The origins of the Institute of Ocean Sciences

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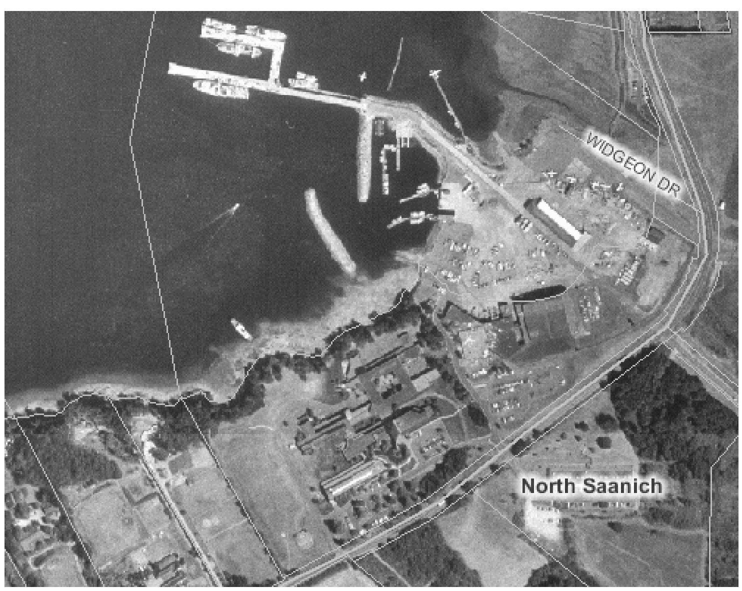

Preface

This volume is very much a work-in-progress. The Institute of Ocean Sciences contains many active and energetic research programs and clearly has an impressive future ahead of it. Thus I did not wish to call this a "History" as significant things seem to be happening week by week.

The document that will be released on the occasion of our 25th anniversary will include chapters describing the state of oceanography before IOS was conceived. The events leading to the creation of IOS, a survey of the library and a survey of computing. That last one is particularly interesting in that nobody could have imagined 25 years ago just how overwhelming would be our dependence on computing machinery.

Each of the chapters was drafted by one or more people and edited by Howard Freeland, with some assistance. I have no doubt that opinions will vary, perhaps some errors have been made. I would like to thank all of those who have assisted this project so-far.

It is regretted that the document does not include all aspects of activities at the Institute of Ocean Sciences. I know that chapters are in preparation concerning the Canadian Hydrographic Service, The Pacific Geosciences Centre and Arctic Oceanography. These sections will be added as they become available. Suggestions have been made that we should add sections on a few other aspects of our organization, such as a brief history of "The Fish" and perhaps histories of some major endeavours, such as the Trans Arctic Survey, Line-P and perhaps P-15N. If anyone feels inspired to document an aspect of the Institute then please come and discuss the project with me.

Howard Freeland
31st May 2003

Index

PACIFIC WATERS AND THE P.O.G. THE ORIGIN OF PHYSICAL OCEANOGRAPHY ON THE WEST COAST OF CANADA

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"It is not an easy job being a scientist before the job exists".

"Every time you hear about a successful application of science, look for the progressive extension of a network."
Bruno Latour 1987, Science in Action, pp.150, 249

Viewed from a distance, the origins of oceanography - a hybrid discipline unlike the pure sciences that fathered it - are hard to discern. Was there a single origin of the ocean sciences, or a number of responses to local needs? How did the sciences that are called oceanography come to be grouped together? The purpose of this study is to examine how a scientific speciality, physical oceanography, spread to a specific setting, a laboratory on the West Coast of Canada, between the 1920s and the mid 1950s. Rather than concentrating on origins *per se*, it shows how physical science was applied to the oceans as habitat for fish, first tentatively, then with increasing self-assurance, and eventually with near-autonomy from the conditions that fostered its first application. It attempts to lift the lid of a Latourian black box before it has quite closed, that is, to open the past of an important research group in Canadian marine science .[2]

The contribution of Canadian scientists to Pacific oceanography was small until the mid 1950s. T.W. Vaughan's International aspects of oceanography,[3] which surveyed international ocean science in 1937, contains no oceanographic information from Canadian sources, and Grier's bibliography[4] of North Pacific oceanography lists only a handful of chemical and hydrographic works, most of them very short, by Canadian authors. Although the whole Pacific was poorly known until the Second World War,[5] the Canadian contribution seems disproportionately small. By the late 1950s, this situation had changed. Writing in 1957, J.P. Tully, Oceanographer-in-Charge of the Pacific Oceanographic Group (P.O.G.) at Nanaimo, British Columbia, expressed the organization and assurance of a scientist in a well-established discipline.

...in the past national oceanographic groups worked as individuals with very little co-ordination. The last few years have seen a revolution in oceanography - at least in Canada. The fisheries and navy have posed definite requirements for oceanographic information, and have provided the resources for work. The Canadian Joint Committee on Oceanography has brought close co-operation with the agencies representing hydrography, tides and meteorology. Furthermore, international co-ordination is reaching the level that has long been enjoyed by these surrounding disciplines.[6]

Earlier Tully had described the role of the P.O.G. as follows:

...the work of this group is directed toward providing an accurate description of the oceanographic conditions in the Pacific and Western Arctic approaches to Canada, in terms suitable for fisheries, naval, social and industrial use, and seeking means of predicting these conditions where possible.[7]

Less than twenty years after Vaughan's survey, an extensive program of oceanographic monitoring, regional surveys, co-operation with other research groups, open sea investigations and education was well established, centred in Nanaimo.

The background of Canadian marine science

In 1900, Canadian marine science was barely beyond the stage Suzanne Zeller has described as *inventory science*, characteristic of an expanding, population-poor nation, extending its frontier across a huge land-mass which required description.[8] Before 1900, Canadian marine science was carried out *ad hoc* by university teachers working during their summer vacations, or by the occasional professional naturalist such as Andrew Halkett (1854-1939) of the Department of Marine and Fisheries, and John Macoun (1831-1920) and some of his colleagues at the Geological Survey of Canada.[9] Universities were small and not research oriented; graduate work was poorly developed, centred in Toronto and Montreal, where the pure sciences and engineering alone were taught.[10] No grants or subventions existed for research[11] and there were no marine research stations.

This situation began to change in 1898, when, under the Dominion Commissioner of Fisheries, Edward E. Prince (1858-1936), a board was established (later named the Biological Board of Canada) to supervise the establishment of a Canadian marine biological station. In 1908, two stations were opened, at St. Andrews, New Brunswick, and Nanaimo, British Columbia.[12] Small, isolated and poorly funded, they were staffed mainly during the summer when university teachers arrived to do their research or study problems of interest to the Board. Even the directors of the stations were only seasonal residents until the 1920s or later (1934 in the case of St. Andrews).

The state of early Canadian marine science is exemplified by the Canadian Fisheries Expedition of 1914-1915.[13] It originated in Prince's desire to expand the East Coast fishery and improve the economic lot of fishermen. He recruited the eminent Norwegian fisheries specialist Johan Hjort (1869-1948) to examine the East Coast herring fishery and other resources. Hjort conducted the expedition with all the marine scientific resources of Europe, tried and tested in the programmes of the International Council for the Exploration of the Sea (ICES) for more than a decade, and with the help of Canadian scientists such as A.G. Huntsman (1883-1972), director of the St. Andrews laboratory. The first extensive oceanographic survey of any part of North America, Hjort's expedition dealt with the plankton, fisheries and hydrography of the Scotian Shelf and Gulf of St. Lawrence. Its report not only summarised results, it served as a text for Canadian marine scientists for at least two generations.14 But texts are only useful when groundwork has been prepared for their use. Sandström's lengthy chapter on dynamic calculations,[15] for example, fell into a void; it was regarded as abstruse by bureaucrats overseeing its publication in Ottawa and was ignored by Canadian scientists, either because of their inability to cope with mathematics or because of their concentration upon pure sciences such as physics, chemistry and biology.

Overall, the effect of the expedition was limited; it served as an ideal, rather than as an example of objectives that Canadian marine scientists could achieve using their own resources. Even in 1931, the International Passamaquoddy Fisheries Commission, established to study the potential biological consequences of damming Passamaquoddy Bay for tidal power, had to recruit foreign specialists such as the Norwegians H.H. Gran (1870-1955) and Trygve Braarud (1903-1985), and Michael Graham (1898-1972) of England, among others, to assure scientific competence in such a wide-ranging study.[16] Examples of how internationally-sanctioned marine science should be conducted in Canada were beginning to accumulate by the early 1930s, but professional opportunities were few or non-existent, funding was sparse at best for anything but the most rudimentary field studies, and pure science was suspect in the Ottawa corridors of power and finance that scientists like Huntsman and his coequal at Nanaimo, W.A. Clemens (1887-1963), depended upon to support their tiny laboratories.

Physical oceanography in Europe and North America

In current usage, physical oceanography deals with the physics and circulation of the sea. As a designation of a discipline and a profession, the name was scarcely used before the 1920's; it came into most common use in North America during the 1950's. European usage, e.g. in Germany, designates physical oceanography as "oceanography"; related fields are marine chemistry, marine biology, and so on, united under the umbrella of Meereskunde, marine science.[17] The roots of European Ozeanographie lie in physical geography, not in physics or the marine sciences.[18]

Dynamic understanding of oceanic circulation increased rapidly afterVilhelm Bjerknes's theorem of baroclinic circulation in fluids, first devised for meteorology, was applied to the oceans by Johan Sandström and Bjørn Helland-Hansen in 1903 and 1905.[19] Dynamic calculations of ocean currents and a general increase in knowledge of the physics of the oceans were promoted by the scientific meetings of the International Council for the Exploration of the Sea (I.C.E.S.) and by courses on oceanography for technicians and scientists at Bergens Museum between 1903 and 1913. The Geophysical Institute in Bergen, founded in 1917 to induce Bjørn Helland-Hansen (1877-1957) to stay in his adopted city, became the centre of instruction in mathematical oceanography, drawing students from Europe and North America until the Second World War.

In the United States, early in the century, W.E. Ritter (1856-1944), founder in 1893 of the laboratory that became the Scripps Institution of Oceanography in La Jolla, California, saw the need for a *hydrographer* to link the physical environment to the lives of animals that were the subject of his laboratory's work.[20] He appointed George F. McEwen (1882-1972), a physicist from Stanford, to the laboratory staff in 1908. McEwen, who was an able mathematician, soon learned about, and mastered much of, European physical oceanography, but he regarded the dynamic method devised by Bjerknes, Helland-Hansen and Sandström, as only an expedient, lacking real physical meaning. He seldom used dynamical calculations and apparently taught them reluctantly, although he described them in a widely known monograph in 1932.[21]

On the East Coast of the U.S.A., H.B. Bigelow (1879-1967), a Harvard zoologist, began studying the biology, chemistry and physics of the Gulf of Maine in 1912.[22] He knew of dynamical methods quite early but had difficulty in applying them to his data. Help came in the person of Edward H. Smith (1889-1961), a U.S. Coast Guard Officer assigned to duty with the International Ice Patrol, who had the ability and the need to learn dynamic oceanography. In the course of his PhD study at Harvard with Bigelow, Smith spent 1924-1925 in Helland-Hansen's Geophysical Institute learning the technique and making calculations of current flow around the Grand Banks.[23] When he returned, he published a version of Helland-Hansen's lectures that became widely used as a primer of dynamic oceanography.[24]

In Canada, A.G. Huntsman's concern with the herring fishery of Passamaquoddy Bay, his opposition to the plans for a tidal dam there, the influence of Hjort and the Canadian Fisheries Expedition, and his long-standing correspondence with Bigelow about physical oceanography (among many other subjects)[25] led to the appointment of H.B. Hachey (1901-1985), a young physicist from the University of New Brunswick, as hydrographer at St. Andrews in 1928.[26] Among Hachey's first official tasks was the dynamic calculation of currents from data taken during the Hudson Bay Fisheries Expedition of 1930.[27] In so doing, he was the first Canadian to learn and apply these techniques, using Sandström's monograph (1919) as a text.

Each application of the techniques of dynamical physical oceanography during the first four decades of the 20th century arose out of a specific scientific or practical need, ranging from animal ecology to the tracking of icebergs. When H.U. Sverdrup (1888-1957), a distinguished colleague of Helland-Hansen from Bergen, arrived in California in 1936 to direct the Scripps Institution of Oceanography, he quickly established a thorough training in dynamical oceanography for its students. Recognizing that the small and struggling institution needed a scientific raison d'être and powerful allies, he established liaisons with state and federal agencies to study the California Current, using physical oceanography to determine the parameters of a fisheries system.[28] This beginning, interrupted but ultimately fostered by the Second World War and its aftermath, led to the permanent establishment of mathematical physical oceanography, its growth and institutionalization, in North America by the 1950's.

Oceanography at the Pacific Biological Station

The Pacific Biological Station (P.B.S.) at Nanaimo was separated from its east coast counterpart by geography and by Pacific salmon, then Canada's most valuable marine resource.[29] As the laboratory's first director, W.A. Clemens, recalled:

With the steady expansion of the fisheries, an increasing number of questions had arisen concerning the stocks of fishes and adequate conservation measures for them, and my appointment [in 1924] was expected to lead to the development of a program of fishery research and to the acquisition of basic information on the fish and fisheries.[30]

The reports of P.B.S. directors, year-by-year, invoke the importance of the salmon and other British Columbia marine resources.[31] In 1940, the new director R.E. Foerster (1899-1978) wrote that *the main objective of the work of the Pacific Biological Station is to undertake those scientific studies of the commercially important fishes of British Columbia which will provide the Department of Fisheries with accurate data for its guidance in establishing suitable regulatory and conservation measures for the continued safe exploitation of the fisheries.* But how liberally would the directors of PBS construe the *scientific studies* undertaken at the station? Foerster continued:

...there are those [studies] that have reached the point where fundamental factors governing the reactions of the fish are being investigated, such as those which control migration, those which produce variations in growth rate, abundance of fish, propagation, etc. All are definitely of what might be termed economic importance as well as of scientific value, but some naturally seem of more obvious significance than others. As research progresses, however, the fundamental phases become the primary concern of investigation and, in final analysis, they constitute the essential problem. They hold in so many cases the key to the explanation of the phenomena which, on the surface, are of importance in regulation and conservation.[32]

In Clemens's footsteps, Foerster and successive directors of PBS toed the fisheries line, but continued to support basic research that might eventually prove to be relevant to the fisheries.

Until a permanent staff was appointed, beginning in 1924, the work carried out at P.B.S. varied with the interests of its part-time director and visitors.[33] The second director 1912-1924, Charles McLean Fraser (1872-1946), began regular records of temperature and density in Departure Bay in 1914.[34] Visitors made occasional studies of the plankton,[35] or tried to relate the striking hydrographic variety of the Strait of Georgia to the distribution of marine plants and animals.[36] With R.E. Foerster's arrival in 1923 to work on sockeye salmon in Cultus Lake, the station's dominant line of research was established.[37] But work on the environment of the salmon, especially at sea, lay in the hands of visiting researchers for a few more years.

In 1926, Andrew H. Hutchinson (1888 - 1975), professor of Biology (later Botany) at the University of British Columbia, with the help of Colin C. Lucas (1903-1981), and Murchie McPhail (1907-1989) began a series of summer studies of the hydrography of the Strait of Georgia. Taking their inspiration from the work of H.W. Harvey and W.R.G. Atkins in Plymouth, they attempted to explain the fertility of the Strait (especially its diatom populations) by the mixture of Fraser River and ocean waters.[38] They concluded that the strait was dominated by freshwater from the Fraser, which formed a low salinity cap in mid-strait and provided most of the nutrients for plankton growth (and thus indirectly for fish nutrition). But the greatest abundance of phytoplankton was where the Fraser and ocean waters mixed, northwest and southwest of the river mouth; here some unknown factors (they referred to "mixing"), in addition to nutrients, were most favourable for phytoplankton blooms.[39]

According to Clemens, the work of Hutchinson and his *colleagues served to attract attention to oceanography and also helped me to organize ideas.*[40] He set out to hire an oceanographer, first by trying to attract T. G. Thompson (1888-1961) of the University of Washington to Nanaimo. But Thompson's laboratory was about to be endowed by the Rockefeller Foundation; despite his interest in P.B.S., he stayed in Seattle. In his place, Clemens found Neal Carter (1902-1978), a young Canadian chemist on a post-doctoral fellowship in Germany in 1930. Later that year, Carter moved to Nanaimo as oceanographer and chemist. Within a few weeks, he began to carry on Hutchinson's survey of the Strait of Georgia,[41] and to study the hydrography of mainland fjords as habitats for fish.[42]

***Figure 1**. J. P. Tully and colleagues at the Pacific Biological Station, Nanaimo, British Columbia in 1935. Those in the picture are, (standing, L to R) Anderson, Tully and Large (below L to R) are Hollister and McHugh.*

Carter's workload was heavy. To carry the burden of chemical analyses, an assistant was needed. A young chemist from Manitoba, John P. Tully (1906-1987) was recruited in 1931 (Figure 1). Even though he had lost a leg in an automobile accident during his youth, Tully was highly motivated, extroverted and expansionist in personality. When Carter left P.B.S. in 1933 to direct the Board's Experimental Station in Prince Rupert, B.C., Tully stepped into his place. Unencumbered by any preconceptions about marine science, he set about learning oceanography and applying it in the context set by Clemens and the purposes of the station.

Sea-temperature records had been kept since 1914 in Departure Bay, and since 1917 at William Head, near Victoria. In 1932, Tully arranged to have lighthouse keepers at five locations record daily sea temperature and meteorological variables. As he said later:

...the direct object of this program is the preparation of continuous charts of the hydrospheric and atmospheric variations to show their geographical daily, seasonal and annual variations and their inter-relations with a view to determining the meteorological factors that affect the movements of the various commercial fishes. It is well known that the sea and the air affect each other and that the behavior of one cannot be entirely separated from the other.[43]

Furthermore, the lighthouse observation program, which expanded to more than twenty stations later, was a proxy for work at sea, for, although the Strait of Georgia could be studied from P.B.S.'s small boats,[44] the open ocean could not. Its characteristics and variations off the British Columbia coast were totally unknown in 1932. Tully's solution, along with the lighthouses, was to use ships of convenience. Viewing red-tape as a way to pull oneself along, not as an impediment,[45] he began hitching rides on hydrographic surveying vessels to study the west coast of Vancouver Island and the open Pacific. Aboard the Canadian Hydrographic Service's vessel William J. Stewart, he spent a few days studying the currents of Nootka Sound in July 1933,[46] several weeks between Cape Flattery and Esperanza Inlet in 1934, and three months in the area of the Queen Charlotte Islands in 1935. These experiences were valuable, but frustrating; oceanographic work took second place to charting and to the whims of the chief hydrographer, and was hindered by the unsuitability of the vessel.[47] The solution was to find a better vessel that could be devoted, at least part time, to oceanography. Such a vessel was HMCS Armentières, loaned for a few months each year by the Royal Canadian Navy for oceanographic surveys from 1936 to 1938.

Between February and September of the first year of his offshore surveys, Tully and colleagues occupied 100 oceanographic stations between the entrance to the Strait of Juan de Fuca and Queen Charlotte Sound. In the next two years, he concentrated on Swiftsure and La Pérouse Banks at the entrance to the Strait of Juan de Fuca,[48] showing the variability of water properties, the presence of rapidly-changing eddies, and the existence of areas of cold water just offshore, bounded by even cooler coastal and offshore waters, a situation quite contrary to expectations that a warm *Japanese Current* extended across the Pacific to British Columbia.

Tully summarized the rationale for his work in 1937, stating that: *...the hydrographical investigations...have been primarily directed towards the discovery and measurement of the factors affecting the physical environment of the food fishes. Primary consideration has been given to discovery of the elements of the problem so that it would be possible to reduce the observed phenomena to their primary causative forces and to determine their cyclic nature with a view to forming a firm basis for the predictions of the physical conditions in the fishing areas which might be used in fisheries prediction.*[49]

But the years of the Armentières cruises, ending just before the Second World War, were ones in which Tully's capabilities and orientation as an oceanographer changed rapidly. A B.Sc. in chemistry had not prepared him for the complexity of current analysis. Initially Tully used conventional methods of analysis presented by the tidal expert H.A. Marmer,[50] in which hydrodynamic forces were responsible for the difference between total currents measured by current meters and those that could be resolved as tidal by mathematical analysis. Rapidly, however, Tully began to teach himself the dynamic methods based on Bjerknes's theorem, adapted for routine oceanographic surveys by Sandström and Helland-Hansen.[51] His first text was Sandström's (1919) classic monograph. Only a year later, in 1937, he referred to a variety of works by Bjerknes, V.W. Ekman, G.F. McEwen, and E.H. Smith on dynamic methods of analysis.[52] Never a very skillful mathematical oceanographer, Tully knew his limitations and, in 1936-1937, corresponded with Bjørn Helland-Hansen about the possibility of doing a Ph.D. in Bergen. This came to nothing; instead, Tully began work toward a Ph.D. in T.G. Thompson's Oceanographical Laboratories at the University of Washington where, probably for the first time, he encountered the full range of oceanographic literature.[53] The war interrupted his doctoral research on the oceanography of Alberni Inlet, where in 1939 he had begun work to assess the impact of a sulfite pulp mill being planned for Port Alberni.[54]

Research at P.B.S. was frozen for a time by the onset of the war. Work on the open ocean became impossible. Redirecting himself to Alberni Inlet, Tully completed his surveys in 1942. In 1940 he had begun to construct a small hydraulic model of the inlet to simulate and simplify estimations of the effect of the pulp mill. He quickly developed an interest in experimental approaches to oceanographic circulation that complemented his energetic surveys of coastal waters. Oceanographic surveys, long time-series of measurements (the lighthouse observations) and hydraulic modelling began to loom larger in Tully's view of ocean science. But it was the war that allowed them to coalesce.

<u>Origins of the P.O.G.: evolution of a research program</u>

Canadian physical oceanography entered the Second World War as small-scale, fragmented science carried out independently on the two coasts. It left the war with new organizations, resources and raisons d'être.

Submarines precipitated the entry of oceanographers into the war. The early sonic detection of submarines by ASDIC (precursor of SONAR) was often hindered by vertical changes of temperature. To study these problems on the West Coast, Tully was assigned to duty with the Royal Canadian Navy (R.C.N) in Nanaimo in 1943. On the East Coast, H.B. Hachey returned to St. Andrews from service with the Canadian Army in England for similar work. Tully's group at P.B.S. became known as the Pacific Oceanographic Group (P.O.G.), Hachey's at St. Andrews the Atlantic Oceanographic Group (A.O.G.). Each worked in close contact with the R.C.N. and especially the National Research Council (N.R.C.) and reported directly to the N.R.C. acoustician G.S. Field in Ottawa.[55] When Tully was formally released from the R.C.N. in 1946, the P.O.G. survived and prospered in the post-war environment at P.B.S. Tully, who had been termed *scientific assistant in hydrography* for years, now became in 1949 senior oceanographer and officer-in-charge of the P.O.G., a semi-autonomous and growing research group within P.B.S. The secret of Tully's success and the growth of P.O.G. was the series of projects and alliances that united the P.O.G.'s scientists and technicians; these could always be linked to the primary aims of the laboratory, the study of factors governing the marine resources of British Columbia waters.

The autonomy and effectiveness of P.O.G. and A.O.G. were increased by their inclusion within the Canadian Joint Committee on Oceanography (J.C.O.) when it was established in April 1946. Intended to co-ordinate and promote Canadian Oceanographic research, the J.C.O. was made up of senior members of the Fisheries Research Board of Canada (F.R.B.) (successor to the Biological Board in 1937), the R.C.N., the N.R.C., and later the Canadian Hydrographic Service, the Meteorological Service and the Defence Research Board (D.R.B.) (founded in 1946, and eventually including the Pacific Naval Laboratory (P.N.L.) and other laboratories[56]). The J.C.O.'s members were in close contact with research, had influence with their chiefs or directors, and did not hesitate to find resources for oceanographic work ranging from ships to money.[57]

Tully completed the work for his PhD in Seattle during the academic year 1946-1947. When he returned to Nanaimo, a ship had been assigned for oceanographic work on the West Coast: CNAV Ehkoli, an 84-foot converted seiner, ideal for inshore studies. The next year, HMCS Cedarwood, 165 feet and capable of offshore work, became available.[58] Ships made the expansion of the P.O.G.'s programs feasible, beginning in 1948 with a physical study by Tully, W.M. Cameron, and G.L. Pickard, of the effect of Skeena and Nass River waters on Chatham Sound, near Prince Rupert, traversed by sockeye on their way to and from the rivers.[59] Nearby was Nodales Channel, well-mixed and isothermal, and thus ideal for studying the SONAR signatures of submarine-like objects (and submarines themselves). In what was described as "probably the largest joint oceanographic research operation undertaken in Canadian waters," P.O.G. and United States Naval Electronics Laboratory (USNEL) personnel, including Tully and Cameron, in four ships and two smaller craft, studied the acoustic signatures of iron spheres, a triplane target and a submarine (Figure 2).[60]

***Figure 2**. CNAV Ehkoli towing an acoustic target in Nodales Channel, British Columbia, in 1949 (from J.P. Tully retirement scrapbook, Pacific Biological Station, Nanaimo, B.C.).*

Tully and Cameron's collaboration with USNEL expanded far beyond Nodales Channel in 1949, when the P.O.G. in Cedarwood and USNEL scientists began oceanographic work, much of it security-classified, in the Bering and Chukchi Seas. This was only a first step in yearly Arctic cruises between 1950 and 1954, involving P.O.G., D.R.B. and USNEL scientists, culminating in 1954, when HMCS Labrador joined a group of American vessels in the Western Arctic after negotiating the Northwest Passage.[61]

Closer to home, the availability of Cedarwood made studies in the open Pacific, begun in HMCS Armentières between 1936 and 1938, possible once again. Tully's colleague L.A.E. Doe (b.1916) was put in charge of an extensive dynamic survey of offshore waters between Cape Flattery to the south and Dixon Entrance in the north, extending to 141°W. *Project Offshore* under Doe amplified and extended Tully's early conclusions about the current regime west of Vancouver Island, verifying that the warm water not far offshore was of local, seasonal origin, not the result of the North Pacific Current. When J.L. Reid of the Scripps Institution of Oceanography visited Nanaimo in 1953, he suggested amalgamating data from Project Offshore with that taken by the Marine Life Research Group off the U.S. West Coast. As a result, Doe's publication of the results was the first synoptic account of currents off the North American West Coast, showing the divergence of the North Pacific Current at the latitude of British Columbia, its variations, and the source of the Alaska and California Currents.[62] As a logical extension of this work, Tully and the P.O.G., using HMCS Ste Thérèse, became involved in an even more ambitious survey, NORPAC, the study of the remaining unknown central regions of the North Pacific, north of 20°N into the Bering Sea, during the summer of 1955. This joint project of Japan, the United States, and Canada provided baseline studies of the Subtropical and Subarctic North Pacific, upon which all subsequent work has been grounded.[63] The Canadian contribution was modest - one ship in more than twenty involved in the project - but it indicated the ability of Tully and his P.O.G. oceanographers to make significant contributions to international oceanography only a decade after the changes initiated by the war. Their contribution continued when the P.O.G. was designated in 1955 to contribute to the oceanographic program of the International North Pacific Fisheries Commission (INPFC) in the Northeast Pacific.[64]

International programmes were a measure of the ability of the P.O.G. to undertake significant tasks as a group, but they were not its only activities at the time of NORPAC. When the Institute of Oceanography at the University of British Columbia was founded in 1949, Tully commuted to Vancouver to teach chemical oceanography to its first graduate students, and its students frequently worked with the P.O.G. in Nanaimo.[65] The P.O.G. supported the Institute's first studies of B.C. fjords, an extension of Neal Carter's early work.[66] Renewed studies of the Strait of Georgia began in 1949 under R.J. Waldie,[67] and the Group was also pressed into service to study the Fraser River outflow and Vancouver's sewage disposal problems. Modelling, dear to Tully's heart, was not neglected. A large scale model of Alberni Harbour was the first project, followed by an ambitious (ultimately unsuccessful) model of Hecate Strait arising from the P.O.G. hydrographic survey in that area (which was important for groundfish), beginning in 1954.[68] Under R.H. Herlinveaux, Tully's early studies of the Strait of Juan de Fuca were greatly enlarged in 1950-1951,[69] and bathythermograph data from the ocean weather ship at Station "P" (50°N, 145°W) were compiled and interpreted by H.J. Hollister beginning in 1952.[70] Tully's remark in 1949 that *this has been a busy year* applied in spades to the 1950s, when the P.O.G.'s activities were steadily accelerating, and its organisation was tightening.[71]

<u>The evolution of a research group: fisheries and physical science:</u>

How could a research group like the Pacific Oceanographic Group develop so successfully in a laboratory devoted to research on commercial fisheries? There are four elements in the success of Tully and the P.O.G.[72]

- The ability of Tully to persuade successive directors of P.B.S. of the importance of his work.
- The opportunity brought about by World War II, for physical oceanographers to practice their profession independently of biology.
- The ability of Tully and his group to provide services to other groups such as USNEL, the P.N.L. and the INPFC.[73] The variety of hydrographic conditions on the British Columbia coast made it a natural laboratory for physical study, attractive to collaborators.
- Tully's eclecticism and wish for independence. Although he never gave up the attempt to relate environmental factors to fish distribution and abundance, Tully built his empire opportunistically, regarding shifts of the scientific climate as new opportunities, not as disadvantages. The division between applied and basic science was not a fundamental

issue. What mattered was the opportunity to conduct his own work as effectively and broadly as possible.

Early indications of the independent line that Tully envisioned may be found in the mid-1930s, when his first surveys off the West Coast of Vancouver Island began. In 1937 he wrote of physical oceanographic research on circulation as *classic in its field and scope*, though of great importance commercially. *A program is required that will observe all the significant factors affecting the sea in this area, and reduce them by correlation in the fewest possible factors affecting the fisheries directly. Fisheries investigations cannot possibly be conclusive unless the physical factors of environment are fully considered. Since these factors have not been observed in the past, it is impossible to expect conclusive results from the previous investigations until the physical effects on the observed biological phenomena have been established. This program should have been started in 1900, but as it was not, the fisheries information since that time cannot be related to physical factors in the sea unless these can now be related to meteorological characters that have been observed since that time.*[74]

This was his justification for the lighthouse observations of temperature and salinity that began in 1932. These could be related to physical variation in the open ocean.[75] Many special problems in fisheries biology would benefit from physical oceanographic information - but the same data could give information on ocean dynamics, turbulence, geostrophic, wind-driven and estuarine circulation, upwelling and meteorology.
Thus it follows that in these oceanographic investigations that are primarily designed to discuss the factors directly affecting the fisheries, it is necessary to make a rather thorough study of the factors contributing to those conditions, and as a result, not only are data available for conclusions affecting fisheries research, but also for many fundamental and applied studies in physical geography, physical and chemical oceanography, meteorology, and navigation.[76]

After the War, with the establishment of the P.O.G., the lines became more firmly drawn around the proper function of physical oceanography - and of the group that conducted it. What Tully called the greatly increased "horizon and capabilities of Canadian oceanographic research," were evident soon after the war.[77] Making studies was the proper stuff of oceanography; providing information (to biologists, the R.C.N. and so on) was the outcome of this function, not its cause.[78]

With the increasing autonomy of the P.O.G., Tully set forth its aims during the 1950's, stating that *the overall programme of this group is to describe and predict the oceanographic state in the coastal and offshore waters of British Columbia, and present the information in suitable terms for fisheries, military and industrial use,* he made its operations explicit and separate from other work at P.B.S. Projects would be carried out annually in selected areas; daily observations would be maintained at the lighthouses, ocean models would be constructed if simple observation would not suffice, and oceanographic atlases would eventually be compiled.[79] This was not new (the elements date to the 1930's); what was new was the confidence with which these goals were expressed.

It may have been irksome to his director at P.B.S. to read Tully's remark that *the personnel of the Group are attached to this branch [P.B.S.] of the Fisheries Research Board, for administrative purposes,* which was correct but diplomatically inept.[80] The Group (Figure 3) looked independent and acted independently, gaining strength from the usefulness of its work and its identification (by the mid 1950's) with an international group of physical oceanographers. The P.O.G. ran its own show at P.B.S., having its own office staff, personnel (11 full-time in 1952), and seminar series.[81] Its *esprit de corps* was evidently high. With fatherly pride, Tully wrote of the Group:
We have an association of physicists, engineers and chemists served by a competent clerical and technical staff in the Group at Nanaimo and the Institute of Oceanography at Vancouver, which provides for efficient planning, observation, processing and analysis of oceanographic research. Our Group has high morale, the ability and desire to do good work, and is building a tradition of accomplishment. I am fortunate in having capable associates, and I am proud to represent this company.[82]

Figure 3. *Personnel of the Pacific Oceanographic Group in the 1950's. Front row: John P. Tully, Al Dodimead, Art Groll, Sus Tabata. Second row: Laurie McCracken, Al Stickland, Fred Barber. Third row: Margaret Smith, Dick Herlinveaux, Bev Berisford. Back row: Bert Bennett, Harry Hollister, Terry Terhune. (from J.P. Tully retirement scrapbook, Pacific Biological Station, Nanaimo, B.C.)*

It would not be correct to conclude with a picture of the P.O.G. as an inflexibly independent research group by the end of the 1950's. It had achieved a high degree of independence and a modest, but important, degree of international recognition by and after the time of NORPAC,[83] but it existed within the framework of a governmental organisation, the Fisheries Research Board, whose activities had to respond to events within a broader context of Canadian science and politics.[84] The *revolution in oceanography*[85] that Tully discerned late in the 1950's had further to turn, especially when new ways of estimating biological production were developed. In 1957, he expanded P.O.G. by adding, nominally, a marine chemistry group under J.D.H. Strickland (1920-1970), which was *to experimentally examine the conditions affecting productivity...With the addition of this work, the oceanographic program will be considering all factors affecting climate and productivity of the region of interest in Canada.*[86]

In a further turn, when the Federal Department of Mines and Technical Surveys began to expand into physical oceanography late in the 1950's, Tully was sufficiently sure of himself and of the capabilities of the P.O.G. (especially after its successful venture into production studies) to advise the Chairman of the

F.R.B., J.L.Kask, to *seize the opportunity that is offered in fisheries oceanography and, on the basis of [the F.R.B.'s] considerable experience, define and guide the development of environmental oceanography elsewhere*.[87] Not a counsel of despair in a changing political environment, Tully's advice was the direct outcome of the career he began as a young chemist from the Canadian prairies in Nanaimo in 1931. The P.O.G., securely established in its science, could afford to redirect its work and take on the challenge of uniting the marine sciences.

What Tully could not foresee in the 1960's, the decade with which my paper ends, was the dissolution in the next decade of the whole structure upon which the P.O.G. depended - the Fisheries Research Board, the Canadian Committee on Oceanography, and the near autonomy of his and other government research groups - in the cause of increased accountability to government managers. Physical oceanography had rooted itself on the West Coast of Canada as a result of Tully's and the P.O.G.'s efforts during a 30 year period. At the end of Tully's career it was about to take a new direction. That black box too needs to be opened, to lead us into the recent history of Canadian Oceanography.

NOTES

1. Department of Oceanography, Dalhousie University, Halifax, Nova Scotia, Canada B3H 4J1 and History of Science & Technology Programme, Dalhousie University and University of King's College, Halifax. My research was supported by grants from the Social Sciences and Humanities Research Council of Canada. This paper is a slightly edited version of one printed in P.F. Rehbock and K.R. Benson (eds.) 2001. Oceanographic History: The Pacific and Beyond. (Proceedings of the Fifth International Congress on the History of Oceanography, La Jolla, California). Seattle: University of Washington Press, and is reprinted with permission of the University of Washington Press. For providing their recollections and analyses I am grateful to A.J. Dodimead, W.N. English, George S. Field, W.M. Cameron, the late R.H. Herlinveaux, T.R. Parsons, G.L. Pickard, R.W. Trites, Mrs. Lorraine Tully and the late Michael Waldichuk. Gordon Miller and Pam Olson of the Pacific Biological Station Library, Nanaimo, B.C., Marilynn Rudi, then of the Biological Station Library, St. Andrews, N.B., Sharon Thomson and Susan Johnson of the Institute of Ocean Sciences Library, Sidney, B.C., Graeme Durkin, then of the Library, Dept. of Fisheries and Oceans, Ottawa, and archivists at the National Archives of Canada, University of Toronto Archives, and Harvard University Archives helped in many ways.
2. B. Latour, Science in Action. How to Follow Scientists and Engineers Through Society. (Cambridge, Massachusetts: Harvard University Press, 1987), 274 pp. Latour likens science, as seen from the present, as black boxes in which the events of the past have been hidden. Historical and sociological analysis, which open black boxes, reveal a different picture - "Uncertainty, people at work, decisions, competition, controversies are what one gets when making a flashback from certain cold, unproblematic black boxes to their recent past."
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7. J.P. Tully, "Annual Report", Fisheries Research Board of Canada. Annual Report of the Pacific Oceanographic Group, 1952, p.1
8. S. Zeller, Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation (Toronto: University of Toronto Press, 1986), 356 pp.
9. J. Hubbard, An Independent Progress: The Development of Marine Biology on the Atlantic Coast of Canada, 1898-1939. PhD thesis, University of Toronto, 1993, v + 446 pp.
10. See, for example, B.N. Smallman, H.M. Good and A.S. West, Queen's Biology. An Academic History of Innocence Lost and Fame Gained (Kingston, Ontario: Dept. of Biology, Queen's University, 1991), 215 pp.
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26. Hachey first worked at St. Andrews in the summer of 1927, on "circulation of the waters in Passamaquoddy Bay. Points of interest in connection with some tidal observations at stations near the mouth of Passamaquoddy Bay and on the St. Croix River. Points in connection with the Cooper Power dam" (Report of the Atlantic Biological Station 1927, p.5) - a preoccupation of Huntsman.
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Pacific Naval Laboratory was established by D.R.B. in Esquimalt, B.C. in 1948.

57. In 1959, the J.C.O. was reorganised and renamed the Canadian Committee on Oceanography (C.C.O.). Its influence in promoting Canadian oceanography was considerable through the 1960s. Thereafter, its members increasingly, with notable exceptions, were minor administrators and with the expansion of Canadian oceanographic laboratories and personnel by the 1970s it increasingly became functionless. It disappeared, without being formally disestablished, in the early 1980s.

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69. R.H. Herlinveaux, "Surface Tidal Currents in Juan de Fuca Strait," J. Fish Res. Bd Can., 1954, 11(1): 14-31; R.H. Herlinveaux, "Tidal Currents in Juan de Fuca Strait," J. Fish. Res. Bd. Can., 1954, 11(6), 799-815; R.H. Herlinveaux and J.P. Tully, "Some Oceanographic Features of Juan de Fuca Strait," J. Fish. Res. Bd Can., 1961, 18(6): 1027-1071.

70. S. Tabata, "Characteristics of Water and Variations of Salinity, Temperature and Dissolved Oxygen Content of the Water at Ocean Weather Station "P" in the Northeast Pacific," J. Fish. Res. Bd Can., 1960, 17: 353-370.

71. J.P. Tully, "Annual Report," Fish. Res. Bd Can., Ann. Rpt. Pac. Oceanogr. Group, 1949, p.1. H.B. Hachey, who had been appointed Chief Oceanographer of Canada under the J.O.C. in 1946, attempted to apply the brakes, or at least to focus the attention of P.O.G.; the Group's report for 1951 states that "priorities assigned by the Chief Oceanographer" were to be Georgia Strait, the offshore Pacific, daily observations (the lighthouse programme) and, finally, incidental studies. Relations between Hachey and Tully were frequently strained. Both had powerful personalities and short tempers. Hachey viewed Tully as attempting more than he could accomplish (interview, Dr. R.W. Trites, 2 June 1993). See J.P. Tully, "Annual Report," Fish. Res. Bd Can., Ann. Rpt Pacific Oceanogr. Group, 1951, 1951, p.1.

72. Tully's numerous reports and reviews are the basis of this analysis. See especially Tully, "Oceanographic Program, 1937"; J.P. Tully, "The Program in Oceanography," Fish. Res. Bd Can., Summary Reports of the Pacific Biological Station for 1939, 1939, No. 75, 3 pp.; J.P. Tully, "LIGHTHOUSE Project," Fish. Res. Bd Can., Ann. Rpt of the Pacific Biol. Sta. for 1947, 1947, Appendix No. 125, p.155; J.P. Tully, "Pacific Oceanographic Group," Fish. Res. Bd Can., Ann. Rpt of the Pacific Biol. Sta. for 1947, 1947, Appendix No. 124, p.154; Tully, "Annual Report, 1949"; J.P. Tully, "Review of Canadian Pacific Oceanography since 1938," Trans. Amer. Geophys. Union, 1949, 30(6): 891-893; Tully, "Annual Report, 1951"; J.P. Tully, "Oceanography," Fish. Res. Bd Can., Ann. Rpt for 1951 of the Pacific Biol. Sta, 1951, pp.181-184; Tully, "Oceanography on the Pacific Coast, 1951"; Tully, "Annual Report, 1952"; J.P. Tully, "Review of Canadian Pacific Oceanography since 1938," Proc. Seventh Pacific Sci. Congress, 1953, 3: 1-8, figure; Tully, "Oceanography on Canada's Pacific Coast"; J.P. Tully, "Oceanography along the Canadian Pacific Coast," Int. North Pacific Fish. Comm. Bull., 1955, No. 1, pp.131-138; J.P. Tully, "Oceanography," Ann. Rpt Fish. Res. Bd Can. 1955, 1955, pp.115-126; Tully, "Review of the Oceanographic Program"; Tully, "Canadian Pacific Oceanography since 1953"; J.P. Tully, "Fisheries Oceanography on the Pacific coast of Canada," Fish. Res. Bd Can., Pacific Oceanographic Group, Nanaimo, B.C. Memorandum. POG File N6-28-2(3), 5 December 62, 1962, 5 pp + appendix, pp i-iv.

73. Tully's brief introduction to the work of P.O.G. in 1947 (Note 72), includes a diagram of the P.O.G.'s oceanographic program in which oceanography (above) provided information for fisheries, naval, industrial and meteorological research (below).

74. Tully, "Oceanographic Program, 1937," pp.17-18.

75. Tully, "LIGHTHOUSE Project".

76. Tully, "The Program in Oceanography".

77. Tully, "Review of Canadian Pacific Oceanography since 1938," p.891.

78. Tully, "Pacific Oceanographic Group, 1947," p.154.

79. J.P. Tully, "General," Fish. Res. Bd Can., Ann. Rpt of the Pacific Oceanogr. Group, 1950, 1950, p.3; Tully, "Annual Report, 1952," pp.1-3; Tully, "Oceanography along the Canadian Pacific Coast," p.131.

80. Tully, "Oceanography on Canada's Pacific Coast," p.10. According to an early J.C.O. document, "an Oceanographic Group is, in fact, independent of the Director of a Biological Station, but will be expected to conform to the general administrative arrangements of the Biological Station concerned.

Administrative facilities of Biological Stations will be made available to the respective Oceanographic Groups" (Appendix "F", p.3. A directive on The Joint Committee on Oceanography. In Minutes of meeting of Executive Committee of the Fisheries Research Board of Canada, November 18-19, 1948). Personnel of the P.O.G., depending on their duties, were paid by money from the R.C.N., the N.R.C., or the F.R.B., although it was agreed that the N.R.C. had the responsibility for providing salaries for what was termed "the technical secretariat of each scientific group" (i.e. of P.O.G. and A.O.G.).

81. In 1953-1954, the P.O.G..'s seminar series included "the classical oceanographic subjects with lectures on other interesting scientific topics" ranging from dynamic calculations to music and diving (P.O.G. Scrapbook - Pacific Oceanographic Group Seminar Schedule).

82. Tully, "Annual Report of the P.O.G., 1950," p.7. Tully or other staff members of the P.O.G. contributed significantly to the teaching program of the U.B.C. Institute of Oceanography until the late 1950's, and the Institute's early research depended heavily on cooperation with the P.O.G. (see Note 65).

83. Tully became the Secretary of the Canadian Committee on Oceanography and a Fellow of the Royal Society of Canada in 1964, and was awarded the Manley-Bendall Prize (the medal of Albert 1er de Monaco) by the Société océanographique de France in 1967. Conventional biographical details are in S. Tabata, "John Patrick Tully 1906-1987," Atmosphere-Ocean, 1987, 25(4): 355-357; S. Tabata, "Obituary. John Patrick Tully, 1906-1987," Can. J. Fish. Aqu. Sci., 1987, 44: 1674-1675; and J.H. Tully, "John Patrick Tully, 1906-1987," Trans. Roy. Soc. Can., 1988, Series V, 3: 206-208.

84. Outlined by F. Anderson, "The Demise of the Fisheries Research Board of Canada: a Case Study of Canadian Research Policy," Scientia Canadensis, 1984, 8: 151-156; and F.R. Hayes, The Chaining of Prometheus: Evolution of a Power Structure for Canadian Science (Toronto: University of Toronto Press, 1973), xix + 217 pp.

85. Tully, "Review of the Oceanographic Program," p.1.

86. Tully, "Review of the Oceanographic Program," p.11; J.D.H. Strickland, "The Primary Productivity and Fertility of the Northeast Pacific and the British Columbia Coastal Waters," Fish. Res. Bd Can. Progr. Rpts of Pacific Coast Sta., 1959, No. 113, pp.13-15.

87. Tully, "Fisheries Oceanography on the Pacific Coast of Canada," p.5. Some participants (and historians, including myself) see this as the first step in the loss of power by the Fisheries Research Board and its eventual dissolution between 1972 and 1979. The A.O.G. and P.O.G. did not long survive the demise of the F.R.B.; their staff members were incorporated into other federal government scientific groups.

This picture was not included in Eric Mills' original paper, but is added for its historical interest. It shows the Pacific Oceanographic Group in 1966 when perhaps it was at its peak of strength and ability. Many of the people shown above eventually became important members of the Institute of Ocean Sciences in Sidney, those are indicated in italics. Seated in front are: Doris Luvisotto, Madelaine Sherry, John Tully, Velma Naden, Barbara Mercer, Bonny Bowers and Ken Abbot-Smith. Second row: Ray Sheldon, *Sus Tabata*, *Bill Bell*, Cary McAllister, *John Meikle*, Bob Forbes, Ray Cagna, Ed Barraclough and Robin LeBrasseur. Third row: Mike Waldichuk, John Fulton (above and to the right of Waldichuk), *Dick Herlinveaux*, Percy Wickett, Harry Hollister, Con Armstrong, *Al Stickland*, A. Boyden and Keith Gantzer. Top row: Don Robertson, Ken Stephens, *Larry Giovando*, *Pat Crean* and *Tim Parsons*. Finally, as was so often the case, *Reg Bigham* was at sea.

THE CREATION OF A NEW OCEAN LABORATORY ON THE WEST COAST OF CANADA

Howard Freeland

With considerable assistance from Bob Stewart and others

The Concept is Born

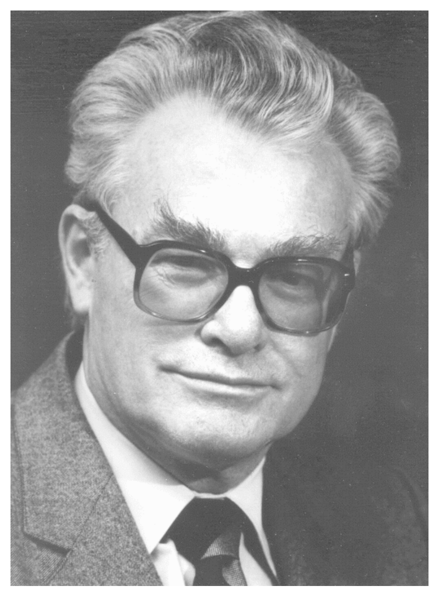
The idea that there should be an oceanographic laboratory on the West Coast of Canada had a long gestation. The idea probably arose many different times until the combinations of will and finances were such that action finally was taken. According to Bill Cameron, discussions about a west-coast laboratory were active towards the end of the Second World War and the circumstances were unusual. Towards the end of the war the British Government decided to create a laboratory in the United Kingdom with a focus on Antarctic Research. Canada was visited by one of the senior scientists involved who was soliciting assistance from the Colonies and Dominions to get this lab built. This overture did not meet with a warm reception.

Dr. G. S. Field certainly proposed forming such a laboratory. He had been working with the Canadian Navy on problems involving underwater sound and had approached Dr. J. P. Tully about starting an acoustics research group on the west coast. Subsequently Dr. Field went to work with the Defence Research Board.

The concept of a west-coast oceanographic laboratory arose again in discussions between John Tully and Bill Cameron. At this time Bill was Director of Marine Science in Ottawa and the idea was received positively by Dr. William van Steenburgh who at that time was an Assistant Deputy Minister in the Department of Mines and Technical Services.[1]

Meanwhile Dr. Bob Stewart was a professor in the Department of Oceanography, University of British Columbia. Bob has had a major influence on the course of oceanography in Canada, and around the world, from his early days at Cambridge University measuring third-order correlation moments in wind-tunnel flows to his eventual interests in global change studies. Bob had a keen understanding of the nature of physical processes in the ocean and imparted deep insights to many people over the years. As an illustration I would cite a paper that was very influential on my own development[2]. In this paper Stewart argues from elementary conservation principles that the circulation of the Atlantic has to be just the way it is. The paper explains why the Gulf Stream breaks away from the coast where it does and most importantly, exactly why there should be a narrow current on the western boundary of the ocean with a slow return flow. There is only one equation in the paper, that equation is not really necessary as the arguments are conceptual and illustrate a deep understanding of the physics involved. This is one of the finest papers ever written on an oceanographic topic.

By the early 1970s Bob had established a world-leading air-sea interaction group at the University of British Columbia, but had come to the decision that it was time for a change. After hearing that perhaps there would be a west-coast laboratory dedicated to oceanography Bob decided that he was prepared to leave UBC to direct the new laboratory. At some point he made overtures to Bill Cameron on this topic. Bill was working in Ottawa at the time and during a trip to the West Coast met with Bob Stewart and an associate where formal discussions took place.



Dr. Robert W. Stewart, FRS
First Director of the Institute of Ocean Sciences

Another person critical to this saga was Dr. Bill English. Bill had served as the first Director of the Bedford Institute of Oceanography from 1962 to 1964 and felt hampered by what he regarded as excess supervision from Ottawa. In the early 1970s he had resigned from his position on the East Coast and started a new job with the Defence Research Board when it became apparent that Bob Stewart was to be the Director of a new oceanographic laboratory. This seemed to offer a new start building a new entity and possibilities the seemed to be very attractive. The result was that when the final decision

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[1] *The Department of Mines and Technical Services eventually became the Department of Energy Mines and Resources and then in the fullness of time Natural Resources Canada. Interestingly my (HJF) letter offering me a job, in 1976, at the Institute of Ocean Sciences was written on EMR letterhead.*

[2] *The influence of friction on inertial models of oceanic circulation. Studies in Oceanography, pp. 3-7, Tokyo.*

was made that an Institute of Ocean Sciences should be created Bill English joined the venture as Assistant Director.

Dr. Bill English
First Director of the Bedford Institute of Oceanography and the first Assistant Director of the Institute of Ocean Sciences.

Finding the Building Site

Bill English and Bob Stewart saw eye-to-eye on one major item, the new institute should be in Vancouver and the reasoning was impeccable. There already was an oceanographic group of significant stature in Vancouver, at the University of British Columbia, and adding a Government Laboratory would build such a large centre of expertise that it would quickly become a world leader. In fact, Bob and Bill had a site picked out, False Creek in Vancouver which much later became the Expo site. The apparent decision to go to Vancouver raised alarm in Victoria leading the Mayor to become involved. There already was a large group belonging to the Canadian Hydrographic Service in Victoria and the Mayor did not want to lose them. He went directly to Jack Davis the Minister of Mines and Technical Services to complain and after a lot of pressure Minister Davis came to a decision. There would be not one, but two new laboratories on the west coast, one in the Victoria area and one in West Vancouver. The former would be the home of physics and chemistry and the West Vancouver Laboratory would house biological oceanography. Any hope that had existed of creating a multi-disciplinary oceanographic laboratory died on the day that Minister Davis made this judgement.

So, it was decided to build an "Institute of Ocean Sciences" on Vancouver Island, somewhere in the vicinity of Victoria. Immediately focus fell on a variety of sites within greater Victoria itself, but none were really adequate. At that time the Department of National Defence was down-sizing and owned a parcel of land close to the airport, on Patricia Bay. The site had been used by the Navy for married quarters and they now wanted to divest themselves of the land. So in fact it was an initiative from DND that ultimately caused the Institute to be built precisely where it is today. As soon as Bob Stewart and Bill English saw this delightful location they seized the opportunity with enthusiasm.

Creating the Edifice

The creation of new federal buildings was controlled by Public Works in Ottawa and they had their own notions of what constituted an appropriate edifice and the prevailing style required that a tall box be built. Bob Stewart did entrust most of the interactions with architects to Bill English and the first site manager, Norm Todd, but he had worked in many laboratories and visited very many more. Over the years Bob had developed very specific ideas about what works and what does not work in a building. At this point several rather unlikely people ended up playing a major role in the design of the Institute of Ocean Sciences. Notable among these are two American philanthropists, Cecil and Ida Green, as well as Judith Munk in California, and Paul Grieve in North Saanich.

Cecil and Ida Green contributed funds that enabled the Massachusetts Institute of Technology to create the Green Building, the home for Meteorology and Oceanography at MIT. Bob had visited this building many times during his career and identified the Green Building as epitomizing a model that does not work.

The Cecil and Ida Green Building at MIT.

What Bob had noticed at MIT was that floors form barriers to communication. Small empires form on each floor with very little exchange from one level to another. He considered this to be a poor model for the Institute of Ocean Sciences and rejected the design. Though it was a concept that would probably have been supported by the Department of Public Works.

Cecil and Ida Green also funded a new laboratory at the Scripps Institute of Oceanography known as the Munk Building. This is the home of IGPP, the Institute for Geophysical and Planetary Physics and is named after the first Director of the IGPP, Walter Munk. Judith Horton Munk had been an active participant in the university community and at the Scripps Institution of Oceanography where she had made major contributions to architecture, campus planning and the renovation and reuse of historical buildings. She took a leading role in the design of the old and new laboratories of the IGPP working closely with the architect, Lloyd Ruocco. Bob Stewart was extremely familiar with this building, described on the Scripps web pages as "a handsome redwood building". When it was constructed in 1964, it set a new standard for design. Not only is it aesthetically pleasing, with its spectacular location on the edge of a cliff overlooking the Pacific Ocean, it has proved very practical in supporting research projects.

So why does it work? In contrast to the MIT building the Munk building is low and follows the natural contours of the ground. The entrances open into wide hallways surrounded by offices with major passageways dissecting the building. This means that scientists on leaving their offices cannot help but meet colleagues and visitors. The result is that people in the laboratory actually know what their neighbours are doing.

The original - The Munk Building at Scripps.

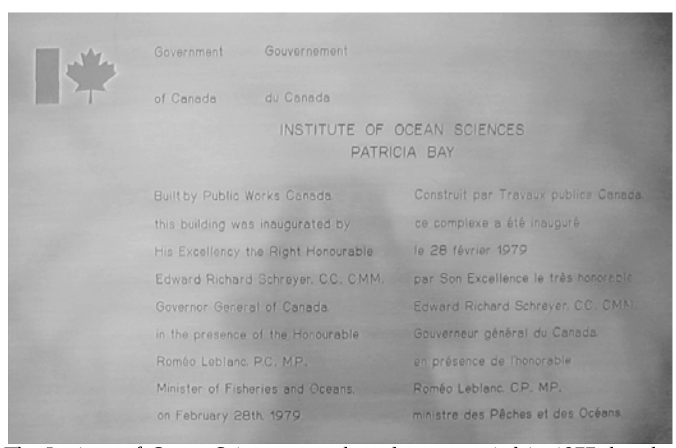
The "copy" – The Institute of Ocean Sciences

Though the Institute of Ocean Sciences is physically very much larger than the Munk building, it is apparent from the diagrams above where the parentage belongs. Bob clearly envisioned a low building following the contours of the land and specifically directed that there should be one major corridor linking the main entrance to the cafeteria with the Directors' areas half way along.[3] IOS has an almost complete absence of the floors that Bob identified as barriers to communications. The concept without a doubt worked brilliantly. The Institute of Ocean Sciences is known world-wide for the strength of its collaborative atmosphere. More than one scientist being interviewed for a job at the Institute has identified as one of the primary reasons for applying here, that this is one of the very few places in the world where a collaborative approach to oceanography has been made to work. This was Bob's concept and his enduring legacy and the concept has had a massive impact on the way we do our jobs at the Institute of Ocean Sciences.

Even at this point the design of the building did not have an entirely smooth passage, but support for the concept came from a most unlikely source. Paul Grieve was Mayor of North Saanich and he was not thrilled by the idea of a major government laboratory being constructed in rural North Saanich. He clearly envisioned the tall box that would be mandated by the Department of Public Works, the large car parks, the flow of people on the narrow, rural roads and he decided that the creation of an Institute of Ocean Sciences would have a dramatic negative impact on the rural ambience of the municipality. Mayor Grieve tried to block the construction of the Institute because of these fears. This was exactly the ammunition that Bob Stewart and Bill English needed to convince Public Works that the low building, as they envisioned, this would keep peace with the municipality. Also, in the interests of peace a berm was built to mask the view of the Institute from the road.

Even at a late stage in construction Bob Stewart's vision held sway. The architectural wisdom of the time required that offices should have windows that cannot be opened. The reason being that if windows *can* be opened they *will* be opened and this messes up the proper flow of air in the heating and cooling systems. Bob insisted, against the strong advice of the architects, that offices should have windows that opened. And anyone who has ever had an office at IOS remains forever grateful that Dr. Stewart won that battle.

During the building phase scientists and technicians moved onto the site using temporary office space in the hangar and in trailers that littered the site. Eventually the new building became available for occupation in 1977. At this point I would like to add a personal anecdote. I arrived at the Institute of Ocean Sciences, from the University of Rhode Island, to take up a new job in March 1977. When I arrived the new building was close to being ready for occupation. We were not yet allowed to move in as it had not been released by the builders for occupation. Instead of being given an office and a desk I was given a trolley for my books and spent some part of every morning searching for a desk that might not be used that day. This was very tiresome. I knew which office had my name on it and one day I decided that I was going to move in. The building still had not been released for occupation, but I was in room 1227 and quite likely the first person to occupy the building.



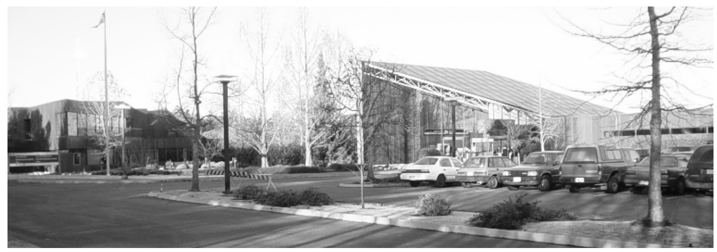
The Institute of Ocean Sciences may have been occupied in 1977, but the official opening ceremony did not take place until February 28th 1979. The plaque commemorating the occasion reads: Institute of Ocean Sciences – Patricia Bay – Built by Public Works Canada this building was inaugurated by his Excellency the Right Honourable Edward Richard Schreyer CC, CMM, Governor General of Canada in the presence of the Honourable Roméo Leblanc, PC, MP, Minister of Fisheries and Oceans on February 28th 1979.

[3] *The original area occupied by the Directors is the same part of the building that in 2003 is occupied by the PICES Secretariat. Gradually with changes in management practice in the Public Service the monolithic "Laboratory Director" concept disappeared and with it the reasons for having a centralised Directors' unit within the building also disappeared. Eventually this space was offered to PICES as part of an attempt to rationalize the management at IOS.*

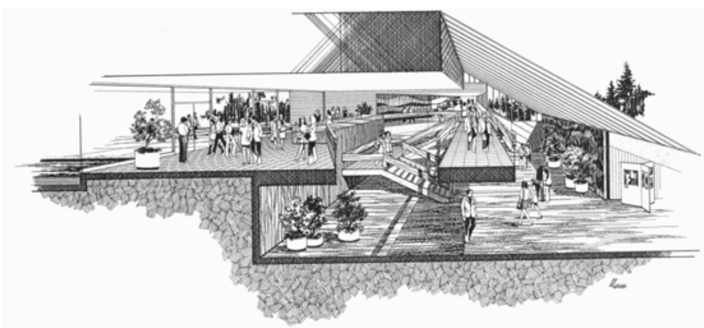
The House that Bob, Bill and Norm Built

The Architect's Drawing / The same view in 2003

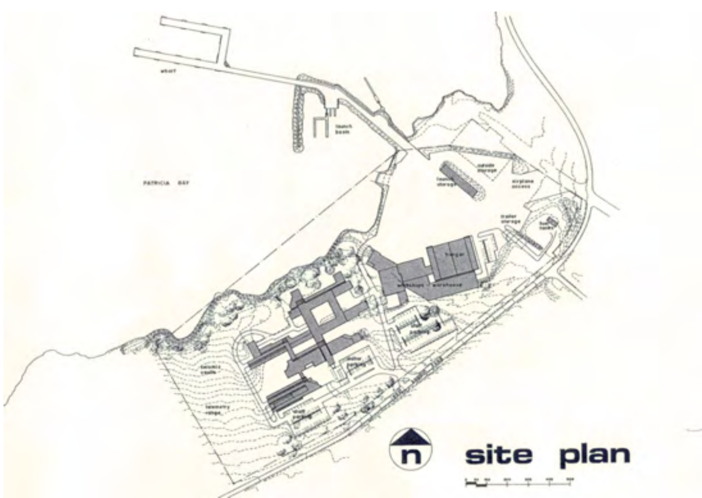

In 2003 the view of the cafeteria area from the water and the surrounding areas remain almost exactly as the architect designed it.

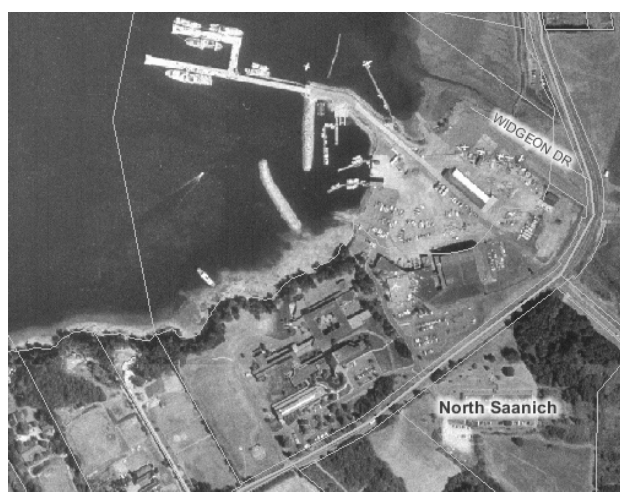



In contrast the visual impact of the main entrance is quite different though the surroundings remain more or less the same. The main entrance was changed at an early stage in the building process.




The perspective is rather different but the inside front entrance remains close to the original design, except for the glass roof.





It is remarkable how little the overall site has changed over 25 years.

THE LIBRARY AT THE INSTITUTE OF OCEAN SCIENCES

by Pamela Olson and Sharon Thomson

Background

As with many other research focussed federal government departments, Fisheries and Oceans Canada maintains libraries at its major research facilities across the country. There are ten libraries in the department's network and each provides support for the research activities at its site. The Institute of Ocean Sciences (IOS) Library was created in 1972 to support the research activities of the newly established west coast ocean research institute.

Facility and collections

Construction of the facility at Patricia Bay commenced in the spring of 1974 and as parts of the building were completed, the various research groups moved in. Before the construction of the Patricia Bay facility, the Library was dispersed among the various Department of Environment, Marine Science Directorate (MSD) and other Department of Environment (DOE) research facilities in the Victoria area. The Library staff, along with the reference collection, catalogue and some documents, were situated at one of the downtown Victoria locations.

In the fall of 1976, the Library moved to the Patricia Bay site. However, its various collections were housed in division offices and a trailer in the hangar. Library staff had to retrieve materials from many different locations when items were required for use by staff in another Division. As new research groups were added to the Library's clientele, core materials were purchased for those groups. It was not until 1977 that all Library collections were housed in one location.

The IOS Library entry as it was in 1977.

The IOS Library entry area again, 22 years later, in 2001. The table is probably the same one as in the 1976 picture shown earlier.

Over the next two decades, the Library received a number of donations. Collections from the Department of Energy, Mines and Resources (DEMR) and Geological Survey of Canada (GSC) were integrated into the Library in 1978. These collections consisted of back issues of core journals as well as monograph publications. In 1983, the Library received two large gift collections from retired scientists. DEMR donated another large document collection in 1985. In 1988, the Canadian Hydrographic Service (CHS) contributed an extensive collection of British Admiralty charts. The Library acquired the entire Technical Records collection consisting of reports mainly concerned with petroleum exploration in 1993. It took the Library staff about 18 months to catalogue the documents and integrate these reports into the collections.

At present, the Library holds over 75,000 catalogued items, including textbooks, technical reports, microfiche, CD-ROM, and video and audiocassettes. The journal collection consists of over 300 titles, approximately 125 of which are current subscriptions.

Staff

At no time has the Library had a staff of more than two people. Currently a solo Librarian manages the Library.

Doris Stastny, the first Librarian, ran the Library under contract to the Canadian Hydrographic Service and reported to the Regional Hydrographer. Plans for the new facility at Patricia Bay included extending the Librarian position to full time. Sharon Thomson was the successful candidate. Sharon was appointed in 1973, and began work in the old Post Office building on Government Street in downtown Victoria. At that time, the Librarian also edited reports and advised authors concerning publications. After Sharon retired in

December 1997, a contractor, Wendy Kluge, ran the Library on a part time basis until Pamela Olson transferred from Pacific Biological Station Library in September 1998.

Sharon Thomson, in 1989, the first IOS Librarian.

Cathie Firth, circa 1975, the first Library Clerk at IOS.

Cathie Firth, the first Library Clerk, began work in 1973. At that time, the position was part-time and it became a fill time position in 1974. Cathie retired in 1985 and Mary Anderson was hired as the Library Clerk but resigned after less than a year in the position. In 1987, Ruth Paget was hired as the Library Clerk. Because of staff reductions in other divisions, Ruth spent three hours a day working in the Purchasing Dept. By the time Susan Johnson replaced Ruth in January 1991, the Library Clerk position had been reduced to half time. In 1993 Susan was the successful candidate for a half time Clerk position in the Purchasing Department, giving her full time employment. The Library Clerk position was eliminated in 1996, a casualty of a downsizing exercise in the federal government. Susan was transferred to a position in the Management Services Division.

Over the years, the Library has taken advantage of a number of federal programs and academic internship programs to obtain temporary staff.

Library Services and Technology

In 1979, the Librarian enlisted the services of programmers from the Computing Services Division to develop a program for the Library's catalogue. With its catalogue residing on the Institute's mainframe computer, the Library discontinued its traditional card catalogue in 1980. The automated catalogue, containing 10,000 records, was in use by 1981. A series of refinements made the system user friendly and client response was very favourable. In 1982, the catalogue became available in microfiche, a popular format for library catalogues in the 1980's.

By this time, the Department of Fisheries and Oceans (DFO) had been created with the splitting of the Department of Fisheries and Environment. The Librarians at the various DFO research facilities formed the Council of Fisheries and Oceans Librarians (COFOL) to work together on matters of mutual concern to the department's libraries. The development of a cooperative catalogue was one of the first projects undertaken by COFOL. At first, the WAVES database resided on a mainframe computer at the Bedford Institute of Oceanography. It was transferred to Infomart, a commercial database provider, in 1981. Since IOS Library had a computer based catalogue, its records were some of the first to be uploaded into the new WAVES database. WAVES continued to develop as the union catalogue of the DFO libraries with all the other libraries adding their records.

At the same time, IOS Library added more features to its automated catalogue. When faced with converting from its Sperry mainframe to a VAX system in 1987, the IOS Computing Services Division chose the Library catalogue as one of the bench tests for the Institute's new database management system. The conversion of the catalogue took longer than anticipated but the results were improved query screens, user friendly menus, remote access and circulation records control.

The WAVES database, released on CD-ROM in 1991, was the first Canadian government database available in this format. COFOL acquired an integrated library system (ILS) in 1992 and over the next few years introduced the various modules. The cataloguing input and online public access catalogue (OPAC) were the first modules introduced. WAVES OPAC was available in all DFO libraries by 1994. As the circulation and serials modules were introduced, IOS Library transferred these functions from the VAX system to the ILS. The Library discontinued use of its VAX catalogue in 1998. In 1999, WebWAVES replaced WAVES OPAC, making WAVES one of the first federal government departmental library catalogues available on the Internet.

The DFO libraries were some of the department's first users of electronic mail systems. When the WAVES database was transferred to Infomart in 1981, COFOL took advantage of the company's electronic mail system to improve communications among members. As well as general correspondence, the libraries began sending interlibrary loan requests by e-mail, speeding up the process considerably. Telecom Canada introduced the Envoy100 electronic mail system in the late 1980's and the DFO libraries, along with many other Canadian libraries, joined the system. Since then, electronic mail systems have improved dramatically and many library catalogues are accessible through the Internet. IOS Library now sends and receives most interlibrary loan request by e-mail. In addition, documents requested by interlibrary loan arrive in electronic format by FTP (file transmission protocol) or e-mail.

Library's role

Established to support the research activities of the Institute, the Library continues in this role. Its principal clients are the research staff of both Fisheries and Oceans Canada and Natural Resources Canada working at the site. As well, the Library offers some services to the consultants from the local marine research community, as well as research staff of other government and academic facilities in the Victoria area.

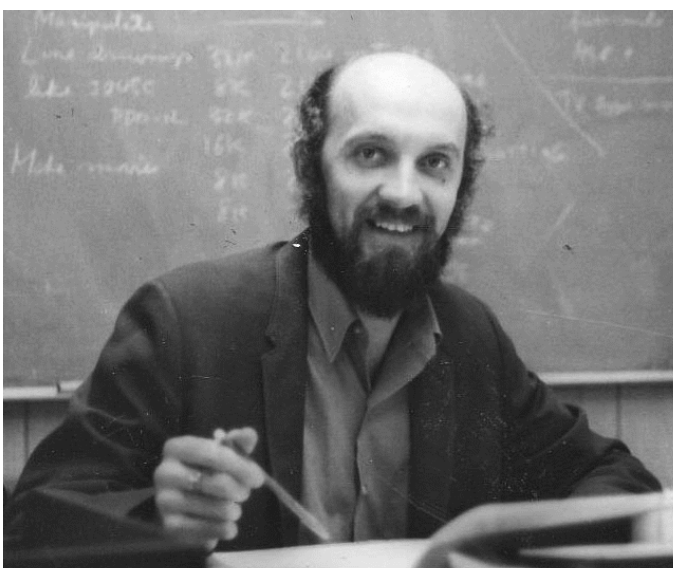
At research facilities such as IOS, the Librarian must be aware always that immediate and easy access to current periodicals, monographs and other resources is a vital aspect of the scientists' research process. Faced with shortages of time, staff assistance and money, she relies on her networks of libraries and library colleagues, frequently obtaining rare and obscure materials at low cost or free of charge. With the emergence of electronic resources, the Librarian is also a contract negotiator for various online services. The research scientists at IOS are fortunate to have a Library managed by a professional Librarian dedicated to providing high quality service.

THE COMPUTING INFRASTRUCTURE AT IOS
Koit Teng

Introduction
This is the story of how the computing infrastructure has evolved at the Institute of Ocean Sciences (IOS) over the last thirty years. In this context, *computing infrastructure* means the staff, activities, hardware, and software associated with the central computing group, originally known as Computing Services. As this group expanded and contracted through various organizational changes and as technology evolved, the scope of the group's activities changed. Nearly all computing applications were integral parts of scientific programs and administrative services. The work done within those groups is only touched upon peripherally in this document.

Some Notes on Terminology:
Although the name of the central computing group changed over time from "Computing Services" to "Scientific Computing" to "Informatics", we will use "Computing Services" to avoid confusion. Similarly, the names of equipment suppliers change. For example "Univac" became "Sperry Univac" and eventually "Unisys"; again we will use "Univac". For brevity, "Pat Bay" will generally be used in place of "Patricia Bay" as the location of IOS/PGC.

The Players
I start by introducing the cast of characters that were instrumental in the development, management, and support of the IOS computing infrastructure. The focus of this section is on the permanent staff, although many others (term, contract, students) made significant contributions.



Koit Teng, the first head of the Computing Services Section in the early days of IOS computing.

The Computing Services section was formed in 1973, with the hiring of Koit Teng as Head and the inclusion of several computer programmers already on staff. These were Allan Douglas (Tides and Currents), Del Smith (Offshore Oceanography), and Bob Johns (Coastal Zone Oceanography). In early 1973, Bob moved to Victoria to assist with the planning for computer facilities at the future Institute of Ocean Sciences. During 1973, the group expanded with the addition of Bill Butcher (Frozen Sea Research Group - FSRG), Cliff Morgan (Ocean Chemistry), and Peter Richards (Numerical Modelling) in support of Dr. Pat Crean's work at UBC.

Anne Woollard joined in 1974, although she had started as a summer student in 1971. Anne would work primarily on numerical models with Alard Ages in Hydraulic Research (Tides and Currents). In 1975, Cliff Morgan left and John Page was hired in his place to work with Dr. Wong and his staff in Ocean Chemistry. Mike Foreman joined in 1976 to work with Falconer Henry in Numerical Modelling.

With the establishment of the Regional Computing Centre at Pat Bay, Bob Johns became *Supervisor of Systems and Operations*, and Del Smith the *Supervisor of Mini-computer* Systems. In 1977, Bill Butcher transferred from support of FSRG activities to a systems analyst position in the Computing Centre. Maureen Woodward was hired in his former place at FSRG. In 1978, Sherman Oraas transferred from Ottawa to the new position of Computer Graphics Analyst within Computing Services. His duties were split between general graphics support for the Institute and the support of hydrographic computers in the field and for automated cartography. Maureen Woodward left and Andrew Wharton joined FSRG in her place.

In 1980, Del Smith left for the private sector. Peter Richards also left and Do Kyu Lee was hired in his place to support Pat Crean's numerical modelling work at UBC. Keith Lee joined Computing Services although he had been around since 1972 as a term employee and contractor. Joe Linguanti also joined Computing, dedicated to Ocean Physics support.

Following the departure of Bill Butcher to the private sector, Len Smith was hired in 1981 as a Senior Systems Analyst to provide support for the Univac and other systems and applications. Tony Ma joined the group as a programmer supporting the Tides and Currents group. In 1982, Bill Green transferred from Defence Research Establishment Pacific into the FSRG position after Andrew Wharton left.

This group remained intact for several years. Computing staff included: 4 in management and support of Central Systems, and 9 applications programmers assigned to various groups. As part of a regional review and reorganization in 1986, a Science EDP Coordinator role (through the Head of Computing Services) was established at IOS reporting to a Regional EDP Coordinator in Vancouver. During 1987 a Review of scientific computing tasks, services, and organization began, headed by Koit Teng and Bob Wilson (Chief, Ocean Information). A key event was a meeting at Dunsmuir Lodge to get input from all computing personnel.

As one outcome of this Review, initial steps were taken towards IOS improving its capability for managing oceanographic data by establishing a "data shop" in the core Computing group.

In 1989, IOS Computing Services was reorganized to focus on core systems support, with dedicated programmers moving to the Science program. The position of Oceanographic Data Manager was established. The Data Manager would develop standards for reporting oceanographic data, and would manage the development and implementation of standard software for the processing, storage, and archiving data.

In early 1992, the PBS computing staff were merged with IOS Computing, reporting to the Head, Computing Services. A "Team Building Workshop" was held in Nanaimo with the combined IOS and PBS Computing staff plus Joe Linguanti (Physics) and Anne Woollard (Tides and Currents).

Science managers and staff provided input to a regional Organizational Review of the Informatics Function, conducted by Price Waterhouse. Resulting from this review, in 1993 Mark Gingerich was hired as the Regional Informatics Coordinator, and in the following year there was agreement on a proposal to Regional Science Executive for a joint review of the current overall informatics function.

Donna Medgyesi joined IOS in the position of Manager, Science Applications. As a "regional" person, her initial responsibilities included overseeing the regional consolidation of Oracle database systems and applications.

In 1995, presentations were made to managers and staff on the consolidation of regional informatics groups. DMR Associates were contracted to conduct an IT Consolidation Study, to *review current computer and networking operations at the three main sites (IOS, PBS and RHQ) and related sites to determine the feasibility, impact and cost/benefit of consolidating these operations into a single configuration providing consistent, equal or better services to regional clients*. The DMR report recommended consolidation to one major site with a second backup site, with projected savings in personnel costs - which could be redirected to serve other regional informatics needs. However, there were a number of serious gaps in the analysis and some philosophical differences between IOS management and study proponents, so agreement was not reached.

A Science Branch meeting in February 1996 reviewed activities and proposals and developed Guiding Principles for the upcoming organizational proposal. A presentation to the Regional Executive led to formation of a regional Information Management and Technology Branch, headed by a Regional Director of Informatics (Mark Gingerich) with the plan of incorporating most of the Scientific Computing staff. Some IOS staff participated in a Transition Working Group established to define roles and responsibilities, service and resource levels, funding frameworks, duties, etc. A final report delivered in August recommended transfer of 6 staff (3 from IOS) to the new regional organization, with 2 more positions to be reviewed. Numerous discussions and meetings took place during the first half of 1997 and in August agreement was reached on transfer of six of the eight Scientific Computing staff (including 4 at IOS) to Informatics. The remaining two would continue to provide "infrastructure" support at current levels pending a longer term agreement. O&M budgets for IOS and PBS were also transferred.

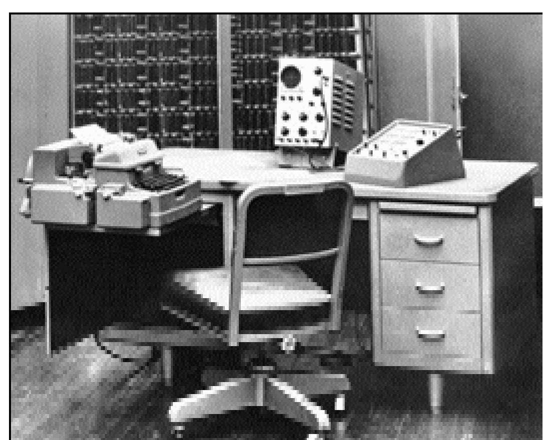
A Transition Workshop was held at IOS in November involving key staff of the new Branch. The focus was on a possible vision, what has been achieved, and next steps. With the departure of the Regional Mark Gingerich, in July 1998, some of the Informatics Branch management load fell to IOS staff. Through Work Force Adjustment Informatics gained a CHS employee (Bruce Johnson).

In 2001, as part of Corporate Services Review, IOS "central computing" staff become part of Corporate Services Branch. For the period August 2001 to March 2002, Koit Teng held the position of Manager, Information Management Division in the new Branch.

In 2002, Bruce Johnson left DFO but stayed in the building to work for NRCan/PGC. Koit Teng was planning his retirement in May 2003, leaving Bob Johns, Len Smith, Bill Green, and Donna Medgyesi to carry on the legacy of IOS Computing, with Ted Luscombe, Laura Murray, and Cameron Inkster looking after the help desk and front line operations in the Computer Room. Cameron replaced Carol Hagel who started in the computer room in 1988 but left in 2002 for new challenges at IOS with the Coast Guard.

Early Days

Computers have been used by scientists since they became available. Prior to the establishment of the Institute of Ocean Sciences, fragments of the Marine Sciences Directorate (Pacific Region, Environment Canada) were located in the Victoria area, Nanaimo, and West Vancouver and using computers. In the late 50s Sus Tabata was one of the first oceanographers to use a computer and learned to program in "machine language" on the first digital computer at the University of British Columbia (UBC) - an Alwac III-E.



The UBC Alwac III-E computer.[1]

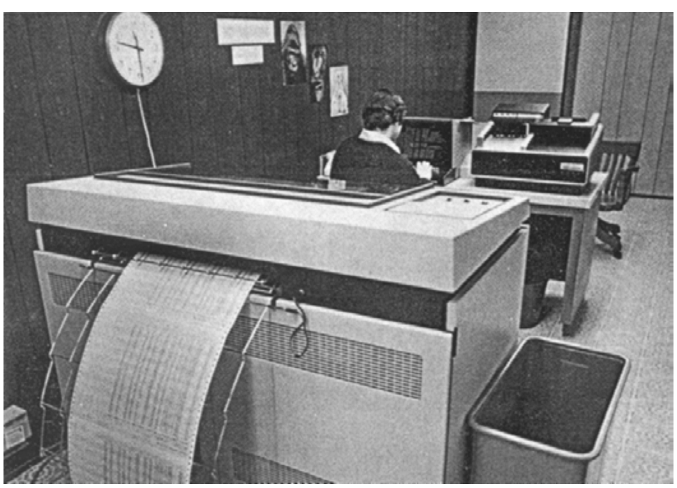
[1] The Alwac III-E computer was nicknamed Alice In February 1960 Alice received a Valentine from Albert Alwac, a computer at Oregon State University. Also in 1960 a reporter for The Province (Pat Carney) played a game of tic-tac-toe against Alice. History records that the human player won.

By 1967, a Hewlett-Packard minicomputer was in use by Hydrography, an early user being Al Ages, who designed the first numerical model of Victoria Harbour. Input was on punched paper tape and output on a teletype. By 1971, automated data acquisition systems were in place, such as HAAPS (Hydrographic Acquisition and Processing System) on a launch with shipboard data processing using a Digital Equipment PDP8 minicomputer and CalComp plotter.

In 1972, Bob Johns established both low speed (teletype) and high speed (card reader/printer) links from the Pacific Environment Institute (later West Vancouver Laboratory) to the UBC Computing Centre. This pioneering effort provided convenient access for David Farmer's group and others to the UBC computing facility.

In 1973, the Computing Services Section was formed, with the hiring of Koit Teng as Head, and the inclusion of Bob Johns, Del Smith (Ocean Physics), and Allan Douglas (Hydrography). A study of computing services requirements was performed and a report [2] was prepared with objectives and plans for provision of computing services for the new Institute, then in its design stages. At that time there were 9 user groupings at 6 locations using 5 in-house mini-computers, and 6 external computing services. The latter were used via telecommunications and physical travel and included: Xerox Sigma 7 (Defence Research Establishment Pacific in Esquimalt), IBM 360 (IBM Service Bureau in Victoria), IBM 370/145 (University of Victoria), IBM 360/67 (UBC), Univac 1108 (Computer Sciences Canada, Calgary).

To serve the scientific groups relocated to the Patricia Bay site in the fall of 1973, a remote terminal facility was established in a trailer inside the main hangar. A Comterm (PDP-11/10) remote batch terminal was installed with communications to external service bureaux (UBC Computing Centre, Computer Sciences - Calgary) via 2000 bps dial-up and low speed terminals. Considerable hardware, software, and communications errors (on the Government switched network) had to be overcome.



Remote Job Entry Terminal at Pat Bay with Bob Johns at the console (1973)

Although preliminary plans had been developed for an in-house computing centre in the new building, departmental management decided that it was necessary to conduct a study to examine regional computing needs for the next several years. This would include Fisheries Operations in Vancouver, Fisheries Research in Nanaimo, the Atmospheric Environment Service, Pacific Forest Research Centre, and others. Options examined were common service bureau, in-house hardware, and facilities management. A price and availability request was prepared and submitted to industry; responses were evaluated and a report was prepared. A hardware solution was recommended, and as the future IOS represented the largest user group, we insisted that the computing centre be located at Pat Bay. However, the prospective mainland users would not agree to this, so we had to reconsider a service bureau option for the near term. As a final twist, in late summer 1975, we were informed that a used Univac 1106 in Ottawa would be made available to us. This was seen as a "unique opportunity to implement the long-term solution at this time". (More on this in the next section).

Meanwhile, a magnetic tape drive was added to the Comterm for retrieving plot files from the UBC computer system, an HP2100A mini-computer and Calcomp 563 plotter were acquired to perform off-line plotting, and a Tektronix 4010 graphical display for plot previewing. A computerized financial accounting and reporting system developed in-house and via contract became operational for fiscal 1974/75. Initially data entry was on punched cards, with operational runs on the UBC computer via the Pat Bay batch terminal, and reports on the Pat Bay printer. This system provided more timely and more usable financial information to managers than the manual system it replaced.

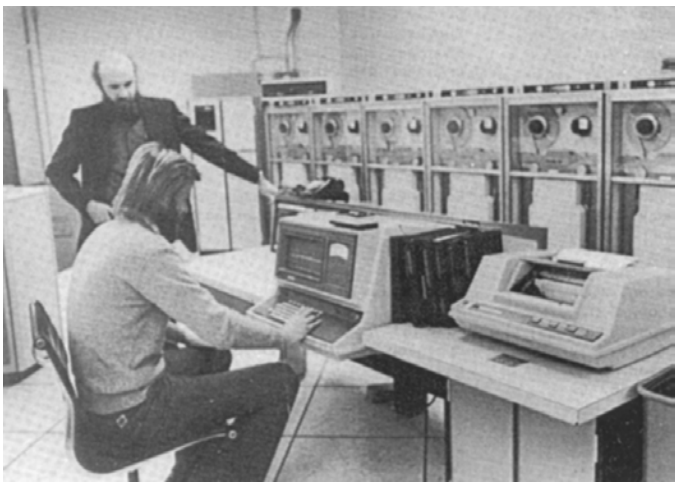
During 1975 upgrades to existing systems continued. Disc sub-systems were added to Computing Services' HP mini-computer and to others. Systems and components were also swapped between groups, software for the three primary HP systems was standardized as far as possible, and a subroutine library and context editor were prepared and distributed for use. These systems were popular and heavily used for many applications while the issue of a large computer for the future Institute was being debated.

During this period and later, Computing Services staff were instrumental in helping program staff to acquire mini-computer systems and upgrades, assisting with specifications and justifications for the higher-level approvals that were then required, typically from Ottawa. The minicomputers were used in applications suited to their versatility, portability, and ability to interface with special equipment, e.g. on ship-board, in the field and in the laboratory.

The Univac Mainframe Era

In late 1975, a decision was made, and funding provided, to acquire a used Univac 1106 "main-frame" computer for IOS. This computer was intended to serve IOS and other Environment Canada units in the region. The configuration: 131K 36-bit words of main memory, 47Mw of secondary drum storage, 6 magnetic tape units, 3 card reader/line printer units, and CTMC communications hardware. The system would support batch processing and time-sharing with standard languages (e.g. Fortran) and application packages. The cost to the department was $438K, which seems immense by today's standards for a 5 year old machine that had the processing speed of an original IBM PC!

So, in 1976 the Environment Canada Pacific Region Computing Centre was established at IOS. The computer system was delivered on May 31 in two large semi-trailer trucks and after considerable site preparation, was installed in a "temporary" location in the main hangar at IOS in a room originally intended for storing Energy, Mines and Resources (EMR) core samples. User training had begun in March, and conversion of programs started in the summer, using a Calgary service bureau. This system would be supported by resident hardware and software specialists provided by Univac and was finally ready for use on October 12. 4 HP 2640 CRT terminals, a large Tektronix graphics terminal (19" screen) and 4 Texas Instrument Silent 700 hardcopy terminals were acquired to provide access to the system from various regional sites. Early users suffered through major difficulties such as intermittent problems with power supply, for example short-duration transient voltage fluctuations resulting in CPU crash and loss of all active runs.



Univac 1106 computer at Pat Bay with Koit Teng (standing) and Ted Luscombe (seated) in 1976

This initiative resulted in increased responsibilities and the hiring of two computer operations staff (under contract) to operate the system console, handle magnetic tapes and plotter output. The senior computer operator was Ted Luscombe; he is still there today (April 2003). An Inventory Management System using System 2000 database management software on the Univac was developed by Anne Woollard. The Financial Accounting & Reporting System was converted from UBC to an in-house HP2100 by Ruby Hlady. For data entry for this application, a Datapoint 2200 intelligent terminal was purchased; data would be logged onto audio cassette tapes, then transmitted to the HP system.

In 1977, there were additions and enhancements to software, including a News processor, Calcomp plotting routines with Tektronix preview capability, mathematical & statistical programs, PL/1 compiler and system performance aids. More database applications were implemented under System 2000 (S2K), such as a Library Book Catalogue, Fish Health Inventory (PBS), and Fraser River Inventory and Herring Spawning (Fisheries Management). Operator hours were extended to 8AM - 8PM and a Help desk was established. Charge-back to users was implemented; the average monthly usage ($24K) was approximately equal to the operating costs.

Hardware upgrades included CPU and memory, improving response time and throughput; a Uniservo 16 magnetic tape sub-system was added with a hardware translator to aid conversion of IBM (EBCDIC) tapes, and additional communications ports were added. A positive power-disconnect switch was installed to disable the system in the event of power interruption and prevent hardware damage. In these difficult times the average system availability was only ~ 90%. However, remote users experienced communications difficulties and some regional users were not willing to use the Univac system. This led to questions about the viability of the regional computing centre and ultimately a review.

In 1978, a motor/generator set was finally installed to regulate the power supply for the system, eliminating most of the short-term voltage fluctuations leading to system outages. A Gandalf MINI-PACX data communications controller was installed and some dial-up lines were replaced by dedicated building circuits for local terminals using Gandalf line drivers. At that time four 300 bps ports were upgraded to 1200 bps[2] for a total of 12 hard-wired terminals and 4 dial-up lines contending for 10 ports.

Software upgrades continued: new versions of Fortran, PL/1, Cobol, System 2000, Text Editor, Sort/Merge, utilities for listing files/tapes, etc. Applications software packages were acquired, such as IMSL mathematical & statistical library, SPARSPAK sparse matrix package, and FESTA time series analysis. A Computing Services Information Bulletin was produced.

A Fisheries and Marine Service A-base Review of the Univac 1106 computer facility concluded that:

- the Pacific Regional Computing Centre concept would be officially abandoned,
- IOS was to retain the Univac for its internal needs,
- investments were to be restricted to maintain present capability, and that
- an independent operational review be conducted, to also examine other means (e.g. commercial service bureaux) of providing the same service.

A catastrophe was narrowly averted on November 3rd 1978 when a salt water supply pipe running overhead through the computer room burst. Fortunately, the water pipe was not under pressure at the time (it was being cleaned) and this happened during the day when operations staff were on duty. There were insufficient funds to relocate the computer at the time, so eventually the salt water pipe was rerouted over the roof of the building.

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[2] Howard Freeland remembers what a miracle a 1200 baud rate seemed to be. One could not imagine ever needing more than that.

Software developments included: improved batch scheduling for small jobs, new versions of language compilers and utilities (plot queuing, plot previewing, tape translation), installation of the LINPACK library for solving systems of linear algebraic equations, and an asynchronous communications handler for foreign devices (e.g. programmable calculators). An Introductory Guide and a User Manual were produced plus online Systems & Operations news files for timely dissemination of information to users.
An external evaluation of the Univac 1106 was conducted in the winter of 1979/80 by Evaluation and Audit Branch from National Headquarters; IOS staff participating in bench-mark studies. The review concluded that despite problems encountered "the majority of users are well-satisfied with the service offered and cost of the in-house service is significantly lower than that of the best (external service) bureau option". Nevertheless many instances of system too busy, response time unacceptable, and system down were reported and observed. The 1106 had become inadequate to handle expected future workloads, and was becoming increasingly costly and difficult to maintain due to its old age. A follow-up internal study recommended that the Univac 1106 be upgraded to a more modern 1100/60, with substantial cost savings.

In 1980, the Numerical Algorithms Group (NAG) library of mathematical routines was acquired, and useful routines from the UBC Computing Centre (UBC*LIB) were implemented. The Financial Accounting and Reporting System (FARS) was also converted to the Univac system. This facilitated the development of an interface to the departmental Financial Allotment Control System (FACS), which ran on the Comshare service bureau. The Univac FARS system generated input transactions for FACS during FARS update runs, eliminating duplicate data entry.

In February 1981 Treasury Board approved an upgrade of the Univac 1106 system to an 1100/60, via directed tender to Sperry/Univac. Two tape drives and the communications controller were retained from the 1106, the rest went to Crown Assets. The 1100/60 hardware was installed in mid-May. This included: 524Kw memory, 2 disk units of 90Mw each, 4 dual density (800/1600 bpi) tape drives, a line printer (760 lpm), 4 synchronous high-speed com ports and 18 asynchronous (300-1800 bps) ports for terminal access.

The new system had 3 times the memory, 4 times the mass storage, required half the electrical power and air conditioning compared to the old system, but cost about the same in terms of hardware and software rental and maintenance. System availability increased from 92% to 96%; improved batch turn-around and time-sharing response was observed. Other improvements included a large 3-pen drum plotter and new levels of the Univac operating system and libraries.

A Floating Point Systems AP-190L array processor (128Kw memory) was acquired via an unsolicited proposal in support of numerical modelling. This was attached to the new Univac and was intended for applications requiring repetitive calculations on large vectors and matrices.

In 1982 the Gandalf MiniPACX exchange (48 lines, fully utilized) was upgraded to a COMPACX IV (128 lines, and other advanced features). This enabled connection of any incoming device (terminal, personal computer, etc.) to any connected service (Univac, mini-computer, etc). The connections could be locally wired or dial-in/out. The NCAR high-level graphics package and the Tektronix Interactive Graphics Library were acquired. After overcoming serious problems, the array processor was fully operational in September. A second remote batch terminal (Comterm 1000) was installed in the Computing Services wing of the main building to provide improved access. The workload on the central system doubled over the old system. A resource control system was implemented: the cost was displayed at the end of each run and immediately charged against the user's allocation of Computer Dollars.

Univac 1100/60 computer (1981) with computer operators (from left) Lorraine Bowman and Lori Thorpe.

In 1983, a Univac DCP/20 front-end communications processor was installed to replace the obsolete CTMC, allowing higher speed computer graphics and protocol flow control to intelligent devices. Four BC Tel 300 bps dial-in modems were replaced by Microcom 300/1200 modems providing a fully error-corrected telephone link from a Microcom device. DATAPAC usage continued to expand; more applications were initiated using outgoing calls on DATAPAC, e.g. access to remote electronic mail systems and remote databases.

The FORTRAN 10R1A (ANSI '77 compatible) compiler was implemented; software libraries were converted to this level. Significant performance degradation was observed on the 1100/60 computer as the workload increased, the largest increase being in the area of numerical modelling (three new ocean modellers had joined IOS).

Yet another performance study was performed and some system reconfiguration was done. Upgrades (more main memory, cache memory, another disk drive) were recommended. By 1984, the Univac was operating at full capacity with no further changes to hardware or system software taking place.

In 1985, the Gandalf PACX network for async devices was expanded; it now supported a mixture of 84 terminals and PCs, with up to 48 service ports for access to various computers, DATAPAC and BC tel dial lines. The DATAPAC service itself was upgraded from 2400 bps to 9600 bps.

The Univac 1100/60 was retired at the end of September 1987 as scheduled. Much programmer time was involved in converting applications to other platforms, primarily the VAX.

The Micro Invasion (Part 1)
The first "micro-processors" were employed in about 1975 and used in systems such as
- Coastal Zone Oceanography: Data Acquisition System (Intel 8080, Guildline CTD/STD),
- Institute Electronics: Intellec-8 (Intel 8080) for micro-processor system development,
- Hydrography: Portable Hydrographic Acquisition System (PHAS), recording on 3M cartridge tapes.

In 1977, the first self-contained micro-computers (Commodore PETs) were used for data logging by Mike Miyake's air-sea interaction group.

A PET Computer.

In 1980, an Apple II personal computer was acquired by Ocean Chemistry and several Commodore PET micros by Ocean Physics for the Acoustic Doppler system, lab data reformatting, and personal computing. A Micom 2000 stand-alone word processor (storage on 8" floppy disks) was leased and installed for shared use. In 1982 four second generation Micom 3000 word processing systems were added with more to come.

A 1981 year-end survey of systems revealed:
- 16 mini-computer systems + 7 large programmable calculator systems, used in the field and lab for various purposes,
- a multitude of micro-processor based data acquisition systems, used in both oceanographic experiments and hydrographic surveys,
- over 40 terminals in use with the central computer,
- 16 personal computers (8 Commodore PETs, 4 Apples, 3 HP-85s, 1 Radio Shack TRS-80); used as controllers in field and lab data acquisition systems, for testing small numerical models, as super-calculators, and as intelligent terminals to the central computer and other systems.

Personal Computers (in June 1982) consisted of:
- 5 Apple-2 (Remote Sensing, Marine Meteorology, Ocean Chemistry x 3),
- 1 Apple-3 (Ocean Chemistry) for word processing,
- 4 HP-85 (Institute Electronics, Coastal Zone, Ocean Ecology, Hydrography),
- 8 Commodore PET (6 in Offshore Oceanography, 2 in Coastal Zone),
- 1 Radio Shack TRS-80 (used by Ocean Information and Chart Distribution),
- 2 Osborne-1 portable computers acquired by senior scientists (John Garrett, Ken Denman) for word processing and problem analysis,
- 2 Digital VT-180 (Industrial Liaison, Hydrography),
- 2 Digital Rainbow (Ocean Ecology),
- 1 Kaypro-2 portable (Numerical Modelling)

for a total of 26 early personal computers, most running the CP/M operating system.


A Kaypro-2 "portable" computer this had a whopping 64k of RAM, two floppy drives and a gigantic 9" green screen. This "portable" weighed in at a mere 26 lbs!

By 1983, personal computers were proving to be cost-effective for many applications. 11 were acquired during that year, including the first IBM personal computers, HP9816S, and Kaypro portables. At that time an IBM XT with 256Kb main memory (RAM), 360Kb floppy disc drive, 10Mb hard drive, serial com port, RGB colour display, DOS 2.0, and BASIC cost $10K. Wordstar was commonly used for word processing and editing.

In 1984, 26 PCs were acquired, continuing the trend to distributed computing. Typical uses were for instrumentation control, scientific data analysis of small data sets, word processing and administrative tasks. Some examples were
- DECRainbow 100 for Chart Sales and Distribution. Used for accounts receivable and inventory control, and planning and scheduling of the chart amendment program.

- IBM PC for construction of Fortran programs of complex interactive numeric Box models on pollutants and CO2 in the marine environment (Ocean Chemistry).
- IBM PC/XT for data entry to departmental financial system (FACS), person-year reporting, stationery stores inventory, telephone equipment inventory, financial analysis, word processing, and electronic mail. Hardware included Microsoft mouse, AST 6-pack Plus expansion card, Epson LQ-1500 dot matrix printer; software was Lotus 1-2-3 (spread-sheet), dBase III (database), Microsoft Word (word processing), Cross-talk (communications). This was a typical "standard" configuration at the time. Total cost ~ $13K.
- 2 IBM PC and 1 IBM PC/XT for senior Computing staff. Configurations and many applications similar to the above.
- First IBM PC/AT, as part of an on-board micro-computer data acquisition system with a digital CTD unit (Ocean Acoustics). Features were Intel 80286 processor, 80287 math co-processor, high capacity (1.2Mb) floppy disc drive, Hercules graphics card, Macro assembler, Fortran compiler, HP Think-jet thermal printer.
- IBM PC/AT for development, testing and application of numerical models of the interaction of ocean circulation with sea ice in the Beaufort Sea. This system was also used as a smart terminal for interfacing with the AES Cray-1 supercomputer in Dorval, Quebec and with the IOS Univac mainframe.

During 1985, 20 new personal computers were acquired for research analyses, program development, word processing, spreadsheet and database applications. This included 13 IBM PCs, but also some compatibles, such as Compaq. A typical configuration was: Compaq Deskpro 4 with 30Mb hard disk, 10Mb back-up tape unit, 640Kb RAM, math co-processor, serial and parallel interfaces, dot matrix printer, monochrome monitor, total cost $9K. The first UNIX computer (HP Integral), and first laser printer (HP Laserjet Plus) were acquired by Tides and Currents. Many PC systems were taken onboard ships for the first time, with considerable success.

In 1986, 14 more PCs were obtained, primarily IBM PC compatibles. Included was the first "lap-top" computer - a Data General 1/2 in Ocean Chemistry. Recommended "standard" software at this time included DOS 3.0, Microstuf Crosstalk 3.6 for communications, Microsoft Word 3.0 for word processing, and Lotus 1-2-3 version 2.0 for spreadsheet analysis.

The VAX

By 1984, the workload on the Univac 1100/60 mainframe computer had increased significantly, reaching effective saturation during the prime shift with little idle time over-night. This was due primarily to new scientists on staff engaging heavily in numerical modelling applications. An uninterruptible power supply (UPS) was installed to ensure reliable power for the central computer systems.

DMR & Associates were again contracted to assess the situation, to examine whether IOS should continue to rely on a mainframe computer for its central computing facility or should utilize distributed super-mini computers with specialized peripherals, and to make recommendations. Their report released in February 1985, recommended replacement of the Univac mainframe by a Digital Equipment (DEC) VAX computer system. Recommendations included: increased processing power expandable to accommodate steady growth, large memory, more on-line mass storage, publication quality and high volume graphical output, easy interfacing of "foreign" devices, scientific libraries, data base management software, full-screen editor, and a "friendly" operating system.

A VAX 785 was chosen over the VAX 750, as the latter was deemed to have insufficient power even in the short term. Design and acquisition of the VAX 785 occupied much of senior staff time (Bob Johns and Len Smith). TB approval was obtained in October; and a purchase requisition was submitted in December.
It should be noted that a smaller VAX 750 had already been acquired and installed for Chart Production applications in 1983. A MicroVAX II was also acquired by the Ocean Information division; primary applications were to be interactive retrieval of oceanographic information from database inventories.

In April 1986, a VAX 785 computer was installed at IOS. The configuration included 16Mb memory, 1.3Gb disk storage, two 1600/6250 bpi magnetic tape drives, three line printers, one QMS laser printer and 24 terminal lines. A number of DEC terminals were acquired for use with the VAX: 27 in total, including a mix of VT-220 (text only), VT-240 (graphics), and VT-241 (colour graphics). The software included productivity aids such as a full screen Language Sensitive Editor (LSE), a Module Management System (MMS) for automating and simplifying the building of software systems, a Performance and Coverage Analyzer (PCA) for software performance analysis and optimization, and a comprehensive graphics package (DISSPLA). In addition the NAG mathematical library was obtained for the VAX, and the IOS Plot library was converted from the Sperry mainframe.

The VAX 785 was upgraded by doubling on-line disk storage, and adding a third magnetic tape drive. Installation of Ethernet and DECnet enabled high speed data transfers between IOS computers, e.g backup of Hydrography VAXs. Enhancements to system software continued, particularly in the graphics area, e.g. Plot Library output to non-Tektronix devices, and World Data Base II mapping data integrated with DISSPLA. The latest NCAR graphics package, utilities for directing graphics output to any device (PLTANY) and for printing graphics files on the QMS laser printer (QMSQ), IEEE signal processing library and TEX scientific document processor were installed. Usage reached a peak of 86% of available CPU cycles in August.

Conversion of major database applications, i.e. the Library Catalogue, and Oceanographic Data Information System (ODIS) to Oracle was completed, under contract. Several smaller databases in support of scientific and administrative record keeping were also implemented in Oracle.

By 1988 the Central VAX 785 had also become overloaded so a proposal for a significant upgrade was prepared. In 1989, approval and funding were obtained to upgrade this system to a VAX 6310. A Micro-VAX 3100 (IOSARC) was obtained primarily for the Ocean Physics Arctic group, to be clustered with the Central VAX for other use as appropriate; this new computer would also reduce the workload on the latter.

In March 1990, the Central VAX 785 was replaced by a VAX 6310 (IOS630); the configuration included 32Mb memory, 2.4Gb additional disk storage, a cluster controller, tape upgrades, etc. The VAX 785 was reallocated to Chart Production, replacing their VAX 750. A Central VAXcluster was established, incorporating the 6310, the 785, and the micro-VAX 3100.

VAX computer at IOS with operator Laura Murray (taken approx. 1990)

In early 1991, priority on the Central VAX was given to running oil spill models of the Persian Gulf (due to the Gulf War). User documentation for the Central systems and network was brought up-to-date, including Information for New Users, Guide to the IOS Computer Network, and Guide to IOS Computer Manuals. The Library cataloguing system was modified (under contract) to create an output tape for uploading to the departmental WAVES database.

In April 1991, the VAX 6310 was upgraded to a VAX 6410, doubling the CPU speed and main memory; 2.4Gb of disk storage were added to the Central VAXcluster plus used disks from EMR-PGC. Management of disk allocations was delegated to Account Managers. The Oracle Database micro-VAX II was incorporated into the Central VAX cluster; the Oracle system and applications were upgraded to version 6.0.

A Versatec colour electrostatic plotter was obtained, primarily for Chart Production and Field Hydrography but also available for other use. Network File Services (NFS) software was installed, enabling the Central VAX to act as a file server for UNIX clients. The VAXnotes computer conferencing (bulletin board) software and a library (IOSLIB) of common Fortran utility routines (developed under contract) were also installed on the Central VAX.

In 1992, the Central VAX was upgraded with Systems Industries "plug-compatible" drives. These were accepted only after Digital agreed that they could maintain the SI disks. Strategy and procedures for managing scratch storage and for backing up PCs over the network were developed, in part by participants of a VAXnotes conference set up for that purpose.

Disc space for users of the Alliant FX/40 (see later section) and for Oracle database applications was made available on the central VAX 6410. The QMS laser printer went down in January, was (temporarily) replaced by an HP Laserjet IIID, and later with an HP Laserjet IIISi. Print queues were established, new forms were defined, and conversion of software was completed. Shared network printer queues and forms were standardized.
The Charts VAX 785 was replaced by a VAX 4300 (IOS430) which was clustered with the VAX 6410, enabling Charts personnel to easily use both machines.

Due to budget cutbacks, operation of the Database microVAX II was no longer affordable. Consequently, a decision was made to move the Oracle database system and applications from IOSMVX to IOSARC (Arctic Physics microVAX 3100). To accommodate Oracle, memory and disk upgrades (incl. 1-Gb disk drive) were installed in the microVAX 3100.

Tape Handling Utilities were developed, tested and documented by Robin Brown. This was a user-friendly interface to VMS Backup that allowed directories, reading, extracting, backups, restores, and making duplicates. It was menu-driven and interfaced to the Operators' USERTAPES database. A Central Systems Disk upgrade was completed in early February resulting in a total capacity of 12.0 Gb on IOS630, and 4.0 Gb on IOSARC.

A review of backup/archival technologies was conducted by Robin Brown. The recommendations were: (1) modernize Backup technology to allow for unattended backup of large volumes of data, (2) increase disk space, (3) purchase a "do it yourself" CD-ROM system for Archival and Data Exchange.
In 1994, a Digital Alpha 3800 was obtained via Regional Headquarters and incorporated into the Central VAXcluster. The configuration included 64Mb memory and 3Gb disk. A further 64Mb memory and a 20Gb Digital Linear Tape (DLT) unit (primarily for backup) were added, plus software including the Fortran compiler and MMS productivity aids, NAG mathematical library, the IOSPLOT and IOSLIB libraries, and the DISSPLA graphics package. Intended use for this machine was for program development and data processing; usage guidelines were published.

<u>Networking and Communications</u>
Earlier data communications technologies were applied as described in the above sections, but in 1986 IOS entered the era of modern networking when an Ethernet local area network (LAN) to link computers and personal workstations was implemented.

At this time electronic mail with the VAX MAIL facility became common for communications between VAX users.

Expansion of this capability to PC users, and for regional and national communications was planned.

In 1988, connections to the departmental network DFOnet were established via a dedicated line and DECnet link (VAX PSI software) with the Regional VAX in Vancouver. Hardware (including thin-wire coax segments, Digital DEMPR multiport repeaters, H4005 transceivers, DEPCA ethernet controllers) and software (including PCSA and DECnet-DOS) were installed to enable Ethernet access for selected PC workstations. The Gandalf PACX was also upgraded to a Starmaster for improved communications.

Over the next few years, network expansions continued into all corners of the IOS building complex. PCs, Macintosh (MAC) computers, UNIX workstations, printers, and terminal servers were all connected. Ethernet interfaces and Digital PathWorks software were installed to link personal workstations to the network. Terminals were connected to terminal servers, eliminating rental costs of dedicated building circuits.

In October 1991 a total of 9 VAX host computers, 56 IBM-compatible PCs, 13 UNIX workstations, an X-terminal, 5 Macintosh computers, and several terminal servers were connected to the IOS network. Transfer of binary files (WordPerfect, Lotus, dBase) was tested and documented. MAC e-mail server and QuickMail software were implemented for CHS to enable communications with other regions.

Installation and debugging of the new DEC MailWorks (e-mail software) took place. A Distributed Directory Service (DDS) update procedure was developed, incorporating ideas from the RHQ (Vancouver) and PBS procedures. The Digital UCX (TCP/IP) Version 2.0 software was installed on the VAX but surprisingly this resulted in new problems with terminal access (telnet), and particularly with file transfer (ftp). This was disappointing in that previous experience with Digital software had been that it was generally strong.

Procedures for backing up PC and MAC hard drives to the VAX was developed and implemented. Four 9600 bps modems were installed for the Dial-in lines incorporating error correction and data compression. The older 2400 bps modems were moved to serve the Dial-out lines.

Training courses were given on Network Concepts and Email Overview, PathWorks for DOS, VAXnotes, and VMSmail. Four seminars on Digital MailWorks were presented to users, in preparation for a move to this e-mail system.

In 1992, group access control lists were set up for various divisions to enable shared read/write directories. The COMPUTING_LIB shared file service was established providing a common access point for McAfee ViruScan, the IOS Phone List, Public User List, and WordPerfect memo and letterhead forms. In 1993, shared directories were added for the work planning process. DOS 6.2 was installed on a network drive; a procedure for upgrading from DOS 6.0 was documented and advertised to users.

Digital MailWorks (now called A1mail) was eventually stabilized at IOS, but we also became increasingly dependent on what happened at other DFO sites. Considerable effort was put into getting the Mailworks directory service operational again after a long outage resulting from a corrupted database at National headquarters. As part of this work, addresses for all IOS users, not just those using Mailworks, were entered into the DDS. This database became the officially supported reference list for DFO Email addresses.

The wide area network linking DFO Pacific Region sites was extended with the installation of a Vitalink bridge between IOS and RHQ in Vancouver. This improved communications with the Victoria Fisheries office, and provided easier access to network resources for both IOS and other Pacific Region users. Network connections were also established between Prince Rupert and Marine Division (IOS).
PMDF software was installed and configured, giving Internet mail access for VMSmail and Mailworks users. Procedures were developed for accessing the IOS dialout modems from PC's using Pathworks. The NETHELP utility package (contributed by Joe Linguanti) of useful routines was installed on the shared public L:\PATHWORK directory. It included NEWPASS which allowed changing a VMS password without logging on to the VAX.

A Bulletin Board system for IOS was implemented (on a recycled PC) as a vehicle of disseminating "ocean information", e.g. temperature maps of the NE Pacific. The general public, including fishermen, were able to dial in to look at this information and download it if they had the capability and interest.

The DFO network was converted from an X.25 packet switched network to a router-based network. This required conversion of all IOS and PGC Internet IP addresses to facilitate implementation of a CISCO router. Changes were made to workstation addresses, Appletalk "zones", the Domain Name server, and the central IOS630 system.

A study on Telecommunications at IOS was conducted. The objective was to rationalize and improve telecommunications services to IOS, recognizing that voice/data/video technologies were coming together. The study looked at the costs for voice and data lines, fax usage, Datapac usage, the BCnet circuit, etc. Investigations revealed that we could obtain much better performance for similar dollars by moving to newer technology so a 10 Mbps fibre-optic link to Regional Headquarters via BCTel's new Ubiquity service was established between IOS and Vancouver in early 1995. To take advantage of the higher speed the IOS connection to BCnet (and the Internet) was relocated to RHQ at this time.

The Gandalf data communications switch and associated services were retired in 1995; some services (Dial-in, Dial-out) were moved to terminal servers; new access ports were provided via a dial-in router (Access Builder). A network cable audit was performed to identify which thinwire segments were out of specifications; repair/replacement was effected where necessary. Anonymous FTP was implemented to allow transfer of large files.

In 1996, the IOS network was upgraded to 100 Mbps by installation of optical fibre, a central FDDI concentrator, routers, and distributed ethernet switches (Cisco Catalyst). Individual workstations connected to thinwire ethernet segments remained at 10Mbps shared access speed. A count of network addresses assigned (as of March) included 50 MACs, 347 PCs, 28 printers, 30 servers, 50 workstations, and 20 X-terminals, although not all of these were still in use.

Upgrades of regional local area networks (LANs) formed part of the overall Common E-mail and Infrastructure Upgrade project during 1996-98 (see also later section "Microsoft and Windows"). For IOS, funding was obtained to replace the thinwire ethernet cabling with Enhanced Category 5 twisted pair wiring, and new network concentrators and switches. The network backbone would be 100Mb, with 10Mb to each desktop via switches in suitably located wiring closets. During the last half of 1997, planning meetings were held, specifications were developed, and a tender to industry was issued. CHS staff (Bruce Johnson, Bill Hinds) at IOS and Informatics staff collaborated on this project. PC network cards were replaced with 10/100 Mbps 3Com cards during the desktop upgrade to Windows 95 and Outlook e-mail (see later section).

The IOS network upgrade was completed in early 1998 by Bruce Johnson. This included 399 workstation connections to 5 wiring closets, installation of switches and concentrators, testing, and training of operations staff. A second CoreBuilder 3500 backbone switch was acquired and installed to provide more network capacity for IOS users, one switch serving CHS' high speed data management needs (up to 400 Mbps), the other one the rest of IOS.

The IOS network and links to external networks continue to be upgraded periodically as demand increases and new technology allows.

Super-computing

Ocean modelling applications such as large-scale ocean models to study climate and to perform ice predictions require the use of the fastest computers available. In 1985, access to the CRAY-1S super-computer at Environment Canada's Atmospheric Environment Service (AES) Dorval facility via DATAPAC got underway. An initial learning period was followed by much productive work. From April to December, two users clocked a total of 27 hours of CRAY time, and IOS usage reached 85 CRAY-1S equivalent hours during 1986/87.

By 1987, an urgent need was identified for a powerful user-friendly "compute server" enabling IOS to follow up on recent successes in the development of ocean modelling applications. Usage of the CRAY X/MP at AES Dorval exceeded 275 hours in 1987/88, but data communications were troublesome and ongoing access became uncertain with "free" usage ending in November. Other local sources for compute cycles became saturated: the Univac 1100/60 was to be terminated, the FPS array processor was ineffective, there was limited availability on a contractor's Numerix AP system, and the Central VAX 785 was needed for general purpose work.

A justification was prepared and approval obtained to replace the FPS Array Processor by a modern mini-supercomputer or attached processor. A request for proposals was prepared and sent to DSS, responses were analysed and a short list was prepared. Len Smith and Patrick Cummins (Ocean Physics) travelled to Boston to do some benchmark runs. Resulting from this, an Alliant FX/40 mini-supercomputer was selected and installed at IOS with user training conducted in June 1988. Most computationally intensive ocean modelling applications were then converted to this system. Benchmark results indicated a speed approximately 1/8th that of a Cray X/MP, which was better than expected.

Over the next three years the system was upgraded with a 2nd disk drive and communications controller, an additional 32Mb memory, TCP/IP and Ethernet link, and a 2nd Interactive Processor. Load sharing was improved by upgrading the Advanced Computational Elements (ACEs). Nevertheless, by 1991 the Alliant was fully allocated with actual usage exceeding 90% of the available time.

In July 1993, a Digital Alpha AXP 3000/400S (64Mb) compute server "Romeo" was installed replacing the then overloaded and obsolescent Alliant computer which was retired in the fall. Although "Romeo" is still in use, most computationally intensive applications have now migrated to a number of scientific workstations obtained over time (see the section The Unix Alternative).

The Micro Invasion (Part 2)

Despite replacement of the old Univac mainframe by new computers of the Digital VAX architecture and the various "supercomputer" approaches, the thirst for computer power on the desktop continued unabated as the technology advanced. This section illustrates how the micro-computer picture evolved at IOS. See also the Unix Alternative, following.

In 1987, 25 Personal Computers were acquired, including:

- First 386-based computer (NOGAP): Compaq Deskpro 386 with 1Mb RAM, 40Mb hard disk, Tseng Labs graphics adapter, NEC Multisync monitor, Fujitsu DL-2400 printer, DOS 3.1, Smarterm 240, IBM Professional Fortran (total cost ~ $12K).
- First IBM PS/2 system (Computing): Model 80 with 44Mb hard disk, 3.5" and 5.25" floppy disk drives, 1Mb RAM, IBM 12" colour display, DOS 3.3 (total cost ~ $11K); this initiated a cascade of PC reallocations.
- Compaq Deskpro 386 for numerical modelling of ice-ocean interaction (Ocean Physics): included 1Mb RAM, 70Mb hard disk, plus Definicon coprocessor board (25MHz CPU, 20MHz floating point unit, 8Mb RAM), and software (total cost for this high-end system ~ $23K).
- first use of Microsoft Windows.

In an attempt to "control" the proliferation of micro-computers by this time a cumbersome regional/national process had evolved for the approval and acquisition of micros; detailed justifications with up to 7 signoffs might be required. To counteract this, work was done with regional colleagues to develop new "streamlined" authorities and procedures for electronic data processing (EDP) approvals.

In 1988, a regional moratorium on micro acquisitions was in effect during April - June, until regional management was satisfied that there was "a clearly understood Regional Informatics Plan which indicates how these local systems and the central computing systems and databases are to be linked and integrated". The freeze was lifted after suitable plans had been prepared and approved. 38 more PCs were acquired, Toshiba portables, and AST desktops being the most popular. The first Apple Macintosh (MAC Plus) was acquired by Willie Rapatz in Tides and Currents. A typical high end field system was: Compaq Portable 386, 20 MHz, 1 Mb RAM, 100 Mb hard disk, 80387 math co-processor, AT-compatible expansion slots, MS-DOS 3.3 (total cost ~ $13K). This one was to be used for quasi real-time monitoring of Ocean Acoustics experiments in the Arctic.

To get the biggest bang for the buck, in 1989 IOS participated in a regional micro-computer bulk buy; in total over 40 were acquired, including 11 Apple MACS. During 1990 ~ 50 PCs were purchased, including the first 486-based computer (HP Vectra), acquired by Ocean Acoustics, and the first "notebook" computer (Texas Instruments Travelmate), for Dr. C.S. Wong in Climate Chemistry.

In 1991, about 55 PCs were acquired, Dell and Vtech being the most popular brands. A typical PC acquisition for personal productivity was a Dell 425E, 4Mb memory, Super VGA monitor, 80Mb IDE disk drive, MS-DOS 4.01, Windows 3.0 (total cost $7.4K). Cascades were common with "super-users" getting new high-end machines, their old computers trickling down to the next level of user or application. Some recycled XT-class PCs replaced the use of Micoms for word processing.

McAfee ViruScan software was provided to numerous PC users so that they could scan their disks for the Michelangelo virus (among others), scheduled to attack on March 6, 1992. No instances of this virus were encountered at IOS.

A Micro Freeze was imposed in Pacific Region (May-June, 1992) to "enable the department to confirm its inventory of micro systems and to undertake a rationalization of how these systems are being used and can be deployed". Science Branch responded with a detailed analysis of how micro-computers are used; computers not in use would be reallocated, declared surplus or written off (broken/spare parts). As of July, there were 279 "micros"; this included 29 XT-class, 44 AT-class, 67 386-based, 23 486-based, 32 laptops, 23 MACs, 20 Unix work-stations, and 41 older (CP/M) machines.

Approximately 55 PCs were acquired in 1992, Dell being the most popular brand, followed by ASI and Paradon. In addition, 11 MACs, 3 SUN and 1 HP/Apollo workstation were obtained. A public PC (Dell 333D) was set up in the Computer Training and Services Room (2609); an HP scanner and software were installed on it for scanning of graphics and documents into machine-readable files. During 1993, approximately 50 PCs, MACs, and workstations were acquired, with the Dell brand being the most popular.

A survey conducted in late 1994 revealed the following:

- 166 PCs were connected to the IOS network, of which 68 met the minimum standard at the time, i.e. 486DX/33. However only 34 had the standard 8Mb memory, and 110 the minimum 120Mb hard disk capacity.
- Of the 62 notebook PCs only 9 met the minimum 486SX/20 standard.
- Approximately 100 PCs were running Windows, mostly Word for Windows, about half Excel and Powerpoint, only 10 with Access database. All had McAfee virus protection through a site license.

The remaining PCs were running DOS 5.0 or 6.0, with WordPerfect, Lotus 1-2-3, and dBase IV in common use.

The Unix Alternative

Evaluation and acquisition of "scientific workstations" began in 1988. With Mike Woodward taking the lead, the Apollo DN3500 was chosen by Tides and Currents. Ocean Physics (Greg Holloway) issued a tender to industry, the contenders being Apollo and Sun Microsystems. Sherman Oraas represented Computing Services' interests on both acquisitions, the main concern being the need to support UNIX in addition to VAX/VMS and PC/DOS.

In 1989, Ocean Physics acquired two Sun 386i/150 workstations (8Mb, 14" colour monitors, 91Mb and 327Mb disk drives, 60Mb 0.25" tape drive, ethernet connections, and Fortran. Tides and Currents obtained four Apollo DN3500 workstations (4Mb and 8Mb, 15" and 19" colour monitors, 155Mb disk drives, token ring network connections).

In 1990, two SUN Sparcstation IPC workstations were acquired for Ocean Physics to support the PERD North Coast Project, i.e. to process and display large quantities of data generated by oceanographic numerical models of ocean circulation.

In 1992, Ocean Acoustics (Grace Kamitakahara) purchased a Hewlett-Packard 730 workstation for use in mathematical modelling, as a network server, and a multi-user replacement for an HP A900 mini-computer system. Some features included 66MHz RISC CPU, 19" colour monitor, 64Mb memory, 420Mb + 1.0Gb disk, DAT backup tape, HP Unix, Fortran and C compilers, networking software (LanManager). Ocean Physics acquired two similar HP 730 workstations to run ocean circulation models.

In 1994, A SUN Sparc 1+ workstation "beetle" was contributed from Ocean Physics to central Computing to provide general Unix services (file services, backups, name services, etc.) to the Institute. An APUnix "stacker" for Exabyte cartridges with 10 slots of 4.5 Gb each was acquired and installed. This device enabled unattended backup of workstation files during silent hours. BACKUP was executed on the Client workstation over TCP/IP with output to a tape cartridge as selected by the stacker.

In subsequent years, most UNIX workstations at IOS have been replaced by more modern equipment. A snapshot taken April 2003 reveals the following systems: 24 Digital Alpha (Tru64 Unix), 14 Intel/AMD (Redhat Linux), 3 Intel/AMD (Mandrake Linux), 5 SUN (Solaris, SunOS), 3 HP (HP-UX), 3 HP/Apollo (Domain).

The Internet Connection

In 1990, IOS became connected to the outside world by the installation of a link (operating initially at 9600 bps) between the IOS local area network and BCnet, CA*net and Internet (research networks). TCP/IP networking software and a Proteon router were acquired for this purpose.

This capability opened up vulnerabilities and in 1991 the Central System was hacked by an intruder who then logged onto other systems world-wide by calling out over DATAPAC[3]. Several other unsuccessful attempts were logged. Users were advised to use "good" passwords and to change them frequently. The McAfee Viruscan security software was ordered (site license for 100 copies) to detect computer viruses attached to incoming files.

In 1992, the public domain MX package was installed to provide a much requested Internet mail service. This solution was chosen because the equivalent DEC software was not quite ready for that purpose.

A Lunchbox seminar to IOS users was presented (in March 1994) by a consultant on Internet resources and applications. This was the first exposure to the power of the World Wide Web for many of the 60 who attended.

An ad-hoc IOS World Wide Web (WWW) working group was formed in 1995 and guided developments in this area. A prototype IOS Web Server was installed on the "romeo" Unix server and became operational in March 1996. Initial IOS home pages and other material were posted. A new Regional Web Server (DEC Alpha workstation) was also acquired, installed at IOS and configured with Unix-based web server software (Apache) by Len Smith. Web pages were transferred, updated, and expanded by branch "information custodians".

Numerous meetings involving IOS and regional staff were held on the subject of Internet access, World Wide Web development and related topics. Ad-hoc regional "technical" and "content" groups were formed. A draft Interim Pacific Region Internet World Wide Web Policy and IOS Web Page Guidelines were developed. IOS staff also participated in deliberations of the Science Sea Lane web development initiative.

IOS Science users expressed concern about the impact that a proposed "firewall" computer would have on the resources, utilities, bandwidth or performance they had come to depend on. The issues were discussed at the "Great Firewall Debate" meeting held at IOS in February 1996. A plan was developed to install the regional firewall in Vancouver between DFOnet and BCnet (Internet) in a "careful measured manner" so as not to "break" existing Internet applications; IOS staff would play a key role in doing this. In 1997, a Milkyway Blackhole firewall was installed initially between the Regional network and the rest of DFOnet. This was to safeguard DFOnet while retaining unrestricted access from IOS (and the region) to the Internet, pending resolution of Science access issues.

IOS staff took the lead in a proposal to purchase and install a second Firewall between the Internet and the regional network, to eventually replace the original NHQ-provided Firewall. In 1998, a Regional firewall computer (SUN Sparc 5/170) and software (Firewall 1) were purchased and installed at RHQ by Len Smith. Security rules were added and gradually tightened while work-arounds for specific applications (those that broke) were developed. Obsolete and inactive network functions on servers were closed down. Overall management was then transferred to NHQ, with primary support to be provided under contract to Bell Sygma. Regional staff would retain a monitoring capability and the ability to request changes as needed.

Regional internet web server functions and pages were transferred to a Windows NT-based Internet Information Server (IIS) server at RHQ, to be outside the firewall. We also began to receive numerous viruses and hoaxes via e-mail. Remote access to IOS network and e-mail by travelling scientists was an issue in 2000. Outlook Web Access for e-mail was proposed as a solution and has been made available in Pacific Region.

In 2001, Secure Remote Access (SRA) was enabled for regional users. The costs involved an installation fee of a few hundred dollars, and a monthly charge of about 21 dollars per month. Today (April 2003), the DFO and IOS networks can be accessed by dialing in to local or 1-800 numbers or from the Internet via Virtual Private Network (VPN) technology. This is expected to replace SRA and PPTP by the end of 2003.

Microsoft and Windows

In 1995 DFO standardized on the Microsoft Windows operating environment, and the Microsoft Office software suite (Access database, Excel spreadsheet, Word - word processing, and Powerpoint - presentation graphics). By this time many IOS users had already acquired these products. The regional standard would also include an Internet browser (Mosaic), Goldfax (for outgoing faxes), electronic Forms, PathWorks networking with TCP/IP, and TeamLinks e-mail.

For the regional implementation a survey was conducted to determine who needed a hardware upgrade (to at least a 486-based CPU, with adequate memory and disk space). The minimum standard then was a 486/33, 16Mb memory, 420Mb hard disk, and 15" SVGA monitor, running Windows 3.1.

The Office Automation project was completed in 1996 by the installation of 40 Patriot Pentium computers (120MHz, 16Mb memory, 1.2Gb hard disk, CD/ROM drive), replacing older equipment which were cascaded to other applications. Again, COOP students played a key role in this deployment and further user training was conducted. At project completion,

[3] Howard Freeland knows who was to blame.

the number of computers OA'd included a total of 135 486-based PCs and 67 Pentiums. As part of this initiative, CHS migrated their desktop workstations from the Macintosh to a PC environment.

The Common E-mail and Infrastructure Upgrade Project was launched in August 1996. The purpose was to upgrade the DFO informatics infrastructure to common departmental standards. These included Microsoft Windows 95 on the desktop, Microsoft Exchange (Outlook) for e-mail, Microsoft Windows NT-based servers, and associated network upgrades

Design of the Windows 95 desktop environment was completed with contributions from IOS staff. Software included McAfee Virus shield, MS Internet Explorer, Outlook e-mail client, and MS Office 4.3. Recommended hardware was a Pentium with 32Mb memory and at least 200Mb free disk space on drive C (although a 486/33 was the minimum acceptable PC).

The rollout at IOS took place primarily from July to September. As part of this, 114 desktop systems were replaced or upgraded in order to meet the minimum hardware standards. E-mail folders were migrated from TeamLinks to Exchange/Outlook as needed. Training (half day and full day courses) was provided to users on Windows 95 and on Outlook e-mail.
During 1998, users experienced problems with "your mailbox is over its size limit", due to limitations on the e-mail servers and the difficulty of managing the required space. In addition there were numerous outages of the e-mail system as we experienced "teething problems".

The rollout of Microsoft's System Management Server (SMS) began at IOS. This networking tool would facilitate future deployment of new applications, and would be used to gather an inventory of PC hardware and software for Year 2000 (Y2K) assessment purposes.

As of April 2003, user desktop systems were configured with Windows 95/98/NT/2000 supported by a network of NT-based servers for domain control, file and print services, and e-mail (Exchange). Office 97 and Outlook 98 e-mail client are in common use. Equipment upgrades and replacements are ongoing and a project to migrate desktops to Windows XP is underway.

The Y2K Projects

By 1998, the Year 2000 Renovation (Y2K) project had become the top priority: a project coordinator (Bruce Johnson) was appointed to look after server infrastructure and PC workstation upgrades for the Region. Project plans were developed for Server and Desktop replacement and remediation. The scope of the project was defined, a strategy was formulated, contract and temporary staff were hired, roles and responsibilities were assigned, a schedule was developed, costs and benefits were detailed, and funding was requested. This was a National project with a Regional component and project office; much collaboration took place.

With an unmovable deadline, Year 2000 Renovation took place in 1999:

- The Y2K project upgraded network, servers, and PCs to achieve compliance with the 1 Jan 2000 rollover date.
- At IOS, ~ 195 non-compliant PCs were replaced, primarily by Mind computers (350 MHz, 64 Mb memory, 6Gb disk drive, etc.) .
- The legacy VAX (IOS630) and Alpha (IOS380) VMS systems were upgraded to have Year 2000 compliant operating systems and layered software products.
- Year 2000 testing was performed on these systems, consisting of clock rollover (to January 1st, 2000) and post year 2000 shutdown and start-up.
- IOS430 (Charts) and IOSARC (Oracle database) were retired.
- The UNIX server "beetle" was migrated from a non-compliant Sun workstation to a Digital Alpha (former IOS web server).
- The Pathworks file and print sharing service was upgraded to the Y2K-compliant version 5.0F. This provided some enhancements including long filename support for compatibility with Windows 95.
- Teamlinks email folders, and most Pathworks file shares and print services were migrated to Windows NT. Obsolete file shares were shut down.
- Some obsolete software was also retired, including DECnotes and the IMSL library. Local software libraries, e.g. IOSLIB, were upgraded.
- PGC changed their Internet access from BCnet (via DFO) to Shaw Cable.

On the actual rollover date there was only a single failure; a dial-in router needed to have its clock rolled back to 1999, due to ambiguous information from the manufacturer. The router was subsequently replaced.

Conclusion

The past thirty years has seen enormous changes in the computer field, which have been reflected in the computing environment at IOS. We have moved from punched card and paper tape input and batch processing on mainframe and minicomputers to sophisticated networks linking together powerful personal workstations and almost instantaneous communications worldwide. Who can foresee what the next thirty years will bring?

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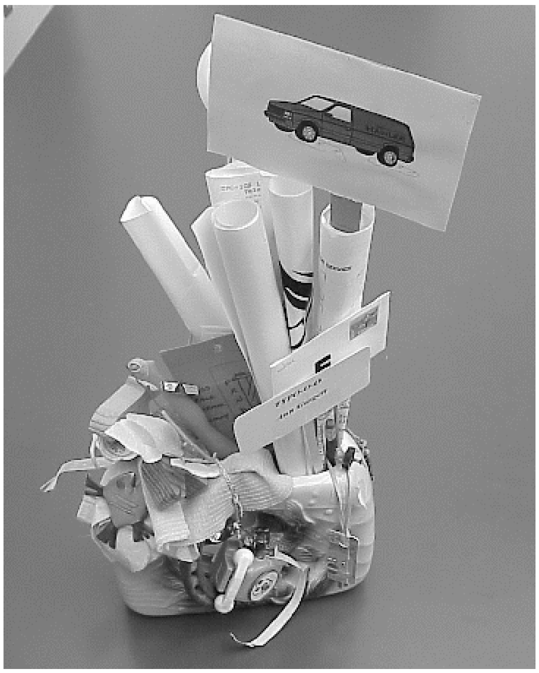
THE FISH

Lorena McDonald and Howard Freeland

Introduction
The Fish is one of the stranger items at the Institute of Ocean Sciences. It is a rather ugly vase that is passed around the building subject to some very specific rules that have evolved over several years. It has been described as a monument to "dumbidity" by some, and by others a special award (to contrast with prestigious things like the Deputy Minister's Prix d'Excellence) for achievements below the call of duty.



The Fish in all its glory.

The Fish was purchased at a garage sale by Lorena McDonald very specifically for the purpose it now fills, the capital investment required to acquire *The Fish* was 23¢.

The Fish Rules
The rules governing an award of *The Fish* are quite simple and sometimes are actually followed, interpretation is flexible:

1. *The Fish* is awarded to an individual or individuals for a significant achievement that falls clearly below the call of duty or below reasonable expectations.
2. It must be displayed in a prominent location in the recipient's office for a minimum of 2 months.
3. It must be decorated in a suitable manner to illustrate the misdemeanour that prompted the award.
4. It must be awarded at a public event, for example, an all staff meeting is commonly used.
5. The recipient is responsible for finding the next recipient and making the award, though assistance is frequently and gleefully accepted.

Jim Gower objected to having received the award on consecutive occasions. His protest was rejected but he was not expected to award it to himself.

Significant Past Awards
The Fish has been awarded very many times and it really is not possible to make a comprehensive list, however, there are many awards that have stuck in the corporate memory so let us try to touch on a few of the lower points and illustrate how *The Fish* is used.

Most people have fond memories of Ann Gargett's win. She sent an email to all staff asking for assistance in a small committee that was directed to improve "Public Displays" around the Institute. At least, that was what she meant to write but there was one critical letter missing, a typo perhaps? The problem of completing the requirements of Rule #3 in this case caused considerable speculation.

Another popular favourite was the award to Deborah Tubman, she arrived late for a time management course. Actually it was both the wrong day and the wrong time.

An unusual double-award was made in 2002 to Howard Freeland and Sherri Willis. This followed a decision made by folks in Ottawa to move our government MasterCards from the Bank of Canada to the Bank of Montreal. We all were issued new cards with instructions to "cut up your old MasterCards." Of course Howard and Sherri could hardly be blamed for misunderstanding; the real problem was the lack of clarity of the instructions which should have instructed us to cut up our old **government** MasterCards, not personal ones.

Jill Rose awarding The Fish to John Davis.

There is a set of awards that have a strong similarity, generally turning on an apparent inability to distinguish one common office tool from another. John Davis, see the picture above, won the award after standing at a fax machine and complaining that the print job he just sent to the laser printer isn't coming out. Bob Lake ranted and raved about his telephone not working while frantically dialling his adding machine. Ruth Paget (library assistant) loudly complained that her computer didn't work. She had two computers on her desk and hadn't figured out to which of these the keyboard she was using was actually attached.

Here is a test for the perceptive reader, we hope you have been paying attention. In the picture on the previous page John Davis is receiving the award from Jill Rose. Who was the winner who immediately preceded John Davis? Hint, check the rules, especially rule number 5.

Accusing Administrative Staff of failing to return your personal passport after you have finished with the Special Passport is not a good thing to do, especially after it is found by the owner being used as a bookmark in a Flopsy and Cottontail book. If you have any doubts, ask Dr. Flopsy as he is now known.

Dr. Flopsy receives The Fish from Howard Freeland and Sherri Willis who in their turn had received it from Bill Crawford, who doesn't remember why he had it.

The Dr Flopsy event has some similarity to another award that turned on lending keys to ones child. One then discovers that the computer can remain inoperable until the child consents to return said keys.

Remaining on the topic of "keys" Howard Freeland won *The Fish* twice. You must remember, when you go through that magnetic metal-detector-thingy at Santiago Airport, yes you do have to take the IOS Master Keys out of your pocket and allow them to go through the X-ray machine. Then you are supposed to pick them up on the other side. Remember all of those announcements in Spanish, probably a rough translation might be "would the dimwit who left his keys at security please come back and get them." Further, you can't avoid admitting to this when you get back to the office.

Howard's achievement in Santiago reminds us of the win by Robin Brown in December 2006. On a trip to Ottawa, Robin left his wallet on the plane from Victoria to Toronto, leaving him in Ottawa with his trusty DFO Identification card (safely in breast pocket), but no money or credit cards. As he so eloquently reported, "arriving in Ottawa with neither money nor credit card is a real bummer", it also wins *The Fish*.

Doug McKone (the first Director of the PICES Office) managed to park his van on an icy slope in the parking lot. The brakes held just fine, but the tyres didn't.

Terry Sowden carefully programmed a fax machine to send 10 pages of text to 10 recipients and then put the paper in backwards. All 10 recipients received, as one would naturally expect, 10 blank sheets of paper.

Lorena McDonald discovered just how close "W" and "S" are to each other on a standard QWERTY keyboard when typing a memo to Dr. Whitaker.

Sharon Thomson (our founding librarian) received *The Fish* for the incident of the dead opossum. The opossum was found dead on the road while she was on her way to work. She called the municipality and was told "we don't have opossums here", so she went back, scraped it off the road and kept it in the library refrigerator until someone verified that it was indeed an opossum.

The "stinkiest office" award went to Brenda LaCroix. We are advised that she complained about a dreadful smell in her office. After air ducts had been disassembled it was then discovered that the problem was on her desk, a coffee cup that had once contained cream had gone over to the dark side.

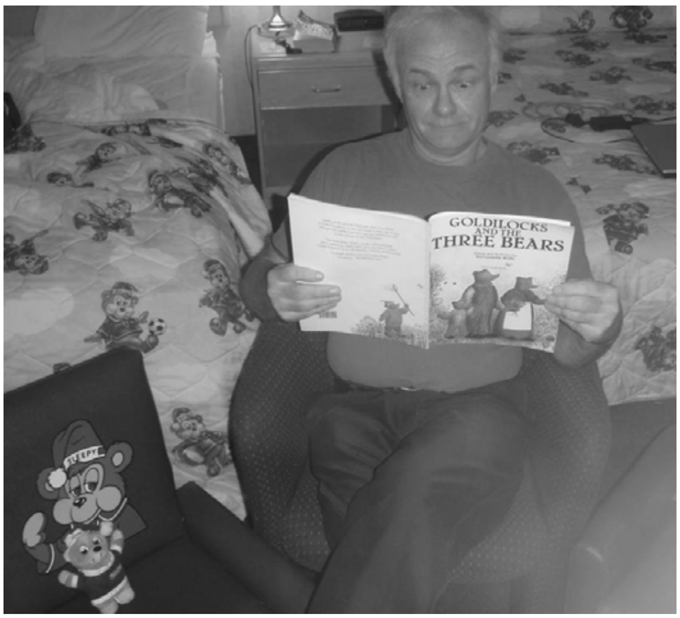
We are advised that Jill Rose has some information about the "Hi I'm Mary" incident but seems strangely coy about it. She readily tells us about the award to Charlene de Reus who came to work wearing shoes of different colours. That would have been fine if she had planned on doing that, perhaps a fashion statement? Perhaps Char can explain the "Mary" incident?

Peter Chandler receives The Fish from Jim Gower, this was for the road kill incident.

An award to Peter Chandler is strangely reminiscent of Sharon Thomson's opossum incident. Peter started by sending a 10 megabyte attachment to all staff. By itself this was clearly not a very good idea and by itself might have resulted in an award.

He then compounded the error with a remarkably ill-advised correction. He compressed the file using a program that attached an icon of a flattened animal, i.e. a piece of road-kill. I suppose that “road kill” is a cute way of representing the concept of “compression” and would have been very amusing except that the contents of the message being transmitted concerned a memorial service.

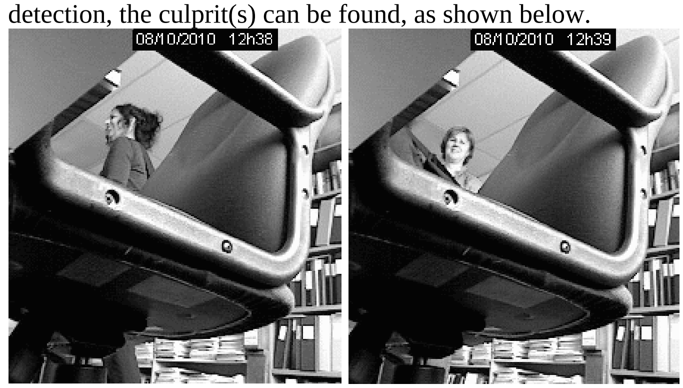
If *The Fish* had a frequent-flier program, then Jim Gower would have the most points. Memorable wins for Jim include the occasion when he tried to go to a conference in India, and failed. It seems that Air Canada was insistent that when India says that he needs a visa to get into their country, they actually mean it, so he was refused permission to board. On another occasion Jim headed out to service equipment on board the Halibut Bank buoy. He couldn’t find the buoy, the reason why was that he hadn’t gone out with a chart. We do print the charts at IOS, he could have visited Chart Sales.



Dr. Robie Macdonald, FRSC, has many awards to his name and so doubtless was thrilled to add yet another auspicious award to his collection - *The Fish*. In this case, it was his failure to reserve a hotel room in Kelowna in a timely manner, for the 2008 annual CMOS Congress that was judged to be a suitably egregious failure. The only hotel room that could be acquired near the meeting site as such short notice was the special "Sleepy Bear" room (see above) at the local Travelodge. As compensation, it did come with its own library, suitable for Dr Sleepy Bear, FRSC.

It took Dr. Sleepy Bear some time to find a suitable candidate to receive *The Fish*, but it did happen and the story began as something of a mystery. Odd little statues, see the picture to the right, somewhat reminiscent of the figures on Easter Island began appearing in Robie’s office. After a weekend or a trip he’d find that perhaps the primary statue had been decorated or perhaps joined by a colleague.

Of course, if you are the person, or persons, who think this is an amusing thing to do, the object is to make sure that you are not caught. However, thanks to the marvels of modern technology, in particular a strategically placed webcam coupled to a computer running freeware that includes motion detection, the culprit(s) can be found, as shown below.



That almost became the second time in the history of *The Fish* that a simultaneous award to two people took place. However, *The Fish* management team determined that one party (Reet Dhillon) had substantially greater guilt and that Tamara Fraser (at right above) had a relatively minor role.