

THE CONTRIBUTION OF THE ROYAL NEW ZEALAND NAVAL HYDROGRAPHIC SURVEYOR

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Paper originally presented at the FIG Permanent Committee Meeting and Centennial Conference, Wellington, New Zealand, October 1988, and reprinted with permission.

Abstract

Some 200 years elapsed between the visit of Abel TASMAN who first sketched New Zealand's coastline and the commencement of the Great Survey of New Zealand by Captain John Lort STOKES, RN, in HMS *Acheron*. However, the several surveyors who did visit the country in those intervening years contributed in a major way to the growth of the nation and included the most famous, Lieutenant James COOK and the less well known, de SURVILLE and d'ENTRECASTEAUX, VANCOUVER, MALASPINA and BAUZA. Between 1848 and 1949, visiting British naval officers conducted hydrographic surveys of increasing accuracy until the Hydrographic Department of the RNZN assumed the role in 1949. Subsequent to that date, a multitude of detailed surveys have been carried out by RNZN officers for national development projects and for general charting purposes. Charts have been compiled and published in New Zealand since 1950 and as there have been significant increases in the size of the area for which the RNZN has surveying and charting responsibility, it is anticipated that there will soon be up to 130 charts published by the Hydrographic Office.

The cost of surveying and charting is very high, but the RNZN will retain the role because of its importance to the security of the nation and to the welfare of all mariners. The position of Hydrographer RNZN is a focal point for national and international dialogue concerning professional standards and user requirements and the Hydrographic Department is instrumental in providing assistance to neighbouring countries so that they may develop the skills to survey and chart their waters and thus better manage their resources. There are important challenges ahead. They include development of techniques, equipment and personnel to meet the requirements of surveying and charting amidst the rapidly advancing technology available.

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This paper outlines the contributions naval surveyors have made to date and their anticipated contributions in the future.

EARLY SURVEYS ON THE NEW ZEALAND COAST

The contribution of the naval hydrographic surveyor to the building of the nation extends rather further back than 100 years, although it must be recorded that the discovery, exploration and early charting of New Zealand were incidental to the main object of those who were involved. Abel TASMAN was seeking to expand the commercial empire of the Netherlands East India Company by the discovery of new lands. James COOK was in the South Pacific primarily to observe astronomical phenomena and to search for the great southern continent Terra Incognita, and de SURVILLE and du FRESNE were assisting France in her competition with Britain for a dominant place in the Pacific.

In 1642, TASMAN sketched the western coast of New Zealand from Hokitika, in the South Island, to Cape Maria van Diemen, in the North Island, and then the Three Kings Islands to the north west. He did not land or explore the country for commercial purposes and thereby earned the displeasure of the Company. On 7 October 1769, COOK made a landfall and commenced his circumnavigation and running survey of the coast which was completed five months later. The Frenchman de SURVILLE arrived off New Zealand in December 1769, surveyed part of the north east coast and had his chart published in 1781, long before the official publication of COOK's in 1816. Another French explorer, Marion du FRESNE, surveyed part of the coast in 1772 until, unfortunately, he was killed by the Maoris. From 1777 to 1800, New Zealand was further visited and surveyed by the British (VANCOUVER), French (d'ENTRECASTEAUX) and a Spanish gravity expedition (MALASPINA [an Italian] and BAUZA).

The 'Great Survey' of New Zealand was commenced in November 1848 by Captain John Lort STOKES, Royal Navy, who commanded the 722 ton wooden paddle steamer HMS *Acheron*. Between 1848 and 1851, STOKES and his officers forwarded 250 fair tracings to the Hydrographic Office in England for incorporation into charts and wrote the first New Zealand Pilot, or Sailing Directions. During these three years, *Acheron* had surveyed 'the chief part of the coasts and harbours of Middle Island and South Islands along with Cook Strait and two portions of the North Island from Doubtless Bay to the Mercury Islands and from Cape Kidnappers to Cape Palliser on the east side, thence to New Plymouth'. Commander Byron DRURY, Royal Navy, commanding the 319 ton brig HMS *Pandora*, continued the 'Great Survey' from September 1851 until early 1855. *Pandora* filled in the gaps in the *Acheron* survey and worked from New Plymouth to Doubtless Bay (when she found, surveyed and named Pandora Bank), surveyed Tauranga Harbour, Manukau Harbour, Pelorus Sound, the Snares Islands in Foveaux Strait and the coast from Mercury Bay to Cape Kidnappers. Commander DRURY's Sailing Directions were published in the New Zealand Gazette so as to be immediately available to local mariners and his fair chart tracings were sent to England for inclusion in the later charts of New Zealand.

Several minor surveys were conducted by naval officers in the years following *Pandora's* departure, particularly at the time of the Maori Wars when many of the ships deployed here took time off from the business of war to carry out surveys. Surveys associated with the development of harbours and anchorages continued and, at the end of the 19th century, HMS *Penguin* was sent to New Zealand to undertake a further general survey. Under the command of Commanders W. PUDSEY-DAWSON and J.W. COMBE, Royal Navy, the ill-suited ship spent five years (1900-1905) working on the east coast of the North Island, in Wellington Harbour and Cook Strait, on the east coast of the South Island and in Westport Harbour. The work by these two officers did not have the same impact as that done by STOKES and DRURY, who had the advantage of being first on the scene and the first to carry out a nearly complete survey, but had the less spectacular responsibility of filling gaps and checking discrepancies in existing charts.

In the earlier years of the 20th century, the naval contribution was mainly opportunity-surveying in the time available during a visit and was thus sporadic and unplanned. In 1911, the first survey of the Three Kings Islands was made by the two specialist survey officers, Lieutenants RENNICK and PENNELL, embarked in the British Antarctic Research Ship *Terra Nova*. Both of these officers had earlier surveyed in New Zealand waters in HMS *Penguin*. In the course of her Antarctic service, *Terra Nova* wintered in New Zealand in 1911 and 1912 but rather than relaxing from the rigours of Antarctic surveying, her officers surveyed in Pelorus Sound, Admiralty Bay, Current Basin and French Pass before returning to the Antarctic.

Ships of the New Zealand Division of the Royal Navy, the forerunner of the RNZN, undertook hydrographic surveys in local waters from 1921. HMS *Veronica* opened up the 'Veronica Channel' to the port of Opuia in the Bay of Islands and her sister ship HMS *Laburnum* worked in Lyttelton Harbour. HMS *Dunedin* surveyed in Stewart Island, HMS *Leith* in Milford Sound and an officer of HM Cable Ship *Iris* undertook a survey of the northern shore of Auckland Harbour.

What has become known as the first modern survey of the New Zealand coast began in July 1937 when HMS *Endeavour*, commanded by Captain A.G.N. WYATT, RN, started surveying in the Hauraki Gulf and the northern Bay of Plenty. This was a modern survey because the ship was fitted with motor launches and rudimentary echo sounders and could thus obtain a continuous profile of the seabed along each sounding line. Hitherto all soundings plotted were spot depths obtained by hand leadline from an open boat propelled by oars or sail. Position fixing was, however, rather more traditional and relied upon horizontal sextant angles measured between triangulated points ashore or beacons laid offshore and plotted by station pointer. *Endeavour's* officers had progressed the survey as far as the Bay of Islands before the advent of World War II brought work to an abrupt halt but even so, 10 new charts were produced as a result of the ship's two years on the coast. One significant feature of the arrangements for the *Endeavour* survey had been the New Zealand Government's acceptance of responsibility for the ship's running costs, stores, maintenance, coal and drawing office space ashore with the Admiralty agreeing to provide only the ship and her crew. Whereas the Royal Navy had previously carried out surveys of the New Zealand coast at its own expense as part of its

responsibility for world wide chart production, the now independent Dominion would benefit from the accrued advantages to overseas trade and coastal shipping that the survey would bring.

In 1942, a professional Royal Navy hydrographic surveyor was sent to New Zealand at the request of the naval authorities to survey Queen Charlotte Sound in anticipation of its use as a fleet anchorage by the United States Navy. The proposed use of the Sound was later discarded, but the modern large scale survey undertaken by Lieutenant Commander C.C. LOWRY, RN, in the small patrol vessel *Elaine* was historically significant as it was the first New Zealand coastal survey carried out under the auspices of the New Zealand Naval Board.

THE HYDROGRAPHIC BRANCH OF THE RNZN

The Early Years

In the period immediately following World War II, the RNZN had inherited a variety of ships and widely experienced officers, but there was neither a survey ship nor experienced survey officers amongst them. The Royal Navy, because of the arrears of surveying in more strategic waters, was not in a position to take up the New Zealand Survey as it had in 1937 with *Endeavour* so, as an alternative, it offered to lend to the RNZN experienced survey officers and a vessel which could be converted for survey purposes. Because of the hard wartime usage to which the surviving suitable vessels had been subjected, the latter part of the Admiralty's offer was declined by the NZ Government but, in 1949, a Royal Australian Navy River class frigate, which had been commissioned in 1945 and used exclusively on survey work until 1948, was obtained on loan. Originally HMAS *Lachlan*, on 5 October 1949 she became HMNZS *Lachlan* and was manned by RNZN general service ratings, a core of RN survey recorders (including one who had served in HMS *Endeavour*), two RNZN volunteer survey officers, three RAN survey officers and two RN survey officers, including Cdr. J.M. SHARPEY-SHAFER who had served as a Lieutenant in *Endeavour*. On 16 November 1949, the New Zealand survey recommenced, this time as the responsibility of the RNZN. At this stage, about 80% of the charts were 100 years old.

In 1950, two 22 m (72 ft) motor launches, constructed in Canada in 1942 for harbour defence and patrol work, were transferred from general service to the hydrographic branch. Re-named HMNZS *Takapu* (gannet) and *Tarapunga* (a seagull), these craft, commanded by young lieutenants of the RAN, RN or RNZN, became responsible for inshore coastal surveys and independent harbour and other large scale surveys.

Between 1949 and 1960, *Lachlan* was commanded by a succession of RN survey officers, amongst whom was Commander G.S. RITCHIE, DSC, RN, who later became Hydrographer of the Navy (U.K.) and later still, President of the Directing Committee of the International Hydrographic Organization (IHO) in Monaco. In February 1960, command of *Lachlan* and the responsibility of Director of Hydrography was assumed by an RNZN officer, Commander W.J.L. SMITH,

OBE, DSO, RNZN, who as one of the two original RNZN volunteer survey officers first joined *Lachlan* in 1949 in Australia. In December 1962, a further step in the growth of the branch occurred when Cdr. SMITH relinquished command and took up the full time appointment in the Navy Office of Hydrographer, RNZN. Thus long term branch planning and policy making could be conducted at Naval Staff level and all chart production and the day-to-day direction of the work of the three survey vessels came under his direct supervision.

Initially, it was intended that the '*Lachlan*' fair charts would be sent back to England for printing under the supervision of the Hydrographer of the Navy. However, pressure of work in England could have resulted in delays of up to two years so, with the co-operation of the Lands and Survey Department, the chart was compiled by a small Hydrographic Section, formed in 1950 and led by two ex-Admiralty cartographers, printed and published in Wellington. New Zealand became a member nation of the International Hydrographic Organization in 1959 and accepted responsibility for the publication of six International Charts and the maintenance of 60 GEBCO sheets. In 1963, an agreement was entered into with the Hydrographers of the Royal Navy and Royal Australian Navy to progressively assume charting responsibility of an area of the South West Pacific formerly charted by the British Admiralty. The agreement also provided for a free exchange of chart reproduction material and reciprocal reproduction rights and it allocated co-ordinated responsibilities for issue of Notice to Mariners and distribution of charts.

In 1970, the Hydrographic Office was removed to its present location in Auckland and was co-located for the first time with the Hydrographic Supplies Division. All chart production, maintenance and distribution functions are now carried out in-house with the exception of chart printing which is contracted out. As Auckland is the base port for the survey vessels, it is most convenient for the seagoing and shore-based branch personnel to be co-located. During the winter lie-up period (late June-early September) when the survey vessels are refitting, fair drawing work is undertaken by survey personnel at the Hydrographic Office.

In 1975, HMNZS *Lachlan* was paid off. She was replaced in 1977 by the present ocean survey ship HMNZS *Monowai* (3800 tonnes) — a former passenger/cargo vessel extensively converted and refitted. In 1979-1980, HMNZ Ships *Takapu* and *Tarapunga* were paid off and replaced by new locally built Inshore Survey Craft (26 m, 100 tonnes) which were commissioned to the same names in 1980.

Surveys for National Development

All surveys that have been conducted for charting purposes have contributed to national development, particularly those which have highlighted areas of interest to commercial fishermen or have proved safe routes for shipping to and from the country's major ports. The approaches to Auckland were adequately surveyed by *Endeavour* before World War II, but the approaches to Wellington and the southern route through Foveaux Strait were not surveyed to modern standards until HMNZS *Lachlan* began work in late 1949. The production of the

charts of these two areas where the weather was often poor, tidal streams strong and rocky shoals common, was a considerable relief to the masters of merchant vessels using these shipping routes.

Since the 1950's, the Navy's surveyors have undertaken a variety of surveys in response to specific national development requirements. The first was in 1956 when the narrowest portion of Cook Strait was surveyed on behalf of the State Hydro Electric Power Department, which was investigating the possibility of laying a power cable across the Strait. There followed surveys at Deep Cove and in the Waiau River for the Lake Manapouri hydro electric power project, at Bluff for the development of the aluminium smelter, at Marsden Point for the oil refinery project, at Tauranga for the wood chip export trade and at Taharoa and Waverly for the establishment of offshore iron-sand slurry loading-buoys. More recently, there has been a comprehensive survey of Doubtful Sound to ascertain shipping routes in anticipation of the export of fresh water. There have been numerous occasions too when specific development surveys have been undertaken by private consultants, but the basis for their work has generally been a copy of an earlier RNZN survey obtained from the Hydrographic Office.

The Hydrographic Branch has itself ventured into the world of commercial contract surveying when eight years ago HMNZS *Monowai* surveyed the route of the ANZCAN telecommunications cable between New Zealand, Australia, Norfolk Island, Fiji, Hawaii and Vancouver. This was a major undertaking of some five months duration and proved the capability of the Navy's surveyor to work for other than a charting authority.

Development surveys have not only been confined to New Zealand waters or to areas of direct national interest. Port development and shipping route surveys have been undertaken in Rarotonga, Fiji, Western Samoa and Funafuti and, although of direct benefit to those nations, New Zealand has also benefitted from the proof of safe access for its export shipping trade.

The RNZN and Hydrographic Surveying

Occasionally there arises the question 'Why does the Navy undertake hydrographic surveying in New Zealand?', the implication being that perhaps another organization could do the job. As in the majority of countries, the service is performed by the Navy because, apart from Defence survey requirements, charts must be available to all prospective users at reasonable cost and the Navy is the only government owned agency equipped for carrying out the task. The annual cost of running the three survey vessels amounts to several million dollars per year and the wages for work ratio in the Navy are very low when compared with Union rates, e.g. no overtime rates are paid. On wages alone, commercial costs would be enormous. The production costs of a survey are therefore considerable and when added to the average cost of production of one chart, about \$25,000, it quickly becomes apparent that on a cost recovery basis, the retail price of a chart, about \$300 per copy, would be quite unreasonable.

Hydrographic surveying has a role in national security; there will always be a need to provide the Fleet with vital bathymetric, oceanographic and geological

information essential for the effective deployment of maritime forces and the success of naval or joint operations in countering any threat. Additionally, there is the role of the Naval hydrographic surveyor in establishing and maintaining mine warfare control procedures.

Undoubtedly, the cost of maintaining a surveying service is high, but the RNZN has supplied and will continue to supply this service to the nation and to the international mariner at much less cost than could anyone else in the country.

The Role of the Hydrographer RNZN

The Hydrographer RNZN is responsible to the Chief of Naval Staff for all matters relating to hydrography and Defence instigated oceanography, the technical control of ships employed on surveys, naval and civil personnel training, the co-ordination of chart production, chart maintenance and distribution, and the maintenance of the Tidal Library of New Zealand which includes its contribution to GLOSS, the Global Sea-Level Observing System.

Apart from surveying and charting within New Zealand's EEZ, the responsibilities of the Hydrographer extend to the shores of the country's dependencies in the Pacific. These are Tokelau, Niue and the Cook Islands and, under the charting arrangement with Australia and the United Kingdom, the Samoa Islands, an area amounting to 6,861,522 sq sea miles of the South West Pacific Ocean (see Fig. 1).

In addition, he has a responsibility to the IHO for the collection and presentation on 1:1M Plotting Sheets of random sounding data over 10,600,855 sq sea miles of the SW Pacific. From this data are compiled the General Bathymetric Charts of the Oceans (GEBCO) (see Fig. 2).

To date, 114 charts have been published and the projected total of New Zealand produced charts is over 130. Six new charts are part of a scheme on 1:1.5M agreed with UK and Australia to cover an area stretching from Australia to the Cook Islands, while at least 10 new charts will be necessary to replace the old large scale British Admiralty (BA) charts of Tokelau, Niue, Samoa and the Cook Islands and an additional 3 charts will be necessary to replace BA charts of the Kermadecs and sub-Antarctic Islands. The production of these charts relies predominantly on a seagoing survey staff of 11 officers and 36 ratings plus an office staff of 37 civilian draughting and nautical officers, chart correctors and sales staff.

The Hydrographer is the national representative in the IHO and, under the auspices of the NZ Institute of Surveyors, is currently the national delegate to FIG Commission 4 (Hydrographic Surveying). Because of his position, he is a focal point for hydrographic matters generally and, through the IHO, contributes to the working parties established to address particular aspects of the profession's standards, technology and training. Of significance to all professional surveyors who may be involved in or contemplating hydrographic work is the availability through the Hydrographic Office of internationally evolved standards for the training of hydrographic surveyors and the conduct of their surveys. These standards are a

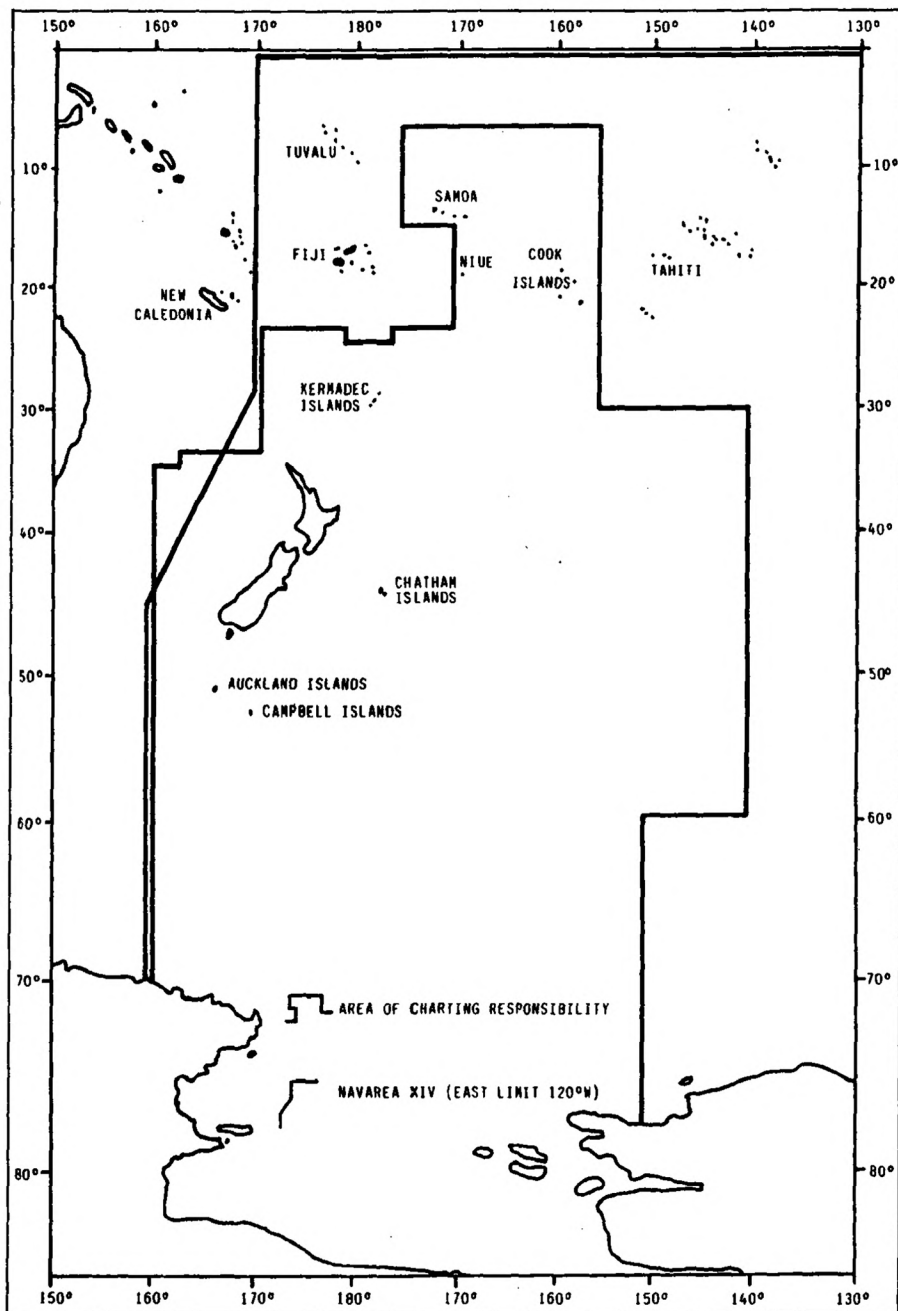


FIG. 1. — New Zealand's charting limits and area of responsibility.

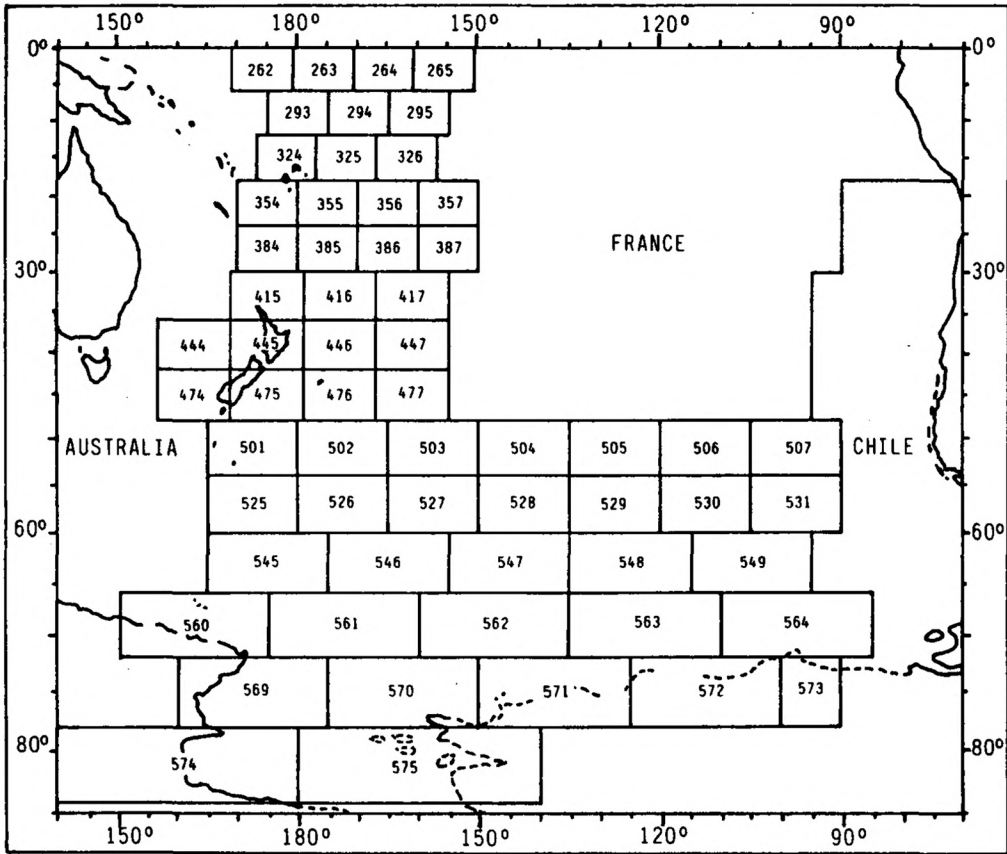


FIG. 2. — General Bathymetric Chart of the Oceans (GEBCO).
Index showing 1:1M sheet numbers in New Zealand's area of responsibility.

most important contribution to the surveying community for they establish criteria against which the quality of the profession can be measured.

Contributions to New Zealand's Pacific Neighbours

The Hydrographic Department of the RNZN is aware of the contribution it can make, and indeed is making, towards the development of the hydrographic surveying and charting skills of its Pacific neighbours. For several years prior to 1987's politico/military events in Fiji, the RNZN had trained Fijian naval personnel ashore and at sea. Theoretical and practical training was given in surveying and also in cartography in the Hydrographic Office. Combined RNZN/RFMF surveys were undertaken in Fijian waters to the considerable benefit of both parties and senior RNZN cartographic staff visited Fiji to help establish chart publication processes there. During the past eight years, some officers of the Royal Malaysian Navy's surveying service have been given draughting training in New Zealand and others have received practical surveying experience at sea.

In recent months, a Nautical Information Officer from the Hydrographic Office has participated in a Maritime Boundaries Delimitation Workshop in Apia, Western Samoa. This workshop was organized by the Forum Fisheries Agency in Honiara, Solomon Islands and enabled a wide Pacific audience to benefit from the experience and knowledge of NZ, Australian and Canadian experts in the field.

The awareness of all New Zealand's neighbours to the value of the resources in their offshore areas has been sharpened in recent years and many are taking a more vital look at the surrounding oceans. The RNZN will continue to contribute towards mapping for these resources by virtue of its capability for determining bathymetry, measuring gravity and magnetics and ascertaining seabed quality as an extension of the normal requirements of charting surveys in the Pacific region.

Future Challenges for the RNZN Hydrographic Department

So that the survey and cartographic functions of the Hydrographic Department may retain their current capabilities and yet move forward in the wake of international professional and technical advances, established programmes exist for recruiting and training personnel as well as for assessing and acquiring new techniques and equipment. These programmes require continual re-evaluation to ensure that human and financial resources are managed as effectively as possible, given the finite nature of these resources.

In late 1989, the second generation Hydrographic Automated Data Logging and Processing System (HADLAPS) will be commissioned in *Monowai*, *Tarapunga*, *Takapu* and the three Survey Motor Boats carried by *Monowai*. The design of this system represents a quantum leap forward in the flexibility, speed, accuracy and convenience of data handling and depiction, and is soundly based on 10 years experience of *Monowai's* original HYDROPLOT system. As the technology of data handling at sea advances, there becomes an even more pressing need for automation of cartographic and nautical information processes ashore. The challenge to be faced during the closing stages of this decade will be the design and acquisition of such a system. It will enable the Hydrographic Office to be fully functional in the modern methods of handling and exchanging data through digital information systems and the production of charts using computer assisted draughting techniques.

Both at sea and ashore there will be the ongoing requirement to evolve procedures to meet new equipment standards and accuracies. Rather than the role of the naval surveyor and cartographer diminishing as time advances and more surveys reach completion, there will be the need for more detailed and specific work in some areas. Additionally, there is the necessity for continual updating of older work to meet the demands of more sophisticated chart production processes and the demands of the customer, service or civilian.

An added challenge will be the establishment of means by which this country's expertise in hydrographic surveying and cartographic matters can be made available to our South Pacific neighbours who are developing hydrographic ser-

vices, or who are desirous of doing so. This is not a matter which can be progressed hastily and will depend upon a great deal of goodwill and understanding within and beyond the surveying profession.

CONCLUSION

The contribution of the naval hydrographic surveyor towards building this nation spans over 300 years and, as time passes, the primary role of surveying for the production of charts continues to be one of undiminished importance. The naval surveyor's work in national development projects has been complemented and supplemented by others during the last 20-30 years, but there remains a vast quantity of hydrographic information yet to be acquired, collated, compiled and published and the Hydrographic Department of the RNZN is the only indigenous organization fully equipped to undertake the task.

Coincident with the broadening of the hydrographic surveying base in New Zealand there is of increasing importance the need for awareness of, and adherence to, internationally recognized standards of training, expertise and product so that the customer can be confident of value for money. The Hydrographer RNZN is the national focal point for matters of professional standards and much useful information is therefore available via the Hydrographic Office.

Given the resources and the national will, the Hydrographic Department can continue to play its part in building this nation in the eyes of its South Pacific neighbours too, through assisting with the development of their hydrographic surveying and charting skills.

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