheries sector although the Director of Fisheries for NORDCO indicates that over the next few years this pattern could shift and that industry will take a more active role in fisheries research.

One additional point that emerges in reviewing the Fisheries Division current performance is the emphasis on unsolicited vs. solicited proposals. This trend is consistent with the current funding pattern through Government agencies.

The Fisheries Division was understaffed for the first three years of NORDCO's existance and only acquired a director 11 months ago. Therefore, development of this area of the company is just beginning to occur. Consequently, the assessment of the division's performance must be based on identified opportunities rather than historic performance. Proposals have been prepared or are in preparation for a number of projects ranging from fishing gear technology such as the automated otter-board device ($43,000) to a major ($5 million) 5-year research and development program for D.F.E. Should a number of these proposals be accepted then the Fisheries Division will rapidly become a major financial contributor to NORDCO's operation. As indicated earlier in this paper, it is believed that investment in

the development of fisheries technology will grow substantially in the coming years. Should the route for development of the fisheries continue to be via the government and through contracts to consultants, then NORDCO fisheries research has a promising future.

5.3 Oceanographic Research Division

The Research Division is at present very fully occupied with contract work and as long as the offshore exploration conditions persist at the previous level the type of work done by the division will continue to be in high demand.

The division's current state of projects now fits very well with the stated objectives of NORDCO. The division's activities fall into five categories as follows (1) Iceberg Movement and Characterization, (2) Sea Ice management, (3) Physical Oceanogarphy and Meterology, (4) Oceanography and other disciplines related to oil spills, (5) Instrument Development. Total staff is at present 20.

The iceberg subject area comprises two contracts with a combined value of half a million dollars making up about fifty percent of the total contract value for the division.

The field of oceanography includes contracts totalling a quarter of a million dollars and although they are heavily dependent on one client - Imperial Oil - they

nevertheless fall into the exact area of NORDCO's concern - wave, current and meterological analysis for the Davis Inlet and Labrador/Newfoundland waters. There is only one small contract in the field of ice management however.

The work undertaken by NORDCO in the field of instrument development should normally be dervied from the needs of work in the various subject areas, or be related closely to them, and, in fact, the one research contract in this area is connected with the Shoe Cove Satellite Receiving Station development. Under this heading of instrument development, in-house work is going ahead at a low level to explore the potential of a disposable current meter system which is a concept of NORDCO personnel. Again, this is an entirely appropriate activity for NORDCO so long as it is subject to very objective control from the point of view of market development.

In the area of oil spill investigation, contract work is small and, in general, the projects are concerned with the oceanographic aspects of oil spills, and in one case, concerning the detection techniques. This project springs from the connection with remote sensing technology.

The contractual work discussed here represents roughly $1.1 million and some 75% of it is generated from

non-Government sectors. It is divided among ten projects and there are in addition three proposals in preparation. In-house projects, other than the instrument project noted above, are carried out mainly when contract work slackens off.

6. THE FUTURE

NORDCO's future will be influenced both by market demand and the roles it is intended to carry out. This section deals specifically with market prospects and the options available should a change in NORDCO's roles be envisaged.

6.1 Prospects

In order to assess the potential markets for NORDCO it must be recognized that the firm provides services to two major industry sectors (1) offshore oil and gas, and (2) fisheries. The prospects within these two sectors are quite different and therefore they are separately analysed herein.

6.2 Offshore Oil and Gas Sector

The markets within this industry have been treated according to their geographic location and the definition has been drawn between the East Coast Market and Other Canadian Foreign Markets.

(a) The East Coast Market: Offshore exploration activities at least have a life of three further years, with an annual expenditure of perhaps $3 million on research operations, data analysis and methods development in the various fields of interest to NORDCO, i.e.:

Oceanography

Ice movement and management

Iceberg movement and management

Meterological Forecasting and navigational aids

Geophysical and geotechnical investigation

Further, it is probable that within fifteen years, development and production will take place at some level on the East coast or in the Eastern Arctic, implying also continued exploration work in the intervening period. Meanwhile, shipping traffic in the area will grow.

Therefore, to put the prospects at their minimum, there will be at least three years wherein the accumulated competence and resources of NORDCO can be used to do immediately available work. Judged by the past performance of other Canadian companies, in the absence of NORDCO, a large proportion of this work would probably be done outside of the Province.

(b) Other Canadian and Foreign Markets: NORDCO has built up an organization which is capable in some areas of competing for work elsewhere in Canada and internationally.

As a principle of industrial development, any company faced with the possible loss of its local markets should be encouraged to use its accumulated skills to sell outside the Province but to remain based here.

NORDCO could therefore over the three years or more at its disposal, sharpen up its specialty areas to the point where work outside the Province is able to account for a large measure of the company's viability.

The Canadian Government is committed to Canadian excellence in ice covered waters and also to the growth of recognized centres of expertise. This combination of policies should be a strong reinforcement to NORDCO's combined pursuit of business in these spheres, across Canada and internationally, regardless of future local demand.

6.3 Fisheries Sector

The Newfoundland fishery is generally recognized to need a high degree of development - requiring new companies and new methods - development - in harvesting, processing and transport.

Since there is a committment from both levels of government to the fishery as a continuing and growing resource industry in the Province, the need for development should be clear.

The immediate market for NORDCO to sell its services in fisheries technology is however extremely limited despite the obvious need for same.

It would appear that for the next 2 to 3 years at least that governments must be the major clients. It will probably take at least that long until the local fishing industry realizes that it is not only government that has a responsibility for research and development in the fishery.

On the foreign scene there appears to be a number of opportunities for NORDCO to obtain contract R & D work. To date foreign contracts have not been actively pursued but the current level of enquiries suggests a ripe market.

6.4 Market Summary

In summary it can be predicted that NORDCO should be able to find an ample market for its services in the offshore oil and gas sector at least for the next 2 to 3 years. The fisheries prospects however will require substantial government involvement before a local private sector market develops.

6.5 Options

If we accept the premise that there are three major roles an organization such as NORDCO can perform then it remains for us to assess the implications of possible realignments of the role priority. The roles, again, are NORDCO as a consultant, a catalyst and as a research and development organization. We have seen that to date NORDCO,

with qualified success, has attempted to carry out all three functions simultaneously while establishing a corporate identity. Here we will explore a number of role options for NORDCO's future and assess some of the implications based on an assessment of NORDCO's performance to date and expected future market conditions.

Option 1: No Change in Role Assignment

NORDCO would continue to operate as it has in the past. This means that NORDCO would continue its efforts to act as a catalyst and foster the growth of new marine related industry. In addition, a percentage of NORDCO's time and money would be invested in research into and the development of new technology. These two roles would imply a continued development of joint ventures as well as continuation of investment in in-house research. Thirdly, NORDCO would continue its efforts to perform the role of a commercial consulting firm.

If NORDCO were to continue in its present form two consequences are inevitable. The first is that NORDCO would require a new building to accommodate the growth in staff and captial equipment. This will be necessary as the number of consulting contracts available and the development of its research capabilities will require more space than is currently available. The expected growth in the fisheries

division will be impossible in the existing facilities. The second consequence is that NORDCO will continue to require government financial assistance. It is clear from past performance and projections of future prospects that NORDCO contract revenue is insufficient to support the staff necessary to perform both the R & D functions and catalytic role in the local community. It is estimated that the funds required would be at least the level of past years and if NORDCO was to acquire its own premises, a large input of capital would be necessary, in the immediate future.

Option 2: Delete Role as R & D Organization

NORDCO would look quite different under this option and would likely find itself much closer to the marketplace. It would still be able to perform its catalytic role but perhaps on a reduced basis. It is unlikely that NORDCO would be able to undertake much in-house R & D and in turn would require less government funding. There would be fewer unsolicited proposals prepared for industry and government and therefore innovative activity at the local level would be reduced.

The cost of maintaining a staff of highly skilled scientists and engineers during periods when commercial contracts were not available would still have to be paid for. If profits generated from contracts were insufficient

these people would certainly have to leave the organization. Additional cost savings could be realized through a reduced investment in R & D facilities and equipment.

This option overall could provide a substantial reduction in the required amount of government funding with the resultant cost being a decrease in technological benefits.

Option 3: Pure Consultant

This option would enable NORDCO to shed the non-revenue generating roles of an R and D organization and a catalytic agent. From a pure financial standpoint, this option is perhaps the most attractive. In a fairly short period of time, given current market conditions, NORDCO would be able to achieve the goal of self-sufficiency. Continued Government subsidies would still be necessary for at least two years to enable NORDCO to continue to upgrade staff qualifications, and become more knowledgeable about operating in the conditions it must face in northern waters. The nature of the business is also such that the risks of lost equipment, unforseen delays attributable to operating in the Northern environment, or other project implementation problems such as equipment failures, often impose substantial financial losses on specific projects. In an organization of the size of NORDCO, it is not always

possible to provide sufficient contingency allowances in project budgets to compensate for such large variances on specific projects. Financial assistance would also be necessary to enable NORDCO to acquire the buildings and equipment necessary to carry out projects which are now on the table.

Another weakness associated with this option is that much of the valuable R and D work in which NORDCO is currently involved would have to be discontinued. Much of it could perhaps be assumed by C-Core, or the Ocean Engineering Group at MUN, but some work would inevitably be discontinued in its entirety. Such R & D work related to weather forecasting, iceberg related research, and the Shoe Cove Station are examples of valuable R and D work which might be in jeopardy should NORDCO shed its R and D role.

Another concern is the fisheries related research which NORDCO has been pursuing. If NORDCO were to become purely a consulting firm, some sort of special arrangements would still be necessary with the respective Governments to enable NORDCO to continue much of the potentially valuable work it has commenced in the fisheries field.

With respect to the discontinuation of the catalytic role, there does not appear to be any disadvantages to the

Province. This role perhaps more properly belongs with the development oriented departments of the Provincial and Federal Governments. In any event, as discussed earlier, NORDCO has not been highly active as a catalytic agent, and thus discontinuation of the role would not be immediately adversly felt by the ocean industry in the Province.

In conclusion, while this option appears on the surface to be a financially attractive one, and paves the way to privatization of NORDCO, there are drawbacks. Continued financial input would be necessary by both Governments, and much valuable R and D work would be lost to the Province.

Option 4: Delete Role of Catalyst

This option provides for the continuation of NORDCO as a consulting and research and development organization. As seen in the evaluation NORDCO's past performance as a catalyst for new industry has not been major. Therefore, the formal deletion of a catalytic role for the corporation would have minor impacts both on the corporation and the local economy. NORDCO's presence would likely still generate some business activity and the continued purchase of goods and services in the Province would have some economic spin-off value. NORDCO would still require financial assistance as the active pursuit of a catalytic role, for the firm, historically has experienced neither a major cost or benefit to the operation of the firm. Therefore, the level of funding would remain as in Option 2.

7. CONCLUSIONS AND RECOMMENDATIONS

The preceding chapters have covered a wide range of issues related to NORDCO's past, present and future prospects. The strategies, and evaluation requirements outlined in the Agreement have been matched against NORDCO's past performance. The three roles of NORDCO have been examined, and the current state of project activity has been discussed. The future of NORDCO, particularly with respect to role priority, was given attention also. This chapter attempts to consolidate the major conclusions the Evaluation Committee has reached on the basis of the material outlined in the preceding chapters, and makes some recommendations for the future.

7.1 Conclusions

1. NORDCO was conceived and formed at a time when there was great optimism in both the fishery and offshore oil and gas sectors. The 45 months of NORDCO's existence did not see the general growth and activity hoped for in these areas. Consequently, the take-off of NORDCO did not materialize in the time frame originally envisaged.

2. NORDCO experienced great difficulty in recruiting qualified personnel for senior positions. This has had negative implications to the development of the firm in terms of internal management, commercial development and technical credibility.

3. NORDCO has attempted to operate with three distinct roles - as an R & D organization, as promoter of ocean technology to the private sector and as a commercial consultant. In response to the assumption that NORDCO was to achieve self-sufficiency in the first 5 years a relatively greater emphasis has been placed upon commercially oriented activities. However, remunerative work has not been sufficient to finance the two remaining roles. It appears that continued subsidies will be necessary if NORDCO is to continue to perform its present roles.

4. Most of the research and development projects undertaken by NORDCO concerned ice and icebergs. The emphasis in the conduct of such research was on the development of a knowledge base of ice characteristics and the dynamics of ice movement. As a result of this work NORDCO's expertise in this field has been given some recognition on the international scale.

5. NORDCO's role as a catalyst was inhibited by its other role as a consulting firm. The requirement that NORDCO act as a catalyst in the formation of new ocean industry oriented firms meant that in effect it was encouraging competition for itself. This in turn conflicted with NORDCO's assumed goal of self-sufficiency.

6. NORDCO's involvement in joint ventures with Canadian, local, and foreign firms enabled the Corporation to gain considerable knowledge in terms of staff training, field experience, equipment testing, and general consulting business practice and has expanded market opportunities for the firm.

7. NORDCO has not had to this point a significant impact upon the Newfoundland economy in terms of supporting or creating activities which created or maintained employment. NORDCO has encouraged and participated in the expansion of new industry to a limited degree, and the future may see some of these activities emerge as significant contributors to employment growth in the Province. At present, however, current definable benefits do not exceed the costs incurred by both Governments in subsidizing NORDCO's operations.

8. NORDCO's activities to date have not had a significant impact on the broadening of economic opportunities in the Province.

9. NORDCO has not had significant impact upon income levels in the Province.

10. Direct employment within NORDCO has had some positive impact by creating opportunities for technical and professional personnel within the Province.

11. NORDCO has made progress in upgrading the knowledge base associated with the physical marine environment. The development of this knowledge base will enable NORDCO to play a valuable role in designing appropriate technology for northern ocean research and development as well as in reacting to future environmental problems.

12. When compared to two other Provincial research organizations (Nova Scotia Research and Ontario Research) it was clear that the mandate and funding structures were different. This underlined the uniqueness of NORDCO's situation where it is required to combine effectively three differing roles.

13. Current and future demand for NORDCO services is encouraging. Both the Oceanographic Research and Operations Divisions face at least three (3) years of high demand from offshore exploration activity. Prospects for the Fisheries Division are closely tied to government policy and investment in the modernization of the fisheries over the next 5 years. The success

of the division will be related to the degree of commitment of the governments and the extent to which the government agencies choose to contract work. It is not clear that the fishing industry, itself, is prepared to invest in the development of new technology in the short term.

14. A continuation of a certain level of R & D within NORDCO is essential if it is to keep abreast of changing technological needs.

15. Based on past performance should NORDCO cease to play a catalytic role but continue as a consulting agency and a research and development organization then there would be no change in the requirement for subsidization. The cost of performing the catalytic role has been more of revenue lost rather than direct cost to the firm.

16. Given current market prospects it is probable that NORDCO could operate as a commercially viable consulting firm with a greatly reduced R & D role and no direct attempt to act as a catalyst. In the short-term this would likely necessitate some reduction in staff.