

STRATEGIC CONSIDERATIONS FOR INTERNATIONAL HYDROGRAPHY IN THE 21st CENTURY

by Barbara A. BOND ¹

Abstract

This year is the 75th anniversary of the establishment of the International Hydrographic Organisation (IHO). We also rapidly approach the 21st century. It is perhaps an appropriate time to reflect on the range of changes and challenges which face international hydrography and on the role of the IHO as the facilitator and catalyst for the increasing level of cooperation and collaboration required in the digital era.

INTRODUCTION

The first International Hydrographic Conference was convened in London in June 1919 and was attended by the representatives of 24 nations. The stated objective of the Conference was:

"To consider the advisability of all maritime nations adopting similar methods in the preparation, construction and production of their charts and hydrographic publications; of rendering the results in the most convenient form to enable them to be readily used; of instituting a prompt system of mutual exchange of hydrographic information between all countries and of providing an opportunity for consultations and discussions to be carried out on hydrographic subjects generally, by the hydrographic experts of the world."

The Conference established the International Hydrographic Bureau (IHB) which began its activities in 1921, now generally regarded as the effective date of

¹ Deputy Chief Executive, Hydrographic Office, Taunton, UK.

the establishment of the IHO, although, strictly speaking, the Inter-Governmental Convention of the IHO was not drafted until 1967. This year, 1996, therefore represents the 75th anniversary of the IHO and, as we also rapidly approach the 21st century, provides an appropriate moment to consider the future challenges for international hydrography.

THE INTERNATIONAL NATURE OF HYDROGRAPHY

The "founding fathers" of the IHO recognised the international nature of hydrography 75 years ago and, whilst individual nations will rightly have their own national priorities, there has been increasing recognition of the international nature and importance of hydrography, witnessed not least in the growing membership of the IHO which presently stands at 62 Member States (MS). Given the nature of the maritime environment, this is hardly surprising, but it is arguable that the international perspective has been increased by the advent of the electronic era.

THE TECHNOLOGICAL REVOLUTION

Perhaps the most tangible challenge which we face is that of technology. In just about every walk of life we are faced with the new technologies, to an extent that it is perhaps no longer appropriate to refer to them as "new". Certainly the use of computers is not new in hydrography. Some hydrographic offices (HOs) have been utilising them for thirty years, initially in the 1960s to process mathematical calculations in the preparation of grids, graticules and projections for chart construction purposes. Later they were utilised to render more efficient the chart production processes, so that today many HOs are operating digital production systems. There are some extremely impressive ones to be seen in HOs around the world, with end-to-end digital production systems running from the initial capture of raw data at sea, through the analysis, processing and databasing of those data, and their subsequent management and promulgation in a variety of forms, both analogue and digital, to meet customer requirements.

Survey data are increasingly captured automatically and are rendered to HOs in digital form, massive amounts of it, which required to be processed and often merged with existing analogue data into a form which the navigator can understand and use. There has been a positive revolution in surveying techniques from lead-line surveys and echo sounders to satellite imagery, remotely sensed techniques, airborne laser collection, radar imagery, and multi-beam sounding systems.

A similar revolution has taken place in navigational positioning systems with the advent of the Global Positioning System (GPS), which utilises the World Geodetic System (WGS) as its principal reference. The navigator is now able to obtain his precise position in real time to an accuracy of a few metres. He now knows where he is as opposed to where he was! His tools of navigation, principally the chart, must respond to these changes.

There is now a wide availability of high performance digital technology to support integrated bridge systems. The bridge of a modern ship is a very different environment today than it was even a decade ago. The systems are largely electronic and increasingly interfaced. As a result, the navigator increasingly requires charts and related publications in digital form.

The challenge to the IHO is how to reconcile the understandable need for debate, some of it lengthy, with the need to move at the speed of emerging technology and the mariners' demands. If national HOs do not find a way to respond to the market in a timely fashion, they will be progressively marginalised by commercial forces with obvious consequences for the IHO and official data.

ELECTRONIC NAVIGATIONAL CHARTS (ENC)

Mariners are becoming more knowledgeable of the potential benefits of digital data and, as a result, rightly more demanding. They are impatient to get hold of high quality, official, digital data and they will not wait forever. Many commercial companies have been quick to recognise this market and have rapidly digitised the paper charts of many national HOs, usually with, but too often without, the permission of the HOs concerned. National HOs have been perceived as lagging behind; The latter, as the official national hydrographic authorities, have recognised the need to produce a digital product which fully meets the International Maritime Organisation (IMO) and IHO specifications and standards, and are more aware than most that to do this means the production of good quality, fully verified data. This, in turn, is difficult -though not impossible), time consuming and, not least, expensive. The picture has been further complicated by the fact that only recently have some of the related standards been formally adopted (i.e. IHO S-57 Edition 3, IMO ECDIS Performance Standard). Whatever national HOs produce in the digital world, it must be at least as good as their products in the paper world and must be supported by at least the same level of service (e.g. correction, distribution).

We are all aware of a very real market need for ENCs to provide the data fuel to drive Electronic Chart Display and Information Systems (ECDIS). Equally we have all realised just how expensive the production of vector data is, not least because many HOs have been geared to produce paper charts for many years, and the production of vector data requires the forward investment in new equipments which many national governments find difficult, if not impossible, to make.

RASTER CHARTS

Paralleling the development of ECDIS has been the emergence of Electronic Chart System (ECS). These vary in complexity and functionality, and many commercial systems are already in the market place whilst the full development of official ECDIS is still a little way off. In recognition of this delay, and of the proliferation of ECS using commercial data of indeterminate quality, a number of

HOs are making available raster versions of their paper charts. The combination of official raster charts with suitable software and display systems (provisionally referred to as Raster Chart Display System (RCDS)) offers the potential to reduce the navigator's workload, and increase safety and the protection of the marine environment. If such systems are supported by a regular updating service, they have the potential to be fully equivalent to the existing paper chart, whilst bringing considerable savings in effort on board ship.

One important aspect of raster data which many in the user community are now realising is that it provides an ideal educational/training medium to facilitate the transition from analogue to fully structured vector data. An important consideration is that in the raster regime the mariner learns how to use a digital chart, the contents of which are fixed, whilst in the more complex vector regime, he has the ability to select which chart data to display. Additionally, because a raster chart is a digital facsimile of the paper chart, the user immediately identifies with the screen image. Raster technology has moved apace over recent times and can now be combined with vector overlays to provide much of the functionality required by a ship's navigator. In addition, this vector overlay capability permits many of the warnings associated with vector data and the ECDIS to be provided by the RCDS. Clearly the availability of structured vector data will considerably enhance the potential use, but a user who is already accustomed to using raster data with a vector navigational overlay will likely find the unfamiliar screen image of the ENC the easier to handle and accept.

WORLDWIDE ELECTRONIC NAVIGATIONAL DATABASE (WEND)

Norway provided the catalyst in 1991 which caused the IHO to formulate the theoretical WEND concept. The concept has much to commend it, but however attractive it is in theory, it will only prove as good as its implementation in practice. Successful implementation of the WEND concept of Regional Electronic Navigational Chart Coordinating Centre (RENC) requires an unusually close degree of multi-lateral cooperation; in essence it provides the ultimate litmus test for the IHO. The early indications are, however, good. The Northern Europe RENC was the first to be established, earlier this year. It is co-ordinated by Norway and the UK, and involves 14 European Member States who are already cooperating closely in their united desire to prove that the concept can be made to work in practice.

The role of the Northern Europe RENC as the prototype of the WEND concept has received an impetus from a number of Member States outside the European area who have recognised the potential value of their existing vector data both in safety terms for the mariner and in financial terms for them, and have indicated a desire to see their existing vector data managed and disseminated through the Northern Europe RENC; action is already in hand to effect this, not least for the benefit of the mariner.

No-one involved in the Northern Europe RENC is under any illusion of the scale of the task which faces us. The design of the framework within which the

management and distribution of the digital products can be effected is proceeding apace, together with a massive data capture programme, but the task is enormous and simply cannot be managed by any one Member State alone. Electronic charting re-enforces the need for Member States to work ever more closely together in the interests of efficiency and effectiveness which will, in turn, support the mariner and his continuing safety.

THE PEOPLE CHALLENGE

There is no doubt that public sector employees have enormous strengths and none more so than in national HOs. We have well-educated, well-trained, expert staff, many of whom spend a significant part of their careers with us. As we face the many challenges of the changing environment in which we operate, we have had to learn to be pro-active, rather than simply reactive. Certainly, we have had to learn new processes, procedures and approaches, but we must not fall into the trap of throwing away the very strengths we need. We must retain the skills and expertise which allow us to build on the past, whilst also divesting ourselves of philosophies and practices which have no place in the modern world. We must challenge the statement "that's the way we always do it around here".

What is now also different is the sheer volume and speed of the changes which are upon us. In many cases, they are revolutionary rather than evolutionary. We have not only had to acquire new skills, but we have also had to translate the professional and technical skills learned by many of us in the age of paper, pen and ink to an age of computer and satellite technology. In 1988, the doyenne of American cartography, Barbara PETCHENIK, writing in the *American Cartographer*, wrote these words: "enthralled as we are by computer-processed digital data, the human being's visual and analytical capabilities still far exceed machine capability". We forget PETCHENIK's words at our peril and they are still true today. Perhaps the greatest challenge of all is to persuade our staff that their skills and expertise are needed as never before; the computer is only as good as the data in it and the person driving it.

PRIVATE SECTOR INVOLVEMENT

I alluded earlier to the perceived threat from the private sector and there is no doubt that national HOs will see their activities progressively marginalised if they do not rapidly rise to the challenge of the digital era. But, if we perceive the private sector as a threat, then a threat it will be. There are ways in which we can sensibly co-exist with it to our mutual benefit and to the benefit of the mariner. Many national HOs already collaborate closely with private sector companies, seeking to utilise their particular strengths whilst, at the same time, concentrating their own effort on the things which HOs do best. The British Government, for example, has launched its Private Finance Initiative (PFI) which seeks to attract private investment in the activities of suitable government departments. This certainly has the potential

to overcome many of the problems encountered in identifying up-front investment monies for many of the developments already identified. Many companies possess the skills and expertise which we in national HO's recognise that we lack. The secret will be to harness those which complement our own core skills. This is certainly a new direction for national HO's, which a number have already explored and implemented.

COST RECOVERY

Many HO's are increasingly coming under pressure from their national governments to recover a greater proportion of their operating costs. This has caused them to look critically at all aspects of their operation to ensure that they operate as efficiently and effectively as they can, and that they are maximising the return on the investment of their taxpayers' monies. Whilst, so far as I am aware, no nation presently seeks or plans to recover its surveying costs through its chart sales, many HO's are seeking to recover an increasing proportion of the costs of their charting activity through their commercial activities. Whilst these cost recovery targets may be perceived as perfectly reasonable stipulations by national governments on their HO, some national HO's perceive their efforts to meet them as being frustrated by the success of larger HO's in selling charts beyond their own national waters. This perception has led increasingly to demands for all IHO Member States to acknowledge the intellectual property rights in other nation's charts and publications and to pay royalties for their use.

1992 INTERNATIONAL HYDROGRAPHIC CONFERENCE

It may well prove in the years ahead that IHO Member States will look back on the 1992 Conference as something of a watershed in the affairs of the IHO; certainly for some of us who were present at that Conference, it is already regarded as such. The most robust debate centred on Technical Resolution (TR) A3.4. This is the TR which has long under-pinned the "free" exchange of data for adoption or compilation purposes. The word "free" in the English language has two meanings: it means "freely available" (in French "disponible") and it also means "without charge" (in French "gratis"). In the 1992 debate, many Member States expressed the view that whilst their data remained freely available, it was not necessarily available without charge. Effectively, TR A3.4 constituted a waiver on copyright and that was perceived by some Member States as unfair.

BILATERAL ARRANGEMENTS

It appeared that a significant point of principle had been raised in the 1992 Conference, a principle that each nation should respect the copyright vested in other nations' charts and publications, and pay royalties if such are invoked. It, therefore, became UKHO policy to pursue a programme of bilateral arrangements with all other MS of the IHO to ensure that our paper chart and publications' inventory continued on the basis of agreement with our IHO colleagues and not simply on the basis of a TR which some regarded as unfair. We also perceived that, with the developing WEND concept, such bilateral arrangements were going to prove an essential pre-requisite of international operations in the digital era.

Together with our colleagues in the North Sea Hydrographic Commission, we established a framework document for bilateral arrangements between HOs, a document which was circulated to all Member States under the IHB Circular Letter (CL) 48/1995. Based upon that document, the UK has to date had discussions with 70% of IHO Member States and concluded agreements with over 25% of IHO Member States. Not all Member States require a formal arrangement: some have authorised the UK to continue to utilise their charts and publications without constraint and all but two of the remainder have already indicated their willingness to sign the arrangement, presently delayed only by the need for some HOs to obtain approval from higher authority and by the UK's constrained resources and our inability to staff all bilateral arrangements quite as promptly as some Member States (and the UK) would wish. It is, however, our aim to conclude bilateral arrangements with around 50% of all IHO MS by the time of the next IH Conference in 1997. Our intention will be to maintain that momentum and reach a successful conclusion with the remaining nations at the earliest opportunity thereafter.

The view has been expressed that the discussion centering on TR A3.4 at the 1992 Conference represented a quite basic shift of emphasis of IHO business. The free exchange of hydrographic information between MS was one of the fundamental tenets of the IHO, a fact which the then President, Rear Admiral Sir David HASLAM, pointed out during the debate. It could, therefore, be perceived that any move away from a genuinely unrestricted and international flow of hydrographic information could potentially undermine the very basis on which the IHO operates. Throughout all our bilateral discussions, our experience to date does not support this view. Indeed, the very act of negotiating and agreeing a bilateral arrangement appears to be serving to strengthen cooperation and collaboration between Member States as well as contributing a new dimension to the IHO. It is a dimension which may prove vital in securing the future of the IHO and it is a dimension which already translates into the digital era. Cooperation and collaboration, by their very nature, may involve compromise in order to realise a pragmatic solution to the challenges which face us. If this is true in the paper world, it is the truer in the digital world where there is little possibility of rising successfully to the challenges which face us without close co-operation of the kind required by the WEND concept.

GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

One aspect of technological development which we should not overlook is the emerging GIS market. I recently heard a colleague in one Member State remark that some 90% of their current digital chart sales were not to the navigational market, but to the GIS market. That speaks volumes for the potential value of digital charts and it is an area in which national HOs are taking an increasing interest. The primary requirement of any GIS is the underpinning geographical template to which all spatial data sets require to be referenced before their true value can be realised. We need to recognise that the digital data sets we produce for marine navigational purposes are also spatial geographical templates, and that fact opens up to us a further potential market in the GIS area.

Many national HOs have already started a useful dialogue with their national topographic mapping agency with a view to producing integrated digital geographic data sets in the coastal zone. Coastal zone management is a subject which is increasingly being addressed by national governments. Any realistic coastal zone management policy requires, as a principal management tool, an up to date, integrated, geographic data set. In the analogue world, such an integrated data set required considerable additional effort and expense. In the digital world, it is the easier to achieve and is arguably a natural spin-off from the provision of navigational data which is our primary purpose.

INTERNATIONALISM

Perhaps the one area of our planet which can be regarded as truly international is Antarctica. It is, therefore, worth considering the international hydrographic situation in Antarctica as possibly reflecting the extent to which IHO MS can, or cannot, work together for the common good.

It was also at the 1992 Conference that the Permanent Working Group on Cooperation in Antarctica (PWGA) was established in response to a request from the United Nations Antarctic Treaty Coordination Meeting (ATCM). The PWGCA has held four meetings in the past four years, including a preliminary one, and has, under the guidance of Rear Admiral Giuseppe ANGRISANO, IHB Director, as INT Chart coordinator, agreed and endorsed an INT Chart Scheme (Area M) comprising 93 charts at small, medium and large scales. It has further agreed producer nation allocation for all these charts between the 19 nations involved, many of whom are actively collaborating in the joint production of some of the charts to ensure that each chart contains the best available data. To date 2 charts have been published, a further 20 are scheduled for completion later in 1996 and 1997, and 11 more by the year 2000.

It has been my privilege to chair the PWGCA since its establishment and the one hallmark of its work which I have noted most is the spirit of cooperation

demonstrated by all the participating Member States. There are two obvious benefits. Firstly and most importantly, the international mariner will receive, in the shortest timeframe possible, charts containing the best available information to support safe navigation in the treacherous waters of Antarctica which, year on year, experience an order of magnitude increase in maritime traffic. Secondly, considerable financial benefits accrue to the participating Member State in sharing the workload and costs. In essence, benefits accrue to both users and producers, which has to be the best equation of all.

If the work of the PWGCA can in any way be regarded as a true reflection of the increasing spirit of internationalism in the IHO, then the auguries are good.

CONCLUSION

There is no doubt that the IHO and its constituent Member States HOs face a daunting range of challenges to the way in which we have traditionally operated in the past, but that is the nature of the world in which we live and operate. We all need to consider new directions and new paths. The challenge for the IHO is that we all choose the same ones and that they prove to be the right ones. The opportunities are there: it is our choice as to whether or not we grasp them and pursue them successfully into the 21st century.

ACKNOWLEDGMENT

Whilst the views expressed in this paper are the responsibility of the author alone, she readily acknowledges the input (wittingly or unwittingly) of many colleagues in the UKHO and throughout the IHO in discussion and debate, both formal and informal, with them over the past few years.