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Ocean Information Services

Study Group Report to the Ad Hoc Interdepartmental Committee to Discuss the Requirements and Availability of Ocean Information Services

Government of Canada
Fisheries and Oceans

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Department of Fisheries and Oceans
Ottawa 1980

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[1] This report represents the findings and recommendation of the Study Group, based on interviews and discussions held with governmental and nongovernmental clients of ocean information services.

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OCEAN INFORMATION SERVICES STUDY
EXECUTIVE SUMMARY

An interdepartmental study team was constituted in the spring of 1980 in response to a perceived need for new and improved ocean information services to keep pace with increased offshore developments. The team was charged with identifying problems with present ocean information services, pointing out obvious gaps in government programs and recommending how federal responsiveness to the requirements of Canadian marine activities would be improved.

The study team held many meetings across the country with a representative sample of offshore interests in order to discover their perception of government ocean services and to identify their requirements.

The meetings generated many observations and comments from which the study team extracted the following recommendations.

1. It is recommended that thé Marine Environmental Data Service and the Atmospheric Environment Service prepare, maintain and disseminate a data directory of marine data holdings in Canada.

2. (a) It is recommended that:

   (i) advice and consultation on observational practices and guidelines for marine data collection, storage and analyses should be made available from the federal government so that data gathered within Canada is of uniform quality.

   (ii) consideration be given to the task of preparing guidelines and standards for the observation of those marine parameters for which it is feasible and for which no present directives exist.

   (b) It is recommended that a reference list be published of marine instrumentation with comments on their respective cost, performance, calibration requirements and basic characteristics for the use and guidance of both the private sector and government.

3. (i) It is recommended that Ocean and Aquatic Sciences, or some equivalent organization, undertake a study on the feasibility and usefulness of an inventory of major marine scientific and environmental data collection programs undertaken in Canada that would be updated on a yearly basis.

   (ii) It is recommended that government and non-government scientists cooperate more fully in joint research programs. This cooperation would necessitate better dissemination of future research plans by both parties and a government/industry mechanism set-up for integrating them.

4. (i) It is recommended that OAS and AES work closely together to improve real-time and near real-time operational marine products.

   (ii) It is recommended that OAS and AES prepare reports on the usefulness, feasibility and resources needed to prepare a Canadian marine science atlas and climatologies from available data holdings.

5. It is recommended that:

   (i) the Arctic be addressed by the government as a frontier area needing a coordinated approach and special consideration for marine data collection and the development of marine services over the next decade. The marine research and data programs required should be undertaken cooperatively by government and industry, with government retaining responsibility for overall coordination.

   (ii) the Atmospheric Environment Service and Ocean and Aquatic Sciences jointly review the adequacy of marine information services in the North in preparation for anticipated developments in the next decade.

(iii) accelerated hydrographic services in the Arctic be urgently undertaken by government to ensure the safety of Arctic marine shipping operations.

6. (i) It is recommended that federal departments and agencies providing marine services examine the accessibility of these services to their clients and where necessary identify national and/or regional contacts to improve the provision of advice and information. Consideration should be given to interdepartmental cooperation in order to provide a more comprehensive marine information government service.

(ii) It is recommended that the availability of information on government activities be actively disseminated and public relations improved through brochures, displays and advertisements.

7. It is recommended that an interdepartmental plan be prepared to lead the government marine services and data collection program into the next generation of capability in the oceans and coastal waters. The plan should identify resources required and should be spread over a five-year period commencing in 1982-83 providing a comprehensive and coordinated approach to platforms, instruments and facilities.

8. It is recommended that:

(i) the agencies responsible for marine services investigate the specific requirements identified in interviews (Appendix C) in order to assess whether corrective action can be taken.

(ii) the agencies report back to a further meeting of the interdepartmental committee in the spring of 1981 on the status of the actions taken on the identified requirements.

(iii) the interdepartmental committee also assess the adequacy of the actions taken on the recommendation of this study.

(iv) the interdepartmental committee give approval for wide dissemination of this report.

OCEAN INFORMATION SERVICES STUDY

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OCEAN INFORMATION SERVICES STUDY

1. Introduction

Managers connected with, or having interests in the oceans fully recognize that the situation in the marine environment is changing rapidly. Technological advances are influencing and changing the traditional industries of fishing and maritime trade, and producing new ventures into non-renewable resource exploration and production. Man, in fact has emerged from the "pioneering" age where the ocean was an unexplored, little-understood environment into the homesteading age where the ocean must be described, harnessed and conserved for the benefit of present and future generations.

In order to better plan, design, operate and manage marine activities, continual research must be undertaken, data must be gathered, observations analysed, results interpreted and the eventual products disseminated to the user in an acceptable form. When the user population changes or expands, new services must be implemented or existing services augmented and improved. The great cost and effort involved in undertaking and maintaining an expertise in the ocean and providing the necessary marine services has, in the past, forced the responsibility onto government and the public purse. However in recent years, the pressure of economic advances into the ocean environment has encouraged industry to increase their initiatives in marine science in many areas to the extent that their efforts now equal or surpass those of government. In general, industry needs site-specific, rapid responses to everyday problems whilst government must consider long-term and regional questions. Industry wishes to innovate and exploit; government must regulate and protect. A balance must be struck. Is government being responsible to the needs of the marine community? Is government spending enough public monies on present day marine science problems or placing too much emphasis on classical oceanographic research studies with longer term benefits? These were some of the questions that prompted an interdepartmental meeting, held in March, 1980, and led to the formation of a study team to search for the answers. Briefly, in its terms of reference (Appendix A), the study team was directed to meet with representative cross-sections of offshore interests in order to obtain their perception of government ocean science and marine services. The study team was to identify problems with present services, to point out obvious gaps in government programs and to recommend how the federal responsiveness to marine activities can be improved.

The study team, headed by Ocean and Aquatic Sciences (OAS), of the Department of Fisheries and Oceans (DFO), and assisted by other departments, particularly the Atmospheric Environment Service (AES) of the Department of the Environment (DOE), held many meetings across the country. These are listed and reported in Appendix B. The result was an objective sample of concerns and observations, from a broad selection of marine interests. From these observations and concerns the study team has developed the recommendations in Chapter 3 which represent the broad requirements of marine interests. The more specific requirements identified in the interviews have been listed in Appendix C. It must be noted that although the study team made every effort to reach the most representative sample possible, there are certain anomalies and omissions. The study team hopes that these will not prove serious or detract from the main thrust of the recommendations.

2. Government/Industry Responsibilities

In a conservative system with incremental changes in requirements, government is capable of maintaining basic services, responding to long-term needs and regulating continuing activities. In a rapidly changing system however, government is hard-pressed to respond to new demands, accelerate its programs and provide adequate control for new activities. The problems of government are compounded during periods of fiscal constraint when established programs compete with new initiatives for the money available. The marine environment is no exception to this situation and for the past decade government has been struggling to respond to the rapid growth of industrial interest in Canada's offshore and frontier lands. To date the result has led to confrontations between the economical benefits of immediate exploitation and the social and environmental concerns for controlled growth. Unfortunately, arguments for both sides are often based on data and research that are unavailable or incomplete, resulting in costly delays to decision making whilst the private sector and government undertake studies to fill the data gaps. The industrial share of these studies is growing

as government finds itself unable to carry out the necessary work in a suitable time frame. Industrial-sponsored programs also lead to a balance of expertise being transferred to the private sector, which, in the extreme, could erode the capability of government to adjudicate and challenge scientific arguments on behalf of the Canadian people.

In general, therefore, government has to operate on the following philosophy, as it has been seen to evolve during the last decade, and supported with observations obtained from the various meetings during the study.

> *The Canadian government must possess a knowledge that will advance on an equal and parallel course with important advances in industrial and resource development. In so doing, it will endeavour to assist industry in the planning, management and operation of these advances and in the safe and effective operation of industrial activities. It will however keep a distinct and responsible voice apart from industry in order to regulate and control those activities in a manner commensurate with its legal and moral obligations to the environmental, economical, political, social and security aspirations of the Canadian people.*

The Canadian government may require industry to bear the burden of data gathering and research to justify the approval of specific projects, and to assist in the expense of providing necessary services in areas where industry is a sole or special client and will require industry to make available to government the data holdings for the benefit of future analyses and decisions.

Government has a responsibility to provide services of broad interest to the Canadian people and to discharge functions on behalf of the social and economic well-being of those people (for example the protection of the marine environment). Government must be prepared therefore to pay for the ability:

i) to judge whether an activity will impact adversely on the environment or society which it is charged with protecting;

ii) to evaluate submissions by industry for proposed actions;

iii) to determine the data and analysis required for a management decision;

iv) to provide services that are of general benefit to the nation;

v) to act as a storehouse of knowledge for regions or sophisticated areas of science where the scope or complexity of the task is such that government is the logical source;

vi) to effectively and adequately discharge its obligations under law;

vii) to be forward looking in terms of science and technology and provide incentives to industry to ensure the continuing success of the Canadian private sector in the face of international competition.

In general, industry should pay for special services it requires directly and uniquely to increase its capability to operate profitably. Industry should also provide specific services, data, monitoring and research uniquely connected with its operation.

Where possible, and particularly in areas where industrial pressures accelerate programs of government science and services, government and industry should work jointly to fill the identified data and research gaps as rapidly as possible so that the ensuing activity is neither unjustifiably delayed nor pursued with foolish haste.

In the general observations that follow, government was often seen to be responsible for long-term, national and regional research and to be the provider of basic services, whilst industry was responsible for short-term, site-specific evaluations and special related services. Government was also seen in the role of overall watchdog for data, research and activities in the marine environment from whatever source.

Finally, within government itself, the science and service sectors have responsibilities towards their regulatory counterparts. Management decisions must be based on the best available data but the expertise for the collection, analysis and interpretation of these data does not often reside in the regulatory bodies. Therefore, the science and service sectors must respond to the needs of the regulatory agencies in order for government to be effective. For their part, the regulatory agencies must be prepared to identify their needs and cooperate with the science and service sectors in the establishment of the necessary programs.

3. Meeting the Needs of the Ocean Community

In the time frame available for the study it was only possible to meet with a representative selection of offshore interests. Government departments were requested to name contacts for the purpose of liaison with the study group and these were used to set up appropriate departmental and private sector meetings. The non-governmental meetings were arranged with the assistance of the regulatory agencies and included meetings with representatives of the fishing, offshore oil and gas, shipping, coastal engineers, environmental consultants and defence interests.

The summaries of the discussions held are given in Appendix B. The meetings endeavoured to assess the perception of government held by the client or activity sector being interviewed. In general the study team felt that this was achieved, although isolated cases occurred where opinions expressed were not felt to be representative or well informed. However, in these instances the reason could invariably be traced to a lack of government/industry communication, which in itself was a significant finding of the study.

A more difficult problem to assess is omissions from the meeting schedule, that is, those sectors and interests that had an important contribution to make and were not included. It has to be accepted that these omissions exist; however, the study group attempted to minimize these through a careful selection of representative clients. It is not felt that additional interviews would significantly alter the recommendations of the study, although they would certainly generate more detailed requirements of the type extracted from the discussions and listed in Appendix C.

3.1 A National Marine Data Management System

All sectors of the marine activities interviewed expressed the need for a national data management system. The form of the system described varied slightly from meeting to meeting but the general requirement was consistent throughout. In this regard the findings of the study group echoed those of the 'Lapp Report' of 1979. The federal government was seen as possessing the only capability and mandate in the country for such an undertaking. The present national oceanographic data bank, the Marine Environmental Data Service (MEDS), was identified as the nucleus for the 'wet' side of marine data while AES, through its existing data banks handles the 'dry' side. Again, following the 'Lapp Report', there wasn't any pressure for a single all-encompassing national data bank but more of a need for some facility within government that should be aware of marine data holdings wherever they were held.

A great deal of discussion took place on the question of government versus private data holdings. Although some propriety was recognized, particularly in those cases where industry was engaged in competitive exploration for marine resources, it was widely agreed that data should eventually be freely available, and even for restricted data, the source and content should be identified so that negotiations for their release to potential customers could be made. Reservations were expressed by industry on the cost of preparing and submitting data to national or regional files or of responding directly to requests themselves but the benefit of a comprehensive marine data capability was generally seen to outweigh any disadvantage.

Recommendation 1. It is recommended that the Marine Environmental Data Service and the Atmospheric Environment Service prepare, maintain and disseminate a data directory of marine data holdings in Canada.

Discussions with the Director of MEDS have revealed that this recommendation is already being implemented in part for the data holdings within OAS, with plans to extend the inventory to departmental, interdepartmental and national data files at the earliest possible date. AES data holdings already tend to be comprehensive due to the national data network in existence.

No mention has been made in the above as to the types of data that should be handled in a data inventory. This was intentional because the data requirements varied widely depending on the interest of the clients being interviewed. However, the broadest need was seen to be in the areas of temperature, ice, wind and waves. Specific requests for data inclusion or availability are extracted in Appendix C.

3.2 Formats, Standards, Guidelines, Instrumentation

As stated earlier, the federal government is seen as being the responsible manager for national and far-reaching scientific activities. It was to be expected therefore that government was generally accepted as having the mandate to advise on data formats and standards, to provide observational guidelines and to recommend instrumentation, as is done by AES for atmospheric data. It is also obvious that data should be collected and stored in a compatible manner by all parties across the country in order to facilitate usage and interchangeability. Again, international standards must also be adhered to for the same reasons. The acceptance of a federal responsibility in this regard was widely endorsed by the meetings, although specific interests and points of view ranged widely from client to client and from meeting to meeting.

The regulatory agencies saw the service-oriented departments as being responsible for assisting them with establishing regulations for data collection, reporting and analysis at all levels. These ranged from the setting of regulations for required parameters, advising on instrumentation, training technicians, and advising on formats for data reporting and analysis. The amount of available industrial data could be increased through pressure being brought to bear by regulations demanding compliance with data collection standards. A factor that bears heavily upon the access and acceptance of data for national use is data quality, especially in cases where data are in an averaged or partially-analysed form rather than raw data. Standards for the collection, and analysis of these data would enhance the capability of a national data facility to quality control data from all sources. For data to be handled in real-time, some standardisation of data reporting is essential. For non real-time data, the most important objective is to obtain data of known quality, and format is of secondary importance.

The ability and expertise available within government in the form of analytical software was thought to present a national resource that could usefully be shared with industry.

The need for standards and guidelines was seen to be pressing because of the amount of data presently being collected by offshore industry, because of the future demand for oceanographic products and because of the existing amount of data of unknown quality across the country.

Although government was generally seen to carry the responsibility for data management, the preparation of guidelines, standards, etc. could be provided by contract to private industry with guidance from government scientists. It was recognized that the personnel involved in such an exercise must be knowledgeable and experienced. An urgent need was seen to be in the area of biological data; national marine biological data files are either scarce or non-existent and there is an absence of standards and guidelines for collection and storage. It is recognised that many biological parameters are not amenable to standardisation, but nevertheless, progress towards data compatibility in observational practices and quality was considered desirable by many users.

Recommendation 2(a). It is recommended that:

i) **advice and consultation on observational practices and guidelines for marine data collection, storage and analyses should be made available from the federal government so that data gathered within Canada is of uniform quality.**

ii) **consideration be given to the task of preparing guidelines and standards for the observation of those marine parameters for which it is feasible and for which no present directives exist.**

Many clients identified the usefulness of advice and information on marine instrumentation. The difficulty of keeping abreast of technological advances, or even current capabilities, and the resources needed to test and evaluate new equipment, generate a requirement of pooling resources and information. The federal government was seen both to have the greatest capability and to hold the responsibility for coordinating this activity.

Recommendation 2(b). It is recommended that a reference list be published of marine instrumentation with comments on their respective cost, performance, calibration requirements and basic characteristics for the use and guidance of both the private sector and government.

3.3 What's Happening in Offshore R & D?

The growth in economic importance of offshore resources and the corresponding haste for exploration and development has led naturally to a mushrooming of consultants, engineering firms, manufacturers and other secondary industries anxious to meet the needs of the developers. Concurrently, there has been a requirement within government to expand environmental research and monitoring in areas of offshore industrial activity to maintain a regulatory and management role. Where governmental resources have been unable to respond to the pace of exploration, industry has been forced to undertake its own environmental studies. Therefore there exists a situation conducive to duplication and waste. Data are being gathered and research undertaken in a fragmented and piecemeal fashion. Not only is industry unaware of many of the research projects being undertaken by government and vice versa, there is also a lack of awareness of research projects amongst industries and within government.

There were many opinions expressed at the interviews along the lines of the usefulness of a national program inventory. In concept the suggestions varied from an expansion of the "Directory of Marine Scientists", put out yearly by the Canadian Committee on Oceanography, to include research projects, to the submission of information yearly in a given format to a national data file on ongoing and planned marine programs. As with a data inventory, some propriety would have to be recognized and certain information protected; however, generally, a brief description of research programs (of a size of $5,000 or over per year for example) with the name and address of the scientist-in-charge was seen to be highly desirable. Most speakers were of the opinion that if such a system were implemented advantages would outweigh disadvantages. The abstracting service, ASFIS, Aquatic Sciences and Fisheries Information System, is a computerized, internally-managed inventory of research abstracts that could form a model for such a national research program inventory.

One of the questions asked at the interviews related to ease of access to government science and expertise. The answers depended on the degree of personal contacts held with government scientists; those that had close contact with researchers in government institutes seemed to have little problem in finding sources of information and assistance; however, others, less fortunate, were often left frustrated and disappointed. An inventory of marine science projects could only serve to ease the situation.

Finally, several appeals were made during the interviews for increased program cooperation between the government and the private sector. Two or three examples were given of joint scientific endeavours, all being major projects. Closer cooperation from the planning stage would eliminate duplication of effort and some of the present loss of data.

Recommendation 3(i). It is recommended that Ocean and Aquatic Sciences, or some equivalent organization, undertake a study on the feasibility and usefulness of an inventory of major marine scientific and environmental data collection programs undertaken in Canada that would be updated on a yearly basis.

Recommendation 3(ii). It is recommended that government and non-government scientists cooperate more fully in joint research programs. This cooperation would necessitate better dissemination of future research plans by both parties and a government/industry mechanism set up for integrating them.

3.4 Data Analyses and Products

There are two distinct types of data services that can be provided. The first is the production of real-time or near real-time analyses which can be directly used for operational management and the second is the non-real time analyses of climatological significance that are essential for planning, design, operation and management. The former requires an operational network for the rapid collection, analysis and dissemination of data, such as presently exists for real-time meteorological data and forecasts. Marine broadcasts of wind, sea state, fog, ice, etc. need to be updated several times per day in order to be effective. Also in this category are phenomena that must be described for operational use but whose variation is such that up-dating may be required less frequently. These include wave forecasts, wave persistence, ice predictions, currents, areas of upwelling, and thermal fronts, ocean temperature conditions, etc. and can be used for ship routing, oil and gas drilling, fishing, defence purposes, etc. It is obvious that some of the parameters needed for operational use are surface-oriented and therefore are jointly of interest to both oceanographers and meteorologists. Again, much of the operational network and technology needed for ocean services already exists in AES and the opinion that OAS and AES should cooperate closely in the area of marine services was expressed several times during the interviews. Already anticipating such a development, the two Services are presently working on a Memorandum of Understanding that will increase cooperation and liaison between the two Services. In the international field a reporting and analysis system for oceanographic data is also jointly managed by oceanographers and meteorologists, under the auspices of the Intergovernmental Oceanographic Commission and the World Meteorological Organization respectively. The major parameters measured to date are temperature and salinity; plans to expand this coverage are being prepared.

A great many clients thought that it was a federal responsibility to produce interpretive analyses of data holdings in the form of climatologies, or atlases, where appropriate. These atlases were thought to be invaluable to all types of offshore activities for the preparation and planning of environmental impact assessment, design criteria, operations, etc. The knowledge that the preparation of such analyses would involve new federal programs in ocean data did not detract from the wide support that this development received. It is recognized that these services will also be addressed by the Canadian Climate Program, currently being developed by DOE, and that coordination of effort by DFO and DOE is essential.

From a scientific point of view there has been increasing emphasis over the past few years on world climate variations which, because of the great influence of the oceans in the climatic process, has produced a corresponding need to produce accurate and up-to-date climatologies of the marine environment. The importance of marine climatology to the fishing community and fisheries management was also expressed at the Ocean Climate Workshop by those who wished to correlate the climatic variations of the physical marine environment with the abundance and behaviour of fish stocks. An example of the cost-benefit of these studies to the fishing industry was the failure to locate the mackerel run off the east coast for each of the last two years. The cause was thought to be attributable to variations in physical conditions forcing a change in migration path. The cost of the unsuccessful search was about $\$¾$ million and the loss of profits another $\$½$ million.

Recommendation 4(i). It is recommended that OAS and AES work closely together to improve real-time and near real-time operational marine products.

Recommendation 4(ii). It is recommended that OAS and AES prepare reports on the usefulness, feasibility and resources needed to prepare a Canadian marine science atlas and climatologies from available data holdings.

3.5 The Northern Frontier

The frontier exploration and development taking place in the Canadian Arctic clearly influenced the responses at many meetings. The Arctic is still relatively unexplored; marine data from Arctic waters is sparse, hydrographic data is incomplete and services provided to the northern community inadequate for future needs. Due to this vacuum in research and data, many consultants are concentrating their efforts in the North, gathering and analysing data to use in the design and operation of industrial equipment and activities. Even so, the pace of economic development threatens to overtake the available knowledge and research.

Concern was widely expressed at the lack of adequate data for northern operations (Arctic marine transportation, harbour construction, creation of offshore islands, activities on or over ice, operation of drill rigs in ice-affected waters, pollution control, etc.). These concerns were amplified by the foreseen timetable for oil and gas production and movement to southern markets from the North by 1985, a deadline impossible to meet for much of the data needs unless immediate remedial action is taken. Delays to the production programs were seen as inevitable.

Ice research was identified as a priority along with the absolute necessity for adequate navigational charts, aids and marine services. These requirements do not come as a surprise; DFO has prepared submissions on ice research and hydrography in the North which, in the present fiscal climate, have not yet been funded. The need for greater meteorological, oceanographic and environmental data in the Arctic has been recognized and recorded ever since the discoveries of oil and gas in Prudhoe Bay, Alaska, heralded the frontier explosion of resource activity. Nevertheless, the rationale must be made to government that the opening up of a third ocean boundary must produce unacceptable demands on a marine science budget that had operated virtually on a two-ocean system until up to a few years ago. There is an obvious limit to resources that can be diverted from east to west, especially when the extension of fisheries jurisdiction and hydrocarbon exploration and transportation are adding to the workload in those areas, and when research in the Arctic can imply costs that are considerably higher than those in more temperate waters. Also of priority were gaps in wind, wave and ice data, the latter, including the identification of icebergs and their movements, is urgently required for the east coast of Labrador. Generally, increases in oceanographic data for all offshore areas were identified as a natural consequence of the present industrial activities.

Recommendation 5. It is recommended that:

i) the Arctic be addressed by the government as a frontier area needing a coordinated approach and special consideration for marine data collection and the development of marine services over the next decade. The marine research and data programs required should be undertaken cooperatively by government and industry, with government retaining responsibility for overall coordination.

ii) the Atmospheric Environment Service and Ocean and Aquatic Sciences jointly review the adequacy of marine information services in the North in preparation for anticipated developments in the next decade.

iii) accelerated hydrographic services in the Arctic be urgently undertaken by government to ensure the safety of Arctic marine shipping operations.

3.6 The "Cloak of Invisibility"

The government was seen as maintaining a low profile by most of the private sector and indeed interdepartmental knowledge of programs and projects amongst government departments also seemed inadequate. A lack of communication between government departments and between government and industry leads to duplication and ineffective use of national resources. Where personal contacts have been established, the situation is overcome; however, it may take years for a new industry to develop a personal set of contacts with related industries and agencies. Therefore, what is seen to be required is a "window" into government, a phone number and an address within a service department, that will provide answers or direct requests to the appropriate knowledge source for response. The "windows" must be well publicized, and this in itself would call for a public relations and marketing effort of some magnitude.

The provision of a focus for requests is, of course, only part of the invisibility problem. An additional effort must be made to inform the public, private sector, and other government departments of programs and activities being carried out. The dissemination of such information always presents a difficult choice of vehicle. Research reports from government are freely available but are of usually limited general interest because of the complexity of the subjects treated. Annual or biannual reports on the other hand are usually condensed to a minimum of information which can also lead to a breakdown in communication transfer.

Recommendation 6(i). It is recommended that federal departments and agencies providing marine services examine the accessibility of these services to their clients and where necessary identify national and/or regional contacts to improve the provision of advice and information. Consideration should be given to interdepartmental cooperation in order to provide a more comprehensive marine information government service.

Recommendation 6(ii). It is recommended that the availability of information on government activities be actively disseminated and public relations improved through brochures, displays and advertisements.

It must be repeated here that although this recommendation was generally seen to be needed, a few areas of the marine sector felt that the liaison and contact with government service departments was entirely satisfactory at present. For example, the interaction between the Ship Owners Association and the hydrographic, marine weather and navigational services of government was reported as excellent; the annual meetings between government and industry to discuss complaints and request action has had a long history of success.

3.7 The Next Generation

The crystal ball has already yielded its secrets for the next decade. The development of remote sensing in the marine area, advances in satellite positioning and communications, automation of instrumentation, new technology and computer capability will impact markedly on the ability to collect data and provide services in the marine environment. The greatest result of all these advances will be in the handling and assimilation of data in near-real time. Although the primary raw data will continue to flow through the responsible scientist, there will be the equivalent of 'quick-look' data arriving from many sources in a near-real time mode at regional and national centres. Ground truthing and computerized quality control techniques for these data will have to be developed, and a scientific and technical competence established for analysing and interpreting the information. This latter competence could be handled by the private sector in much the same way as the 'Landsat' imagery is processed, or a group of "operational" oceanographers could be established within the government.

Remote-sensed imagery is not a new phenomena; it has become a standard operational tool for some land-based management operations but applications to the ocean sector with the exception of ice observations, are in the early stages. Many new sensors have already been proven; many others have yet to be tried. However, it is certain that changes due to these new data sources will be significant.

Ice reconnaissance in general, and the identification of multi-year ice in particular, is possible through cloud and in conditions of total darkness using remote sensing techniques such as Side Looking Airborne Radar (SLAR) and Synthetic Aperature Radar (SAR). Laser altimetry can provide information on the dimensional characteristics of ice pressure ridges. Ice parameters, and of course the navigational and communication aspects of satellite use, are all extremely important to Arctic shipping.

It is expected that the Coastal Zone Colour Scanner (CZCS) and possible new air borne techniques (laser flourorsensor methods) will provide maps of chlorophyl and productivity for the fishing industry, and future extensions of these and similar techniques could produce marine pollution data. Altimetry data is expected to become an important part of studies directed at ocean circulation and for the identification of sub-surface features. The microwave sensors, in addition to their ability to penetrate cloud cover can provide data on sea state, wind and current strength and direction. Over the Horizon Radar (OTHR) is another tool possibly capable of sensing these parameters on a much broader scale.

During the interviews, although satellite imagery was the major innovation discussed, some mention was made of automated data collection techniques and other new technology. The automation of ships of opportunity would provide a broader and more reliable data base for ocean information. Equipment established on or adjacent to drilling rigs will also provide important data. These sources of data will most probably transmit data directly to shore via communication satellites, both complementing the research platform data and providing a valuable real-time ground truth for satellite imagery.

The advances in positional accuracy and the relative cheapness of equipping vessels will enable a much improved management of offshore activities to be maintained for search and rescue, fisheries management, sovereignty and marine transportation.

Remote sensing will facilitate the collection of data and the preparation of ocean products for surface-related phenomena, which will also provide some indications of sub-surface processes, especially if ground truth observations are available for correlation. Concurrently, improvements in sub-surface sensors, especially in the acoustic field are expected to make substantial improvements in the quantity and quality of water column and seabed data.

The broadening of the data collection and marine services required over the next two decades will require an investment to replace obsolete equipment with the new generation of platforms, instruments and facilities. A coordinated plan for this program, although initially requiring some capital investment, will provide an economic payoff in the longer term. This cost-benefit will not only arise from the more effective and efficient management of offshore activities but the resulting technology will enable the cost per unit data to be reduced substantially.

Recommendation 7. It is recommended that an interdepartmental plan be prepared to lead the government marine services and data collection program into the next generation of capability in the oceans and coastal waters. The plan should identify resources required and should be spread over a five-year period commencing in 1982-83 providing a comprehensive and coordinated approach to platforms, instruments and facilities.

3.8 Follow-Up Activities

During the course of the interviews there were many instances of site-specific or parameter specific requirements. It was not considered necessary to provide recommendations individually for these requests but these have been extracted from the discussion summaries and are listed in Appendix C. The Study Group has identified responsibility centres to address these requirements. It was felt that several months should be allowed for managers to investigate the requirements and actions to be implemented. However the Study Group recommends that a status report be given in the spring of 1981 on the progress of decisions taken. At the same time, departments should meet to discuss the adequacy of steps taken on the main recommendations of the study.

Recommendation 8. It is recommended that:

i) the agencies responsible for marine services investigate the specific requirements listed in Appendix C in order to assess whether corrective action can be taken.

ii) the agencies report back to a further meeting of the interdepartmental committee in the spring of 1981 on the status of the actions taken on the identified requirements.

iii) the interdepartmental committee also assess the adequacy of the actions taken on the recommendation of this study.

iv) the interdepartmental committee give approval for wide dissemination of this report.

4. Previous Studies

It was always the intention of the Study Group to take into account related studies already completed. In all cases the recommendations of this study were seen to follow-on and complement previous findings. The

Study Group found 29 recent reports relating to its work and has listed these in Appendix D. Statements from these reports have also been extracted or summarized in the Appendix so that the correlation of previous work with that of the present study can be more easily identified.

From the extracts presented it is obvious that there is widespread concern, echoed by the present report, about the present and foreseen marine capability in Canada. This capability must be in place in order to develop offshore activities in support of the various resource industries. Much of Canada's future wealth lies in her offshore resources and it is to her advantage to attain and maintain a high level of expertise in this area both for the economy and social well-being of Canadians and for the maintenance and preservation of her marine environment.

5. The Cost

The Study Group is of the opinion that certain short-term improvements and developments can take place in ocean services through existing resources. However, in the long term, government will have to make a substantial commitment to carry the ocean services through to the end of the century at an adequate level. This commitment must commence with a capital outlay to upgrade facilities and instruments to the next level of capability. Future operating costs are expected to be relatively lower per equivalent unit of data than at present, although large increases in quantities of data may lead to an overall increase in operating costs. Certainly the cost-benefit of a coordinated data collection network will far outweigh the initial resources expended in its establishment.

The benefits of a high level expertise in the marine environment are not always predictable. The side scan sonar mesurements in the Beaufort, for example, although being tested for another purpose, revealed the presence of ice scours, which have had one of the most significant impacts on sea bed engineering and design of oil and gas operations in the Arctic and East Coast.

Some of the equipment and facilities will have interdepartmental interest and use. For example, communication and position-fixing satellites will collect and transmit data available for scientific, operational and management purposes. Data collected will be analyzed and the products arising will be used for regulation, control and descriptive purposes. It would be inefficient to duplicate the existing or planned facilities for satellite data transmission and processing but rather these should be used interdepartmentally. The same rationale applies to computer hardware and software.

Creating a window within government for better public access to data, products and expertise will undoutedly require some additional effort and resources if government is to achieve anything approaching the Marine Information Advisory Service (MIAS) of the U.K. MIAS was a direct result of the North Sea Oil and Gas developments and grew from a similar situation to that in the Canadian offshore. The special extent of the Canadian coastal waters and the added effects of the northern environment amplify the problems faced in the North Sea. An ironical point may be that the very advertisement of our wares may lead to a quantum jump in demands that cannot be absorbed by current budgets.

Data collection can be made more efficient through the national acceptance of observational standards for data quality, facilitating the interchangeability amongst data sources and data banks.

With regard to the Arctic program, it is recognized that research and data collection must precede the resource development. The transfer of effort from programs from other marine areas is not considered to be a viable alternative, and new resources must be identified. It is highly relevant that over three-quarters of identified data needs from this report, and from the findings of previous studies, relate to the Canadian North. It is not under the terms of reference of this Study Group to identify the source of funds; however, the relationship of the future needs to the resource industries suggests that some joint effort between government and industry is called for.

Coordination of industrial and government programs of data collection and services will also require the involvement of universities as the source of technical and research personnel for both communities. Education requires long term planning and therefore manpower availability is a first consideration for any marine program.

In general there are initiatives presently underway that have a direct relationship to the financial requirements of the recommendations within this report. Firstly, as has been stated elsewhere, some of the recommendations are already recognized and are being implemented. Program submissions to Cabinet are already in existence or planned for some areas (for example, 'Sea Ice Research' and 'Hydrographic Activities in the North' are two submissions that relate specifically to the results of this study although the fate of these particular initiatives has not been settled). The MOSST submission on R & D recommended that the 'Ocean Sector' be considered as an area of potential growth. The Interdepartmental Committee on Space has developed a five-year plan that will undoubtedly be used in the future for ocean purposes.

The Study Group recognizes a broad range of interests in ocean services that have to be coordinated and brought together for effective implementation. The mechanism for coordination should be agreed inter-departmentally and may take the form of a new initiative or an existing committee. There presently exists the Canadian Committee on Oceanography (CCO) and the Panel on Ocean Management (POM) although neither of these have a mandate to advise Treasury Board of financial requirements, a responsibility that the Study Group feels is a 'must'.

APPENDIX A

OCEAN INFORMATION SERVICES STUDY GROUP
TERMS OF REFERENCE

To meet with specified contacts of government departments and agencies, having an operational interest in the marine environment, and through them related contacts in the Canadian marine industries in order to:

1. Determine the requirements of government departments and agencies and industry for new or improved ocean data services, ocean information services and products.

2. Estimate as far as possible the location and availability of facilities, data collection systems, analysis systems, dissemination systems, expertise and resources needed to satisfy identified requirements, immediate and long term.

3. Place the above requirements in priority order relative to their urgency, number of clients and governmental capability to fulfill.

4. Report back to the interdepartmental ad hoc advisory committee on Ocean Information Services by the end of June with recommendations for organizational mechanisms and extent of services.

APPENDIX B

INTERVIEW SUMMARIES
OCEAN INFORMATION SERVICES STUDY

Others Contacted

1. Nova Scotia Research Foundation
2. British Columbia Research Foundation
3. Federal-Off-Shore Services Ltd.
4. B.C. Chamber of Shipping
5. Council of Marine Carriers
6. DOT Research and Development Centre
7. OAS Scientific Information and Publications Research
8. Canadian Hydrographic Service
9. Marine Environmental Data Service (MEDS)

OCEAN INFORMATION SERVICES STUDY

Meeting with DND, Ottawa, May 8, 1980

Present: D. Nowell, R. Banks, R. Stoddart, G. Holland, J. Keen

Discussion Summary

DND have some joint programs with other government departments as, for example, the DND surveillance flights which have great use for sovereignty, fisheries and pollution monitoring. DND also affords assistance to universities and other outside agencies during operations such as NORPLOY.

The METOC Centre, Halifax provides wave forecasts twice daily which are made available routinely to oil and gas interests, merchant shipping, etc., by radio facsimile, at no charge. Wave forecasts are transmitted for 12, 24 and 36 hours ahead based on analyses which are updated four times daily, although only three are transmitted. Separate transmissions are made to AES offices over dedicated landline circuits. On the west coast a more limited wave forecast program is transmitted over the Esquimalt radio facsimile broadcast.

Fisheries use the METOC Centre, Halifax SST charts regularly, the once-weekly chart being distributed to fishing captains and fishing companies; in addition to radio and landline transmission, there is an extensive mail distribution of this chart. METOC now has a 20-year record of SST but the charts have not yet been microfilmed, nor have they been analyzed as historical data sets. The demand for sub-surface charts from non-military users is small but weekly charts are mailed to a controlled list of users on both east and west coast.

DND has a very considerable international oceanographic involvement. On the non-military side the METOC Centres contribute to the IGOSS program. Within the military, Canada is a founder member of the NATO Group on Military Oceanography and, in addition, has bilateral agreements with the United States through the MCC Sub-Committee on Oceanography. DND also has a joint program with Huntec on bottom reflectivity. A great deal of support is received from USN channels and if these were halted there would be a severe problem. NATO, through international agreements, provides for the exchange of data between allies. Acoustic products are the most widely demanded by the military. The USN and CF historical data bases are indadequate for Canadian waters and perhaps MEDS could assist in filling this requirement. There is liaison between DND oceanographic personnel and scientists within OAS concerning requirements for experimental and research data, etc.

Charts of temperature anomalies based on monthly and seasonal means would be very useful for both east and west coasts. There is a need for climatological atlases additional to those already available from NAVOCEANO and other sources.

In the non-operational field, ocean data and analyses are essential for equipment design and planning purposes. There is not sufficient traffic between OAS and the military to warrant a "military liaison officer". The biggest and most complex area was seen to be the east coast, whilst for the west coast the present situation was seen to be adequate.

For emergencies DND must have the capacity to respond. A lack of data in specific areas was noted including bottom currents, strategic data for site-specific areas and sediment and surficial sea bed geology.

DND noted the usefulness of CHS navigational and special charts. There would be a special DND need for more accurate charts as CHS held basic data at about twice the density as usually presented.

DND could look to other federal government departments for assistance in the provision of equipment and platforms for specific purposes. Advice could also be sought on data software and process modelling. Sophisticated data and expertise for coastal zones may be a requirement that could be met from data collected and analyzed for environmental purposes.

New technologies developed for civilian use could have importance for DND. Examples discussed included over-the-horizon radar, satellite altimetry, microwave radiometry and multi-spectral sensing. The parameters concerned were sea state, wave height and direction, currents, wind, pollution, ice, icebergs, sea level anomalies and bathymetry. Ground truthing was seen to be a problem for most satellite observations.

While naval vessels have only a limited capability to operate in ice infested waters, DND makes extensive use of ice information both for ship operations and for use in weather forecasting. There is need for improved ice services including an iceberg reporting and forecast service. DND currently relays products of the Ice Forecast Central in Ottawa to ships at sea via the Halifax CFH radiofacsimile broadcast. The quality of transmission of this broadcast is normally excellent.

OCEAN INFORMATION SERVICES STUDY

Meeting with Officials of Department of Transport, Ottawa, May 9, 1980

Present: C. Stephenson, R.W. Parsons, J.L. Woodbury, G.L. Holland, J. McTaggart-Cowan, R. Keeley, R.B.L. Stoddart, N. Anderson, G. Legge, G. Smith, A. Geddes, D. Leitch

Discussion Summary

The transport officials indicated interest in several areas of offshore activity. Offshore oil and gas exploration and production were related to the responsibilities of their Department through shipping support, safety, clean-up, contingency planning, marine and air transportation to and from rigs and tanker traffic. Relationships exist between Transport Canada and other departments such as DINA, EMR, DOE and DFO. Prior to the split of DFE into separate departments, Transport had a sole source for environmental considerations, which they found preferable. Ocean services which were useful to their responsibilities were current, sea temperature and tidal data and products, mostly on a real-time site-specific basis. A need was foreseen for computer models of surface drift and dispersion for the combat of pollution incidents.

In the area of pollution control, Transport was concerned with both ship safety measures and the pollution from ship operations. Research and development were required in these areas, particularly for the Arctic regions. Ice and temperature data from the Arctic were 'sketchy'; the ice zones presently specified are identified on inadequate data. A need was stated for ice formation in relation to days of freezing, as was a predictive capability for transportation closure to and from the drill site. In the Arctic there was insufficient knowledge of the effect of low temperatures on operation and design of equipment, for example the embrittlement of steel.

For shipping operations modern linear programming techniques should be developed to calculate the optimum path for transportation through ice in respect of the presence of ice thickness, cover, types, movement, pressure, etc. possibly on a weekly basis. Off the Labrador coast and in the East Arctic an iceberg monitoring service was required. Data collected by and needed for icebreakers especially in a new year-round role would have to be reassessed.

Continuing with the question of Arctic problems, the R & D required for clean-up facilities and equipment in ice-covered waters was addressed. No significant recommendations had yet been identified by AMOP. The present state-of-the-art admitted that nothing very substantial could be done for a pollution incident in Arctic ice. Again the absence of knowledge for year-round navigation in ice was emphasized; present expertise was based mostly on summer data. The modelling of ice movement in the Beaufort Sea was progressing but still far from adequate. Ice knowledge in the Arctic was being pursued by individual companies such as Dome and Petrocan. Much of this data would be valuable for environmental services. Government was seen as providing a minimal but crucial service in the areas of sovereignty, ship support regulation, environment and research. Navigational aids were seen to be a government responsibility, Loran

C positioning for example, wind and marine data, ice and icing conditions. Historical data should be held by government and be available as atlases. Year-round icebreaking would present a problem. Presently Transport is in the design phase of an Arctic Class 10 hybrid nuclear icebreaker. Earliest availability, if construction is approved by Cabinet, is 1990. Industry proposals are for year round transport by 1985-6. It is Transport's view that at least two projects, with the potential for almost daily transits, would be required to warrant the support of the Polar Icebreaker.

Government has concern that its position in regard to the Arctic waters as internal waters be demonstrated by all government departments. Results of the Law of the Sea negotiations will clarify the international view. Transport has the responsibility to extend its vessel traffic management systems, into a year round system and as a mandatory system. Very reliable navigation positioning and communications systems are required for Arctic conditions, before traffic management, traffic routing will be feasible.

From the Hydrographic Service route surveys and comprehensive surveys were required with the former being the most urgent. Navigational aids would not be placed until adequate charting was accomplished. Radar alone would not be sufficient.

Satellite communications and environmental observations were seen to be important, both in the north and on east and west seaboards. SURSAT has shown the value of such observations as sea state, ice, icing conditions, etc.

As for present seasonal levels of traffic, hydrography was stated to be adequate at present. A priority requirement from CHS is the correct location of land on the hydrographic charts in addition to bathymetry. It was suspected that the process of metric conversion resulted in less detailed information for some hydrographic charts.

Improvement was needed in the transmission of facsimile data, commercial ships should be able to receive these products, arctic coverage was presently inadequate and should be improved. Research was needed for operational short-range radar ice reconnaissance from ships.

In general cost benefit advantages would accrue to Transport from current information and wave data. Several relevant publications were cited:

— A Marine Transportation Research and Advisory Board Report
— The CARC Publication on Lancaster Sound
— Proceedings from Montebello Workshop by Dome and Melville Shipping
— Bibliography on Sea Ice

A need was foreseen for standardization of ice data on an international scale.

The meeting concluded with a short discussion on possible industrial sources of information that may prove to be useful to the study.

OCEAN INFORMATION SERVICES STUDY

Present: Lt. Cdr. Oake, Lt. Cdr. Brodie, G.L. Holland, May 14, 1980

Discussion Summary

The opinion of these officers was that the current DND capability in oceanography is minimal. Canada relies heavily on bilateral exchange with the USA (US Navy) and, as a result, the METOC Centre's capability to originate products to meet DND's needs is badly out of date. This situation is worse on the east coast

because of the more complex water masses over and close to the extensive continental shelf, while the oceanography on the west coast is more manageable due to the Pacific's more homogeneous and predictable characteristics.

Some specific needs were identified:

— Surface and sub-surface current structure would aid in more accurately determining hydrophone depths and sonobuoy pattern distortion.

— The Canadian SST and Thermal Front Analysis Charts are not accurate enough for the DND operator to identify features of operational significance.

— Bottom-type and composition charts are neended for several anti-submarine warfare (ASW) and mining applications.

— DND would like to have the capability to produce its own oceanography support products.

One problem is that the data flow from the MEDS archives is not adequate, probably due to the lack of focus between OAS and DND with regard to satisfying DND needs. In addition, there has been very little communication between DND and OAS scientists. One outcome of this lack of communication is that METOC is now not up to state-of-the-art provision of oceanographic products, and therefore, doesn't have the ability to satisfy DND requirements.

Among the oceanographic products required by DND is an adequate thermal front analysis which depicts the main east coast features, and an anomaly chart of these features in near real time. Secondary requirements are seasonal analyses of vertical current structures and surface drift. For the delayed mode products, climatology is of increasing importance to modern ASW technology and more specific information required in some areas. For example, more detailed charts of bottom composition and slopes are required. There was some requirement noted for ice data although there was no urgent need for ice forecast capability except for specific operations. Iceberg data in real time is required for submarine operations off the east coast.

Some DND requirements for emergency situations, i.e. environmental contingencies and Search and Rescue, were noted.

It is the opinion of these officers that DND will continue to need a separate oceanographic/acoustic service capable of producing products unique to military operations.

OCEAN INFORMATION SERVICES STUDY

Meeting with DINA, Ottawa, May 19, 1980

Present: O. Loken, J. Keys, M. Feldman, C. Mageau, G.L. Holland, R.B.L. Stoddart, R. Keeley, R. Douglas, W. Appelby, N. Anderson, M.K. El-Defrawy

Discussion Summary

There were two distinct interests represented at the meeting, the technical interest of the regulatory responsibilities and the environmental interests. For arctic marine transportation it was considered essential that government be seen as a controlling agent. Bathymetry, effective ice forecasting, navigation aids, search and rescue, and contingency planning were all cited as examples of governmental responsibility.

In the Beaufort Sea the oil and gas industry was approaching a production capability. Past needs related to offshore design and operating capability; future emphasis would switch to near-shore requirements, construction, dredging, etc. Information on marine mammals was needed to enable DINA to enforce quotas and manage stocks. Several mining interests were being developed in the North. International concerns were stated for marine pollution questions in the Beaufort Sea and in the Davis Strait. Mention was made of illegal

fishery in the latter. For year-round shipping better information is required on large bergs and growlers. The use of SLAR will greatly increase available data.

DINA can dictate to industry what data needs to be collected by the proponent. An area of concern to them is whether they are demanding the correct format and variables. It is current practice to ask the operator to collect data from each site. Would it be preferable to deploy a fixed array at one place in the region and obtain a more comprehensive time series?

Who is responsible for the analysis and interpretation of the data gathered by industry at the behest of government? Industry says government is responsible but usually government is unable to handle the task. Nevertheless, it was seen to be a government responsibility. The Atmospheric Environment Service was receiving and using these data. Some of the oceanographic data were being received in MEDS but calibration problems are being experienced. DINA uses its production and construction regulations to set the data requirements for the proponent. Government is still required to judge the value of these data although DINA now trusts the quality more than in the past.

In addition to the industrial data, government must collect its own data at least to some extent. Data quality is an important element of any data collection program and is seen to be a government responsibility. Sometimes government seems preoccupied with quantity. Some data are vital to the design of offshore production systems, ice scour being a good example.

In the opinion of DINA, AES and OAS must work more closely together. Sufficient current data exists for present DINA regulations. More information was needed on ice pressures and ice pack characteristics and movement, especially in the Beaufort Sea. OAS could provide a worthwhile service to DINA through technical assistance and advice on the collection of oceanographic data for inclusion in regulations.

Bathymetric soundings were good in mid-channel but often non-existent elsewhere. OAS will be relied on heavily to supply adequate charts for the North. DINA has a small competence in oceanographic matters mainly used for liaison purposes between scientists and managers. DINA can apply its regulatory measures as a lever for the collection of data. DINA also contracts out a limited amount of scientific studies mainly in the biological area.

For contingency plans, DINA enforces regulations to increase preventative measures and to ensure the operator conforms to policies such as same season relief well capability. Small spills are required to be handled by the operator, larger spills must have a joint industrial and government response. There are indemnity bonds posted by industry.

A problem with MEDS was identified, especially with current data, in that much of the data were unavailable and stored in the regions. There was a need for a single data source. In fact it was seen as essential that all data, including industrial data gets into or is identified in one government source. This source should also, where possible, utilize quality control measures on the data set. A possible new role for MEDS would be the quality regulation of industrial data sets. A regional versus national requirement was discussed but it was reaffirmed that as a minimum a comprehensive governmental data inventory should be held. There was also a need for standardized observation, calibration and data transmission procedures. One specific request was that OAS personnel should accompany DINA officials to meetings with industry to identify requirements and procedures for ocean data variables in conjunction with drilling operations. DINA agreed to inform OAS in the future of such meetings.

Industry was seen as virtually the only source for Arctic biological data. Government can access what has and is being done by industry but that is all. There is not enough biological data available to set adequate environmental regulations. There must be a long-term plan established for the collection of environmental data from the Arctic and the completion of the necessary research. Government has the responsibility to look after the long-term research projects.

DINA promised to set up a meeting with representatives of the oil and gas industry, and would broach this subject at the Fairmont Workshop.

OCEAN INFORMATION SERVICES STUDY

Meeting with DOE, May 22, 1980

Present: Bob Weir, Hugh Boyd, Jim McTaggart-Cowan, Geoff Holland, Dick Stoddart, Denis Rivard

Discussion Summary

Preliminary response within CWS apparently indicates a satisfaction with the provision of scientific support from OAS. This was tempered by the recognition of Mr. Boyd that the response was also indicative of a lack of awareness of ocean service capabilities. Further questioning led to an indication that ocean climatology atlases could be very useful to wildlife (sea birds in particular) studies.

The present objective of the sea bird studies is to determine the natural population fluctuations (years to decades). The mapping of the population is largely complete. Future studies on effect of man are somewhat dependent on the results of studies of natural variations. The requirement for water quality monitoring, i.e. PCB, heavy metals, etc., is being presently fulfilled.

Mr. Weir, looking towards the regulatory requirements, noted the need for sensitivity charts, water quality atlases, oil spill detection and trajectories, sub-surface currents, coastal oceanography, water chemistry related to pollutant transport, plume effects related to drilling operations and coastal outfalls, technology evaluation, and research into site specific and general phenomena.

There is an urgent need for government expertise to interpret industrial data, and EPS is concerned with the erosion of this expertise. It is most prevalent in biology but oceanography appears to be another area where federal capability is decreasing.

Government is putting itself in a position whereby its own expertise is falling sadly behind industry. If government is serious about regulating and managing arctic development, then plans must be put in place now. Failure to do this will lead to second-rate decisions, over-regulated activities leading to inefficiency or under-regulated activities leading to environmental damage. Similar problems are being encountered in the U.S.A. where federal government expertise is being challenged in court from two sides, e.g. environmentalists and industrialists.

OAS is not responsive enough to the needs of government in the area of environmental protection. Provision of site specific data and advice, management information for advance planning and input into regulations for industry are all required. The base level of research and data, particularly in the Arctic, is too low. The lack of hydrographic and oceanographic data and knowledge in the N.W. Passage is causing concern because of the imminent plans for year-round marine transportation.

For the future, the production phase of offshore oil operations in the Beaufort Sea and on the Grand Banks will generate increased needs for data and expertise. Also in terms of marine transportation in ice-covered waters, industry will have Arctic-X capability by 1985. Government is ill-prepared for these developments.

There is a real need foreseen for government to encourage the collection, processing and archiving of oceanographic data from all sources. Much industrial data is presently lost to the national facility and hence to Canadian users. The first requirements are to standardize equipment for the gathering of oceanographic information, train observers, establish formats and arrange for the prompt transmission of data to MEDS. These requirements can be regulated by DINA and/or EMR for the offshore oil and gas industry. Presumably this could be extended to other industries, such as those associated with OAS or other federal government contracts. It is recognized that the regulation of industry's response to these conditions will require near real-time monitoring of the data flow. It was suggested that OAS investigate the possibility of providing mechanisms for the relaying of oceanographic measurements on a near real-time basis for data management purposes.

OCEAN INFORMATION SERVICES STUDY

Meeting with DPW, May 26, 1980

Present: K. Rowsell, C. Glowdowski, G. Holland, R. Stoddart, J. McTaggart-Cowan, N. Anderson

Discussion Summary

Public Works is regarded as a service department itself, acting as consultants for offshore and coastal construction activities as requested by other government agencies. In order to carry out their design and evaluation responsibilities DPW needs a certain amount of engineering data. These data are obtained where possible from government sources; if the data are not available then contracts can be let to obtain the necessary information or occasionally agencies are requested to carry out data collection programs on behalf of DPW. In some cases the latter can be done on a joint program or cost recovery basis.

The top requirement at present is seen to be information on ice, including ice movement, freeze-up and break-up, thickness, composition, cover and climatology, as well as research results on such features as polynias. A less common measurement but one that is seen to be vital for arctic marine construction is the mapping of sub sea floor permafrost on a site specific basis together with sea floor temperature. Most of the DPW needs tend to be site specific because of the nature of their responsibilities; however, if a better general climatology for environmental conditions, wind, wave, temperature ice, etc., were available then site specific information could be more easily correlated to known long-term trends and savings in time and effort could be made. In actual fact, in some cases the installation of equipment on site (i.e. a wave recorder) would usually be too late to satisfy the requirement for engineering design or evaluation and the engineer must resort to extrapolating data from the nearest available observations or from other known environmental conditions.

DPW also noted that in some cases the provision of wave data from MEDS was being provided in an unacceptably slow manner. It was noted that industry had sufficient data on ice sources and would supply at a cost.

A lack of planning coordination was seen in the gathering of marine data. More interaction in the planning stage would allow Public Works to identify some of their needs in advance so that data collection programs could be adapted to future sites of interest.

In more detail the parameters of most interest to DPW were identified as follows:

Marine Weather (including waves)

Site specific wave diffraction and refraction models allow wave information to be extrapolated from offshore wave climatology. Also, as the wave climatology is lacking in most areas, wind data are used to establish the wave climate. Wind data again are lacking for the marine environment and sometimes these data themselves need to be extrapolated from atmospheric pressure maps. DPW saw a need for better wind and wave strength and direction coverage in Canada.

Other marine weather information is important for the operation of coastal and offshore facilities, and therefore have to be known.

Coastal and Geomorphological Data

Accurate bathymetry is essential for any port or terminal location and many of the present charts are dated in some areas. This is becoming a problem due to the increase in ship draught. Water levels, tides, currents, sediments, littoral drift, shoreline processes, sea bed cores and reflection seismic surveys are all necessary ingredients for coastal engineering and construction.

Wave energy models are becoming available that could be correlated to shore erosion. Shore erosion maps are not available for engineering purposes except in the Great Lakes; provision of such maps could be a

future priority. Storm surge data are important in the Beaufort Sea as are data on bottom conditions, roughness, ice scouring.

More general points were made in concluding the discussion. Eighty percent of DPW's effort in marine engineering was on expanding existing facilities. To design these expansions data is required. One possible solution is to ensure that existing facilities collect basic oceanographic data that could be available in the design of future expansions.

Some concern was expressed in the apparent conflict between environmental protection and economic benefit. There were penalties seen for "environmental overkill". An example given was the case of dredging in the St. Clair River.

It is difficult for a department such as Public Works to identify what data is available in government. There was seen to be a need for a data inventory and a focus for marine information.

OCEAN INFORMATION SERVICES STUDY

Meeting with EMR, May 27, 1980

Present: R. Edwards, B. Pelletier, L. Rowe, A. MacQuillan, R.A. Givd, G. Holland, J. McTaggart-Cowan, R. Stoddart, J. O'Shea

Discussion Summary

It became quickly obvious that a large portion of the EMR effort in the marine environment was of a similar nature to that of DFO, that is, a provider of science and services rather than a client. No unfulfilled needs were identified by the marine geologists. In fact, the regional groups operate out of the DFO institutes and the cooperation has been traditionally good amongst the various groups. Interaction is close at the scientific level, and AGC and PGC rely totally on DFO for computer support, ships and other facilities. When asked about ship time allocations for EMR, the reply was that, although pressure from other users often resulted in problems of timing and length of courses, there was no serious problem. The use of submersibles PISCES was thought to be important to marine geophysics.

Data that were important to marine geophysics were hydrographic (especially the natural resource charts), tidal, meteorological and wave information. Some inshore current and wave data were collected by EMR scientists themselves. CCRS noted that they had recently updated a study on user needs in remote sensing of the ocean; some aspects of that review will be useful to incorporate in the present OAS-led study. CCRS identified the usefulness of joint (cost-sharing of aircraft) programs between themselves and other departments in the use of remotely-sensed data. Other modes of service are lease of CCRS aircraft by Canadian companies and individuals for remote sensing programs at $1,000-$2,000 per hour and applications demonstration projects from $18.50 per sensor line mile. CCRS will prepare a document on future satellite capabilities in ocean sensing for the benefit of this study.

The EMR responsibilities in the regulation and control of the offshore oil and gas industry are definitely a unique client of DFO services. Data are needed for assessment of offshore structures, production facilities, operations and related activities. The DOE baseline study taking place for the East Coast has identified many of the needs. Iceberg information, size and drift are presently inadequate for offshore drilling and production activities. Sea ice, floe size, tidal surges, wind and wave climatology, currents (surface and subsurface) were all identified as data requirements. The four areas of EMR involvement are regulation, contingency planning, operations and environmental assessments. DFO input is required in various degrees for all of these areas. EMR is presently initiating guidelines for the collection of data by the proponent and, contrary to the view held by DINA, the need for technical assistance by DFO personnel wasn't seen to be a problem.

For the future, the production phase for offshore oil and gas on the East Coast would generate increased

data and advisory requirements. Laying of pipelines to the gas fields off Sable Islands would need sediment and bottom conditions, shallow water oceanography (current and waves), etc.

Other areas of possible future interest were gas exploration north of PEI, aggregate and optical sand mining nearshore, tidal power in the Bay of Fundy (including salt water intrusion into the watershed), deep ocean mining (low priority) and the development of ocean-oriented satellite programs.

OCEAN INFORMATION SERVICES STUDY

Meeting with Ship Owners Association, Ottawa, June 4, 1980

Present: Admiral Timbrell, G.L. Holland

Discussion Summary

At the outset, it was made clear that no problem was seen with the present services, hydrographic and marine weather, received from the federal government, and that the cooperation between the shipowners and the federal government in these two areas was excellent. Furthermore, no requirements were foreseen for 'oceanographic' data.

A yearly, two-day navigation conference, with participation from the masters of the 176 ships and federal officials concerned, deals with complaints or plaudits in the fields of navigation, port facilities, communication and marine weather. In addition, a yearly meeting is held with the Dominion Hydrographer and his officials to discuss requirements and shortcomings of navigational charts.

On being pressed, Admiral Timbrell admitted that opening up shipping lanes in the Arctic winter season could require additional sea-ice data in order to ensure that ships standards were adequately set for these new conditions. A similar study was contracted to Lloyds to specify the increased strengths required to permit 'Lakers' to traverse the Gulf of St. Lawrence to Sydney at certain times of the year. The latter study used wave climatology as its major factor, whereas the northern requirement would need ice strength and thickness charts. Sea ice research was seen as an obvious requirement.

Shipbuilding and ship operations were treated as completely different industries with differing requirements.

As shipowners, some difficulty had been experienced with the federal authorities over environmental issues, in particular, sewage treatment for ships, environmental constraints placed on ship passage by the Fisheries Act and vessel discharges. These, however, were not associated with a lack of knowledge of data availabilility within the federal government but more of a legal nature and an inability of government bureaucracy to settle on standards compatible with other countries and IMCO.

OCEAN INFORMATION SERVICES STUDY

Meeting with SNC, Montreal, June 5, 1980

Present: R.J. Griesbach, H. Kremer, R. Mayor-Mora, T. Alepian, M.H. Clark, G.L. Holland, R.B.L. Stoddart, N. Anderson, J. McTaggart-Cowan

Discussion Summary

There was an immediate requirement for a central government service for the dissemination of data and data products. The SNC group of companies provided some advice on ferry operations for which waves, tides,

storm warnings, and ice data were necessary. Industrial environmental data should be available to all. There was a need for standardization of data and data products for ocean variables. A great amount of industrially-collected data were available from bore holes and dredging companies. Were they being assembled and utilized?

Other areas of interest were:

— coastal development, harbour and sea defence construction
— offshore oil and gas; iceberg scour was very important
— dispersion studies for pollutants in both the air and ocean environments
— marine pollution; there was a need for pollution models but these presently lacked adequate data.

Other sources of potential data gathering that were presently seen to be under-utilized included coast guard vessels and port and harbour authorities.

For ice-covered waters more data were needed for specific locations. Presently there was a severe deficiency in ice information. Iceberg data lacked both a present and historical data base. Petrocan is presently doing a study on icebergs in the Davis Strait.

For the oil and gas interests, areas that could be assisted by government included deep ocean wave climate, i.e. movement and management expertise, and sub-seabed permafrost occurrence and behaviour. More joint programs between government and industry should be undertaken and computer software programs for reducing and analyzing data should be exchanged.

Government was seen to be responsible for climatological data and industry for site-specific data. Government should act as a broker for all collected ocean information, knowing where it is, what it is and how it is available. The environment belongs to Canada, so should the environmental data. It would be extremely useful to have an address (focus) within government to which to approach for information or to send data and reports. Contracting-out and contracting-in programs were both seen to be useful.

Government could supply and keep up to date a list of available ocean parameters and relevant contact points to which to direct inquiries. Presently, government was seen to be very invisible to outside interests and this should be corrected. Government has a role in research, and transfer of technology could take place through programs such as executive exchange.

It was felt useful to depict some specific non-hydrographic information on the hydrographic charts, for instance details on geodetic datums.

OCEAN INFORMATION SERVICES STUDY

Meeting with The Shipping Federation of Canada, Montreal, June 5, 1980

Present: Capt. Nicol, J.A. Crichton, J. McTaggart-Cowan, R. Stoddart, N. Anderson, G.L. Holland

Discussion Summary

With the exception of metrication, little criticism of government services was received from the Shipping Federation. There was a requirement noted for better end-of-season meteorological forecasts for the Great Lakes navigation. With regard to the Arctic, the Federation representatives pointed to an early lack of adequate discussion between Government and Industry, prior to formulating laws and regulations. The Arctic Waters Pollution Prevention Act was cited as an example. This lack however, has been corrected and full discussion is now entered into before the fact.

Vessel Traffic Management was cited as a government 'overkill', that is, although it is a good system, it is being enforced in areas where it is not required.

Insufficient dredging in some navigable waters is a major constraint for shipping operations. Ships have had to meander back and forth through shipping channels in order to avoid 'high spots' that should have been dredged. It was questioned whether or not DOT had its priorities in the right places relative to expenditures for VTM activities versus dredging activities.

The Federation provides ice advisors for the Gulf of St. Lawrence traffic and in general thinks that the ice data is good. Icebergs are not a problem for the trans-Atlantic trade. Growlers could be dangerous.

Pollution regulations are now seen to be adequate, although a strong argument was delivered about the necessity for standardization of these regulations internationally. The Federation is satisfied with the availability of government expertise. Finally, the importance of government consultation with the shipping interests was re-emphasized and that environmentalists could cause problems through their ignorance of commercial operations.

OCEAN INFORMATION SERVICES STUDY

Meeting with the Oil and Gas Marine Interests, Calgary, June 6, 1980

Present: P. Hunt (Chevron); M. Comyr (ESSO); S. Liesemer (Mobil); H. Westergard (Aquitaine); J. Davies (Petrocan); R. Pilkington (Dome); P. Vandall (EMR); J. McTaggart-Cowan (AES); O. Loken (DINA); C. Mason (BIO); G. Holland (OAS)

Discussion Summary

The discussion opened with a brief introduction by Dr. Loken, followed by a presentation by Mr. Holland. The first reaction expressed by the meeting was that government was not very welcome and that private industry could do a better job on their own. However, it was admitted that it was good to have access to long-term government data. The Canadian offshore represented a very large area; the site-specific data was the prerogative of the individual operator.

If government took all available data and performed a quality control operation, especially on wind and wave data, so that it was known whether the data could be trusted, then this would be a valuable service. Government should be responsible for regional climatologies.

Industry could obtain a better wave forecast for site-specific use from private sources than was available from government; industry was willing to pay for this service. Dome remarked that for the Beaufort Sea, Dome contracted with government for wave and weather prediction and ice forecasts at rates competitive with other sources. ESSO was reasonably satisfied with AES products although also using forecasts of their own. They required a 90% accuracy for storm prediction.

In the East it was felt that AES should be able to provide the best service but some concern was felt as to the rotation of chief forecasters responsible (Sable Island) which led to a non-continuity in interpretation. The oil and gas interests needed site-specific accuracy and were willing to pay for this; government should be responsible for regional coverage.

The government products on ice forecasts were generally felt to be satisfactory but an extension to the season or even year round requirements would be needed. This requirement would mean SAR satellites or SLAR all year round remote sensing. Even if the observations are satisfactory the predictions are not. In particular it was stated that an adequate prediction of break-up and freeze-up was not yet developed.

The iceberg problem could be the most serious problem for the eastern region. Iceberg plotting, surveillance flights and research into movement and prediction were required. Government should consider providing additional coverage and predictive capability.

Much of the present sub-surface data held was site-specific. If operators need sub-surface predictions they go out and contract for the service or do it in-house. For sub-surface current data it was admitted that operators have no good time series data. A twenty-day record was accepted as being not much good, although better than nothing. Short records, taken out of context, could be misinterpreted. However, MEDS could provide a service through an inventory of accessible data holdings. To the oil companies government involvement with the programs themselves was seen to be most important. If joint initiatives were undertaken then the access to data did not present a problem.

Hydrographic work was urgently required for the Northern Marine Transportation routes. Most companies have better regional charts than CHS. Some private vessels could be used as ships of opportunity for gathering hydrographic information although the cost would have to be covered. An accurate route through the areas of pingoes was required.

Dome uses government scientists in exchange for logistic support. Government scientists provide advice and consultations on ice scour. For the ice dynamics model of the Beaufort Sea, Dome is cooperating with AES and OAS scientists in a joint effort. Mobil has excellent support from BIO on the East Coast.

In general, it was felt that better information on the programs and expertise within government would be useful to industry. Industry looked to RMEC/IERC to set out long-term areas of interest and did not feel that a new national initiative to look at these questions would help.

For northern navigation requirements the present positional systems were not sufficient, the inertial guidance providing less than the required accuracy due to the influence of the continual ice impacts. Decca and satellite systems for navigation and communications were required. A government requirement was seen in the area of seismic activity; no private source of such data and expertise was available.

The oil and gas industry saw government as being self-motivated in research and insensitive to industrial requirements. EMR (Vandall) said that his Department also found DFO to be not responsive to industrial needs. Industry was not quite so critical but thought that the private sector responded to given problems in a more concentrated manner, although realizing that on the whole government had longer-term objectives. There was a difference in perspective between government and industry.

Industry welcomed the initiative by OAS to involve industry in the evaluation of its research program, as they see an advantage to government scientists being "plugged in" to industrial programs. Joint initiatives were stressed as being very welcome, especially if this was done in the planning stages. Mike Lewis (AGC) was cited as an example of excellence in this regard; his input to industry in terms of the ice scour problems was seen to be extremely valuable.

Government should be able to assess the overall data base and move to fill in obvious discrepancies. Government could provide a service to industry as a liaison between industry and the Defence Department (military observations and classified research).

For the satellite area, in the future government was seen to be able to play a role. Industry may require the quick-look type of optical analysis from satellite data. A general need for SAR and SLAR data for ice observations was mentioned. Industry could be favourably inclined towards cost-recovery if industrial needs were addressed. The cost of computer tape of satellite data was a major obstacle.

OCEAN INFORMATION SERVICES STUDY

Meeting with Acres, Calgary, June 6, 1980

Present: L. Gloin, J. McTaggart-Cowan, C. Mason, G.L. Holland

Discussion Summary

Although Acres/Sante Fe is a newly formed consortium to serve the needs of the offshore oil and gas industry, it is still too recent a move to have formulated a specific entity. However, Calgary Acres did comment on the study.

The first point was that government lacked visibility and that a viable focus was missing. However, it was recognized that the oil and gas industry in Calgary was relatively new and that government had not had sufficient time to respond.

Acres (Calgary) is primarily concerned with non-marine activities. Some interesting points were made:

i) Data on ice strengths, etc. are vital to the industry although site specific data is not a responsibility of government.

ii) Acres (Calgary) would subscribe to a system of participatory cooperation in data exchange from all sources with an inventory of data held by government.

iii) The data from the Arctic would be vital for defence purposes in time of hostilities.

iv) Some concern over time spent by consultants, etc., if they were required to submit standard forms of their activities.

OCEAN INFORMATION SERVICES STUDY

Meeting with FENCO (LAVALINE GROUP, Montreal), Calgary, June 6, 1980

Present: A. Manchinu, C. Bastian, H. Kivisild, Rimo Razard, J. McTaggart-Cowan, C. Mason, G. Holland

Discussion Summary

The group is engaged primarily in ice-related engineering design and construction of floating structures, harbour works and marine facilities for the Arctic environment.

A strong approval was expressed for the concept of a focus for marine information in the federal government and an inventory of data holdings, programs and expertise. There was an expression that a rigid system may not always be the best replacement for the present hit-and-miss system. Something could be lost from knowledge gained by being passed from contact to contact. In general, however, the rapidity and accuracy of response would be greatly increased.

A brochure on the FENCO activities was handed to the study team.

Essentially all the information and data collected by FENCO is site specific. There is a need seen for basic data, especially on ice movement, ice forces and ice pressure.

In FENCO's opinion there is a large amount of data lost to general use due to the proprietary nature or its economic value to an industrial company. In this regard government could act as a broker for all ice data, carrying the responsibility of knowing what was available, where and when. A data management plan,

approved by all interests, would be advantageous. There would obviously be some reluctance on the part of companies and consultants to part with their own data, whilst desiring data from other sources.

Government is seen as a useful source of data. Seismic data was mentioned as being of interest to civil engineers, but little data being available.

Future activities are foreseen in the development of ice engineering expertise. Government should show interest in the data available and required on ice rubble accumulations in the vicinity of man-made islands, structures, etc., in the instrumentation of ice measurements, in the procedures used for observations, in the formats for data presentation and in the training of technicians.

FENCO itself has ice data, accumulated over eight years of research, and could be regarded as a leader in ice-strength engineering. A need for government regulation and safety standards for operations on and over ice could be a responsibility required by government but unable to be carried out.

OCEAN INFORMATION SERVICES STUDY

Meeting with NOAA/Ocean Services Group, Washington, June 8, 1980

Present: Bert Thompson, Bill Grimmell (NWS), G.L. Holland, R. Stoddart, R. Keeley

Discussion Summary

The NOAA Ocean Services Group (OSG), which is co-located with the National Meteorological Center (NMC), produces central guidance charts of sea surface temperature and ocean frontal analysis. These products are essentially generated through an automatic process and sent directly to users. The charts require regional interpretation by field units. The OSG is presently evaluating the data inputs (type and amount) that are required for the product output. Other products that could be put out by the OSG are at various stages of development; these include thermal structure, current forecasts, wave analyses, ice forecasting, etc.

Some of the users of the SST charts were identified as fisheries interests (swordfish and tuna), search and rescue operations, and those interested in fog prediction. Global analysis of SST is carried out every second day on a 200 km grid, the first day for the northern hemisphere and the second day for the southern hemisphere; it is sent on the GTS once a day. The global SST is particularly useful in the vicinity of the equator during the hurricane season for research purposes, for the Peruvian fishery, and for navigation (delineation of the Gulf Stream). The OSG provides the SST input to the World Climate Program. SST charts are provided to users by facsimile and by mail.

Frontal analyses using ships of opportunity and satelite data are conducted on a daily basis and are provided to users by facsimile.

The OSG will be taking over responsibility for publishing "Gulf Stream" (East Coast) and "Fishing Information" (West Coast), both of which provide SST information as monthly summaries. Additionally, the OSG will be providing information similar to that contained in their two publications on a near real time basis, as requested by fisheries.

Another use for the SST and frontal analyses has been in guiding the selection of sites for instrument deployment (by the Navy) (XBT's, buoys, etc.) without having to find specific features by trial and error whilst at sea.

It has been estimated that a 3% saving on fuel and timing can be made for marine transportation using the Gulf Stream analysis to route ships with respect to current.

A major obstacle in providing better global and regional analysis is the lack of standard climatologies.

In the U.S.A., industry is not regulated in the same way as in Canada and hence there is no inducement for industries to provide marine data to central agencies.

The OSG is currently working on a Gulf Stream prediction model which will provide 10-day forecasts, a high resolution wave spectral forecast model, and a mixed layer model which has been adapted (added salinity) from the Denman model.

A "Facsimile Products Guide" prepared by the U.S. Navy Fleet Weather Central was provided to the Study Group Chairman for information.

NOAA is presently trying to obtain additional resources for ocean services for both the OSG and the establishment of new regional Ocean Service Units under the Coastal, Offshore and Oceanic Prediction Services (CO-OPS) plan.

OCEAN INFORMATION SERVICES STUDY

Meeting with NOAA (NODC), Washington, June 8, 1980

Present: Jim Churgin, Doug Hamilton, Rene Cuzon-de-Rest, G.L. Holland, R. Stoddart, R. Keeley, Bert Thompson

Discussion Summary

Doug Hamilton provided the group with a presentation on quality control methods used in the National Oceanographic Data Center. Two reports were distributed: "Environmental Models for Quality Control" and "XBT Quality Control System of the National Oceanographic Data Center." More than 90 percent of the data are processed without problems; approximately 5 percent of the data can be corrected by returning to the originator along with a note pointing out discrepancies in the data set. There are now approximately 900,000 XBT and 400,000 MTB files archived at NODC. While there are many users of these data, the data are provided only upon specific requests, tailored to meet user needs. While no atlases of data analyses are prepared by the NODC, it was suggested that some might be generated as input to the climate program.

New data bases that will be implemented in NODC are: (a) all data connected with OTEC, and (b) index of all oceanographic data collected along SEASAT tracts. A future thrust in NODC will be to review access to the NODC data banks to suggest ways of decreasing turn-around time for user requests. Also being investigated are means to archive ocean pollution-type data. NODC has been involved in providing oceanographic data and information for several recreational brochures funded through the Sea Grant program.

While NODC has established an inventory of where data is located, they have found that this service is not widely used. Likewise, NODC has found that there are few requests for IGOSS data and they are presently questioning the continuance of the program.

A number of ocean products/brochures/reports were provided to the study group during the Washington visit. These include:

1. San Francisco Bay — Recreational Climate, 36-page brochure, Sea Grant Publication.
2. The Visitor's Climatic Guide to West Michigan's Shore, 40-page brochure, Sea Grant Publication.
3. Vacation and Weather Guide to Coastal North Carolina, 28-page brochure, Sea Grant Publication.
4. A Quick Guide to Ocean Environmental Data Files, 4-page reprint from February 1979 Sea Technology.

5. User's Guide to NODC's Data Services, 72-page report.
6. Guide to Information on Research in Marine Science and Engineering, 55-page brochure by NOAA.
7. ESIC Brochure, fold-out brochure on the Environmental Science Information Center.
8. CEAS Brochure, fold-out brochure on the Center for Environmental Assessment Services.
9. NCC Brochure, fold-out brochure on the National Climatic Center.
10. NGSDC Brochure, fold-out brochure on the National Geophysical and Solar-Terrestial Data Center.
11. Introduction to World Data Centre A: Oceanography, 9-page brochure.
12. Mariners Weather Log, 163-page sample of NODC bimonthly publication.
13. The EDIS Environmental Data Base Directory, 3-page EDIS reprint.
14. GAS: A File — Independent Generalized Application System, 2-page reprint.
15. EDIS, 31-page sample of EDIS bimonthly report.
16. Guide to NOAA's Computerized Information Retrieval Services, 34-page NOAA/EDIS guide.
17. NODC/WDC-A Fact Sheet, one-page summary of data held by NODC data bases and World Data Center A data bases.
18. Oceanic and Related Atmospheric Phenomena as Viewed from Environmental Satellites, 43-page NOAA report.
19. Two samples of products issued by the Navy-NOAA Joint Ice Center, 2 pages.
20. NODC Brochure, fold-out brochure on the National Oceanographic Data Center.
21. NODC Applications Products, 28-page report.
22. The National Oceanographic Data Center, 5-page reprint from the Mariner's Weather Log.

OCEAN INFORMATION SERVICES STUDY

Meeting with Acres Ltd., Niagara Falls, June 12, 1980

Present: Roy Tanner, Ian Hill, Stuart Bridgeman, Leslie Smythe, Paul Denison, Ron Douglas, Neil Anderson, Jim McTaggart-Cowan, Geoff Holland.

Discussion Summary

Paul Denison was the Acres consultant who is mainly responsible for the Marine Applications Council report on Oceanographic Data needs. Acres commented that there is normally very little information available at any particular site; it is company policy to investigate what information is available from government or other sources before embarking on a data collection program of their own. Data collected by Acres could be classified as confidential by their client. Where possible, the site specific data would be correlated with available regional climatic or longer time series data. The climatic data would hopefully be available from government.

Emphasis was given to the view that it is necessary to have contacts in government in order to access data, products and expertise. Sometimes it is necessary to pass through several persons before reaching the correct contact and also a personal letter requesting the data is often required. Types of data needed include:

Climatic data of all types
Wind
Waves
Currents
Freezing Spray
Icebergs

The participants agreed that in principle all environmental data should be made available generally. It was seen as an excellent and proper responsibility of government to hold an inventory of data sets stating: where, what, when and who was holding them. They see no real problem in submitting a form containing such information although pointed out that this would be a prerogative of their clients. One problem mentioned would be the cost of providing their own data on request, although this could be charged on a cost recovery basis, or preferably be submitted to a national facility.

The data inventory is seen as being very useful indeed, although it must be kept up to date.

For some parameters it would be useful to have a standardized format for data, particularly if the data were in digital form. Caution must be exercised in the development of any plan. If it were to be useful, data quality standards collection methods are important and sometimes it would be necessary to return to the original data. In some areas, such as much of the biological parameters, the necessary guides and standards are not yet available. Government could play a very useful role in development of these, a task that is outside the capability of most of the non-government interests. For biological data there are some guides available for fresh water, but for measurement, processing and interpretation in the marine waters much is needed to be done.

Compliments were paid to the data products put out by the wave climate study and this was cited as an example where industry would follow the government lead if the lead was seen to be a good one. Wave climatologies based monthly on hind cast data will be available shortly for the Great Lakes and Labrador Coasts.

Mr. Denison remarked that it would be ideal if both ocean and atmospheric data could be available on a near-synoptic basis (three days to two weeks, say).

The discussion returned to the need to use the raw data at times, perhaps not so much for feasibility studies, but for design studies or rare events, etc. It was pointed out that interpretation of raw data would probably never be totally standardized unless by computer software. The availability of software at a government data bank for standard products is seen to be a good thing.

Atlas-type data, such as the Great Lakes Erosion Atlas, are seen to be very useful, and in the marine environment storm surge/tsunami run-up charts could be valuable, although Acres would expect to do some of this work themselves.

In response to the question of accessibility of government scientists to private interests, the response was that, at best, there should be a limited number of places in government to access individual experts. Some scepticism was expressed on whether an inventory of experts could be kept up to date.

Acres uses university scientists as consultants and government experts in an advisory capacity. Examples quoted included Dr. D. Greenberg, BIO, for the Bay of Fundy tidal model, and the work of Central Region for the Great Lakes Erosion Atlases. In general, for Acres, government response to their requests has been very good, and no problems have been experienced. Whether government could respond to the time frames needed for design studies is not known.

Acres' impression of government research is that there is a fair degree of overlap in responsibilities and some redundancy between government departments and even between government and private industry. It is useful for industry to have a voice in government planning at least for applied research. For basic research universities should be utilized.

Acres often deals directly with overseas clients and agencies in situations where it does not appear appropriate to involve Canadian government authorities.

OCEAN INFORMATION SERVICES STUDY

Meeting with Paul LeBlond (GIROQ, UBC), June 17, 1980

Present: R. Keeley, R.B. Stoddart, G.L. Holland, P. LeBlond

Remarks: See attached letter from Paul LeBlond to G.L. Holland.

Discussion Summary

For university use the present information service is seen to be sufficient. There are usually no pressing problems for university research and therefore if the data is unavailable or tardy it presents no problem. However, there is a difficulty in obtaining data that is not archived even if it is known to exist.

Climatologies are very important and are presently virtually non-existent. A basic inventory of data sets would be extremely useful and the publication of these in a scientific atlas form should be done. There are very few places where there is confidence in the quality and quantity of data available. There was seen to be an absence of regional data offices. Overall data management in Canada should be done forcefully by government and data sources should be actively pursued wherever possible.

Government scientific personnel were generally responsive to universities who were also seen to be well served with laboratory facilities and platforms. It is not always clear what research the government is undertaking and some projects tend to continue regardless. This is not always a bad situation as unstructured research can be the most inventive.

The offshore interests were not yet ready for ocean services in an operational sense. This could be a good time to prepare guidelines for collection, analysis and format of data. In the area of requirements for offshore, wave information, climatologies and forecasts were seen to be required for future needs.

Government could charge for some of its services but this is bad for the consulting industry. It was seen however to be worthwhile for government to charge for some services although recognizing that universities were unlikely to be a client in this regard.

It may be possible for a private company selected by tender to work with MEDS to supply data and analyses to non-government clients, in the same way as satellite data presently gets distributed. At the present time MEDS is not set up as an operational facility but this should be a future consideration.

OAS and AES should work very closely together in the marine area.

G.L. Holland,
Ocean Information Services Study Group
Marine Information Directorate,
Fisheries & Oceans,
240 Sparks St.
Ottawa, Ont.
K1A 0E6

Dear Geoff:

My participation in the Ocean Information Services Study Group, during the tenure of my contract with the Québec Region of F&O, originated, at the request of Dr. Filteau, out of my general interest in the services provided by the Marine Information Directorate. I have received the information distributed on that matter so far but, in view of my imminent departure from Québec and of other demands made on my time between now and then (June 15th), it looks as though my contribution to the activities of the Study Group are likely to be minimal. I would like to present a few ideas to the Study Group from the point of view of a university and sometime-industrial user: this may well be all that I have to contribute to the Study Group.

From a general point of view, it appears that the demand for Marine Information has increased rapidly, with growing activities in adjacent seas in the fields of resource exploration and exploitation, fisheries, transportation and protection of the environment. The research role played by the coastal laboratories (BIO, IOS) and the archival role played by MEDS are no longer seen as meeting the needs for environmental information and forecast. Although there are already some Marine Forecast Services provided (METOC Wave Analyses. AES Marine Forecasts) there is a demand for real time sea-state forecast which is not being met by Government Services (The oil companies have to provide their own wave prediction models in many areas). Whether this service should be provided by the government may be a matter of debate; — I think it should: it is certainly technically feasible. A similar demand, perhaps more difficult to satisfy, concerns the prediction of ice movement and conditions in navigable waters — arctic and eastern. Providing these services on an operational basis seems well beyond the present capacities of MEDS (as I perceive them) and might require an organization parallel to (or perhaps more simply an extension of) the operational services of AES.

From an archival point of view, MEDS now provides an excellent but restricted service. It is extremely difficult to obtain information on currents (tapes of current meter data) short of going to field laboratories such as BIO and IOS and interesting someone in running the computer to produce the information of interest. For someone with good connections with government scientists, like myself, this may not be insuperable; for an outsider it would seem almost impossible. The same difficulty is encountered in trying to extract recent data, which may be sitting in someone's drawer waiting for analysis. While one should respect the right of the scientist who gathers the data to scrutinize it first, one might argue that data collected for research purposes by a government organization should be placed as soon as possible within the public domain, in fact as well as in theory.

In a more constructive vein, I would like to suggest, as a long-term development, the growth of the Marine Environmental Data Service into a wider and more widely spread organization with operational as well as archival and informational responsibilities. Such a Service, either as an extension of its present embodiment, or as a Marine Branch of AES or again as part of an umbrella body (an Environmental Forecasting Service for example) grouping Atmospheric and Oceanic (think of the U.S. NOAA), would have a presence in the F&O labs, where it would arrange for forecasts, direct and coordinate the archiving of all marine data (including biological, chemical, geological. . .), answer public requests for information and perform an informational role in compiling atlases of marine properties.

This view is based on a conception of the role of government scientific services as providers of information and understanding to the public (which may include other government departments) rather than as laboratories primarily concerned with fundamental research. The development of the service aspects of F&O would then, according to this view, proceed partly at the expense of some existing parts of the Department. Undoubtedly a very unpopular view with my colleagues who are pursuing careers in fundamental science with Fisheries and Oceans! I am not suggesting that all scientists be saddled to applied problems, but only that

more emphasis be put on service aspects: fundamental research can be done elsewhere too, whereas only the government is responsible for providing necessary but non monetarily rewarding services.

The above ideas are presented rather sketchily and are perhaps too vague and general for immediate usefulness. I put them forward as a modest contribution to your deliberations and I stand ready (by my telephone, that is) to discuss them further at your request.

With best regards

Paul H. LeBlond

c.c. Dr. G. Filteau

OCEAN INFORMATION SERVICES STUDY

Meeting with Representatives of Fishing Insterest, Vancouver, June 19, 1980

Present: Don Faulkner, J. McTaggart-Cowan, A. Cornford, G. Holland, Mike Forrest and Janet Pentland, Pacific Gillnetters; Fred Yeung, Pacific Trollers Association; Athol Laing, Prince Rupert Fish Cooperative Association; Luis Souza, Fishing Vessels Owners Association of British Columbia; John Davis and Brian Murray, Fisheries Management

Discussion Summary

When the purpose of the study had been outlined to the group and comments requested on the adequacy of government services there was an immediate response concerning hydrographic charts. There were two main complaints, the one most generally held being the unavailability of charts at the outlets, and secondly the inaccuracies (omission of hazards) present. The Trollers Association had been advising its members to buy American charts for the Canadian areas. When asked whether the inaccuracies had been reported the meeting was told that it was a 'mystery' to the fishermen who they should contact. This point was repeated several times and for several items, that is, that the government may be doing very useful work in many areas but that this was not communicated adequately to the fishermen and the contact points for these services were not known; a better liaison was obviously required. It was unfortunate that the trollers and draggers were not represented by the fishermen themselves, however, it was thought that a fisherman with years of experience was only interested in large-scale charts with accurate depths and hazards. Other data were placed on the charts by the fishermen themselves and jealously guarded.

The gill netters had a special problem with chart availability. The opening and closure of the fisheries occur virtually in one place and at one time. This leads to a rush on particular charts which are soon sold out and typically the replacements do not arrive on time. Government could possibly anticipate fishermen's needs better through the 'Fishery Expectaions' forecast published once a year.

Most fishermen do not receive 'Notices to Mariners' and not all fishermen known how to use a chart. Other points mentioned were the gaps still existing in West Coast coverage and confusion caused through the changes to charts from metrifications. Fishermen have accepted that they 'have to live' with metrification and would prefer a final chart with metres rather than transitional ones showing both feet and metres. Again, on metrification, concern was expressed on the absence of adequate Canadian based instrumentation, presently most fishermen bought radio sonar and positional equipment from the U.S.A. In future, the sonar and positional equipment would be non-metric (U.S.A. has decided to retain the foot, 16 system) and Canadian charts will be metric. It was emphasized that absolute positioning is very important to the fishermen.

The discussion then turned to marine weather services and some criticisms received. For the gill netters, in small boats and working inshore, the local weather reports were essential for safety and operation. Transits across the straits and gulfs are hazardous unless undertaken in good weather. Presently the updates on local weather reports are inadequate and should be raised from the present eight hours to two hours per update. Weather reports are received both from the Coast Guard and the regional AES office. There may be problems associated with a delay in updating the C.G. reports. There are many boats traversing the coasts and night reports are also important. It was mentioned that tug-towboats have special needs and also when the herring-row fisheries were in operation there were upgraded forecasts. The representatives admitted that in general weather observations were not reported in by the fishermen and this was something that should be done. The general feeling was that the forecasts were useful when the local weather reports were not sufficient. Personal interpretation and local effects will always be important. Present regional divisions for weather reporting were adequate. In the northern B.C. coastal waters the USCG forecast was used. A few blank areas, as far as receiving weather forecasts are concerned, occur along the coast.

There was no strong support for a wave forecast service and if the local reports were updated frequently this would suffice. There was also no strong support for more sophisticated services such as sea surface temperatures, subsurface temperatures, currents, surficial geology, etc. It was not thought that the fishermen are aware of possible benefits so that there would have to be an education process before any of these services would be usefully applied.

Extremely strong support was expressed for the retention of the lighthouse keepers. There was an obvious rapport between the fishermen and the lighthouse keepers who not only managed the light and fog warnings but reported on weather, waves, visibility, general situation and kept in touch with the fishermen often at their own expense and with their own equipment. They were responsible, in the opinion of the fishermen, with saving many more lives than they were given credit for.

A criticism was levelled at the government bureaucracy and the feeling that it was wasting effort on non-vital issues. "Take away the top eight floors of the fisheries regional offices and instead keep the lighthouse keepers."

The government needed to assist in the training of fishermen in the use of charts, weather services, government programs, etc. This could be done through courses, educational T.V. or brochures. Much oceanographic equipment was lost to the fishing efforts, and the Trollers Association promised to help IOS in informing the fishing fleets of the whereabouts of oceanographic equipment. The various associations have yearly meetings or regular meetings with the Fisheries Management and these could be better used to keep a liaison between the industry and the available services.

In general the fishermen were satisfied with the contact with fisheries scientists.

OCEAN INFORMATION SERVICES STUDY

Meeting with Beak Consultants, Vancouver, June 19, 1980

Present: Don Faulkner, J. McTaggart-Cowan, A. Cornford, G.L. Holland, Noel Boston

Discussion Summary

The government cannot afford to duplicate its services because of the large size of the coastal area and the relatively small resources available. Beak has generally good relationships with government scientists but occasionally has difficulty with the administrative aspects of science contracts, and more flexibility in these matters would be welcomed.

For data and data reports, the published material was accessible although unpublished data was difficult to track down and good personal contacts were necessary. In most cases Beak was able to find out what data had been collected.

It would be very useful to have an inventory of data holdings across the country. Some concern was raised on the problem of stating the location of industrial studies as this would indicate the activity in the area. This problem would not bother Beak Consultants except through the wishes of their clients, in fact Beak would welcome a more open declaration of research and monitoring programs. Beak would also be willing to submit regular (yearly?) reports on their own activities, however again it would be the clients who would decide when the data becomes public.

Ocean data collection and archival would benefit from national guidelines and standards. It was accepted that for the atmosphere these were largely in place. Formats for reporting data were also very important and a government initiative on this would be appreciated. For quality control procedures, national standards may be premature, only some companies would be capable of accepting such procedures.

The government role in data gathering and services should be concentrated on the more exotic process-oriented regional and longer-term programs whilst industry would deal mainly with the shorter-term, more specific problems. Obviously, such a statement would have many exceptions but should be generally true. Industry cannot offer complete data coverage because it operates on a profit motive and government must take up the slack. Industrial programs should be monitored through industrial liaison and public awareness.

The quality of industrial research and monitoring depends on the cost factor and credibility of the scientist involved. For responsible firms if the time factor is too short they will refuse the contract; however, industry will usually find some source willing to undertake contracts regardless of time limits.

Returning to the question of standardization, these could possibly be done by contract with industry, industrial or professional associations, by government, or any combination of these. They would have to be internationally acceptable.

Arctic data are presently the most difficult to obtain and there is some reluctance by government scientists to release Arctic data. Another area where data and information are low is in the chemical and biological fields. Not enough is being done in the creation and updating of sensitivity maps. This job could be too big for either government or industry and a possible joint venture is required for systematic mapping under government supervision.

Information on instrumentation, their capability, intercomparability, accuracy, etc. is absolutely necessary and no doubt would be very useful to all operators. It should be a government responsibility as only government would be seen to have no conflict of interest. Beak would like to see this done. In terms of instrument development government is capable of looking farther ahead than industry but Beak (Noel Boston) requested that a more expert voice than his should be questioned.

Government (ITC) gives good support for overseas initiatives and probably at the right level of funding. It was mentioned that the international market was an entirely different situation. Government should undertake high-risk research. There is a national need for government to be aware of what is going on both within its own government circles, in industry, in university and in other countries. This can be done through international initiatives (UN route, etc.) or by workshops, information transfer, etc. supported by government.

OCEAN INFORMATION SERVICES STUDY

Meeting with GENSTAR Marine, Vancouver, June 19, 1980

Present: Jacques Heyrman, William Millen, Don Faulkner, J. McTaggart-Cowan, G.L. Holland, A.B. Cornford.

Discussion Summary

Wave data and characteristics were an important aspect of ship design and operation. In some operational fields, for example military applications, missile launch would be predicated on the ship bearing in fields of

acceptable wave strength. The firm was involved in ship design, towing operations, iceberg control and into many joint ventures with other offshore interests. Much ocean data were thought to be held by industry, that was not accessible to government, however much of these data were short term and could be open to misinterpretation if made public.

GENSTAR is a consultant to Petrocan in the movement of barge-mounted plant equipment and associated logistic services.

GENSTAR receives marine services direct to its vessels using the facsimile broadcasts but noted that this was not always accessed by smaller operators. Government would need to supply the service. There was a need for a better definition of products and more site specific information. For towing the local conditions are very important as the activity is more vulnerable. Wave information is used for routing; damage to tows can result if speeds are not reduced in severe weather, also crew fatigue becomes a problem. This was also a major factor for military purposes where crew fatigue must be avoided for 24-hour alert conditions. In the design of vessels the architect takes into account (1) safety of platform, (2) comfort of crew and (3) continued effective performance of sensors. For these the primary input is the wave characteristics, statistical wave data, from the projected area of operation. There is still insufficient data available for these purposes.

During shipping operations damage is sustained through wave action, in towing to the barges by 'slamming' (which would then call for a reduction of speed, although some tow design in ballasting, etc. was done beforehand depending on foreseen conditions, continued exposure leads to metal fatigue problems, crane barges, etc.) and container vessels because of their high speed. The latter could do with ship routing information although in general the industry was slow to accept change.

There was no problem experienced in obtaining data from government. Wave climatologies were seen to serve a wide audience and should be done by government. Government was also seen to be a source of sophisticated knowledge, facilities and equipment of great use to industry although with DND there were security problems. There was little success in obtaining even limited data from DND. Algorithms and software from government could be useful to industry.

GENSTAR considers that the ice tank facilities operated by Arctec in Ottawa are adequate for their purposes. However, for both commercial and technical reasons, GENSTAR would seek bids from the larger ice tanks which exist in Finland, Germany and Holland. This was adequate and there was no need to set up a national duplicate. However, advantage of government facilities was in having a quicker response time. There is seen to be an upsurge in shipbuilding with the Canadian naval program arriving shortly. Although GENSTAR was a bidder the tender for the design went out of the country. GENSTAR itself is in a joint venture with the French firm C.G. DORIS on the design of various platforms.

More data on the location, frequency and movement of icebergs were necessary, and in general, Arctic data was required. The Arctic was seen to be the growth area for ocean industry, to a large extent the southern markets have plateaued. GENSTAR has a joint venture with Swan and Wooster for coastal construction. Most areas being relatively shallow need hydraulic model studies.

Government has good hardware which is useful to industry. An observation was that dealing with government usually led to a more deluxe requirement than would arise from a similar requirement in industry.

GENSTAR obtained most weather data from government sources although they did employ private consultants for weather forecasts, especially longer term, 5-10 days. These were useful for the towing operations which are expected to operate at a 75% capacity. Cost effectiveness is sensitive to the slowing down of tows to accommodate weather. Wave forecasting will be an inevitable future service and government should be involved. In the north the most interest was in the ice forecast.

GENSTAR would be interested in training and equipping their vessels with instruments. There are several hundred units in total. The present experience is that they can receive many different reports from units in the same area and they are obviously reported in an unscientific manner.

The U.S.A. has Ocean Service Units (OSUs) associated with the regional weather offices. In GEN-STAR's view the more data we have from offshore the better. There will be a quantum jump in requirements when the offshore oil and gas goes into production. We need data now to prepare for this.

In the Arctic satellite navigation and communication will be essential.

OCEAN INFORMATION SERVICES STUDY

Meeting with Gordon Tidmarsh, Martec Ltd., and Shirley Conover, MacLaren Marex Inc., Bedford Institute, June 23, 1980

Also Present: C.S. Mason, G.L. Holland

Discussion Summary

There is a significant requirement for biological data and a single data bank is preferred. At present data sets are held in MEL, in fisheries and in private industry at different levels of sophistication. A single data bank held in MEDS would be beneficial, although realizing that data quality can be a problem. A ready access to data and an identification of the source would be very useful. Data quality is of secondary importance at the moment due to the sparseness of biological data of any kind.

Several man months of effort would be required in order to design the necessary data system, followed of course by the necessary software itself. A standard data base and format would resolve many of the biases presently existing in data sets.

In the data requirements for offshore oil and gas the biological data is very loosely handled. This could be a valuable starting point for a national data set which others could follow. The fishermen themselves provide a difficult problem because of the jealousy with which they guard their movements.

There would be a requirement for government funding to arrive at a given format but should best be done by contract. A problem is foreseen with the time taken by scientists to properly format their data in an adequate time frame. However, if this is done MEDS can handle a standard format for the archives. Fishermen may not see an advantage. Oil and gas interests will cooperate if they have ready access to data. The cost is considered to be a government responsibility. A study to develop such guidelines and format will take experienced people and should cover all biological data from nutrient content to bird and mammal counts.

Climatologies are extremely useful as are scientific atlases with physical parameters and processes expressed. An atlas of the Scotian shelf with residual drift, processes, boundaries, etc. would be valuable even if it were recognized that such information only represented the best available interpretation and was not definitive. The Arctic atlas prepared under contract to EPS was cited as a useful example of what can be done.

BIO is responding to clients' needs by preparing lists of data held, programs underway, and field projects planned.

MARTEC has prepared an unsolicited proposal to prepare climatologies for design purposes based on available data on waves, currents, etc. Shirley Conover although not quite as aggressive on the need for scientific atlases, thought that they represent an obvious gap. It was considered that such atlases would not fulfill a researcher's requirement and therefore government scientists would not be impressed by an atlas.

Very little need was seen for synoptic or near-synoptic products although some satellite data were used and would be more frequently used in the future. Satellite data would force the use of synoptic products. Ocean satellite data should be handled similarly to the LANDSAT output, that is, a private company could handle the marketing from the government data source. Industry needs access to the data rather than the equipment although until operative government should be responsible.

A common complaint against the government was the lack of attention to descriptive occanography, although the situation is now improving. It is even now very difficult to obtain raw data from a scientist who is generally possessive of his own data and suspicious of the interest of other interests. A need was seen for more interaction between private and government scientists especially for the latter to get into industry to face reality. The executive interchange program was considered cumbersome for most applications.

An East Coast failure to facilitate technological transfer and industrial support was compared to the perceived situation in IOS. Too often the government hires technical help instead of building up industrial expertise with demanding contracts under close scientific scrutiny. The attitude of government scientists in general is of second class science in private industry. There should be more complementary government/ industry programs with a mutual sharing of the collected data. Most R & D is happening in private industry in spite of the government rather than because of it. In general government laboratories have a cloistered attitude. If Canada is to succeed in the world markets there is a need for greater trust and challenge for the scientific industrial community.

OCEAN INFORMATION SERVICES STUDY

Meeting with Representatives of the Fishing Community, Halifax, June 24, 1980

Present: J. McTaggart-Cowan, G.L. Holland, Fraser MacNeil, Tissa Amaratunga, W. Doubleday, DFO; Bert Smith, CHS; Jean-Paul Lussiaa-Berdou, Hussiococu Quebec; Wayne Davies, Newfoundland Shipowners Association; Bruce Chapman, Atlantic Fishing Vessel Association; Allan Billard, Eastern Fishermen Federation; Bill Brushett, Newfoundland Fisheries Products; Gene Gorman, PEI Seafood Proc. Association

Discussion Summary

The representatives expressed an interest in any oceanographic information such as currents, marine climate, seasonal forecasts, ice predictions, sea temperature, fog, etc. that would make the fishing operation more efficient. Wind, wave and ice information, and forecasts were very important for the Labrador fishery. It was mentioned that the Russian distant water fleets had been using oceanographic data for fisheries operations for many years, and twenty-five years ago a scheme was proposed to undertake the same service for the Canadian fleets. However, although the big fleets thought it an "interesting idea" it was not followed through.

The government has research vessels and overflights of the coastal waters. Data gathered by these could be useful to the fishing industry. An interesting example was cited — for the last two years, the fleets have missed the mackerel run. Three quarters of a million dollars were wasted each year in ship deployment and half a million in lost revenues. Presumably, the mackerel run took place but because of some change in ocean parameters the location was different and the run undetected.

The fisheries would need synoptic information, able to be related to gridded charts. It was accepted that information from fishing vessels would be needed and therefore a possible requirement for scramblers. Such a system could be expensive but a possible split in costs would be that the fishing industry provided the instruments and the government provided the system. The capital expenditure would need to be carefully studied with perhaps a pilot study initially. At the present time spatial resolution is a problem that may be resolved shortly through the use of satellites.

It is relatively easy to provide near surface sea temperature but other ocean data would present a problem. Fisheries Research have 20 stations around Maritimes in lobster areas and these are relatively inexpensive, about $400 per location. However, it is very easy to spend up to $50,000 per location for deep offshore sites.

It was pointed out that foreign and Canadian data do come in over the international IGOSS network. Some consideration should be given to a systematic coverage of a given area for a particular fishery, cod for

example. This could be done for about 15K per vessel instrumented. Government should coordinate the data available. Offshore oil and gas interests are required to collect site-specific data and BIO is presently assisting with the drafting of guidelines for this data source. This year there will be 82 current meters on the Grand Banks and only a quarter of these are government owned.

Marine weather services presently are seen to be fairly accurate and meeting the needs of the fishing community. They are updated four times a day at least and more often when conditions warrant. Fishermen use the weather radio; some south of Halifax use the U.S.A. forecasts. The regional meteorological representative stated that site-specific forecasts could be prepared on a cost-recovery basis of $3-4 per forecast. This is an "add-on" to the usual service. The individual reports received from fishermen were very useful to the forecaster. In general there was little coverage from fishing fleets, and this was thought to be because of the general reluctance of captains to reveal their position.

The hydrographic charts, especially the latest fishing charts, were highly regarded by the fishing industry. The service and accuracy were acceptable and metrification not seen to be a problem. The Hydrographic Service would welcome feedback from the fishermen, especially for wrecks which were not always picked up by surveys.

Ice forecasts were important but more information on ice movement would be appreciated. This information does not come over the radio. Forecasts of the pack ice in the Southern Gulf needed better dissemination. Some fishermen do not know about the available ice charts. Greater use of TV and radio would help. For Newfoundland, the ice information was generally felt to be good although sometimes the ice moves faster than the up-dating of charts can assimilate. Cloud cover can be a problem. A thirty-day ice prediction chart is available from AES which some fishing representatives were not aware of and thought may be useful for planning purposes. The industry and AES should generate a dialogue for special fisheries requirements.

For the environmental impact of oil and gas exploration and production not much significance was attached to the next 10-20 years. One area where government support was needed was seen to be for training and preparedness for clean-up exercises in case of major emergencies. Preventative measures needed more government activity. Coast Guard were seen to be concentrating very heavily on Vessel Traffic Management (VTM) schemes and there was a suspicion that not enough attention was being paid to routing ships to minimize pollution and the impact on fisheries.

Finally, the point was made that certain types of marine data and forecasts did not often get into the wheelhouse where it could be used. More effort should be spent in reaching the user. Data are not being interpreted and presented in a form that fishermen can understand. With a better public relations approach to the fishing industry there may be an opportunity to improve government service and at the same time utilize the available experience of the fishing captains. The fishermen were hungry for liaison with scientists and agreed with the concept of a corps of graduates able to relate to both industry and science in order to bridge the gap. Such a system is in place in the U.S.A. It was felt that there must be a way to use science to improve the fishing operations. Some ocean science development should be focussed to find methods for reducing costs of catching fish.

OCEAN INFORMATION SERVICES STUDY

Meeting with the Marine Applications Council, Dartmouth, June 25, 1980

Present: G.L. Holland, John Brooke, R.B.L. Stoddart, J. McTaggart-Cowan, C. Mason, Don Armstrong (Dalhousie), Don Pattan (Dalhousie), Fraser McNeil (AES), Clyde Beals (DREE), Pat Beatty (Shelburne Marine), F. Ferguson (Defence Research Establishment), Graham Bligh (Fisheries Management), Gordon Tidmarsh (Montreal Engineering), Graham Smith (Hermes), Ken Farguson (N.S. Department of Development)

Discussion Summary

The Study Group Chairman gave a broad overview of the group's general findings to date. He noted that the federal government was "invisible" to users, that there was a lack of a window on government, that there was a lack of the **total** data picture in the marine environment, that government was viewed as providing regional and long-term data while industry should provide their own short-term, site-specific data requirements, that government should provide standards and formats for marine information in line with international practice, and that there was an urgent requirement for coordination of data collection and archiving in the Arctic. The Council was in agreement with all of these observations.

On a different Council agenda item, the Council was critical of the lack of political importance attached to the ocean by the central government. The Council was particularly critical of the lack of an interdepartmental vehicle, similar to the Interdepartmental Committee on Space, which could focus on ocean related matters. Many federal departments deal with ocean matters from their own perspective; the Council requires a single entry point into the federal government to deal with broad industrial concerns (neither CCO nor POM are seen to be adequate for Council purposes). The Council also found fault with DSS and its Science Center in that they only considered fiscal year funding, that in considering U.P.s the equipment necessary to carry out the U.P. must already be available in-house, and that there were no monies earmarked for the marine environment, as is the case for other sectors.

STUDY OF OCEAN INFORMATION SERVICES

Meeting with Quebec groups involved in fishing, Quebec City, June 27, 1980

Present: Paul-André Bolduc, William Déraspe, Georges Drapeau, Serge Labonté, Jean-Paul Lussiau-Berdou, Bernard Marois, Lucien Poirier, Denis Rivard, Harold D.G. Smyth, Jean-Claude Therriault

Discussion Summary

Mr. André Bolduc summarized the services provided by the Marine Environment Data Services Branch (MEDSB), and copies of a description of these services were distributed. Mr. Bolduc described the three data banks, which cover tides and water levels, waves and oceanographic data. A discussion followed and it was recommended that the MEDSB and its services should be more widely publicized in order to inform potential users. A request was also made for a point of contact other than the Director. A participant commented on the slowness of responses to requests for service.

The unreliability of tide forecasts on the North Shore was pointed out and it was requested that a reference port on the North Shore be identified in the tide tables. A request for a tide study on the Magdalen Islands was also made. In addition, participants would like to see a permanent wave-measuring station at this location to study wave climate in the Gulf of St Lawrence.

One of the participants reported that the Canadian Hydrographic Service's charts of the Gulf are based on old soundings (1939?); he mentioned his own experience of an error of seven fathoms on one specific occasion. In general, the charts of the Gulf are very old and need to be updated. The Canadian Hydrographic Service is being asked to produce charts on a smaller scale in order to provide more details about the sea bed. It was reported that the charts for fishermen like the ones produced for the Nova Scotia shelf are very useful and that something similar should be produced for the Gulf.

Mr. André Bolduc then asked whether a chart of surface temperatures would be useful for the Gulf of St Lawrence. The usefulness of such an item for the kinds of fish caught in the Gulf has not been demonstrated. However, it could become useful if there is a revival of interest in fishing for mackerel, which is at present of somewhat marginal economic value. Because it is often difficult to interpret temperature charts, fishermen may be sceptical about the information provided. Even if these charts were reduced to their simplest possible forms, fishermen would have to be educated in their use.

Currents in the St Lawrence estuary were then discussed. It was pointed out that a study of surface currents (up to ten metres) was essential in the area around Ile Verte near the port of Gros Cacouna. To show the currents on a chart, a simple method such as indicating the direction with arrows is preferred.

It was also specified that chemical data could be sent to the MEDSB if the format were specified.

Mr. Bernard Marois described the meteorological services available. These are of three kinds: the ice climatology and forecast centre, the Metoc centre (weather and oceanographic centre) and the forecast centres which issue marine forecasts. The centre in Quebec issues two forecasts per day for the St Lawrence. He also distributed two brochures describing Environment Canada's services. These were greatly appreciated and it was mentioned that Environment Canada did not advertise its products sufficiently to the fishermen. Fish plants were suggested as being excellent locations for distributing information to fishermen. In this regard it was also mentioned at the meeting that the Technical and Scientific Research Branch, Quebec, had technicians responsible for gathering unloading data in the major Quebec ports and that they could distribute this information.

It was mentioned that fishing boats do not have the equipment for receiving facsimiles on board. In addition, the problems with reception in the Gulf of St Lawrence were pointed out. The VHF has a limited range and the Riviére-au-Renard station is not powerful enough to cover Chaleur Bay. There seems to be a dead spot from west of St Pierre and Miquelon to east of Anticosti Island. The same problem occurs along the Saguenay River because of the particular geography of this area. There is another dead spot between Cap-à-l'Aigle and Ile Verte in the St Lawrence estuary. Weather bulletins from Stephenville, Newfoundland, are issued in English only.

A constant underestimation of the wind speeds predicted was reported. This problem, although known to Environment Canada, seems to affect fishermen in particular because their boats are so frail.

Two daily forecasts are made for the St Lawrence. In addition to these two forecasts, amendments are made if atmospheric conditions change: for example, a change of more than 45° in the direction of winds of more than 15 knots or a variation of 10 knots or more in winds of more than 20 knots. This criterion is high and it was suggested that small craft warnings be given before these levels are attained.

With regard to wave forecasts, it was suggested that the area be extended west of Anticosti Island into the estuary where the waves are shorter and more dangerous (especially in the fall), and that these forecasts be included in radio weather bulletins.

In the case of ice forecasts, it was requested that they be made for periods shorter than thirty days, especially at the time of the seal hunt near the Magdalen Islands.

To complete the study of the tides and waves in the Magdalen Islands area, a request was made for a weather station at this location so that the importance of this area in the meteorological-oceanographical study of the Gulf would be recognized.

STUDY OF OCEAN INFORMATION SERVICES

Meeting with the Corporation of the Lower St Lawrence Pilots, Quebec City, June 27, 1980

Present: Paul-André Bolduc, Laurent Dubé, Bernard Marois, Jean-Paul Racette, Brian Tait, Ken Williams

Discussion Summary

The atlas of currents in the St Lawrence, published in 1939, was discussed and in general the information is still valid.

Mr. Dubé mentioned that an atlas of currents is very useful for teaching navigation to new pilots in the Lower St Lawrence. Aside from this, the atlas is of very little use in navigation.

He also mentioned that the current at Gros Cacouna would have to be measured so that high-tonnage ships could use the port. In addition, the forecast of currents in the tide tables for St-Roch-de-la-Traverse was very useful and the information given was accurate. The representing of currents in the form of tables is more useful. In the tide tables, the presentation in feet/metres is very useful, although not necessary for the moment. Mr. Dubé also mentioned that a table for converting feet/metres/fathoms would be very helpful on marine charts.

Mr. Dubé discussed weather forecasts with Mr. Marois and seemed satisfied with the wind forecasts issued by Environment Canada.

OCEAN INFORMATION SERVICES STUDY

Comments from R.E. Thomson

Recreational Boating: Are we meeting the need for better marine information?

With regard to the general surface circulation within the protected coastal waters, we are probably on the right track, at least as far as most boaters are concerned. Only at certain times, such as during sailboat races (Str. of Georgia Race, etc.) or power squadron log racing is there a "need" for detailed current charts. Otherwise the type of computer generated atlas for the Strait of Georgia-Juan de Fuca Strait being worked on by S. Huggett and P. Crean is probably adequate. Moreover it is debatable whether we could produce current charts at the detail people would like to see.

I do, however, see four areas where some additional effort is required:

1. Wind-Wave Predictions:

Wind-generated waves are of concern to most recreational boaters. Using present techniques it should be possible to provide mariners with 6-hourly wave-height forecasts for inshore waters in addition to the present wind forecasts.

One of the main hazards to small boaters is "rips" set-up where seas oppose relatively strong surface currents. These features are common to southwest B.C. owing to the presence of strong tidal currents and comparatively large-fetch bodies of water. Dangerous rips often exist at the entrances to narrow tidal passes and at the mouth(s) of the Fraser River. Sea-state predictions combined with a greater awareness of possibly dangerous areas would help eliminate many of the capsizings that occur in local waters.

2. Currents:

More measurements are needed in the stronger tidal passes to provide information on the times of the currents as well as their spatial variability within the channel. In most cases there are preferred and safer courses through a channel at a given stage of the tide. Last summer studies were made of the surface currents in Porlier Pass and the First Narrows; more detailed knowledge of other passes of this type are needed and the results presented in atlas form.

3. Charts:

Most pleasure craft lack sounders yet spend considerable time in shallow, often rock-infested waters. Strip charts such as those which exist for the Gulf Islands have proved popular and should be extended to include all waters of the Strait of Georgia-Desolation Sound area. For small boaters, accurate detailed charts of all nearshore zones are required and they should be easy to use even for someone sailing single-handed.

4. Awareness:

The growing number of persons using local waters requires an increased effort on the part of government to ensure adequate awareness of possible hazards associated with waves, currents, and commercial traffic. The public cannot be expected to read the results of scientific or hydrographic studies; somewhere along the line these data need to be put in layman's terms and published in an accessible form.

OCEAN INFORMATION SERVICES STUDY

Comments from K.G. Anderson, FENCO, St. John's, Newfoundland

Discussion Summary

FENCO (Newfoundland) Limited is presently involved in providing services in the fields of planning, environmental consulting, Arctic engineering and oceanography, feasibility studies, harbour and port developments, engineering, management, feasibility, municipal works and offshore oil consulting. These services are related to the following fields: marine transportation, coastal development, marine pollution, offshore oil and gas, Arctic development, and sea floor. The environmental constraints in their field studies are: lack of flying weather, rough sea states, pressured pack ice, and lack of detailed hydrographic charts for coastal Labrador.

FENCO requires from Ocean Information Services current data, meteorological data, wave data, local weather and ice forecasts. Present requirements are met, and/or deficiencies compensated for by undertaking field studies to obtain this information. FENCO cannot compensate for lack of local weather and ice forecasts. The majority of the information gathered is of a proprietary nature. FENCO presently measures ocean currents, wave data, sea temperature and salinity, wind speed and direction, and local ice coverage.

A large data set is required of oceanographic and meteorological conditions as well as detailed hydrographic information for offshore Labrador. It would be of great assistance to have real-time capabilities in oceanographic monitoring for new techniques such as over-the-horizon radar, remote sensing application, ice surveillance radar and oceanographic sensors.

OCEAN INFORMATION SERVICES STUDY

Comments from Archie McQuillan
Canada Centre for Remote Sensing, Ottawa

Approved/Projected Remote Sensing Satellite Programs for the 1980s

Canada Centre for Remote Sensing (CCRS)

CCRS has an airborne program involving three types of flying projects:

(a) **Commercial Lease:** At various prices for each aircraft and (somewhat) dependent on total scope. This could include, for example, acquisition of SAR data.

(b) **Applications demonstration projects** at $18.50/line mile.

(c) **Internal R & D Projects:** This also includes cooperative projects where another department may put up development dollars and CCRS assigns resources as negotiated.

National Oceanic Satellite System (NOSS)

This jointly funded program (NASA has an R & D role, and NOAA and Defence operational roles) is scheduled for its first launch in the second quarter of 1986.

The new monitoring system is proposed as a limited operational demonstration of the feasibility of providing from solar-orbiting spacecraft, in near-real time and under varying weather conditions, continuous observations of the earth's ocean surface winds, sea state, surface water temperature, wave height, ice and other geophysical measurements.

Data from the proposed satellite system should improve the efficiency, safety and cost of ship operations, transportation, offshore oil and gas exploration and drilling, platform operations, marine construction, commercial fishing, pollution monitoring, ice monitoring and marine search and rescue. It is expected to be especially useful in improving NOAA global weather forecasting services. The U.S. Navy expects to use data from the monitoring system for the selection of operating areas, ship routing, strategic operations, anti-submarine warfare, acoustic predictions, tactical ship routing and global ocean data forecasting.

Coastal Ocean Monitoring Satellite System (COMSS)

The European Space Agency COMSS concept is still evaluating priorities for possible payloads, including an optical instrument (OCM: Ocean Colour Monitor), a radar altimeter, a scatterometer, a passive Imaging Microwave Radiometer (IMR) and a Synthetic Aperture Radar (SAR). The COMSS satellite is planned for an early 1986 launch.

The main potential application of, and geophysical parameters observable with, candidate COMSS instruments are as follows:

IMR	—	wind speed, SST, ice cover, ice age, atmospheric liquid water, atmospheric water vapour, detection of precipitations
Scatterometer	—	wind speed and direction, wave length and direction of gravity waves
SAR	—	wave length and direction of gravity waters, ice cover, internal waves
Altimeter	—	sea state, wind speed, ice cover, precipitations, ocean surface topography (currents, tides, marine geoid . . .), ice sheet topography (height changes, slopes . . .)
OCM	—	chlorophyll detection and concentration, yellow substance, turbility, SST

Système probatoire d'observation de la terre (SPOT)

The CNES's (France's aerospace centre) SPOT project consists of a multi-mission platform carrying payloads adapted to particular missions. The main feature of this satellite, now scheduled for 1984 launch, is the 20m multispectral (10m pachromatic) spatial resolution of the HRV (high resolution visible) scanners. It is probable that CCRS will receive SPOT data.

Landsat-D

Two satellites with a six-month time interval between launches are planned by the U.S.. Technical difficulties are likely to delay launch until sometime in 1982. Landsat-D and D[1] will carry multispectral scanners almost identical to those on Landsat-1, 2, and 3, and a new optical scanner, the Thematic Mapper, characterised by higher ground resolution (30m), larger number of spectral bands (7), and day/night operation capability.

Marine Observation Satellites (MOS)

Three Japanese sea satellites are planned. Among these, MOS-1, is the first to become an approved program and is scheduled for launch in 1984. SAR is being considered for future programs and may be used on MOS-3.

Microwave Radar (SAR) Data From Satellites

Spaceborne SAR technology has been proven in concept by the Seasat satellite, and experimental SAR sensors will be flown aboard NASA's Space Shuttle. Satellite SAR data is probable in the late 1980s. SAR data may be available from COMSS (1986), MOS-3 (1989) and/or a joint U.S.-Canada radar satellite program.

OCEAN INFORMATION SERVICES STUDY

Telephone Conversation with Melville Shipping
Calgary, July 8, 1980

Present: Dr. B. Dixit, R.B.L. Stoddart (by phone)

Discussion Summary

To date, Melville Shipping has primarily used AES's meteorological data for design purposes through computer simulations. Now that they are going operational, they are finding more and more need of oceanographic data such as surface currents, tidal currents, surface temperature, salinity, wave data and sea ice distributions, types, thicknesses and pressure.

Much of Melville's present interests are in the Northwest Passage, in Parry Channel towards Viscount Melville Sound (a high priority for more accurate hydrographic charts from Melville's point of view) and in the Baffin Bay and Davis Strait areas. Surface current information is required for ship routing and in determining the movement of surface ice. Surface temperature and salinity monitoring is necessary to determine corrosion rates; Melville will be assessing various hull coatings of friction reducing agents. It was suggested that this latter type of assessment might well be carried out through cooperative government/industry arrangements since the results will undoubtedly benefit future shipping interests in the North (i.e. they are interested in it primarily as a "pilot project").

The lack of a focus on oceanographic data and information was noted as a serious problem for the nation. The example was given that AES had a central telephone number as a referral service for meteorological data, but there was no similar service provided for oceanographic data.

It would be very valuable to know where information and data sets are located so that individual agencies can exchange these or purchase them on a bilateral basis. Government is looked to for the provision of such a service. It was recognized that government would be knowledgeable about data files that were collected because of various legislations or regulations. However, it was felt that there was a considerable amount of other data that was being collected for other purposes that government did not have a handle on. As a matter of principle, Melville Shipping would be in favour of some central government agency, such as MEDS, gathering listings of data availability, even if the actual data is presently proprietary. Melville could offer a description of the oceanic projects that it has been involved with, in the event the above suggestions were generally adopted.

There was considerable interest in innovative developments in the marine environment such as the use of over-the-horizon radar. Melville Shipping is not aware of the full range of interests in the OAS science program; for instance, they get IOS reports as a matter of course but not BIO's. Even though annual reports would help Melville in assessing what research had been undertaken in OAS, they are more interested in documents which would outline current and planned activities in order that industry can assess possible

cooperative joint ventures and dovetail their own planning processes for research with that of government laboratories.

Oceanographic biological considerations were seen to be more in line with the interests of Petro Canada.

It was recognized some wave data were being made available in marine weather broadcasts. It was stated that this service needed to be upgraded so as to provide a continuing real-time and forecast service that would provide significant wave heights, periods and frequencies. Some wave data are being provided by the U.S. Coast Guard for more southerly shipping routes.

Melville Shipping is cooperating with AES in the Electra weekly overflights which observe and chart ice distribution, types and thicknesses. There is a need for more accurate ice thickness data and more accurate ice pressure data. Presently they are primarily generated using theoretical calculations.

OCEAN INFORMATION SERVICES STUDY

Telephone Conversation with Mr. W.A. Gow and Dr. W. Erickson, Canada Centre for Mineral and Energy Technology, with respect to Marine Corrosion in Canada

Discussion Summary

The Mineral Sciences sector has a contract with the University of New Brunswick on the "Effect of the Marine Environment on Concrete". Details can be obtained from Dr. Malhofa (996-5449). Metal corrosion was dealt with in a small way at the Physical Metallurgical Laboratories. There was a project being carried out on corrosion under arctic conditions, but more generally the group was working on fractures and behaviour of metals (for example fractures in propellors are being studied for both CCG and DND). The group has an interest in marine corrosion and feels there is a central role to be played by government laboratories.

The northern marine technology requirements were cited as a useful area of study (Project Officer J. Gilmore 993-4527) with prospects of cost-benefit rewards. The areas under study pipeline connections and integrity although present efforts had not included sub-sea surface pipes, this would obviously be a future need. Bibliographies on marine corrosion could be fairly easily put together; centres of excellence presently exist in Defence Research Establishment Atlantic, Halifax, and Defence Research Establishment Pacific, Esquimalt.

OCEAN INFORMATION SERVICES STUDY

Meeting with Representatives of NRC, Ottawa, July 14, 1980

Present: J. Ploeg, L. Gold, E. Funke, C. Kirby, R. Browne, D. Murdey, J. McTaggart-Cowan, R. Keeley, R. Stoddart, G. Holland

Discussion Summary

The NRC is a special sector of government. It has a general mandate for research and standards which relate in part to the marine environment. Those present represented the Hydraulics Laboratory (coastal and ocean engineering); the Physics Laboratory (standards and instrumentation); Marine Dynamics (ship and platform performance and design); and Building Research (northern engineering).

The Hydraulics Laboratory serves both the Canadian government and the private sector with engineering research facilities on ocean related structures, both deep ocean and coastal with a predominance of the latter.

There are eight privately owned hydraulics laboratories in Canada that cover most of the fresh water hydraulic modelling. Marine coastal models tend to be large and complex and although NRC has attempted to pass this capability to the private sector, there have been few takers to date, industry being of the opinion that the large capital investment for floor space and equipment cannot be easily justified in the private sector.

The research requires data on waves, winds, currents, tides and water depths. Ice information will also be needed when the ice modelling tank is completed later this year. Wind data present little problem. Where actual data are not available, the laboratory resorts to synoptic charts and these are sometimes difficult to find. Current data are scarce and hard to track down. The offshore demands for moorings and platforms lead to a requirement for wave data. Recent research has indicated that the very large structures presently being designed and built react to energy grouping of the wave field with a response period of several times the wave period. Thus a structure that may have a natural frequency of discrete ocean waves (0-20 secs), may be jeopardised by the longer periods of energy bursts due to wave groupings. This information is seen to be critical for design; the grouping parameter however is not yet included in the analysis of wave data. Wave data can produce these parameters by calculation even though the instrument response is not sensitive to the actual energy grouping period, although verification by suitable proto-type measurements would be desirable. There is a need for an international recognition and acceptance of wave grouping parameters. One problem is that the present day trend is to average wave height and period (very much in the same way as wind measurements are treated). This analysis obscures the grouping parameter. In general, NRC feels that Canada is performing well, relative to other countries, with regard to wave data coverage, and it would be unrealistic to anticipate a much greater level of effort. Industrial data should form part of the total available data base, although proprietary restrictions and data quality were seen to be a problem. Government standards for oceanographic data, if accepted or regulated, would prove to be beneficial. Government should take the lead in offering software packages for data analysis.

The Physics Laboratory has a mandate for standards and has entered the ocean instrumentation field through its work on reversing thermometers; now NRC engineers are also working on salinity, ice temperatures, plankton counts and size, and data buoys (surface pressure). The laboratory must know what oceanographers want in the way of standards and then work with industry to develop an acceptable and marketable instrumentation. There is some lack of communication seen both in the knowledge that oceanographers have of the NRC work and vice versa. Presently the liaison is carried out through an NRC engineer who visits oceanographic laboratories regularly.

The laboratory operates under cost recovery, with the charges covering capital outlay. When a project is a research one, the general rule is not to charge for salaries, only O & M and capital. When the laboratory is used for testing designed works, NRC charges salaries plus 100% overhead if NRC is allowed to publish the test results. If the research is proprietary so that NRC cannot publish results, NRC charges salaries plus 200% overhead. Where possible, advice is given free so as to encourage industrial use of NRC expertise.

The Marine Dynamics Laboratory is the national facility for ship hydrodynamics with about 50% of the work commercially oriented and 50% DND. Wave data are required, significant wave height and period over the ship routes. Wave hindcasts are becoming generally acceptable and available in this regard. Wave groupings are also seen to be an important factor for ship safety. Special considerations are required for towed surface and sub-surface bodies. Some experience has been gained on towing ice bergs. For offshore structures detailed, site-specific data on currents, waves (grouping and breaking) and wind would be needed. Northern developments have led to the need for ice data of all kinds. NRC is constructing an ice tank facility in St. John's, Newfoundland and feels it is a little premature to specify the data available and required for this laboratory. Again, propriety of data, especially from the oil and gas industry was seen to be a problem.

It was agreed that government should hold an inventory of data and projects, and could regulate for industry to identify their data holdings to government.

The Building Research Laboratory did some research into the properties of sea ice, and interface with industry in this work. The characteristics of sea ice, for design purposes, need to be measured. The techniques for gathering the data, ice climatologies, anomalies, were also cited as areas to be addressed. Government was seen to be responsible for regional coverage and industry for sites and project-specific data. Dr. L. Gold had

recently completed a study on "R and D for Engineering in Cold Regions" and had concluded that sea-ice research needed to be added on to the oceanographic research mandate in Canada, that there was a lack of cohesion between ice related research projects, and that a centre for ice research would be beneficial. A "modest" program was required to concentrate on building up an ice data base. Data existed in industry and government, but funds were required for their collection and collation.

There will always be a need for government research, although research projects themselves will change. Research performed in government laboratories today, will become standard practise for private industry tomorrow. Therefore, government research was seen to be forward-looking, high risk and in the forefront of science and scientific engineering. Government needs its own expertise to evaluate, regulate and manage its responsibilities. Part of this expertise should be syphoned off to private industry to keep it competitive. This benefit is a direct spin-off of government excellence in research. Government must be able to respond to industry, to take on challenges needed by, but outside the capability of industry. It must be able to anticipate the needs.

More specific areas of data requirements were discussed and included:

1. The need for offshore tidal data out to the edge of the continental shelf for hydraulic and mathematical tidal models.

2. The new ice facility in St. John's would require increased and broader ice data for its research, and an inquiry was made into provisions presently being made to increase the ice data base.

3. The need for an ice data bank, managed by professionals who are active in the field, to collect and collate available data, to judge the quality, and recommend standards and formats, was considered to be important.

OCEAN INFORMATION SERVICES STUDY

Comments from Fisheries Research Branch, Department of Fisheries and Oceans, Ottawa

Summary

Fisheries scientists require oceanographic information and services in support of stock assessment, impact assessment and other fishery management activities. Many ongoing projects, which aim at the understanding of the environmental conditions in relation to commercially exploited fish populations, have an oceanographic component. The DFO annual groundfish surveys, the Scotian Shelf Ichthyoplankton Program, the Flemish Cap Experiment and the inshore/offshore lobster experiment are a few examples. Consequently, fisheries scientists are involved in all aspects of ocean data acquisition, as well as data processing, retrieval and analysis.

Hydrographic and meteorological factors currently being examined are water temperature, river run-off, wind, ice cover, circulation patterns, etc. (a comprehensive list is presented in the Proceedings of the Oceans and Fisheries Climate Workshop, March 1980). There is a considerable potential for incorporation of fisheries data into the system and for analysis of fisheries/oceanographic data to serve particular needs, e.g. impact assessment and resource assessment. Improved dialogue is required on the best means of developing this potential. In many fisheries management projects, the monitoring of the physical factors is undertaken as part of the project in order to ensure the relevance of the physical data collected, as well as to establish the continuity of the time series. In general, the Marine Environmental Data Service (MEDS) receives and stores oceanographic data from various fisheries projects. However, use of the data summaries and analyses has been inadequate up to now. Under present circumstances, many users find it more convenient and even necessary, to process their own oceanographic data to obtain results on a usable time frame. Since some users express satisfaction with the MEDS services, the problem may be one of communication rather than of substance. It

would seem appropriate that the problems be aired, given the key role that data banks must play in future fisheries activities. The potential of MEDS for sensitivity mapping should also be examined.

Regarding data gaps, the major concerns appear as the lack of year-round bottom temperature data and maps of circulation patterns on a year round basis for all areas critical to fisheries resources. Also, there is need for improved availability and distribution of satellite data on sea-surface temperature, ocean fronts and chlorophyl. Unfulfilled monitoring needs can be summarized as follows:

— offshore buoys at selected fishing banks for surface and water column by oceanographic parameters;

— bottom temperature recording designed relative to benthic fishery needs;

— chemical monitoring (nutrients, dissolved oxygen) at fixed oceanographic stations to detect long-term nutrient cycles;

— coastal environmental monitoring;

— detailed environment monitoring during periods of spawning for selected key commercial species;

— monitoring of phytoplankton biomass and production, and zooplankton biomass and species composition, in areas of high fish production.

Increased monitoring programs are necessary to address questions such as the daily accessibility of fish to inshore gear, physical oceanographic barriers to fish movements, physical oceanographic characteristics of spawning sites and fine-scale distribution of fish species in relation to shelf break fronts. In general, it is felt that the interpretation of the seasonal and life history movements of fish stocks, and of the distribution patterns of sedentary species, are hindered by an inadequate understanding on the major fishing banks of the characteristics of the bottom waters, of the currents (tidal and residual), and their seasonal variability.

DFO operates many vessels under the fisheries research and the fisheries surveillance programs; these vessels could be used as "ships of opportunity" for data acquisition. Fisheries research vessels are already contributing to the acquisition of oceanographic data but the potential role of fisheries patrol vessels should also be examined. Similarly, observer programs may be used for such purposes.

A general comment obtained from scientists outside the federal system, concerns the visibility of oceanographic services. Requests for information are generally on an ad hoc basis and many require non-standard "products" or analyses. Regarding the internal DFO organization, there is a general feeling that the interface between Fisheries and OAS should be more firmly established and that joint concerns be determined.

OCEAN INFORMATION SERVICES STUDY

Meeting with AES, Downsview, July 29, 1980

Present: R. Stoddart, R. Keeley, G. Holland, G. Needler, J. McTaggart-Cowan, R. Asselin, D. O'Neill, R. O'Brien, A. Campbell, R. Dodds, G. Morrisey, C. Jarvis, W. Pugsley, S. Lambert, W. Markham, M. Berry

Discussion Summary

J. McTaggart-Cowan opened the meeting which consisted of two main agenda items: firstly, to discuss the impact of the recommendations of the study on AES, and secondly, to outline the requirements of AES as a client. G. Holland then briefly summarized the findings of the study team in the area of ocean services. It was agreed that AES and OAS would need to cooperate in many areas in order to achieve the marine service

requirements without unnecessary duplication. The findings of the study team and its recommendations did not cause any great difficulties as far as AES future plans were concerned.

The meeting then concentrated on AES needs from the oceanographic community and each of the sectors represented gave their special requirements.

Operational Services

The most pressing requirement from the ocean is real-time data for assistance with forecast models. AES is willing to put out to the users any operational product required on a real-time or near real-time basis. Some of these products could be oceanographic in nature, chlorophyl, mixed-layer depth, etc., and oceanographic expertise would be needed to formulate the product but the operational expertise and facilities are with AES.

Other real-time applications were in contingency situations, for example, oil spills where current data would be needed for oil trajectory models. It was thought that a Marine Climate Atlas of available data for Canadian ocean areas of interest would be very useful for operational, management and emergency use.

It was recognized that the work being done by AES and OAS on surface phenomena (e.g. sea surface temperature and waves) should be complementary. In the case of wave measurement an inherent difference was recognized between the discrete time series measurement of water surface movement for engineering purposes and the averaged parameters used to describe sea state.

Research

Dr. Needler commented on the difficulty of modelling surface currents off the east coast; not enough was known about the tidal, residual, and wind-induced interactions to construct a model capable of yielding useful results. The expertise available however was not far removed from that needed to provide ocean "weather" that is the "fronts" and "systems" moving past the continental shelf.

AES indicated that there were many areas of oceanographic research needed by the meteorologists, including ice physics (ice rheology, thermal properties, freeze-up, break-up, air/ice and water/ice interface stresses and processes). Coastal circulations, surface currents, sea state, ice and icebergs are all important for operational predictions such as fog, icing, local winds, surface drift and sea state; where no data exists empirical relationships are used. The boundary layer research is of equal concern to AES and OAS. It was not felt that present contacts were very effective.

New technology, especially in the form of developments in satellite sensing and communications, was an obvious area for collaboration. AES plans to develop more marine products from satellite data and ground truthing data and oceanographic expertise will be needed. There is a lack of manpower to develop these in the short term. Dr. Needler commented on the disappointment felt by many ocean scientists on the payload of the NOSS satellite, with the possible exception of the altimeter, although AES felt that the sensors to be carried would prove very useful to the meteorological community.

Ice

Many of the requirements of the Ice Forecasting Branch have already been mentioned above but W. Markham emphasized the usefulness of surface and near surface currents for ice prediction. In the North, hydrography, thickness and ridge geometry were needed and a network of ice thickness stations and ridge strengths would be required for Arctic navigation. Another product that would be useful to the offshore oil and gas industry is iceberg predictions (size and abundance); it was thought that industry should be responsible for predicting the movement of specific icebergs. Dr. Needler asked whether the flow through the archipelago would affect the formation and movement of ice and it was thought that this information would be very useful.

In terms of new instrumentation cooperative research was required for the passive microwave radiometer, over-the-horizon radar and local radar ice observations.

DND/METOC

The meteorological and oceanographic centres at Halifax and Esquimalt presently produce several marine charts that are available to the public. These include Sea Surface Temperature (SST), Mixed-Layer Depth and Wave Analyses. There is a need to automate these procedures with the help of OAS and AES. METOC requires easily-accessible data bases; some of these are available at MEDS. Marine atlases of the data holdings would be very useful; ocean current models are also needed for DND search and rescue activities.

Climate

All time series data are valuable for climatic purposes. The most urgent need is presently for global SST and monthly climatological means. The global ocean circulation model will be required for incorporation into the global atmospheric model. A climatological inventory of data should be available.

It was thought that more use could be made of research vessels for ground truthing of satellite data, for example, using radiometers on board ship for confirming SST measurements. Reliable wave information would be equally useful. The Wave Information Workshop to be held in BIO, October 7-9, will be a worthwhile cooperative effort.

Other

In other areas of research models of wind and wave processes, freezing spray in the North, the impact of climatic changes on ice fields and the micro-changes in ice fields due to ship passage were seen to be future developments.

APPENDIX C

SPECIFIC REQUIREMENTS FOR ACTION WHICH WERE IDENTIFIED BY CLIENTS DURING THE COURSE OF INTERVIEWS

The following observations have been extracted from the interviews (Appendix B) and are in addition to the general recommendations found in the main body of the report. The majority require attention by only one or two federal agencies; suggested responsibility centres are listed not necessarily in order of importance. No comment is made by the Study Group on the validity of the client observations.

Observation (Source)	Responsibility Centre
— OAS should investigate the possibility of relaying oceanographic measurements on near real-time basis for data management purposes (DOE)	OAS/AES
— Prepare products of temperature anomalies based on monthly and seasonal means for both coasts (DND)	OAS/AES
— Require surface temperature and salinity monitoring in the North to determine corrosion rates (Melville Shipping)	OAS/AES
— Investigate establishing two additional tide stations on the East Coast; north side of Gulf and Iles-de-la-Madeleine; establish wave stations at same locations (Quebec Fishing)	OAS
— Provide information of "rip" hazards to small boaters (Boating)	OAS
— Require offshore tidal data to the edge of the continental shelf (NRC)	OAS
— Obtain and provide more information on times and spacial variability of current information in strong tidal passes (Boating)	OAS
— Analyses of vertical current structures and surface drift are needed in near real-time (DND)	OAS
— Require current data around Gros Cacouna (Quebec pilots)	OAS
— Require surface current information in the North for ship routing and ice movement (Melville Shipping)	OAS
— Require information on the subsurface current structure for the setting of hydrophone depths (DND)	OAS
— Determine the characteristics of sea ice (NRC)	OAS
— Investigate possibility of a private company supplying MEDS data and analyses to users (LeBlond)	MEDS
— Investigate time delays in the provision of wave data from MEDS (DPW)	MEDS
— Increased statistical wave data needs to be gathered for various areas (GENSTAR)	MEDS/AES
— Require instrumented wave data to determine energy grouping periods (NRC)	MEDS
— Examine calibration problems of oceanographic data received from industry (DINA)	MEDS
— Provide some non-hydrographic information on hydrographic charts, for instance details on geodetic datums (SNC)	CHS
— Examine if metric conversion has resulted in less detailed information for some hydrographic charts (DOT)	CHS
— CHS ensure accurate location of land on the hydrographic charts in addition to bathymetry (DOT)	CHS

Observation (Source)	Responsibility Centre
— Urgently require route surveys from CHS (DOT)	CHS
— Hydrographic work is urgently required for northern marine transportation routes (Oil and Gas)	CHS
— Accurate charts required for pingo areas (Oil and Gas)	CHS
— Require detailed charts for nearshore zones for pleasure craft (Boating)	CHS
— Require detailed hydrographic charts for coastal Labrador (FENCO)	CHS
— Require more **details** of bathymetry in the Gulf along lines of Scotian shelf charts (Quebec Fishing)	CHS
— Require update of hydrographic charts for the Gulf of St. Lawrence (Quebec Fishing)	CHS
— Assess timely availability of hydrgraphic charts to fisheries (West Coast Fishing)	CHS/Fisheries
— Assess hazard omissions on hydrographic charts (West Coast Fishing)	CHS/Fisheries
— Examine potential use of MEDS for sensitivity mapping (DFO/FRB)	MEDS
— Require year-round bottom temperature data (DFO/FRB)	DFO
— Require maps of circulation patterns on a year-round basis in areas critical to fisheries resources (DFO/FRB)	DFO
— Improve availability and distribution of satellite data on SST, ocean fronts and chlorophyll (DFO/FRB)	OAS/Fisheries/AES/EMR
— Establish offshore buoys at selected fishing banks for surface and water column parameters (DFO/FRB)	OAS/Fisheries/AES
— Ensure fixed-station chemical monitoring to detect long-term nutrient cycles (DFO/FRB)	DFO
— Increase monitoring of coastal environment (DFO/FRB)	DFO/DOE
— Monitor phytoplankton biomass and production, and zooplankton biomass and species composition, in areas of high fish production (DFO/FRB)	DFO
— Investigate using fisheries patrol vessels as "ships of opportunity" for data acquisition (DFO/FRB)	OAS/AES/Fisheries
— Ensure better interface between Fisheries and OAS to examine joint concerns (DFO/FRB)	DFO
— Investigate availability of metric instrumentation for fishermen (West Coast Fishing)	DFO
— Investigate bilingual reporting of marine weather (Quebec Fishing)	Fisheries/AES/DOT
— Need to evaluate plume effects related to drilling operations and coastal outfalls (DOE)	DFO
— Examine range of OAS products for input to AES concerns, possibly through the formal mechanism of a Memorandum of Understanding, to include such aspects as:	OAS/AES
– real-time operational products such as chlorophyll, mixed-layer depth, current data, etc.	
– research, such as ice physics, circulation, currents, remote sensing, etc.	
– climate, such as global SST, atlases, circulation models, etc. (AES)	
— Need an international standardization of ice data (DOT)	AES/OAS
— Need for additional research into freezing spray	NRC/AES/OAS
— Develop computer models of surface drift and dispersion for the combat of	AES/OAS

Observation (Source)	Responsibility Centre
pollution incidents (DOT)	
— Provide storm surge/tsunami run-up charts (ACRES)	OAS/AES
— Storm surge data required in the Beaufort Sea (DPW)	OAS/AES
— Improve Canadian SST and Thermal Front Analysis charts (DND)	AES/OAS
— Improve ice movement modelling in the Beaufort Sea (DOT)	OAS/AES
— More information needed on ice pressures and ice pack characteristics (DINA)	OAS/AES
— Provide information on ice, including ice movement, freeze-up and break-up, thickness, composition, cover and climatology, as well as research results on such features as polynias (DPW)	OAS/AES/DOT
— Need more accurate ice thickness and ice pressure data (Melville Shipping)	OAS/AES/DOT
— Sea ice and iceberg data are severely lacking (SNC)	OAS/AES
— Require iceberg plotting, surveillance flights and research into movement and prediction (Oil and Gas)	OAS/AES
— Require more data on the location, frequency and movement of icebergs (GENSTAR)	OAS/AES
— Require deep ocean wave climate (SNC)	OAS/AES
— Require real-time and forecast service for significant wave heights, periods and frequencies (Melville Shipping)	OAS/AES
— Require more frequent updating of marine weather (Quebec Fishing)	AES
— Provide better updates on marine weather services on West Coast (West Coast Fishing)	AES
— Provide 6-hourly wave forecasts for inshore waters (Boating)	AES
— Investigate underestimation of wind speed in the Gulf (Quebec Fishing)	AES
— Need better wind and wave strength and direction coverage in Canada (DPW)	AES
— Develop adequate prediction of break-up and freeze-up (Oil and Gas)	AES/OAS/DOT
— Will require ice forecast season extension (Oil and Gas)	AES
— Require ice predictions for shorter periods than thirty days (Quebec Fishing)	AES
— Required better end-of-season meterological forecasts for Great Lakes navigation (Shipping Federation)	AES
— Need information on ice movement via radio messages (East Coast Fishing)	AES
— Investigate means of getting marine data and forecasts to fishing vessels (East Coast Fishing)	AES/DFO/DOT
— Investigate transmission problems (VHF) and receipt of marine data on fishing vessels (Quebec Fishing)	DOT/DOC/Fisheries
— Encourage fishermen to report weather observations to AES (West Coast Fishing)	AES/DFO
— Establish sensitivity maps (Beak)	DOE/DFO
— Need for sensitivity charts (DOE)	DFO/DOE
— Shore erosion maps needed for engineering purposes (DPW)	DOE/OAS
— Provide DOT with a sole source for environmental considerations in emergency situations (DOT)	DFO/DOE

Observation (Source)	Responsibility Centre
— Examine problems of data flow between MEDS archives and DND (DND)	MEDS/DND
— Provide DND with more of the compilation data base for some hydrographic surveys in order to have more accurate hydrographic data available to DND (DND)	DND/CHS
— Require bottom-type and composition charts (DND)	CHS/EMR
— For specific areas, collect and provide bottom currents, strategic data for site-specific areas, and sediment and surficial sea bed geology (DND)	OAS/DND/EMR
— OAS should provide technical assistance and advice to DINA on collection of oceanographic data through their regulations (DINA)	OAS/DINA
— Information on marine mammals needed to enforce quotas and manage stocks (DINA)	DINA/DFO
— Investigate retention of lighthouse keepers (West Coast Fishing)	DFO/DOT
— Information required on large bergs and growlers for year-round shipping (DINA)	EMR/OAS/AES
— Require an ice data bank (NRC)	OAS/AES
— Assess sub-sea floor permafrost on a site-specific basis together with sea floor temperature (DPW)	NRC/EMR
— Assessment of sub-seabed permafrost occurrence and behaviour is required (SNC)	NRC/EMR
— Examine effect of low temperatures on equipment, for example the embrittlement of steel (DOT)	NRC/EMR/Metallurgy/ AES/DOT
— Data and expertise required for northern seismic activity (Oil and Gas)	EMR
— Collect and analyse ice information in relation to degree days of freezing for prediction purposes along marine transportation corridors (DOT)	AES/DOT
— Improve transmission of facsimile data, extending areal coverage and potential users (DOT)	AES/DOT/DND
— Research operational short-range radar ice reconnaissance from ships (DOT)	DOT/OAS/DOC/AES
— Require better positional system for northern navigation (Oil and Gas)	DOT
— Investigate ship routing schemes to minimize pollution and impact on fisheries (East Coast Fishing)	DOT/DFO/DOE

APPENDIX D

EXCERPTS FROM RECENT REPORTS, ARTICLES, ETC. WHICH INDICATE A NEED FOR NEW OR IMPROVED OCEAN INFORMATION

In order to assess studies, observations, etc. which have indicated problem areas in the provision of ocean information, the following compilation has been prepared from recent (back to 1977) literature. In some cases the excerpts are verbatim while in others they have been summarized. These excerpts can neither do full justice to the content of the observation, nor provide the associated substantiation. Herein they are not placed in any order of priority, and no comments are made as whether or not the noted gaps are being addressed in some manner. The reader is referred to the original texts for more detail.

1. Report of the Interdepartmental Study Group on Ocean Information Systems, Philip A. Lapp Ltd., 1979.

   The study group recommended that

   "a mechanism be established or identified to carry out on a continuing basis an integrated inter-departmental ocean information planning function to:

   a) continually assemble and monitor user needs (federal, provincial and municipal governments and industry) and identify gaps that need to be filled,

   b) plan future ocean systems facilities in response to needs,

   c) perform cost effectiveness studies on how new technologies can reduce costs and improve efficiencies in accomplishing current and future mandated management functions,

   d) identify necessary R&D, and arrange for it to be done by government or industry using government technology agencies for advice and scientific program monitoring,

   e) examine and take the necessary action to ensure needs are being met for technological requirements that tend to fall between mandates, such as communications and data transmission facilities,

   f) monitor and audit foreign technology development programs,

   g) identify long-range opportunities for the ocean information supply industry,

   h) recommend suitable mechanisms for multi-departmental funding for major capital procurements,

   i) establish and help to maintain standards for archival data collection, handling and storage, and

   j) encourage the establishment of an ocean information referral service.

2. MOSST position on the Lapp Report, 1979.

   "**Recommendation 1:** The Panel on Ocean Management should establish a permanent office or strengthened secretariat, with both DFO and non-DFO participation, and with terms of reference based on the Study Group's recommendation, to address R&D and other issues associated with the continuing planning of ocean information systems."

As a starting point in translating this general recommendation into more concrete action, it would be useful if the proposed office or strengthened Panel secretariat could carry out specific projects in the near future. Certain candidate issues have already been flagged in this document, and an additional project could address the inter-relationships among a number of current or impending decisions on surveillance tech-

nologies. Thus, MOSST further recommends to the Panel that the following be addressed as soon as possible by the proposed office or strengthened secretariat:

> "**Recommendation 2:** A study should be undertaken with the objective of establishing an archival system clearing house or referral service which would maintain a centralised, easily accessed, up-to-date inventory of where various types of ocean information are stored and how access to this information may be arranged.
>
> **Recommendation 3:** A review should be carried out on the present status of marine environmental baseline studies conducted by both industry and government (especially in the Arctic and sub-Arctic), with a view to establishing requirements for a long-term marine environmental assessment framework, and to analysing the government's overall scientific capability to evaluate environmental assessment studies.
>
> **Recommendation 4:** An assessment should be made of the implications for the government's overall ocean surveillance capabilities arising from the interrelatedness of decisions expected in the short-term on Sursat follow-on, Dash-7R procurement, Tracker replacement or lifetime extension."

3. Panel on Ocean Management Review of the MOSST Position on Ocean Information Systems, 1979.

> "It was decided that the secretariat should not be expanded, but task teams drawn from various departments should be formed as required. Further, it was recognized that information retrieval was a general problem and it was decided that a review of archival systems and associated referral systems should be established as soon as possible. The Chairman agreed to request the DFO Marine Environmental Data Service to develop guidelines on this subject."

4. Lancaster Sound: Issues and responsibilities, Canadian Arctic Resources Committee, 1979.

> "In particular, specific parameters of sea ice conditions, heat budget, ocean circulation in three dimensions and its variations over time, water chemistry gradients, and weather systems should be studied. These studies should be conducted at appropriate times throughout the year, at selected locations such as the open water edge, the areas of glacier outflow, the entrance to Navy Board Inlet, and in western Lancaster Sound. The purpose of these studies should be to determine the role of local and regional physical processes in creating and maintaining the particular biological and physical conditions of Lancaster Sound. The studies should build on the data, understanding, and techniques or other integrated process studies – such as the North Water programme, AIDJEX, and the NORSEX experiment north of Svalbard but should be adapted to the specific situation in Lancaster Sound."
>
> "Ongoing studies of marine biological systems are urgently required. Greater attention should be given to the character and stabilities of food chains, and to the basic ecology, biology, and sensitivities of organisms comprising lower trophic levels.
>
> Critical nodes or integrating links in the web of arctic food chains – such as arctic cod – should be studied carefully to determine the stability and resilience of the system, and to help understand the relationship between changes in the physical environment and their biological consequences in particular parts of the ecosystem."
>
> "Increased attention must be paid to the consequences of the changes of climate that may reasonably be expected in the Lancaster Sound region, and of the extreme ranges and variability of weather conditions that could occur during the next few decades. More precisely, attempts should be made to identify particular parameters of extreme or persistent meteorological conditions to which specific biological functions or technical operations are vulnerable. In this way, the analysis of weather and climatic behaviour can be related to the biological or industrial operational consequences. Awareness of variations in weather and climate should henceforth be a central factor in economic and social planning, in environmental protection policy, and in commercial investment."

More specific observations can be found in the body of the report on pages 33 to 56.

5. Environmental Overview, Beaufort Sea Development, Dome Working Draft, 1980.

"In general, the meteorological, biological and physical oceanographic properties of Amundsen Gulf, Prince of Wales Strait and Viscount Melville Sound remain poorly understood. As a minimum, information sufficient to permit the development of adequate oil spill contingency plans will be required."

"Information is required on the biological significance of epontic life and arctic cod to the northern marine ecosystem.

Additional chemical data are required for the Beaufort development area, to permit the adequate future assessment of possible changes which may result from development activities. In particular, improved baselines are required for the present levels of "contaminants" in the water column, sediments, and biological tissues."

6. Lancaster Sound Drilling, Report of the Environmental Assessment Panel, 1979.

— "lack of information on winter circulation which is expected to be different from summer circulation"

— "a more detailed understanding of current variability is also necessary before a predictive capability for iceberg movements can be established"

— "another area requiring much improved data and understanding of current variability under differing atmospheric conditions is in the modelling of oil slick trajectories. As well, knowledge on currents, particularly nearshore, will have implications for spill countermeasures effectiveness and fate of oil determinations"

— "a more extensive meteorological program should have been carried out to provide more reliable statistical data and to achieve a detailed understanding of the weather regime in Lancaster Sound"

— "contingency planning, analysis of potential contamination and fate of oil considerations require a knowledge of wave climate throughout the region"

— "there are knowledge gaps related to the detailed behaviour of icebergs"

— "further information is required on the movement and behaviour of ice floes, which can also pose a serious threat to operational safety"

— "baseline knowledge is not generally available from government agencies responsible for biological research and management"

— "given the apparent importance and proximity of these organisms (epontic) to oil under ice, a scientific understanding is required"

— "that oleoclasts exist and can counterbalance oil contamination. An understanding of the distribution, abundance of these organisms and their rate of neutralization of oil seems important when trying to intelligently discuss the effects of oil on the environment"

— "there are some very basic aspects of Lancaster Sound which can only be addressed by a relatively long-term research program and which should properly be the objective and responsibility of government programs. Examples are long-term climatic variation, the sublethal ecosystems effects of a blowout, or the basic mechanisms which lead to the high productivity levels found in

Lancaster Sound. In this latter aspect, present federal marine ecosystems research programs are not commensurate with the need"

— "in support of this policy, (Oceans policy, 1973) the Panel concludes that there is an urgent need to strengthen or expand long-term Arctic science programs."

7. Grand Banks Oil Spill Contingency Plan, Mobil 1980.

— "there is a general lack of good data for the oceanographic parameters on the Grand Banks especially in the winter months"

— "detailed current data does not exist for the area of the Grand Banks for either the summer or the winter months"

— "an understanding of the overall circulation of the water masses in the area is necessary to be able to understand that on the Banks itself"

— "groundtruth data for the winter wave climate on the Grand Banks is scarce"

8. Termpol Assessment of the Kitimat B.C. Marine Oil Terminal Proposal, Canadian Coast Guard, 1977.

"Physical environment considerations included oceanography (hydrography, tides, waves, currents and physical/chemical parameters) and meteorology. Some additional data on climatology and meteorology were provided. For both subject areas, deficiencies of information were identified and study proposals were made for hydrographic, oceanographic, and meteorological service subject areas.

Hydrographic tidal current information is required in the relevant seaward approaches to Kitimat, including Principe Channel, Dixon Entrance and Hecate Strait. More comprehensive investigations of Anger Anchorage should be carried out to determine its suitability as an anchorage. An oceanographic program should be undertaken covering Douglas Channel and East Hecate Strait. Such a program should include field observations of oceanographic parameters and the development of vertically integrated numerical models. Tidal current information is required to support the development of oil spill scenarios and hence to enable the assessment of possible impacts upon marine environment quality."

9. Beaufort Sea 1979 Issues and Environmental Concerns, An Assessment Report by the Arctic Waters Advisory Committee (AWAC), 1980.

"It is recommended that government initiate a regional baseline data collection program to establish: natural background levels for various toxic elements; quantities of specific pollutants, known to have cumulative effects, entering the Beaufort Sea from all sources and a survey of the biota which may be affected."

"It is further recommended that government and industry continue investigations into the behaviour and fate of waste contaminants discharged to the Beaufort Sea."

"It is recommended that current efforts by industry and government into developing oil spill countermeasures be continued and accelerated."

10. Marine Transportation R&D Advisory Board's recommended list of projects, 1980.

The Board has identified some 25 projects which they are considering for implementation. Some of these are directly related to OAS ("automatic digitising to improve chart production" and "development of a digital hydrographic data base") while others are ocean-related; i.e. listing of Canadian marine studies, compendium of ice characteristics, ice management for seaway extension, ice identification using microwave radiometers,

directory of ice navigation studies, environmental prediction system research, long-range ice prediction, dredge spoil disposal, sea swell suppression, Arctic ports and harbours, and ice hazard detection techniques.

11. Parameters to be Remotely Sensed for Ice Reconnaissance, jointly prepared by the Arctic Petroleum Operators Association and the East Coast Petroleum Operators Association, 1978.

    "The continued and expanded use of satellite systems to collect synoptic meteorologic and oceanographic data for the purposes of providing both an aid to forecasting and an expanded historical data base is advocated."

    The real-time coverage requirements referred to were: for oceanography – wave height, period, direction; currents, surges; temperature, salinity; and for meteorology – wind speed, direction; temperature; visibility, precipitation.

12. Environmental Aspects of Arctic Marine Transportation and Development, E.F. Roots, 1979.

    — need a better understanding of the two main oceanographic systems (clockwise Beaufort gyre, anticlockwise circulations of Labrador Sea – Baffin Bay and Hudson Bay), the forces that drive them and their interaction if we are to operate efficiently and safely, protect marine resources and make the best use of them, and avoid damage or failure because of unexpected or inadvertent changes.

    — among the most urgent needs for environmental information in Canadian arctic areas is the need for understanding the internal characteristics of the distinctly different assemblages of sea ice in Canada, and for developing the theoretical understanding and observational data that will allow predictions, on the basis of real-time observations, of the future behaviour.

    — biological studies are required to assess physical or chemical changes in a marine environment that is subjected to severe stresses and variations.

13. Report on the Application and Enforcement of Part XX of the Canada Shipping Act in Fishing Zones 4 and 5, Canadian Coast Guard, 1978.

    "Scientific knowledge on the trends, levels and biological impacts of pollutants in fishing zones 4 and 5 from vessel operations and transportation of pollutant cargoes is generally inadequate."

14. Monitoring and Research with Respect to Petroleum and Chemical Pollution from Shipping Activities, DFO, 1979.

    — "a resume assessment of data from cruises, monitoring and research projects should be prepared every three years in order to determine the relative change (if any) in pollutant levels and effects in water, sediment and biota in the specific geographical areas (fishing zones)."

15. Canadian Climate Program Workshops

(a) Oceans and Fisheries, 1980

    This workshop identified the following ocean climate related needs:

    Services

    — provision of existing data and fisheries effects along with improved interpretation of data for research purposes.

    — improve existing synoptic and predictive data products, and develop new products including ocean frontal analysis, atmospheric indices for coastal areas and sea ice climatologies.

Monitoring

— of the temperature and circulation of the upper layers of the ocean.

— maintain CO_2 time-series in the vicinity of OWS "P".

— improve monitoring networks for meteorological, physical oceanography, biological oceanographic and fish population variables for continental shelf areas and coastal embayments.

Research and development

— cross-shelf mixing, fresh water influence, winter water mass formation and seasonal changes in wind patterns should be studied: on the Labrador Shelf, in the Queen Charlotte Sound (Hecate Strait/Dixon Entrance system) and in the Gulf of St. Lawrence.

— develop numerical model of the oceans' mixed layer to couple with AES's GCM.

— study northern water formation including overflows, deep-mixed layers and deep convection.

— study northern part of the Gulf Stream system where intensive interactions take place.

— undertake process studies to reveal causal mechanisms linking small-scale events of biological significance and longer scale climatic phenomena.

Data Collection

— develop standard formats for data, ensure more use is made of alternate platforms for data collection, and develop satellite-based data acquisition systems to monitor variables such as sea surface temperature, waves, surface currents and chlorophyll.

(b) Carbon Dioxide Workshop, 1979.

— a Canadian Marine Carbon Centre be developed to provide a focus for CO_2 activities related to the complex marine carbon cycle.

— maintain CO_2 time series in the vicinity of OWS "P".

— research CO_2 exchange between the atmosphere and the ocean, in particular carbonate chemistry and the processes of deep convection in the oceans.

— efforts be made to develop a carbon cycle modelling capability.

(c) Climate Research Workshop, 1980.

— develop a mixed layer ocean model coupled to the atmospheric general circulation model.

— improvement of physical resources in the models, e.g. boundary layer processes.

— evolutionary development of ocean models including a possible 3-D ocean model.

— global atmospheric/ocean impact studies such as those directed toward the CO_2 problem.

— encourage and expand efforts in diagnostic ocean climate studies.

— process studies should be aimed at leading to understanding and parameterization of processes important to modelling the coupled atmosphere – ocean system.

— provide an ocean observing system to monitor the upper layer of the ocean and its interaction with the atmosphere.

— encourage scientific exchange programs among the oceanographic and the meteorological communities in government, universities and industry.

(d) Energy, 1980.

— develop a data base for offshore areas subject to present or likely future oil and gas exploration and development.

— improve models and techniques for deriving selected parameters from basic data sets, for example sea state . . . and oceanographic parameters.

16. Professor Roger Revelle's Comments on Satellite Measurements and Synoptic Mapping of the Oceans, 1979.

The present systems of ocean data management are inadequate from the standpoint of attempts to predict short-range variations in climate, variations from several weeks to several months, because the data do not come in soon enough. We need an automatic data transmission system for XBT observations so that they will be immediately transmitted to a data centre where they could be compiled, manipulated and used.

Satellites may have at least four very important measurement capabilities, the most important being the measurement of sea level. If we could map the sea level of the ocean, we would be mapping the geostrophic currents at the surface, that is the total current motion at the surface related to the pressure field. If we could at the same time know the temperature and the density distribution below the surface, and thereby the baroclinic circulation, we would have a real understanding of the large-scale motions in the oceans.

Other things that the satellites can measure are wind stress on the sea surface, currents near the surface by doppler signals of various kinds and, very roughly at the present time, the surface temperature. We need to be able to measure the ocean temperature from satellites to within a degree Celsius because the interannual variations are of the order of a degree Celsius.

In general, with the satellites we need not ground truth but sea truth and one of the most important kinds of sea truth will be an extensive programme, particularly on islands, of tide gauge installation, maintenance and operation. Member states of the IOC can contribute to this important part of the monitoring programme.

One of the most successful components of the so called FGGE Experiment, and of previous GARP Experiments, has been the drifting buoys, which are now scattered, several hundred of them, all over the Southern Oceans, and they have behaved very well. Unfortunately, these buoys give only meteorological information at the present time, that is surface ocean temperature and atmospheric pressure. What needs to be done is to develop these buoys so they will also measure the temperature of the water and maybe even the salinity of the water below the surface and the currents in the upper water layers.

Between all of these different kinds of instruments, it should be possible, as I suggested earlier, to make ocean synoptic maps of the same kind that we now obtain of the atmosphere. Unfortunately, these maps may need to be in considerably greater detail than maps of the atmosphere, because of the size of the mesoscale eddies. Here we have some hope of a new type of measurement which has been given the fancy name of acoustic tomography.

17. IOC's role in Ocean Climate, 1979.

The IOC, in conjunction with SCOR, is sponsoring a Committee on Climate Changes and the Ocean (CCCO), which is providing the lead on the oceanographic portion of climate programs, including:

(i) a) definition of the oceanographic experiments necessary for atmospheric and ocean climate research, as well as the identification and development of requirements for long-term ocean monitoring;

b) evaluation of proposals for ocean monitoring programmes resulting from the first meeting of the Group on the Pilot Ocean Monitoring Study;

(ii) symposia and workshops on oceans and climate;

(iii) identification of advanced technology applications such as from satellites, acoustic tomography and drifting buoys, which could be used in the oceanographic programme in support of the World Climate Programme;

(iv) development of proposals for programmes on marine ecological climate studies, palaeoclimate of the ocean, sea ice variability studies and studies of the role of the ocean in the carbon dioxide cycle;

(v) further work on theory and modelling of ocean dynamics relating to problems of climate research;

(vi) identification of those climate activities of particular relevance to oceanography in developing countries.

18. The Need for Action – Oriented R&D in the Canadian Arctic, G.R. Harrison, Dome, 1979.

—develop techniques which give high resolution measurement of ice properties and ship traffic conditions from aircraft and earth satellites in all weather and in darkness.

—obtain improved understanding of the effect of oil in Arctic waters.

19. Science Policy – The Industrial Dilemma, R.A. Dick, Melville Shipping, 1979.

Some recommendations can be made for streamlining the process of obtaining a consistent up-to-date centralized bank of research data for the Arctic.

—A centralized government agency should be set up with powers to administer and control government promoted marine research and development activities.

—This organization should have a mandate to consolidate all information presently available that reflects upon commercial operations in the Canadian Arctic, before proceeding with further studies. It is absolutely essential that all existing information is catalogued and analysed such that commercial organizations can have access to every item of data relating to a potential commercial venture.

—This centralized data bank/R&D centre should be staffed by highly qualified personnel in the various fields of endeavour. The staff is to have responsibility for actually conducting the research, and for managing, validating and accepting any consultant conducted studies.

—The staff of the R&D centre should have the authority to proceed with the various approved studies, on some priority basis, after giving reasonable attention to details like Canadian content and selection of study method.

—The technical capability of marine oriented government agencies should be upgraded to allow the Canadian regulatory authorities to take an authoritative role in setting design standards.

20. Policy for the Management of Data Collected by OAS Programs or Submitted to OAS Under Various Agreements and Regulations, OAS, 1980.

—the national and regional archival centres will, as a minimum, provide data inventories of their

holdings and a referral service for data collected by OAS and other major marine programs where the data are not stored in the centre;

—data submitted to OAS by industry under the EARP, requirements of the Oil and Gas Act, or for various other reasons and that submitted by other government departments should be incorporated into existing systems where possible;

—Canada will actively pursue the acquisition by exchange of oceanographic data collected by foreign vessels operating in the Canadian area of interest.

21. Transcripts of Proceedings of the Federal EARP on the arctic Pilot Project, Resolute, 1980.

p.55 — Level of ice and weather information services needs to be increased for year-round marine navigation.

p.67-69 — More research is needed especially on the biological significance of polynias.

p.75-76 — lack of sufficient information pertaining to:

— Bridport Inlet biota, winter biology,
— Anadromous fish populations,
— hydrographic information along portions of proposed shipping routes.

p.123 — concern expressed over the possible effects of climatic change on winter sea ice conditions which could adversely affect tanker operations.

p.139-140 — Bridport Inlet marine ecosystem data base lacks information on spatial and temporal variability. Also similarity to other high arctic marine inlets should be determined.

p.208 — shipping operations in the Arctic will require significant infrastructure to include inter alia navigational aids, . . . ice and weather forecasting, and hydrographic charts.

p.474 — an assessment is required of the biota in ballast water uptake zones to determine potential implications.

p.622 — alternate ship routing through Fury and Hecla Strait would require hydrographic work (and biological investigations) in Northern Foxe basin.

p.660 — controversial use of polynias – both biologically sensitive and attractive as shipping routes; of particular biological interest are those located at entrance to Jones Sound.

p.800-803, 1088 — navigational route along coast of Bathurst Island lacks sufficient hydrography data; also CHS interested in Greenland coast but has no mandate.

p.810 — ice ridging in Baffin Bay – Davis Strait area needs quantitative data.

p.1086 — more work is needed on route selection – i.e. integrated analysis. Also, year-round baseline ecosystem monitoring (including oceanographic parameters) is needed at Bridport Inlet prior to monitoring under the APP.

22. Research and development for Engineering in Cold Regions, NRC, 1979.

Amongst other items, the study recommended:

There be established a Centre for research on sea ice.

The roles of the Centre would be:

— To collect, evaluate and consolidate past research results and experience concerning the ice covers of the Arctic and off the east coast of Canada;

— To undertake and provide financial support for studies on the characteristics of ice covers and floating ice masses;

— To foster the development of capability to provide sea ice distribution and movement forecasts on an operational basis;

— To "manage" the knowledge provided by the above activity and make it readily accessible to all concerned with cold regions engineering work.

— The Canadian Government provide at least $5 million over a period of five years for research directed to improving Canadian capability in cold oceans engineering.

A committee of individuals from the private sector, government and universities should be set up under the National Research Council to determine the research to be carried out, manage the program and evaluate the results. This should be preceded by an in-depth study to clearly identify the capability that should be developed, the amount of money that should be provided and the areas in which the investment should be made. The program should complement initiatives by the Department of Industry, Trade and Commerce, to support the development of the Oceans Industries. Industry should be strongly encouraged to provide matching support. The program should be reviewed at the end of five years to determine its effectiveness and whether it should be continued.

— There be a study of the environmental data base required for northern and cold oceans engineering practice; this study to be carried out by the Department of Indian and Northern Affairs in collaboration with government departments and agencies with relevant responsibilities.

In carrying out this study consideration should be given to the adequacy of present regulations and guidelines, to their economic impact for northern and cold oceans engineering practice, to the adequacy and appropriateness of the present data base and to the data and environmental studies that are still required to establish sound regulations and guidelines.

23. Reassessment of Fundy Tidal Power, 1977.

— Concerns relate to the effect of changing water levels on the mud-flat habitats for migrating birds, the possibility that a tidal barrier might impede the movement of anadromous fish, other fisheries aspects, recreation, mineral exploitation, navigation and land erosion. Detailed study of these effects and of possible mitigation measures will be necessary during any further project investigations.

24. Program Evaluation, Ocean and Aquatic Sciences Headquarters, 1980.

— There were serious criticisms from the ocean industry sector, to the effect that the OAS Program is not geared to national priorities, that it is uncoordinated, especially with regard to the arctic and that OAS does not consult industry in program planning.

25. DOE Baseline Study Program, Atlantic Region, 1980-81.

— In many cases, the type and level of data held by other government departments and industry is unknown. More importantly, no coordinated evaluation of the information currently available has been undertaken by the department (DOE) in conjunction with expertise from other departments and industry. Program gaps in the marine environment were identified in a number of

instances: enhanced programs of meteorological, sea-state, and ice data collection; accelerated studies on modelling and prediction of oil spill movements and dispersion; iceberg data off the east coast; background levels and persistence of petroleum related pollutants in the marine environment are relatively poorly understood; major gaps in physical oceanography such as surface and subsurface currents, sedimentation effects and wave fields, iceberg and pack distribution, scour distribution and frequency; in chemical oceanography the general characteristics of water and sediments need to be clearly documented; baseline data on primary productivity, food chain dynamics and bacterial productions are needed; effects of extensive oil contamination on plankton are, as yet, undetermined.

26. Report on Coast Guard Services Provided Along Specified Route Segments and in Northern Resupply Areas.

    — This report notes that of the 125 hydrographic charts that cover the arctic waters, the data used has been collected during the last half century from a variety of sources, and except in the few well surveyed areas, such as Lancaster Sound, the charts are extremely suspect.

27. Canadian Arctic Transportation System Viability, DOT, 1980.

    — Statistical data on sea ice thicknesses, ridge dimensions, and ridge frequency for the Canadian Arctic in general and the proposed VLCC route in particular is sparse. Moreover there appears to be a need to coordinate the overall acquisition, research, recording, storage, recall, forecasting, and operational dissemination of these categories of ice data and related matters.

28. Research and Development for Ocean Engineering in Cold Regions, Pallister Resource Management Ltd., 1978.

    — Unique problems are introduced by an ice cover and by the movement of ice masses. It has been determined that the presence of ice imposes very significant technological requirements for the safe and economic production of these resources. The subject that requires the most research and is the focus of this report, is "ice engineering".

    — Four research programs into ice as a material are recommended. This research would lead to a greater ability to work with ice, predict its movement, divert its large masses, and install structures capable of withstanding its impact. To accomplish these ends, fundamental research is needed, firstly to identify the engineering properties of ice more thoroughly, and secondly to quantify the dynamic behaviour of various ice formations. From an enhanced knowledge of its static and dynamic properties, ice research can then be applied most meaningfully to site-specific ice movement prediction, impact attenuation and ice utilization.

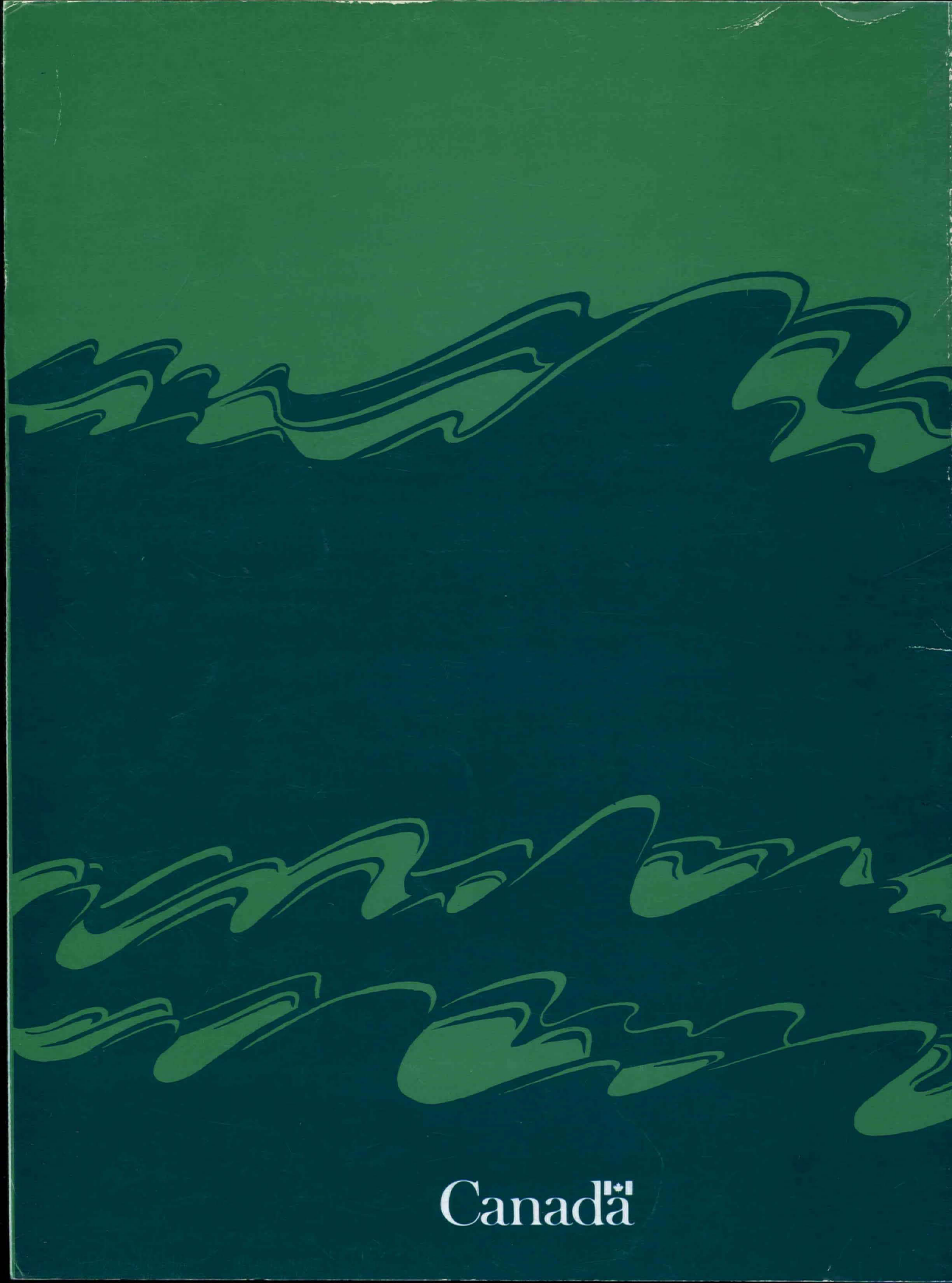
      Secondary subjects requiring research are the aspects of seafloor engineering and petroleum engineering relative to working within ice and cold waters. Research in these areas would lead to an increased capability of operating on and below the seafloor beneath an ice cover. Enabling technologies also require research and development, with an emphasis on the application of remote sensing, communications, and instrumentation. These areas, as well as the fields of transportation, materials and equipment require R&D efforts as ice-related problems. Synoptic data programs have been considered to the extent of developing improved methods of acquiring and processing baseline data.

29. NOAA Issue Paper on CO-OPS Plan, 1980.

    — Specific ocean services system improvements were proposed in FY 80 under the Coastal, Offshore, and Oceanic Prediction Services (CO-OPS) Plan. NOAA's FY 81 Congressional Submission proposes to establish three new Ocean Service Units (OSU) at Key Weather Service Forecast Offices on the Pacific, Gulf, and Atlantic Coasts, and to augment the Ocean Services Group at the National Meteorological Center (NMC).

— The FY 82 budget increase will "buy out" the remainder of the CO-OPS Plan adopted in FY 80: 1) establish five new Ocean Service Units; 2) complete augmentation of the NMC Ocean Services Group staffing; 3) complete oceanic staffing of NESS Satellite Field Services Stations (SFSS) at each of the designated OSUs and at NMC; and 4) initiate the first purchase of the Shipboard Environmental Data Acquisition System (SEAS) to improve recovery of surface meteorological and oceanographic observations from the coastal, offshore and high seas regions.

— The requested positions and resources will allow NOAA to meet the growing need for improved ocean services to marine users. This program will permit better planning of marine operations and activities; enhance safety of life and property at sea and along the coastlines; and reduce the potential for litigation against the government charging that inadequate marine services are provided.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