HYDROGRAPHIC SERVICE, ROYAL AUSTRALIAN NAVY

Paper presented by Australia[1]

Introduction

The Hydrographic Service, Royal Australian Navy, was founded on 1 October 1920, when the Admiralty intimated that it was unable to accept further responsibility for hydrographic surveys in Australian waters.

Almost from the beginning of settlement in Australia, surveys of its lengthy coastline had been undertaken by ships of the Royal Navy, and the resultant charts were published by the Hydrographic Office of the Admiralty. Up to 1825, these surveys were entirely exploratory; but, by that date, a series of Admiralty charts based on the work of Commanders Matthew Flinders and Phillip Parker King, RN, had been published to give initial coverage for the entire Australian coastline.

Subsequently, during the next 100 years, as the need arose, particular portions of the coastline were surveyed in more detail. The more notable surveying voyages of the early period were undertaken by Commanders Wickham and Stokes in HMS *Beagle*, Captain F. P. Blackwood, RN, in HMS *Fly*, Captain Owen Stanley, RN, in HMS *Rattlesnake* and by Captain H. M. Denham, RN, in HMS *Herald*.

During the period 1860–1880, a most distinct advance was made in Australian charting, when each of the Australian colonies agreed to share the costs of the surveys with the Admiralty for the purpose of issuing a new series of Admiralty charts. These charts remained in active use for almost 100 years. In some cases, they have not yet been withdrawn and remain in use today.

From 1880 until the outbreak of the First World War, the Royal Navy, partly at Australia's expense, maintained at least two surveying ships in Australian waters, working mainly in the Great Barrier Reef, in Western Australia and Tasmania and in the south-west Pacific islands. Even after the war, surveying in Australia was resumed by the Royal Navy in 1919 and continued until 1926, while the RAN Hydrographic Service was finding its sea-legs.

HMAS *Geranium*, the first Royal Australian Navy surveying ship placed in commission, was employed at first, from 1920, on harbour surveys connected with defence; but with the advent of another surveying ship, HMAS *Moresby*, under the command of an experienced surveyor, Captain J. A. Edgell, RN (later Vice-Admiral Sir John Edgell, Hydrographer of the Navy), more ambitious surveys were commenced in the Great Barrier Reef, and in the Darwin and Clarence Strait area, Northern Territory. The *Geranium* was paid off in 1927, followed by the *Moresby* in 1930. In 1934, the latter vessel again resumed work and continued surveying alone until 1939.

With the commencement of the Second World War in the south-west Pacific, hydrographic information regarding the Solomons, New Guinea and North Australia fell far short of operational requirements. Not only had large areas remained unsurveyed, but the state of charts and sailing directions covering the remaining areas left much to be desired.

As the war in the Pacific progressed, the increasing hydrographic requirements of the allied navies meant a large increase in the RAN Hydrographic Service. In 1945, the surveying vessels consisted of two sloops, one frigate, five corvettes, three tenders, two lighthouse tenders and three harbour defence motor-launches. In all, this was a considerable increase from the solitary sloop engaged on surveying duties before the war, with the result that substantial progress was made in surveying northern Australian and New Guinea waters. Not all the surveys, however, were of permanent value, as some were undertaken for the specific wartime purpose of the moment.

In 1946, the future of the RAN Hydrographic Service was considered by the Australian Federal Cabinet. It was planned for the Navy to continue hydrographic surveys with three surveying ships and three tenders, so that in a period of twenty-five years modern surveys would become available and make possible the issue of a new series of modern Australian charts. At the same time, an agreement was signed between the British Admiralty and the Australian Commonwealth Naval Board, making, in effect, the Hydrographic Office, Sydney, the charting authority for Australian waters and certain islands within the limits of Australia's sphere of influence.

Unfortunately, three years later, the Royal Australian Navy found that manning and other difficulties made it essential to reduce the surveying ships' complements; but harbour surveys were continued from the ships immobilized in Sydney. One frigate, HMAS *Lachlan*, was transferred to the Royal New Zealand Navy. For three years, no progress was made in the national survey; but in 1952, the surveying programme was again resumed with HMAS *Warrego* and *Barcoo*. At times *Barcoo* was paid off and, in 1958, HMAS *Paluma* was converted for survey

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* The following papers relating to the present agenda item are reproduced above, under the agenda items indicated: "Cartographic activities in Japan (hydrography)", presented by Japan (agenda item 6); "Status of hydrographic surveys and oceanographic research in Indonesia", presented by Indonesia (agenda item 6); "Photogrammetric research work on the Gulf Stream", presented by the United States of America (agenda item 8).

[1] The original text of this paper, prepared by G. C. Ingleton, Hydrographic Office, Sydney, and Captain D. W. Haslam, Hydrographer, Royal Australian Navy, appeared as document E/CONF. 52/L.36.

work. HMAS *Moresby* was commissioned in 1964 when *Barcoo* and *Warrego* were finally paid off.

In view of these circumstances, the twenty-five year programme planned in 1946, with three tenders, has been somewhat delayed, but progress has been made. The coastal waters over the continental shelf from Spencer Gulf in South Australia to Palm Passage in Queensland have been covered by modern surveys. The north and east coasts of Tasmania have almost been completely surveyed. Within the Great Barrier Reef and Torres Strait large areas have been covered by adequate surveys and these areas are being surveyed in the next five years by HMAS *Paluma*, concentrating principally on establishing shipping routes for deep-draught shipping.

Between Torres Strait and King Sound in Western Australia, most of the shipping routes have been surveyed, as well as the more important harbours and approaches. Between King Sound and Exmouth Gulf some large detached areas have been surveyed, and the principal shipping routes through this vast unsurveyed area will be surveyed within the next five years.

Thus, by 1970, the main shipping routes through the more complicated waters of Australia will have been completed, leaving yet to be done the coastline between North-West Cape and Kangaroo Island. In addition, special surveys will be required for developmental and other purposes, and certain regions must, of course, be resurveyed from time to time.

In New Guinea, progress is also being made with hydrographic surveys and, during the next five years, surveys are scheduled of the main shipping routes in New Guinea.

The diagram at the end of this paper shows areas completed by modern Royal Australian Navy surveys, and areas to be undertaken in the next five years, as laid down by a meeting of interested authorities, held in Canberra in 1965, and known as "Hydroscheme 1965". As in most other countries, the responsibility for surveys within the established harbour limits rests with the local or state harbour authorities, who have various vessels and surveyors engaged in the continuous task of surveying the busy port areas. Information from these sources is made available to the RAN Hydrographic Service for inclusion in Australian charts, and excellent co-operation exists to ensure that these port charts are maintained up to date. In addition, much useful information has been received as a result of commercial seismic and other mineral exploration expeditions, which have usually employed electronically controlled echo-sounder tracks in their surveys.

Surveying ships

During the current year, 1966, only two surveying ships are in active employment in the RAN Hydrographic Service, the *Moresby* and the *Paluma*.

HMAS *Moresby* is the first ship in the Royal Australian Navy to be specially designed for hydrographic surveying duties. All previous vessels employed by the RAN Hydrographic Service commenced their life as warships in general service and were subsequently converted for surveying duties.

The *Moresby* was built by the State Dockyard, Newcastle, New South Wales, and launched on 7 September 1963. The vessel was commissioned into naval service on 8 March 1964 and undertook its first survey work in the approaches to Hobart, Tasmania, between April and June of the same year.

The *Moresby*'s statistics are shown below.

Displacement: 2,500 tons.

Length over-all: 314 ft, with 42 ft beam.

Propulsion machinery: Diesel electric.

Complement: 130 officers and men (including 5 surveyors).

Speed: 18 knots. (Range: 10,000 miles.)

Equipment: Two ship's echo-sounders, type 771; one EDO echo-sounder, type 185, with precision depth recorder (PDR); one Lambda two-range Decca fixing aid; one Hi-Fix two-range fixing aid; high-accuracy radar, type 979; three 34 ft surveying motor-boats, fitted with echo-sounder, type 772; one Westland Scout helicopter, capable of a maximum all-up weight of 5,000 lb and a speed of 115 knots.

The running cost of each surveying day's work achieved is approximately $A4,000.

Experience with Lambda in the *Moresby* suggests that, in North Australian waters, the ship can be fixed to a maximum range of 200 miles from the shore station by day, and of 100 miles by night. HI-FIX has been used satisfactorily to a distance of 60 to 80 miles both in Torres Strait, Tasmania, and north-west Australia. With these aids, the ships can survey regardless of visibility and much further offshore than is possible with horizontal sextant angles between series of marked positions ashore or of floating beacons at sea. The new geodetic control available in Australia and use of tellurometers greatly increase the time available each year for sounding, whilst the possibility of using electronic fixing at even greater distances offshore, possibly using satellites and computers, is being investigated.

The *Moresby*'s echo-sounders, type 771, record depths up to 900 fathoms, while the EDO with the PDR can record depths up to 6,000, should such an ocean depth exist.

The Scout helicopter enables a Lambda or HI-FIX slave station to be erected in a day. Rough-country vehicles —"desert rats"—will be used when this is not available. Each slave station takes about half a day to calibrate and in an ideal case, where previous ground control is available, the *Moresby* has started sounding within four days of arriving in the area.

The newer surveying motor-boats have been fitted with bunks, galley, etc. to enable them to work independently of the ship for short periods on detached duties, especially the inshore sounding and inner waters.

HMAS *Moresby* is also equipped for a limited oceanographic role with a small laboratory and an oceanographic winch, and equipment includes bottom samplers, gear for water sampling and bathythermographs. Other equipment could be installed, but with so much hydrographic work to be done, it is not intended to use the ship for more than routine oceanographic observations.

HMAS *Paluma* was formerly the *Motor Store Lighter* No. 252, but, after a short trial period on survey work, the vessel was formally commissioned and re-named in May 1958 as a surveying ship. "Paluma" means "thunder" in the aboriginal dialect and the name was previously carried by a celebrated unit of the Queensland Navy, which was also employed on surveys in the Great Barrier Reef in the 1890s.

The *Paluma*'s statistics are shown below.

Displacement: 208 tons.

Length over-all: 124½ ft with 24 ft beam.

Propulsion machinery: Two Ruston Hornsby Diesel.

Speed: 9 knots. (Range: 17,000 miles.)

Complement: 28 officers and men (including 3 surveyors).

Equipment: One ship's echo-sounder, type 771; one Hi-Fix two-range fixing aid; one Radar, type 975.

In addition, a 34 ft surveying motor-boat accompanies the *Paluma* for boat-sounding work, and is fitted with echo-sounder, type 772.

The running cost of each surveying day's work achieved is approximately $A1,000.

In spite of its small size, slow speed and inability to hoist the accompanying surveying motor-boat, the *Paluma* has accomplished a good deal of useful work, and has recently been much improved with new radar and other equipment.

Oceanographic data

At present, the Royal Australian Navy has not an oceanographic vessel designed as such, but, since 1960, two frigates, HMAS *Gascoyne* and *Diamantina* have been employed partially on oceanographic work. Each vessel has made some five or six cruises each year varying from ten to thirty-five days each with scientific teams supplied by the Royal Australian Navy Experimental Laboratory, or the Commonwealth Scientific and Industrial Research Organization (CSIRO), Division of Fisheries and Oceanography, Cronulla or various Australian universities.

Both ships took part in the International Indian Ocean Expedition, although the *Gascoyne* has normally worked in the Tasman and Coral Sea areas.

Results of these oceanographic cruises have mostly been published by CSIRO.

Within the Hydrographic Office, an Australian Oceanographic Data Centre has been established to assist in the promulgation of these scientific results and for the accumulation and dissemination of oceanographic data.

Hydrographic Office

The Hydrographic Office was moved from the Royal Australian Navy Dockyard, Garden Island, in April 1964, to the eighth floor of the IBM Building, Kent Street, Sydney. This provides excellent conditions for chart production and enables the many people requiring access to the office to enjoy it without the restrictions involved in dockyard security.

Subsequently, probably in the mid 1970s, it is intended to move the Hydrographic Office to Canberra, to a new building being designed as a mapping centre to house the mapping agencies of the Army, Navy and the Division of National Mapping. It is considered that the close association of these mapping authorities can be better achieved if they are situated in one building, with easy access to such common services as air photography, triangulation data, co-ordinatographs, cameras and printing facilities, etc., and that the production of Australian charts will be further expedited.

The present staff of the Hydrographic Office consists of:

1 Captain—Hydrographer, RAN;

1 Commander—Deputy hydrographer, RAN;

1 Lieutenant commander—Assistant hydrographer and superintendent, charts;

1 Lieutenant—Naval assistant in charge of equipment and Hydrographic School (with 2 surveying recorders);

1 Retired lieutenant commander—Notices to Mariners (with 2 assistants);

1 Retired lieutenant commander—For planning and archives;

1 Retired lieutenant commander—Australian Oceanographic Data Centre;

2 Drafting officers—Records section;

1 Chief cartographer—In charge of drawing office;

1 Senior drafting officer—Deputy chief cartographer;

1 Senior drafting officer—Verification of documents;

1 Senior drafting officer, 6 drafting officers—Compilation section;

1 Senior drafting officer, 4 drafting officers—Fair drawing section;

2 Drafting officers—Photographic section;

1 Senior drafting officer, 1 drafting officer—Lettering section;

1 Drafting officer—Employed at the Army Mapping Centre, Bendigo, for liaison in connexion with printing and compilation of topography;

1 Clerk, 1 female typist—Secretariat.

1 Lithographic printer has recently joined the staff.

The Hydrographic Office in Sydney is the repository of hydrographic information for Australia and preserves the original surveys and other hydrographic and oceanographic data, as well as archival copies of published Australian and Admiralty charts. In this office are planned the charts and the hydrographic instructions for the surveying ships for the essential data, upon which these charts are constructed. The compilation of the charts is undertaken in the office and the production processes up to the stage of supplying reproduction material from which the plates can be made. The making of the chart plates and the printing is undertaken by the Royal Australian Survey Corps, at its establishment in Bendigo, Victoria, by some private firms in Sydney and by the newly recruited lithographic printer.

The Hydrographic Office also promulgates weekly Notices to Mariners and other data, and answers many hydrographic problems forwarded by the various marine, shipping and harbour authorities in Australia. In addition, Australia has assumed responsibility for an extensive area surrounding this continent, for the compilation of plotting sheets for the General Bathymetric Charts of the Ocean, to be published by the International Hydrographic Bureau.

Attached to the Hydrographic Office, but in a separate building close by, are the Royal Australian Navy Chart Depot and the Royal Australian Navy Chart Agency, both of which hold considerable stocks of Australian and Admiralty charts and publications for the Royal Australian Navy fleet purposes, as well as for sale to the general public. The charts are kept up to date by chart correctors, and otherwise maintained according to special requirements. This section has eighteen civilian employees.

Australian chart planning

In 1963, a charting arrangement was made between the Admiralty and the Australian Commonwealth Naval Board, to replace gradually the existing Admiralty charts of the Australian charting area, by Australian charts, which the Admiralty, in turn, would reproduce in facsimile and issue, or put on sale with its Admiralty chart agents.

The main purpose of this agreement was to circumvent duplication. During the past twenty years, the Australian charting programme has been making good progress, and from these charts the Admiralty had been correcting its own coverage of Australian waters, until a considerable amount of duplication has come about.

This problem had been foreseen in 1946. But at that time the Admiralty were reluctant to allow the replacement of Admiralty charts by Australian charts. However, as the standard of Australian charts reached an equivalent standard with that of the Admiralty, and as the problem of maintaining world-wide coverage of Admiralty charts became considerably more difficult, the sensible decision to remove chart duplication was made. Nevertheless, it will be many years before the Admiralty charts of Australian waters are replaced entirely by Australian charts.

By September 1966, the Admiralty had withdrawn thirteen of its charts in favour of facsimiles of equivalent Australian charts. At present, there are 209 Admiralty charts in the Australian charting area, and 133 Australian charts in present use. Eventually, the Australian charting area (limits shown in diagram on page 492) will be covered by approximately 450 Australian charts.

Chart production

Initially, the Hydrographic Office produced the chart original copy by hand-drawing techniques on mediums such as Bristol-board, enamel zincs and various opaque plastic sheets, and a fine standard of penmanship was achieved by the draftsmen. Reproduction by photolithography followed using, generally, a two-thirds reduction on wet-plate glass negatives for stability in scales. The charts would be printed from albumen-coated zinc or aluminium plates by offset printing presses, usually in four colours.

Since 1958, this traditional method has been abandoned in favour of the scribing process on a stable plastic material. As navigational charts are subject to constant revision and correction, the material used must have stability, permanency and first-class reproduction qualities. In addition, it must be able to withstand repeated correction. In the Hydrographic Office, the materials used are Stabilene scribe coat, Chronoflex mat (for positives), Cronar (for negatives) and Kodak dry stripper for lettering. Positives are used throughout the process until the final colour proving, when negative reproduction material (repromat) is supplied to the printer to make each plate (black, blue and magenta) either on pre-sensitized plates or, in some cases, on albumen-coated zinc plates.

The charts are first compiled by the compilation section of the Drawing Office at the same scale as the published chart, and in a simplified style, conforming, however, with the style and lay-out of the final appearance of the chart. The draftsman carefully selects his information from a mass of relevant data at his disposal for the chart, and his compilation conforms to standards laid down, which are similar to those on Admiralty charts. Prints of the compilation are then circulated for checking and approval, both within the office and, where applicable, by outside bodies, such as state lands departments, state and port authorities; even commercial firms which are particularly interested.

The compilation in its final form is then taken in hand for fair drawing and preparation of repromat, by the appropriate section of the Drawing Office. All line work is scribed as continuous lines and opaqued out as necessary. Coral, rocks, cliffs etc., are scribed free-hand. Lettering, soundings and symbols are prepared and stuck-up in accordance with style and agreement in lay-out with the compilation. After a print of the fair drawing is circulated and checked, colour overlays are prepared for the blue and magenta plates, and for the various screens (or tints), which are to be put down on the final black plate. These screens for the land, mud, mangroves etc. are the same as those used by the Admiralty, and greatly assist the Australian charts to conform in style with the Admiralty chart. The lettering is composed of standard faces used by typesetters, with a range of styles selected to give uniformity between charts.

Conclusion

The RAN Hydrographic Service is a small unit with a great responsibility. Australia's coastline and navigable waters are very extensive, and the task of producing modern surveys by the small number of eight surveyors in two surveying ships is a difficult and long undertaking. Similarly, the production and maintenance of approximately 450 Australian charts is also a formidable task for the small staff of the Hydrographic Office. If the proposals envisaged in 1946, for a larger surveying service, could be implemented today, much would be done in speeding up the programme of modernizing Australia's charting requirements.