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BRITISH ADMIRALTY SMALL SCALE CHARTS ANCIENT AND MODERN

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ABSTRACT

This paper is a personal review of the very small scale charts produced by the British Admiralty. It includes a valediction to the UK Hydrographic Office's series of world small scale fathoms charts dating from the 19th century, and goes on to describe the planning and construction of the first modernised metric chart in the replacement series. Also included is a description of the differences between the old and new charts, and a detailed account of the technological processes used to produce the new series.

1. INTRODUCTION

In the late 1970s, as the programme got underway to complete the adoption of the 1:10M series of INT charts, the UK Hydrographic Office turned its attention to the next and final small scale charting programme, that of replacing the series of very small scale fathoms charts of the world. To call the charts a "series" tends to imply an overall strategic design, with some similarity in appearance: but this, I hasten to add, is emphatically not the case, for these eight sheets are a very mixed bunch indeed. Their current edition dates range from 1883 to 1969, and their content and design strikingly reflect the changes in cartographic thoughts and techniques over these 86 years. The five oldest sheets (1883-1927) were produced from copper engraved bases, and the remaining three from mainly hand-drawn enamel-zinc plates.

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2. VERY SMALL SCALE FATHOMS CHARTS

(Listed in current edition date order)

Chart No	Scale	Title	Date of first Publication and current Edition	Inner neat line size (mm)
2059	1:12.5M	North Atlantic Ocean	June 1851 Aug 1883	790 x 730
2203	1:12.9M	South Atlantic Ocean	July 1853 Aug 1883	791 x 638
2483	1:21.8M	Atlantic and Indian Oceans with the western portion of Pacific Ocean	April 1857 June 1886	1430 x 642
2683	1:21.83M	Pacific Ocean	Sept 1859 May 1887	965 x 928
2127	1:14.5M	Atlantic Ocean	Nov 1919 June 1927	765 x 1150
1240	1:12.182M	South Polar Chart	June 1839 April 1949	965 x 608
3934	1:48.4M	The World	Jan 1859 June 1958	963 x 635
4006	1:7.551M	North Polar Chart	Feb 1818 July 1969	963 x 634

Spreading the charts out together on a convenient large clear floor space allows a number of interesting comparisons to be made.

2059, 2203, 2483 and 2683 were all published within a period of four years, between 1883 and 1887. The current North and South Atlantic charts, 2059 and 2203, were published together in August 1883, and despite the numerous corrections and additions made during the subsequent century and more, their overall design as a matched pair remains very evident. Curiously, the chosen scales were almost, but not quite, identical - the difference amounts to 0.4mm over 20° of longitude. Not surprisingly, there is a greater number of soundings on the North Atlantic sheet, where in several areas the density of depth information almost resembles that of a 1:1M Oceanic Plotting Sheet. Apart from a sketchy 100 fathom line, and dotted lines around certain shoals, banks and doubtful depths, no contours are used. Instead, the oceans are peppered with discrete depths, and there is no attempt whatsoever to facilitate the understanding of the underlying sea floor morphology.

In the process of preparing this paper, my growing curiosity about the first versions of these two charts, dated 1851 and 1853 respectively, demanded satisfaction - just how much depth information had our predecessors managed to collect by that time? An hour later, a messenger brought the charts with the answers. Surprisingly, BA 2203 (South Atlantic Ocean) then depicted only one ocean depth, of 2677 fathoms 500 miles west of the Cape of Good Hope (Ross 1840); and one solitary line of 'no bottom found' depths crosses the Atlantic from Cape Town via Tristan da Cunha to the Brazilian coast. The remainder of the chart lies empty. BA 2059 (North Atlantic Ocean) revealed an even more extraordinary picture - or rather no picture at all. Not a single deep ocean depth was recorded, not even that first ocean sounding ever, attributed to HMS RACEHORSE in 1773! Between 1851 and 1883, this picture changed dramatically, as the development of the trans-ocean telegraph cable left its mark in the form of strings of depths crossing the North Atlantic Ocean.

Topographic features on these charts are limited to the depiction of major rivers; no international boundaries are shown; and parts of Africa are described by the nature of the inhabitants - "Country of the Moorish Tribes", for example - rather than by geographical name.

One strange feature was the extraordinary shoal patch, 'Chaucer Bank', in position 43°N 28°40'W. First noted in 1850, it continued to collect further reports for a hundred years, until it was finally disproved by US and UK surveys and deleted from all charts in 1985.

Chart 2127 of the Atlantic Ocean is best taken out of sequence because it is very closely linked with the two previous charts of the North and South Atlantic. Although on a different nominal scale, it nevertheless matches both these charts in true scale. The current edition was published in 1927, and what makes it particularly interesting is that it replaced an absolutely identical chart of the same number which had been published only eight years earlier, in 1919.

Examination of the original printing of the 1919 version reveals that in many places the detail is so blurred as to be unreadable: indeed, I am tempted to say that this image degradation is the worst example in the history of the British Admiralty chart. It is no wonder that, in 1926, the chart was withdrawn.

The cause of the low-quality image becomes apparent after a close study of the detail on the two landscape charts of the North and South Atlantic. There had obviously been an unsuccessful attempt to produce a single portrait chart by combining the two landscape charts. The idea was sound enough in principle, and had the merit of saving expensive engraving time, but the transfer techniques, although widely used, were apparently not able to cope adequately on this occasion. For the record, such transfers were made with a special thin gelatine-covered paper, which was pressed onto the copper plate after the engraved image had been filled with hot greasy lithographic ink. The transferred impression was then laid over a specially prepared zinc plate and pressed by a mechanical roller, after which the paper was carefully peeled away revealing an image identical to that of the copper plate.

The next two charts, 2483, The Atlantic and Indian Oceans, and 2683, The Pacific Ocean, were published in 1886 and 1887 respectively. Once again the scales

are virtually identical (1.2 mm difference over 50° of longitude), but that is about where the similarity ends. Whilst the square-shaped chart of the Pacific Ocean includes no topography whatsoever, its over-long landscape cousin is covered in a mass of topographic detail. Hachures were employed with prolific abandon to delineate a wide rangé of hills and mountains, but the depiction, whilst arresting to the eye, lacks consistency of treatment. The details of hundreds of rivers and their minor tributaries were laboriously engraved and named. In addition, there is a wealth of other information, for example the Kalahari Desert is "covered with dense wood but devoid of water". It seemed a mystery that these two charts, originally designed as a matching pair and compiled and published within a year of one another, should now look so radically different. However, a little rummaging through historical records revealed the answer: when these charts were first published, the rich topographic detail currently depicted on 2483 was also present on 2683. In the course of time, the image on 2683 began to deteriorate as the fine hachuring gradually filled in. In 1931, all the topographic detail was photographically removed, leaving the chart as we see it today.

Looking further back, the original versions of these charts were published in 1857 (2483) and 1859 (2683). The 1857 version of 2483 embraced only the Indian Ocean, and showed no depths and very little topography. In 1869, the limits were extended eastwards to include the Western Pacific, and hill shading was added. The chart had a further life of only 17 years before the current version was published, adding an extension westwards to include the Atlantic Ocean.

The 1859 version of 2683 included the Pacific and Western Atlantic Oceans at a scale of approximately 1:30M, with inner neatline dimensions of 925 x 605 mm; it showed no depths in the Pacific Ocean and only twenty in the Western Atlantic. This chart had a life of 28 years before it was replaced by the current version.

The last of the charts in this series on Mercator's projection is 3934, The World, published in 1958. It has a generous selection of depths, and makes use of a danger line and 100 and 1000 fathoms lines; but the result, like the larger-scale charts described earlier, gives precious little guidance to the structure of the sea floor. Topographic detail is limited to major rivers and lakes, international boundaries and country names.

There were two earlier versions of this chart, dated 1859 and 1874. The first of these was a fairly simple product, resembling the North and South Atlantic charts of 1851 and 1853, but in 1874 a new chart with extended limits was published. Following the examples set by the Atlantic, Indian and Pacific Ocean charts of 1886 and 1887, this chart made flamboyant use of hachures to depict topographic relief. The result is a masterpiece of late nineteenth century engraving and etching, in sharp contrast to our practice in these days of economic constraint. I cannot but be amazed at the wonderful but profligate work of earlier cartographers.

Among many others, the British have long held the Antarctic Region to be an area of special interest. Perhaps, therefore, I should not have been surprised to discover that our first chart of the South Polar region was published as early as 1839, and what a gem it is! Circular in shape, with a diameter of 600mm, it shows not only Antarctica but the tips of the southern continents. From these land masses, and from the sea, come a host of tracks probing the Antarctic continent: illustrious names such

as COOK, BISCOE, WEDDELL, BELLINGSHAUSEN and KEMP are engraved beside them. Like most of the other early small scale charts, this sheet carried no depths. By comparison, the current 1949 edition is well sounded, and the territorial boundaries drawn on it bear witness to man's pressing interest in this extraordinary continent.

The last, and most recent, of these eight charts is 4006, the Arctic Region. It is strikingly different from any of the previous sheets, all of which were printed in black only. Its most notable features are the use of two blue tones, one depicting shallow water and the other showing selected contours, and also the introduction of a grey flat land tint. As no magenta is used on this chart, its printing can still be accommodated on a four-colour press. Although the Admiralty metrication programme had begun at the time of its publication in 1969, it was nevertheless decided to retain imperial units for this chart. My investigations into its earlier versions produced the most unexpected results. In 1875, an Arctic Region Chart was published, on the stereographic projection, placing the North Pole close to the northern border of the sheet and the Greenwich meridian down the centre. This half-Arctic chart included detail as far south as the 50° parallel, and two years later, in 1877, its companion half-Arctic chart was also published. The real surprise, however, lay in the unearthing of the original chart of the Arctic Regions. Like its opposite number in the Antarctic, it is presented in a circular form, but its publication was even earlier, on February 14th, 1818.

"So there it is", I mused to myself, "our entire collection of ancient charts!" But one last search through our oldest and most precious catalogue of 1826 unearthed a final surprise. At the beginning of the nineteenth century, it was common practice for charts to be engraved for Hydrographer by other agencies. Apparently one such agency, owned by the famous W. FADIN of London, Geographer to the King, engraved three small scale oceanic charts. Nearly 200 years later, our archive, having been moved countless times to different repositories throughout the country, was now put to the test. Could these charts be found? In minutes I was presented with these precious documents:

Chart 748 Indian Ocean, published 1817
Chart 357 South Atlantic Ocean, published 1808
Chart 356 North Atlantic Ocean, published 1807

These extraordinary charts, with their floridly decorated titles and simulated paste-on parchments, had been approved by the Chart Committee of the Admiralty and, although lacking the customary seal of the Hydrographer, were nevertheless included in the HO catalogue. As well as a mass of names along the coastlines, they showed the tracks of numerous vessels which had zig-zagged their way across the oceans; and the names of LAPÉROUSE, VANCOUVER and COOK embellish these bravura works.

Once again, unable to resist the lure of these fascinating documents, my eye was drawn to an unexpected island in the South Atlantic, I. Grande. Chart 357 shows a convincing outline for this island: about 30 miles long and 5 miles wide, and situated in position 45°S, 46°W, marked as "according to DALRYMPLE", our first Hydrographer. Moving eastwards, the island appears again, almost identical in shape but now in 39°W, attributed to LA ROCHE in 1675, and reported to have a good harbour! Moving further eastward, to 36°W, COOK also records the island,

again with a broadly similar coastline. All three of these positions lie in an area now known as the Argentine Basin, whose shoalest depths are about 4,500 metres; there are no reports of doubtful depths or vigias in the vicinity.

This mystery is ripe for investigation, but that will have to wait until another day. It is time to close this brief review of the World very small scale charts, a series which had spanned 185 years -now I must face the new problem of how to replace them.

3. EARLY PLANNING FOR THE REPLACEMENT CHARTS

It was recognised in 1976 that the very small scale metric replacement charts could not be started until after the publication of the complete 1:10M International series of charts, expected then to be in the mid-1980s. Nevertheless, a preliminary investigation into the replacement of the small scale fathoms charts was started in the spring of that year.

Chart Scheming - a first attempt

How then to proceed? Our first requirement was to decide upon how many charts were necessary and their respective coverage and scales. Anyone who has tried his hand at chart scheming knows that this activity is fraught with complications: the permutations seem infinite, and the world land mass distribution does not provide the most convenient set of shapes on which to set a regular geometric pattern. As was the case in the nineteenth century, there was agreement upon the need for separate charts of the North and South Atlantic Oceans, and the Indian Ocean was accommodated in the first scheme at the same scale, 1:20M, as the Atlantic charts; but proposals for the much larger Pacific Ocean did not meet with general approval. Between 1976 and 1987, several alternatives were drawn up, each of which moved the scheme a step nearer to the final solution.

Chart Content - first thoughts

Our first thoughts about chart content were influenced by the 1:10M INT series of charts. It was envisaged that a very simplified version of the INT charts would satisfy the necessary planning requirements.

Delayed Plans

Between 1976 and 1983, various proposals for the replacement scheme were considered without any firm conclusions being reached. This period of indecision had no practical effect, as the Small Scale Charting Branch already had its hands full with the INT Small Scale Chart adoption programme. However, in 1983, six small drawings were prepared at 1:20M scale of an area embracing the Azores, Portugal and the West Coast of Africa. These experimental hand drawings, showing a variety

of detail, were made in colour and attempted to simulate the look of a printed chart. They included a range of ideas, from no depths and no contours, to a full depth pattern and a complete set of contours. Some other features, such as ships' routes and isogonals, were also tried out.

Some attempts were made to draw up a set of specifications, but this work was abandoned in the face of more pressing requirements. The scheme was next briefly resurrected in 1987, when proposals were made for a series of five charts covering the world on a scale of 1:20M. Shortly afterwards, staff changes and cuts in the work force of the Small Scale Chart Branch became necessary, and once again the replacement scheme retired into limbo. Four years later, circumstances changed once more, and, as the last adopted INT 1:10M chart was published in February 1990, resources adequate to reactivate the project became available.

4. THE REPLACEMENT SCHEME

Fifteen years of intermittent pondering were at an end. After some discussion, it was agreed that we should attempt to replace the fathoms charts within the shortest possible time scale: our aim was to publish the new series, if possible, within 12 months. To this end, it was necessary to examine, amend and resubmit the chart schemes, to draw up specifications, and to build a production programme with specified start and end dates for each chart. The imminent introduction into the office of automated line-following equipment was a major influence in our design and programme details.

Chart Scheming - an agreed solution

A complete reappraisal of the 1987 scheme led to a number of changes. Whilst the basic concept of a set of five 1:20M charts was accepted, there were clearly advantages in adjusting many of the sheet lines so that the charts could be joined together to form a single unbroken chart of the World. Two additional sheets, one of the Atlantic and another entitled "Eastern Atlantic Ocean to Western Pacific Ocean including the Mediterranean Sea and Indian Ocean", both at 1:20M, could also be created as by-products with very little effort.

The idea of composite world cover at 1:20M gave rise to a similar product for the next smaller scale charts, whereby the two sheets separately covering the major oceans could likewise be combined to form a composite world chart, this time at 1:27M scale.

The northern and southern borders of The World chart at 1:45M were extended to enable the entire world coastline to be included.

The replacement for the Arctic Region chart follows very similar principles to its 1969 ancestor, and the limits are almost identical. In contrast, the Antarctic Region chart differs in several respects from the current version. The scale has been reduced from 1:12M to 1:15M, and the presentation rotated through 90° so that the

0°-180° axis is parallel to the long edge of the portrait sheet. These two changes provide space to show the tips of the regional continents.

VERY SMALL SCALE METRIC REPLACEMENT CHARTS

(Listed in order of publication)

Chart No	Scale	Title	Date of Publication	Inner neat line size (mm)
4004	1:20M	North Atlantic Ocean and Mediterranean Sea	March 1992	980 x 640
4003	1:20M	South Atlantic Ocean	July 1992	979 x 641
4008	1:20M	North Pacific Ocean	*Sept 1992*	1088 x 661
4007	1:20M	South Pacific Ocean	*Oct 1992*	1024 x 641
4005	1:20M	Indian Ocean	*Nov 1992*	982 x 641
4015	1:20M	Atlantic Ocean	*Nov 1992*	673 x 1123
4016	1:20M	Eastern Atlantic Ocean to Western Pacific Ocean including the Mediterranean Sea and Indian Ocean	*Nov 1992*	1152 x 651
4006	1:7.5M	Arctic Region	*Dec 1992*	640 x 980
4009	1:15M	Antarctic Region	*Dec 1992*	650 x 980
4001	1:27M	Atlantic and Indian Oceans	*Feb 1993*	1043 x 767
4002	1:27M	Pacific Ocean	*Feb 1993*	1022 x 767
4000	1:45M	The World	*Feb 1993*	950 x 738

Publication dates shown in italic are projected dates

Chart Content - second thoughts

In discussing the chart design options, a number of other products were examined by the three staff forming the design team. We also considered the long-held view that these charts should be merely very simplified versions of the 1:10M series, showing a bare minimum of detail. This concept was rejected in favour of the creation of an informative and attractive chart specification which would be of real use in planning operations. Our triangular brainstorming meetings were instrumental in identifying which options and combinations of charting elements could be used. The first task was to create a list of elements against which all possible options were noted. For each option, comments were added identifying advantages or disadvantages. Anticipating difficulties about making choices without the benefit of seeing the results, we decided to create three separate proof versions of the chart,

selecting different combinations of elements for each. 17 bases initially seemed necessary to satisfy this goal, a horrendous total which we were eventually able to cut to 10 (five black, four combined black and blue, and one magenta).

Compilation

At about the time that the detailed specifications for the charts were being written, the HO took delivery of several Raster/Vector conversion processors. This new technology was acquired to assist in the post-compilation stages of chart production. It promised fast, accurate reproduction of line work, and the added advantage that the vectorised data could be manipulated for use in other products - in our case, overlapping charts. The choice was easy: it looked like plain sailing. But we should have known better!

The detailed chart specification was greatly complicated by the requirement to generate three quite different proofs from the single compilation drawing. Close discussions with our Digital Production Branch were a constant feature of that period. We were advised to compile the detail in two layers, one containing the linework, the other the text. This separation - a marked departure from our usual one-sheet technique - would preserve the clarity of linework deemed necessary for the conversion of the raster image to vector format. There were advantages in name placing and ease of alteration, but the procedure proved very cumbersome in intricate areas, and when using the port information from five different sources. Choosing to insert the circular "port" symbol on the linework sheet was one of our errors of judgement, as it later proved very difficult to align the beginning or end of each port name with its symbol. The coastline and contours were compiled mainly from photo-reductions of the 1:10M INT charts. In areas of complex bathymetry, it was necessary to use extractor traces, on which greatly simplified depictions of contours were drawn before being reduced photographically to 1:20M scale. Part of the coastline outside the area of the 1:10M INT charts was taken from the World Vector Shoreline Digital Data set. Some bathymetric detail from a map on the polar stereographic projection was transformed electronically to fit the 1:20M mercator projection. It was decided to experiment with a series of hypsometric tints, following the hydrographic convention whereby the shoalest areas are defined by the darkest shade of blue. Different compilation colours were used to depict the 200, 1000, 2000 and 3000 metre depth contours. This method of identification was to prove of inestimable value in the compilation, verification and mask-making processes. We could not have foreseen, however, that these same colours were also to be the source of a significant problem - but so it proved.

The major difficulty with the first compilation at 1:20M was to arrive at a level of generalisation which was not only acceptable for the chart in hand, but which could also be extended to the other 1:20M sheets of the Indian and Pacific Oceans. To achieve a satisfactory solution to this problem, a series of experimental compilations of a complex area of the North Atlantic Ocean was prepared. From these, we were able to define some guidelines for contour depiction, and in particular to lay down rules concerning the numbers of isolated contour loops. The latest 1:10M charts were used in date order, any overlap differences being settled in favour of the more recent edition. In some instances, it was necessary to select

bathymetry from the 1:10M GEBCO Bathymetric Charts. Names of bathymetric features were verified against IHO BP-0008.

Because of the constraints of scale, it was not possible to distinguish between doubtful and other charted data; as a result, some of the Doubtful Depths may look rather too prominent. Reports of Discoloured Water and Breakers were omitted.

The compilation was started in February 1991 and was completed in August. The actual work, which had to be fitted around two more urgent tasks, took 35 days. A complex set of instructions was drawn up for the preparation of the ten basic plates, and was passed with the compilation and a huge sigh of relief, to our Digital Production Branch.

The Reproduction Process - first time

A photograph of the compiled linework was sent to a bureau in London for a one-colour pass on a Scitex Raster Scanner. Afterwards, at Taunton, the raster data was converted to vector format via a VAX 3100 workstation using Laser Scan VTRAK software. The compiled text was captured via a Marconi Macrospeak Voice Recognition System on an Altek digitising table using Laser Scan software. The merged linework and text file was edited on an Apricot Sigmex High Resolution Graphic Screen using Laser Scan Lites 2 software, and the initial verification plot was obtained from a CALCOMP 5800 Electrostatic Plotter. The positive bases were finally made on an ARISTO 306 flatbed plotter, and were delivered by the dates requested.

It was now early October. We were well within our schedule, and were feeling pleased that so many different hurdles had been overcome without mishap. Something had to be done about the naming of the former Soviet Union and the new emerging States, but we had time in hand to await a political solution on that front. Five etch-and-peel masks were combined with other positives to create the first of our three experimental proofs. But our reproduction team, unfamiliar with hypsometric tints, had overlapped screen on screen, with the inevitable moiré effect. Five etch-and-peel coats later, we had corrected that problem, only to run into another. Our helio department now reported that they could not obtain a satisfactory image on the DEP White Astrafoil specially chosen for these proofs. After discussions with the manufacturers, the consensus of opinion was that the material had been too old. We tried again in the following week - and failed once more! Our well thought-out production programme was looking under threat. In desperation, we turned to another drafting film, and at last the three experimental proofs emerged. These graphics, with a set of recommendations, were passed to the Hydrographer and choices were made from the design options.

Chart content - final choices

Apart from the coastline and a few names, the replacement sheets bear no relation to the old fathom charts, or indeed to other metric charts. The most prominent of several major differences is the use of colour. As a result of customer advice, a bright yellow was chosen for the land tint, and this also serves to mark out these planning charts as something different within the standard Admiralty chart

series. In addition, for the first time, four hypsometric tints have been introduced to depict various depths between 200 and 3000 metres; all contour lines are shown in blue, and are unbroken for other detail. Within the constraints imposed by scale, all major and many minor ports have been inserted, as have country boundaries and capital cities. The usual integrated layout for title and notes has been replaced by a self-contained side panel, which also includes indexes of associated charts, details of other HO products and a number of notes.

Thus, with the content of the series agreed, the selected proof of the first chart was returned to the compiler to begin verification.

Proof Verification - first time

Within the hour, any optimistic thoughts I might have been entertaining about the progress of this chart were rudely shattered. It did not need a magnifying glass to confirm what the compiler had found - the digitally-produced coastline did not agree with the compilation! Indeed, in some places it was so markedly different that it bore no relation to the original. A hurried meeting was called as questions raced through our minds. What could possibly have produced such a divergent image? Could we put it right? And had we wasted the money spent on this brave new technology?

Some days later, the multiple causes of the problem were confirmed as a series of unforeseen events which, acting together, magnified the errors at successive stages. They began with the photograph of the linework compilation: because of the variable quality of the coloured inks used, our photo section had been unable to obtain a fully satisfactory image of the various contour lines. At the next stage, Colourmap Scanning Ltd. had to enhance the faint-lines, and this meant that the coastline, originally drawn in dense black, was scanned at an inappropriate setting, producing thickened lines on the raster backdrop image. It then proved impossible to follow these lines with the accuracy demanded by the intricate coastline. Further errors were introduced through our lack of experience of the tuning parameters on the VTRAK system, and the curve-drawing tolerances of the plotting software were also set incorrectly. In our defence, it has to be said that everyone was breaking new ground, and that we were testing the capabilities of the equipment and its operators in quite unexpected ways. Thoroughly chastened, we duly went back several squares, and rescanned the original photo.

The reproduction process - second time.

Now seemingly conversant with all the pitfalls, we set to work again, and the ten new bases were produced without a hitch. Aiming to save time, new masks were made for the yellow land and the 0-200 metre shallow water blue tints only.

Proof Verification - second time

Another *cri de coeur* from the compiler! There was now a mismatch between the edges of some of the adjacent blue hypsometric tints. It is probable that, in trying to match the old and new masks, a slight error had been introduced in Protocol punching for the registration between the first and second sets of bases. Five new and perfect masks were made from the final correct set of bases, and the prospect of publication seemed a reality at last. Anxious to be politically correct, it proved necessary to make amendments to the charting of the Balkan States right up to the date for publication.

5. LAST WORDS

On 27 March 1992, BA chart 4004 was published. By that date, five other charts in the series had been compiled, and three more were in hand. It is planned that all twelve sheets will be published by February 1993, so bringing to an end the long reign of our small scale fathoms charts, with their special attraction and rich history. The sad but necessary replacement of this old fathoms series of world charts gives me an opportunity to look back at our legacy and salute it. I recall some words written by a former engraver colleague ... "One of DALRYMPLE's plates, depicting Nancoury Harbour, first published in 1792, was finally withdrawn in 1959 after a working life of 167 years, a fine tribute to the worth and durability of engraving for printing". The craft skills of the old cartographers were far greater than our own. They made up for their lack of knowledge about the ocean floor with a display of engraving and etching that never fails, even now, to arouse a sense of wonder and applause. They too tested the limits of their technology in making composite charts, just as we have; and the evidence, to be preserved for ever, shows the breadth of vision from which grew their world charts. I hope that they would have approved of our efforts today.