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Editorial

This edition comprises two articles and several notes of information. The first article from Bangladesh describes the operations of the Bangladesh Hydrographic Office and its Navy hydrographic surveyors in a challenging ocean environment.

The second article from Australia provides an update to the improvement initiative impacting the Australian Hydrographic Service technology, organisation and operating environment. This initiative was first described in the May 2016 IHR edition.

The International Centre for Electronic Navigation Charts (IC-ENC) has contributed a Note describing its operations and growth of an additional two offices to support its quality assurance and distribution operations.

In the General Information section, Gilles Bessero, IHO Director has submitted a brief paper on the importance of recognising the copyright issues around a database that is used to generate mapping products. The paper summarises the outcome of case law and its implications for electronic charting.

It is with much sadness to report the passing of Mr. Adam Kerr, past IHB Director and IHR Editor. This edition includes an obituary as well as a review of his recently published book. I first met Adam in 1990 when he attended an IHO technical meeting in Sydney. With my involvement in the S-57 technical standards WG during the 1990s, I was fortunate to get to know Adam quite well. It was an honour to take over the IHR Editor role from him in 2011. His enthusiasm and drive through the IHB contributed to the evolving standards and adoption of CDIS technology.

On behalf of the Editorial Board, I hope that this edition is of interest to you and may inspire you to submit a future paper on the work that you have done or are currently engaged in.

Thank you to the authors for your contributions and to my colleagues who provided peer reviews for the Articles in this edition.

Ian W. Halls
Editor
BATHYMETRIC SURVEY
IN THE COASTAL AREA OF BANGLADESH - A CHALLENGING EXPERIENCE FOR THE SURVEYOR.
By Commander Sheikh Firoz Ahmed
(BANGLADESH NAVY)

Abstract

Hydrography in the coastal waters of Bangladesh has never been an easy task for surveyors. Being situated in the deltaic region, the area is very dynamic. Siltation, shifting of channels, emergence of new islands and low tide elevations, etc. are very common phenomena. Apart from a few common deltaic conditions experienced elsewhere, there are a number of local conditions which are peculiar to this area only. The coastal water is exceptionally laden with sediments coming from upstream and therefore, turbidity is extremely high and degrades the performance of survey equipment. The Monsoon in the region causes extra rainfall and seasonal cyclones add another dimension to the complexity of the area. Salinity is not homogeneous and sea temperature through the water column varies from place to place. The professionalism, prudence and dedication of the Bangladesh Navy surveyors are key factors for successful hydrographic survey operations in the area.

Résumé

L’hydrographie dans les eaux côtières du Bangladesh n’a jamais été une tâche aisée pour les hydrographes. Située dans une région deltaïque, la zone est très dynamique. L’envasement, les chenaux mobiles, l’apparition de nouveaux îlots et hauts-fonds découvrants, etc. sont des phénomènes très courants. Hormis quelques conditions deltaïques expérimentées ailleurs, un certain nombre de conditions locales sont spécifiques à cette zone uniquement. Les eaux côtières sont exceptionnellement chargées en sédiments venant de l’amont et par conséquent, la turbidité est extrêmement élevée et nuit au bon fonctionnement des équipements hydrographiques. La mousson dans la région provoque des précipitations supplémentaires et les cyclones saisonniers ajoutent une dimension supplémentaire à la complexité de la zone. La salinité n’est pas homogène et la température de la mer dans la colonne d’eau varie d’un endroit à l’autre. Le professionnalisme, la prudence et le dévouement des hydrographes de la marine du Bangladesh sont autant de facteurs clés de la réussite des opérations de levés hydrographiques dans la zone.
La hidrografía en las aguas costeras de Bangladesh no ha sido nunca una tarea fácil para los hidrógrafos. Al estar situada en una región deltaica, la zona es muy dinámica. La sedimentación, el desplazamiento de los canales, la aparición de nuevas islas y las elevaciones de las mareas bajas etc. son fenómenos muy comunes. Aparte de algunas condiciones comunes del delta que se experimentan en otros lugares, hay una serie de condiciones locales que son peculiares de esta zona solamente. Las aguas costeras están excepcionalmente cargadas de sedimentos que vienen de aguas arriba y, por tanto, la turbidez es extremadamente elevada y degrada el funcionamiento del equipo hidrográfico. El monzón en la región es la causa de lluvias adicionales y los ciclones estacionales añaden otra dimensión a la complejidad de la zona. La salinidad no es homogénea y la temperatura del mar de la columna de agua varía de un lugar a otro. El profesionalismo, la prudencia y la dedicación de los hidrógrafos de la Marina de Bangladesh son factores clave para el éxito de las operaciones hidrográficas en la zona.
1. Introduction

The Bangladesh coast is located on the most active part of the Ganges Delta. The area is very shallow and a number of rivers and channels are situated along the coast. These rivers and channels carry huge amounts of water from upstream and flow into the Bay of Bengal throughout the year. The estuarine environment along the coast is different from other parts of the world. The water is exceptionally laden with sediment - mostly from the Himalayas. Annually, almost 2.4 billion tons (Coleman, 1968) of sediments are deposited in the Bay of Bengal. This deposition over the years has resulted in the Bay of Bengal being one of the most dynamic environments of world oceans.

The coastal area of Bangladesh has many notable physical characteristics such as the monsoon season, exceptionally high turbidity in the water, large tidal range along with strong tidal streams, tropical revolving storms, etc. The Monsoon causes heavy rainfall in the upstream from June to September each year with runoff into the Bay carrying large amounts of sediment. As the number and capacity of channels vary, there are inhomogeneous mélange of saline and fresh water along the coast. Spatial variation of salinity and temperature is prominent in the area. Various other characteristics that affect hydrographic surveying also differ from place to place.

Hydrographic surveying in the coastal waters of Bangladesh has never been an easy task for surveyors. Due to the unusual characteristics of the coast, most of the hydrographic equipment does not function to their optimum capacity. Sometimes, the degradation of performance is so prominent that the surveyors need extra time and effort to manage the survey work. Apart from the equipment performance, the prudence and professionalism of surveyors are critical factors to ensure the efficient progress of any survey work.

2. Description of the Coast

The extent of the coastal belt of Bangladesh is almost 710 km in an east-west and north-south direction (Golam Mahabub Sarwar, 2005). The coastline which runs in the north-south direction is relatively stable. However, the east-west coastline is highly dynamic. Hundreds of small islands and Low Tide Elevations (LTE) are situated along this coast. The area is very shallow and mostly inaccessible to medium and deep draft vessels. Most of the rivers which form the Ganges Delta fall into the Bay of Bengal through this area.

These rivers carry large amounts of sediment from upstream and deposit the sediment in the Bay. The result of this deposition is the rapid formation of new islands, LTE and shifting navigational channels. Two of the major sea ports of Bangladesh - Mongla and Payra are situated in this most dynamic part of the coast. These sea ports and their approaches require continuous survey to keep them accessible to sea going vessels.

Figure 1: The coastal area of Bangladesh (Google Earth).
3. Characteristics of the Coast

The coast of Bangladesh has a number of unique physical characteristics and phenomenon that makes the hydrographic surveying task highly challenging. Some of these are described below: (Figure 1 shows the main geographical features)

3.1 Tide

Accurate measurement of tidal levels is critical for all hydrographic survey tasks. Tides along the Bangladesh coast are mainly semi-diurnal with small diurnal inequality. Tidal range can reach more than 7m near the Sandwip channel, whereas, it is only 2-3 m on the western side near Hiran Point (BIWTA, 2015). The tide is significantly affected by local conditions such as the geomorphology, configuration and orientation of the coast, upstream flow of rivers, number of openings along the coast etc. As the coastal area is gently shelving and tidal range is high, tide gauges are needed to measure the tide. The offshore tidal range is larger than the onshore range in the central part of the coast which is a deviation from the normal phenomenon. The incoming tidal waters from the south are obstructed by the land features during flooding and the sea level rises very quickly. Time of rise and fall of tides also differs considerably in this region. For any hydrographic survey, much time is dedicated to collecting and analysing tidal measurements to ensure reliable tidal data.

3.2 Tidal Streams

Tidal streams in the coastal area of Bangladesh are very strong. In some areas it can reach up to 5.5 knots (BN, 2015), which makes the surveyor’s task very difficult. Strong tidal streams affect the speed of advance of survey motor boats and it is extremely difficult for the boat coxswain to steer the boat on the planned lines. The strong tidal streams also adversely affect the deployment and recovery of various equipment like Side Scan Sonar (SSS), Current Profiler, auto Tide Gauge, etc. Channels having multiple openings to the sea have peculiar tidal stream characteristics. In many channels, the direction of the tidal stream can be opposite within the same channel during the same tidal conditions.

3.3 Salinity

Salinity along the coast varies with strong gradients. There is fresh water influx into the sea from upstream. This mixing of fresh water varies with the number of channels present in the area as well as with the season of the year. During the monsoon, fresh water influx is considerably more than the dry season. Saline water of the sea is heavier than that of fresh water and hence it remains closer to the seabed. Fresh water coming from upstream remains above the saline water. This results in an inhomogeneous mixing of water layers around the coast. The surface salinity in the open part of the Bay oscillates from 32 to 34.5 ppt and in the coastal area it varies from 10 to 25 ppt. At the river mouths, the salinity decreases to 5 ppt or even less. Along the coast, salinity increases up to 15 to 20 ppt in winter (Firoz, 2007). If the surveyor is not careful, the error budget will increase and this creates difficulties in meeting the survey standard specified in S-44 (IHO, 2008) in terms of depth uncertainty.

3.4 Water Column Temperature

Temperature profile of the water column in the coastal area of Bangladesh is not homogeneous. Due to the influx of fresh water and the number of channels, the spatial variation of temperature is quite prominent and their discharge rate varies from place to place. This creates an inhomogeneous mixing of fresh water in the coastal area. The surveyor has to be very careful to ensure proper calibration of the sensors.

3.5 Turbidity

The coastal water of Bangladesh is heavily laden with suspended sediment. The cloudiness of this water especially during the monsoon is so high that it is impossible to see through it even for few centimeters. This extremely high turbidity degrades equipment performance. In many cases, the attenuation is so high, that sound energy is mostly absorbed and the equipment cannot perform as designed.

3.6 Monsoon Season

The Bay of Bengal is much affected by the monsoon with heavy rain fall experienced
throughout the region. The runoff of water mostly drains into the Bay of Bengal through various river systems of Bangladesh. During the monsoon, turbidity around the Bangladesh coast increases and salinity decreases remarkably. The sea remains quite rough during monsoon which increases the risk for smaller vessels operating in the area. Survey vessels cannot operate during the monsoon season due to safety concerns of the survey motor boats and crew fatigue. This factor shortens survey operations time in the Bay of Bengal. The ideal survey season around the Bangladesh coast is during post-monsoon from November to March only.

3.7 Shallow and Indented Coast

The coastal area of Bangladesh is very shallow and indented in nature. Many of the inshore areas are inaccessible by survey vessel due to the presence of low tide elevation areas and shallow patches. Hence, the main survey vessel has to remain at anchor and send her boats for survey work to distant places. Variable and unpredictable sea conditions often make it very difficult to manage those boats and the progress of work is hampered. This also places the survey boats and teams at risk when returning to the mother ships.

3.8 Shifting Channels

Out of the three major sea ports of Bangladesh, Mongla and Payra ports are situated well inside the coast. So, any vessel coming to these ports need to traverse a long distance through inland waters. These navigational channels are highly dynamic and change almost every year. Surveyors remain very active throughout the year to keep these channels safe for navigators.

3.9 Cyclone

During the pre and post monsoon period, tropical revolving storms (cyclones) are common in the Bay of Bengal. Every year a number of these cyclones hit the coast of Bangladesh often resulting in changes to the bathymetry of the coastal area with new islands and low tide elevation areas. South Talpatti was one such island that emerged after the cyclone of 1970 only to disappear due to the cyclone of 1985 (ITLOS, 2013). This island located at the mouth of the Hariabhanga River near the India-Bangladesh border area, had an area of 2,500 m² in 1974 as per the satellite data released by USA. In the coastal area of Bangladesh, there are many such islands and low tide elevation areas which are created due to the devastating effect of cyclones that have occurred in the past. To identify these changes, frequent updating of the nautical charts is essential.

3.10 Presence of Fishing Fleets

The coastal area of Bangladesh is very rich for some species of fish. The vast majority of the coastal population lives on fishing. Apart from the licensed fishing fleet there are many conventional/traditional fishing activities all around the coast. Fishermen lay bamboo, different types of net and other gear in the sea which cause significant problems for navigation in the area. This fishing gear can also hamper survey operations in the area as many of the portable fixed and towed surveying instruments cannot be used for safety concerns.

3.11 Inaccessibility to the Coastal Area for Coastlining Activities

The coastal area of Bangladesh especially on the western side is mostly inaccessible. Shoreline and landform also change very rapidly in these places. The low gradient of the coast makes the intertidal zone quite large. In some places, there are marine growths as well as mangroves. It is almost impossible to walk along the coast. As a result, coastlining during hydrographic survey is a daunting task.

4. Overall Effect on Hydrographic Survey Operations

The characteristics of the Bangladesh coast described above significantly affects hydrographic surveying operations. Hydrographic sensors do not function as designed, the progress of survey work is affected by the inferior quality of data acquired using various equipment. Frequent re-survey/check surveys need to be undertaken given the changes that occur within short spans of time.
4.1 Equipment Performance

Various physical and environmental factors previously described affect the performance of hydrographic equipment while deployed in the coastal area of Bangladesh. The sensors mostly affected are:

4.1.1 Single Beam Echo Sounder (SBES)

SBES is widely used for bathymetric data collection during hydrographic surveys. SBES transducers can either be fixed on the ship’s hull or have a portable installation on boats/survey crafts. In the coastal area of Bangladesh, a portable transducer installation is widely used on survey motor boats as the area is generally shallow. Performance of these echo sounders to provide depth information depends on many factors such as turbidity, tidal stream, water turbulence, bottom configuration, prevailing environmental condition, etc. Surveyors need to be cautious to understand the situation and to calibrate the echo sounder.

Sometimes, it is difficult to determine the actual bottom due to the presence of a column of soft mud near the sea bed. A dual frequency echo sounder helps in this situation to determine the actual bottom. Again, high turbidity in the water degrades the quality of data. During ebb tide, turbidity is higher as suspended sediments come from upstream. During the 3rd/4th hour of ebb tide when the tidal stream is stronger, the performance of the echo sounder is adversely affected. Sometimes the surveyor is forced to stop the data acquisition and wait for a more favourable condition.

**Figure 2** shows two echograms taken from a SBES profile near Sandwip Island where turbidity was very high and the tidal stream was very strong. The first echogram indicates the presence of noise which needs to be cleaned during processing. The second echogram indicates that bottom was lost and the echo sounder was unable to provide a depth reading. These are common phenomena experienced.

**Figure 3** shows two echograms indicating the effects of turbidity. The first echogram was taken in Meghna Estuary where the sea bottom was composed of soft mud. The image of the sea bottom is almost 2m wide. So, it is very difficult to find the actual bottom. In this echogram there is considerable noise due to the presence of high turbidity. The second echogram was taken in the Cox’s Bazar area where the water is clean. The clean image of the
echogram also confirms that there was no turbidity in the area.

4.1.2 Multi-Beam Echo Sounder (MBES)

Today, MBES technology is extensively used in hydrographic survey operations. MBES gives detailed information of the seabed and many hydrographic offices prefer to use this equipment at least for some important places of their waters such as port and harbour areas, their approaches, etc. Performance of this equipment in the coastal area of Bangladesh is highly affected by the local conditions. Due to the inhomogeneous mixing of fresh and salt waters, the sound velocity profile is unusual which impacts the calibration and performance of this equipment significantly. Again, due to turbidity, optimum swath coverage is not always attainable as the beams are concentrated towards the centre. The quality of collected data is often poor and requires extensive cleaning during processing. Like SBES, MBES also provides improved performance during flooding when turbidity is comparatively less in the area.

Figure 4 shows MBES data collected from Chittagong Port anchorage area at a depth of 9m during ebb tide in the month of April when the upstream discharge was quite high. Due to the presence of high turbidity and an unusual salinity profile, the raw data has significant noise. Even after extensive cleaning, the image of the wreck is not smooth. In the plan view, it is evident that beams are also concentrated towards the centre and swath coverage is 12m only. As per the equipment specification, the
optimum swath coverage at 9m depth should be 90m.

4.1.3 Side Scan Sonar (SSS)

To comply with S-44 special order and order 1 (a) survey (IHO, 2008), full sea floor search is required during bathymetric survey. SSS plays a very important role for underwater search and detection of wrecks, obstructions etc. The performance of this equipment is also dependent on the environmental conditions. The SSS image is often not clear enough if the turbidity is very high. The operating range of the equipment also reduces significantly in such cases. Moreover, due to the presence of fishing gear all around the coastal area, it is not safe to operate the equipment in shallow waters. To overcome these limitations, the low upstream discharge period is selected for SSS operations and the area is cleared before lowering a towfish in the water.

Figure 6 shows SSS images taken at the Chittagong outer anchorage on a known wreck where turbidity is exceptionally high. In ideal conditions, the definition of an image collected using a higher frequency would be better. In the third image, which is collected using a lower frequency, the wreck is more visible than in the other two. Transmitted energy is considerably absorbed by turbid water in the higher frequency. For that reason, even the first image, whilst taken from a closer distance, is not clear.
enough. Sometimes, the performance of high frequency equipment degrades so much that the feature is not visible on the image at all.

4.1.4 Current Profiler

For most hydrographic survey tasks, a current profiler is deployed for measuring tidal streams to depict on nautical charts. The quality of the collected data is influenced by the local conditions and noise to signal ratio is often higher than the normal level. It is difficult to deploy the equipment as the tidal stream is exceptionally strong in some places of the coast. Sometimes the equipment is snagged by fishing operations and lost, hence extra precaution is always needed while deploying this equipment.

Figure 7 is a profile taken using a Sontek Current Profiler (500 KHz) near the coast of Bangladesh. In this image, the current velocity and Signal to Noise ratio (SNR) is visible. Maximum profiling range of this equipment is 120m in ideal conditions. Data less than 3dB cannot be used as it determines the maximum profiling range of the equipment. It can be seen that SNR is close to 0 dB beyond 10m-12m depth. Again, during slack water, the cut off line for 3dB extends beyond due to the presence of high turbidity in the water columns.

4.2. Re-survey/Check Survey

As the area is very dynamic, frequent check/re-survey is required along the coastal area of Bangladesh. The area is dangerous with high risk of grounding if mariners do not use the latest charts available from the Bangladesh Hydrographic Office. Due to the physical conditions, even the main shipping channels shift within a very short time span (see Figure 8). The figure is an extract of INT 7426 showing the approaches to Mongla Port. A marked change in the bathymetry is visible in the two images. These changes in the channel took place within a time span of 3-4 years. A number of vessel groundings were reported in the

![Figure 7: Current profile data](image1)

![Figure 8: The extract of INT 7426 shows the approaches to Mongla Port.](image2)
This makes it challenging for the national hydrographic office to manage the area with limited resources. Moreover, time available for survey operations is also limited due to the monsoon and other local factors mentioned before. The Bangladesh Hydrographic Office always remains busy to plan the survey activities of the area in the most effective way to keep it safe for mariners.

4.3. Unsuitability of Modern Surveying Techniques

Undertaking hydrographic surveys with traditional survey technology and methods is a costly activity. Surveyors remain in the survey ground day after day with their vessels and work day and night to process the data for producing nautical charts. Presently, there are also modern techniques like LIDAR and Satellite Derived Bathymetry. These techniques have the inherent advantages of collecting data with less cost and time. However, these techniques are not suitable for the Bangladesh coast due to the turbid water heavily loaded with sediment.

5. Approach to the Problems

Hydrographic survey operations are not easy to perform in the coastal area of Bangladesh.

Figure 9 shows the area representing the main shipping route for Chittagong port on two products – BA 859 dated 2002 and BN 40001 dated 2009. On 28 March 2010, MV St Kiril grounded in position 21°35.4' N, 091°44.8' E where BA 859 chart shows a depth of 14m. However, bathymetry in that area changed considerably over the period and the recent edition chart published by BN indicates lesser depth in the same position. The vessel grounded for not following the most updated national BN chart available for the area.
However, as a signatory of the SOLAS convention, Bangladesh is committed to providing updated hydrographic information to mariners as per the IHO’s S-44 standards (IHO, 2008). The following aspects are always considered both by the national hydrographic office and the surveyors whilst surveying in this dynamic environment:

- To ensure quality of the collected bathymetric data, extra effort is taken when measuring the sound velocity profile, tide and tidal streams in the area. Sound velocity profiles are collected at short distances to minimize errors.

- Frequent check survey/re-survey is undertaken to identify seafloor changes so that the mariners have confidence when navigating in the area.

- The whole year is not suitable for survey operations due to various factors that prevail in the area. To overcome this issue, increased numbers of survey platforms are being used during the suitable times of the year. BN requires the use of five survey ships/crafts to cover a small area of its jurisdiction.

Most of the equipment does not function to their optimum capacity in the area. To overcome this limitation, the highest quality equipment is used. Best results are achieved by combining the best quality equipment, sound survey methods and the dedication, commitment and experience of BN surveyors.

BN puts considerable resources into training activities. Much of the year is dedicated to training which ultimately improves the competence and confidence of the surveyors to ensure high quality survey results can be achieved for this dynamic environment.

### 6. Conclusions

Being situated in a deltaic region, the coastal area of Bangladesh is very dynamic. Siltation, shifting channels, emergence of new islands and low tide elevations, etc. are common phenomenon in the area. In addition to common deltaic conditions, there are many local conditions which are peculiar to this area. The coastal water is exceptionally laden with sediments coming from upstream and therefore, turbidity is extremely high. Monsoon in the region causes extra rain fall which makes the water characteristics for surveying more complex. The seasonal cyclone adds another dimension to the complexity of the area. Salinity in the area is not homogeneous and the temperature profile through the water column varies from place to place. It is very difficult to quantify the changes of these two parameters in the coastal area of Bangladesh. High turbidity degrades the performance of survey equipment. Even the most sophisticated state-of-the-art hydrographic equipment does not function as well as expected. Measurement of tidal level heights and tidal streams is also challenging. The deployment and recovery of survey equipment such as current profilers, automatic tide gauges, side scan sonar, etc. is difficult and the safety of equipment is a major concern for the surveyors. All these factors increase the difficulty to the surveyors while conducting hydrographic surveys in the area.

As a signatory to the SOLAS convention, Bangladesh is committed to provide up to date information to mariners. Frequent re-survey/check survey are conducted to delineate the changes. Extra efforts are provided for measuring sound velocity and temperature profile while conducting hydrographic survey. Additional resources are used for a comparatively small area. Extensive training activities are conducted so that the surveyors can maintain their competencies and perform their duties in a difficult environment to ensure survey quality requirements are met. Above all, the prudence, professionalism and dedication of the surveyors are one of the key factors for the successful hydrographic management of the area.

### 7. References


8. The Author Biography

Commander Sheikh Firoz Ahmed, (H1), psc, BN joined the Bangladesh Navy on 01 July 1992. He received the gold medal for outstanding performance during naval officers basic training. He completed his “Cat. B” hydrographic course from ‘Ecole des Hydrographes’, EPSHOM, France. He also completed his Cat A Hydrographic course from the National Institute of Hydrography, India. He obtained his Masters in ‘Hydrographic Surveying’ from Goa University, India with distinction. He is a graduate of Defence Services Command & Staff College, Mirpur, Dhaka.

Cdr Firoz commanded a number of BN Hydrographic ships including BNS DARSHAK, BNS TALLASHI, BNS AGRADOOT, BNS SHAIBAL and BNS ANUSHANDHAN. During his tenure on board BNS TALLASHI and BNS AGRADOOT, he conducted bathymetric surveys in the western area of the Bangladesh coast near the Sundarban mangrove forest. As the commanding officer of BNS SHAIBAL and ANUSHANDHAN, he conducted a number of shallow water hydrographic surveys in the central and east coast of Bangladesh. He was involved in the survey of the newly built Payra port approaches which is a very dynamic area of Bangladesh coast. Cdr Firoz also served at the Naval Headquarters as the Deputy Director of Hydrography. There he was involved in the planning of hydrographic activities as well as the management of BN hydrographic resources. (dhdro@navy.mil.bd)
A NEXT GENERATION SYSTEMS ENVIRONMENT FOR THE AUSTRALIAN HYDROGRAPHIC SERVICE (AHS) - AN UPDATE ON PROGRESS.

By Matt Jones and Ian Halls
(FOR THE AUSTRALIAN HYDROGRAPHIC SERVICE)

Abstract

In the early 2000s, the Australian Hydrographic Service (AHS) had a Digital Hydrographic Data Base (DHDB) developed and implemented to enable the management of hydrographic data, the generation of multiple hydrographic products and distribution capabilities for these products. In 2011, an evolutionary sustainment initiative commenced to re-invigorate the DHDB capability (and be re-named) to a contemporary capability. This article provides an update to the status of this sustainment initiative.

Résumé

Au début des années 2000, le Service hydrographique australien (AHS) a développé et implémenté une base de données hydrographiques numériques (DHDB) afin de permettre la gestion des données hydrographiques, la production de produits hydrographiques multiples et des capacités de distribution pour ces produits. En 2011, une initiative de soutien évolutive a commencé pour mettre à niveau la capacité de la DHDB (sous une nouvelle dénomination). Cet article fait le point sur l’avancement de cette initiative de soutien.

Resumen

A principios de los años 2000, el Servicio Hidrográfico Australiano (SHA) había desarrollado e implementado una Base de Datos Hidrográficos Digitales (DHDB) para permitir la gestión de los datos hidrográficos, la generación de múltiples productos hidrográficos y la capacidad para distribuir estos productos. En el 2011, una iniciativa de autonomía evolutiva empezó a reforzar la capacidad de la DHDB (y a darle un nuevo nombre) hacia una capacidad contemporánea. Este artículo proporciona una actualización del estado de esta iniciativa de autonomía.
1. Background

The background to this sustainment initiative is described in Halls (2015). Several of the sustainment activities have been completed and two major system replacements are scheduled early in 2017. The program remains generally on track and is scheduled for completion in 2018. This paper describes the sustainment tasks that have either been completed or will be implemented within the next 4 months.

2. Bathymetric Information Management

The original DHDB implementation used CARIS GIS to manage the set of validated bathymetry point data. The bathymetry model was also tightly coupled to a tidal polygon model. Both data types became more difficult to maintain due to increased data volumes and data type from modern bathymetry collection sensors and the limitations of the current technology. The AHS evaluated CARIS Bathymetry Database (BDB) and, for the past 18 months, has been working through the numerous requirements and data migration activities to not only ensure a successful implementation, but also to retain the maximum content of current bathymetric data.

CARIS BDB will be implemented in February 2017. The implementation phase addressed the following:

- Migration of over 2 billion sounding point features into CARIS BDB from the CARIS GIS Most Detailed Data Base (MDDB) structure;
- Each sounding being migrated needed to be correlated with associated data from a survey data quality database (ZOC). This will incorporate the data quality metadata fields in the sounding record;
- Investigate and rectify any rogue MDDB data;
- Undertake a number of MDDB vs BDB sounding comparison checks;

![Proposed Conceptual Workflow](image)

*Figure 1: Bathymetric information process workflow*
• Enable a new variable grid tidal surface within the business process. The gridded tidal model is generated and maintained by the Tides Information System (TIS);
• Determine new data deconfliction procedures to build and maintain the validated bathymetric surface;
• Determine new business processes for the cartographers to maximise the benefits of CARIS BDB processing tools to improve charting tasks;
• Perform parallel operations to phase-in the BDB capability within a period that is as short as possible to ensure a smooth handover of data operations; and
• Once CARIS BDB is implemented and operational, commence a phased decommissioning of related DHDB system software and tools.

The proposed conceptual workflow for bathymetry using CARIS BDB is shown in Figure 1.

The implementation of CARIS BDB replaces a core component of the old DHDB technology and will be a major milestone achievement. It will provide enhanced capability to support traditional national charting roles as well as new capabilities to support national and military charting and support tasks that require high resolution bathymetry (e.g. high resolution AU6 ENCs, littoral operations, tsunami modelling, coastal zone management, etc).

3. Wrecks Management

The AHS manages about 10,000 wrecks within the Australian Area of Charting Responsibility. Of these, approximately 1,300 are shown on charting products. To date, the wrecks data has been managed in a non-geospatial MS ACCESS database. The initiative has undertaken a task to develop and implement a Web-based Wrecks management system on the new enterprise ArcGIS environment (see Figure 2). The new system has just been accepted into operation.

Figure 2: Enterprise ArcGIS interface for the Wrecks Database
To assist with managing the wrecks shown on national charting products, ArcGIS is used to manage all of the “validated” wrecks (10,000) and will export the “charted wrecks” (1,300) to a CARIS HPD source usage where the representations with the product usages will be established and managed. This will ensure changes to national charting products are triggered from changes to source. The CARIS HPD source data and the ArcGIS validated information are synchronised through a software routine that checks for any differences between features in the two systems.

The ArcGIS database will also export an Additional Military Layers (AML) Large Bottom Object (LBO) product for use in military applications. The LBO product will include a much larger number of wrecks features than is currently shown on national chart products.

4. Maritime Boundaries Information Management

The AHS manages a range of maritime boundaries and regulated area features for use in national and military products. The agency responsible for Australia’s jurisdictional maritime boundaries is Geosciences Australia (GA). The AHS includes GA data in the national ENC and paper charts. For military purposes beyond the national charting area, the AHS uses published information and/or calculates the outer limits using the CARIS Limits and Boundaries software tools. Other regulated areas, military areas, limits, etc. are managed and are either included in national ENCs or exported as an Additional Military Layers (AML) product.

The section responsible for managing these themes has traditionally used two different database schemas and systems to manage the data. Under the improvement initiative, both schemas will be merged into a single schema using S-121 constructs where possible. At this time, the single schema has been created. Data from both current databases have been migrated and the system is being tested. Implementation is due to be completed in November 2016.

5. Tides Information System (TIS)

Development of a system that would streamline the production process and output a digital version of the Australian National Tide Tables (ANTT) commenced in the mid-2000s. Due to the ad-hoc funding arrangement, the system was developed in a fragmented manner with no guarantee of a next stage. Under the sustainment initiative, the TIS development continues in a more structured approach. The TIS stores the tidal levels for all tidal stations in the Australian region (see Figure 3). From this data, the ANTT can be published from the database in PDF as an authorised publication.

![Figure 3: Tidal Stations managed in the DHDB](image)
The tidal levels were also stored in the DHDB Most Detailed Data Base (MDDB) as a set of polygons to provide a maintained polygonal surface for tidal datum adjustment of sounding data for use in charts. With the introduction of CARIS BDB which requires a gridded tidal surface instead, the TIS incorporated a link to ESRI analysis tools to generate and maintain a gridded tidal surface. The grid resolution needs to be variable to support high resolution grid models in key areas such as ports (usually supplied by the port authorities) (see Figure 4) and choke points as well as lower resolution grids for deeper water offshore areas.

A number of enhancements are currently being developed for the TIS and will be implemented on a prioritised basis:

- Improved output for the ANTT and other product formats (e.g. tidal level panels);
- Inclusion of tidal stream data and tools to analyse and validate;
- Manage surveyed vertical datum levels and control marks collected by AHS surveyors;
- Analysis of tide gauge data;
- Spatial interface;
- New software capability to replace the current AusTides application; and
- Future capability to support various S-100 tides related product specifications.

6. Management of Chart Notes

It is easy to overlook the importance of managing cautionary and explanatory chart notes that are used on paper charts and ENCs. When compiling paper charts, the notes were often managed on a product basis. The introduction of ENCs and the need to identify a chart note using the TXTDSC attribute meant that chart notes needed to be managed more effectively.

In the past, the AHS had in excess of 730 chart notes for approximately 470 charts. The AHS adopted a chart note identification scheme and commenced a lengthy process of evaluating each chart note and where possible consolidating like-notes into a single note content. The outcome of the consolidation was a reduction
in the number of chart notes to around 310. The following naming scheme was adopted to enable each note to have a unique filename and be versioned to populate the ENC TXTDSC attributes:

AUxxx_yy (e.g. AU245_02)

where:

AU – AHO identifier as per S-62 (IHO, 2016)
xxx – a unique number
yy – a sequential version number

Prior to the sustainment initiative, chart notes were managed in a MS ACCESS database. To improve the management of the notes for all paper chart, ENC and AML products, a sustainment task was undertaken and implemented in 2016.

The new database manages a note’s content, version (current and previous), references to linked paper chart, ENC and unclassified AML products that include the note, as well as references to the AHS corporate file management system, narratives, etc. (refer to Figure 5). The notes can be exported in a number of formats to meet ENC requirements (ascii text), CARIS Paper Chart Composer/Editor formats (.rtf using the note RGB colours), PDF and HTML. The notes can be exported as a single note or can be embedded together in a parent/child relationship – often used in AML products.

Figure 5: Chart Notes system key components.

The Chart Notes system also has a routine to analyse CARIS HPD source and product usages to identify any chart notes attached to features that may not be listing the current version in the TXTDSC attribute (see Figure 6). It identifies potential issues and allows the user to decide on the actions they want to take and then apply those actions in a single operation.

Figure 6: CARIS HPD interface with Chart Notes system to analyse the validity of the applicable chart notes.
7. Chart Product Management System (CPMS)

The adoption of CARIS HPD in 2013 together with the development of new tools and systems to manage metadata has enabled:

- More consistent compilation practices, system interfaces, data encoding, QC and HPD process workflow;
- Improved ENC product quality – the implementation of CARIS HPD has improved data encoding processes and product management. This has resulted in reducing data encoding errors and improved success rates through IC-ENC validation reports;
- Simplified the current complex QMS documents;
- Reduced overheads in training and software support.

In February 2017, a new Chart Product Management System (CPMS) will be implemented and addresses the follow activities:

- Data migration of paper chart metadata (470 charts) from the existing DHDB Product Profile database to CARIS HPD Product Management Centre (Paper) database fields and Paper Chart Editor;
- Data migration of high resolution one-bit paper chart reprojmat TIFF image files;
- Spatial capture, georeferencing and alignment of paper chart (one-bit raster) reprojmat files;
- Software updates to associated applications that interface to the current chart management systems (notice to mariner tool, web tools, etc.) (see Figure 7);
- Redefining the AusGeotiff product format.

The implementation of CPMS replaces a core component of DHDB technology and will be a major milestone achievement for the overall project.

![Figure 7: Chart Product Management System boundary and external interfaces](image_url)
The interface comprises several components with the specific information accessible through the set of tabs (e.g. Details, Files, References, S-11 & INT Chart, Panels, etc.). The window in the top RH corner will enable the user to view images of the paper chart (single repromat, Geotiff), ENC, web service, etc.

8. Enterprise ArcGIS Implementation

Hydro METOC Information Environment (HMIE) is evolving into a distributed information management environment in terms of systems, technology and processes. Under the previous DHDB system and work practices, a number of bespoke databases were created and maintained where DHDB processes were found wanting. To bring together these databases and to ensure that the AHS had a scalable enterprise geospatial environment, ESRI ArcGIS was implemented in 2016 as an enterprise capability. Key components (see Figure 9) to the architecture were:

- Scalable at each of the web, GIS application and data tiers to support growth in data volumes, processing and presentation;
- Fault tolerant with redundant components where feasible;
- Compatible with service oriented design principles to enable support for evolving business needs and integration with other applications;
- Able to support the production and publication of web services internally to the AHS and externally to the public web; and
- Capable of participating in overarching high-level business processes being implemented via the current (and future) workflow management tools.

Figure 8: Main CPMS interface
9. Workflow

The current DHDB workflow has not been reviewed or re-aligned to current business processes. To address workflow, the AHS engaged a consultant to review its "as is" state, develop a set of requirements and identify a "to be" state and project plan. A new workflow management system (WfMS) will be developed and implemented over the next 6 months.

The functionality of the WfMS is decomposed as follows (refer to Figure 10):

- **Authoring Tools**: The capability that allows the development and maintenance of Workflow Models;
- **Workflow Library**: A persistent store of Activities and Conditionals that enable the rapid development of Workflow Models through reuse and refinement;
- **Workflow Engine**: The entity responsible for the orchestration and execution of Workflow Models. This entity manages the flow, events and actions of a Workflow Task (being the individual instantiation of a Workflow Model). The Workflow Engine also maintains the state of Tasks (such that it can report at any time on the status of any given Task) and keeps an audit trail to support forensic activities;
- **Workflow Queues**: Queues are used by individuals and functions to manage and track their current workflow responsibilities. The Queues are maintained as part of the Workflow Engine state mentioned above, and collectively represent the current work underway within the WfMS at any given time;
- **Reporting Tools**: The business intelligence toolset for querying state and statistics of Tasks. Note that this capability may not be best served within the WfMS and may benefit from a solution that has a wider remit than just Workflow (e.g. potentially a Business Intelligence suite may regard the state store within the WfMS as just one of many sources it can derive a report on).
10. DHDB – what's in a name?

The original project that commenced in the mid 1990s was titled the SEA1430 Phase 1 - Digital Hydrographic Data Base (DHDB). Unfortunately to the uninitiated, this was often interpreted as a relatively simple database solution – what was so hard about developing that? In reality, the DHDB was a complex, tightly bound system. Further, the DHDB was initially delivered as a standalone (air-gapped) system which made it difficult to deliver hydrographic products and information services to customers.

In sustaining the capability within a contemporary context, the capability needed to be renamed to remove the simple and usually mis-understood perception of the DHDB as a standalone system or “database”. The name that was decided was the HMIE.

A rolling program of ICT infrastructure improvements has resulted in a connected (HMIE) system which makes it easier to share information and products with external customers. For the purpose of managing complexity, and in order to assist in maintaining security, HMIE was broken down into a number of separate zones. The HMIE zones are described in Table 1 and the interfaces between the

![Workflow Concept Model](image)

**Figure 10:** Workflow Concept Model

<table>
<thead>
<tr>
<th>Zone 1</th>
<th>Hydro METOC Information Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comprises the DHDB Mission System alongside the AHS managed systems and resides at the AHO in Wollongong.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone 2</th>
<th>BAE Systems Support Link</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uses a standard DHDB development image and is logically part of the DHDB Mission System. Resides at BAE Systems office in Adelaide, South Australia.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone 3</th>
<th>Hosted Service (cloud)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comprises a certified SaaS mail service and secure solution for transferring files. It resides in a contractor’s de-militarised zone (DMZ) in Canberra and will grow to host AHS Web Services (AHS online)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone 4</th>
<th>Gateway</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Securely connects the other zones together and to the Internet.</td>
</tr>
</tbody>
</table>
While a significant effort has been invested into securely connecting HMIE, there is a need to continually improve HMIE ICT infrastructure in order to enable future business agility. The current activities include:

- Incorporation of email services into Fed Link, which will enable email to be securely exchanged with Australian Government Agencies;
- Migration of AHS Web site (hydro.gov.au) and supporting servers to Zone 3. This activity will allow work to begin on the automated publication and dissemination of information; and
- Implementation of remote access (similar to CITRIX) to HMIE Zone 1 is being considered, with planning to commence towards the end of 2016.

11. Organisation Impact

Organisations are social entities that have a culture, a formal and informal structure, goals, activities and resources.

On the whole, the AHS organisation structure has not experienced much change since the original implementation of the DHDB in early 2000s. Through implementation activities the AHS is:

- Moving towards a “information-centric” rather than “product-centric” organisation;
- Implementing changes to the physical organisation structure supporting such activities; and
- Broadening aspects of training to extend staff core competencies.

Figure 11: HMIE Zone interfaces
The change to the organisation structure is a challenge, particularly in a government sector employment framework. Due to the Wollongong location, staff turnover is quite low and this imposes limited flexibility and opportunities for staff when it comes to implementing organisation structure and process changes.

12. The next 18-24 months

The sustainment of HMIE still has a number of key systems changes to be worked through. Over the next 18-24 months, the sustainment activities will focus on:

- Survey and Chart Planning capability;
- Hydrographic Product Sales and Distribution System (HPSDS);
- Integration of the Source Information Receipt Framework (SIRF) into the enterprise ArcGIS system;
- Source Data and records management system;
- Business analytics;
- Satellite Derived Bathymetry;
- Management of oceanographic and meteorological information;
- Online services and the exposure of information via Web Service technology;
- Implementation of a new test and development capability - potentially cloud based.

13. Conclusions

The evolutionary sustainment of the DHDB (now HMIE) is a lengthy programme that commenced in 2011 and is now planned for completion in 2018. Adopting an Enterprise Architecture (EA) approach to the sustainment activity is providing considerable benefits for the AHS in aligning its business requirements, strategy and goals and systems.

The evolutionary sustainment of the HMIE is already positively impacting AHS operations. In reality, the sustainment never ends, but at least this overall activity will provide the AHS with a contemporary solution that meets the legislative requirements of Defence and its customers.

14. Acknowledgements

The authors would like to acknowledge the support of the Hydrographer of Australia and the AHS Directors and all staff for their support of the sustainment initiative. The diligence of the Capability Manager and the expertise of the BAE Systems project team supported by the software vendors are much appreciated. This activity is a collaborative effort.

15. References


16. The Authors’ biographies

Ian HALLS commenced work at the Australian Hydrographic Office (AHO) in 1979 as a trainee nautical cartographer and has been involved in the development of hydrographic information management and chart production systems since the mid-1980s. This period included serving several years on IHO ECDIS/S-57 technical committees. He is a past Director of HSA Systems Pty Ltd and resumed working at the AHO in 2009 after 15 years in private industry undertaking systems engineering, hydrographic surveying and charting activities. He is currently managing a team that is responsible for maritime boundaries, large and small seabed objects, navigation aids, place names, and littoral information depicted on national and military hydrographic data, products and services within the AHO. Ian is also working with a small dedicated team to sustain the Digital Hydrographic Database (DHDB now HMIE) solution developed in early 2000. This involves software, hardware and ICT refresh of the various source data receipt, validated information, production, distribution, and workflow sub-systems using an enterprise architecture approach. (ian.halls1@defence.gov.au)
Matt JONES commenced work at the Australian Hydrographic Office (AHO) in 2000 as an ICT support officer and has been involved in the design, development and maintenance of hydrographic and defence information systems since. This period has included several years as a systems administrator, systems developer, security manager and as the manager of the ICT section. He is a Professional Member of the Australian Computer Society (ACS). He is currently working as a business analyst and is responsible for the cloud environment which is utilised to securely share hydrographic information via the internet. Matt is also working with a small dedicated team to sustain the Digital Hydrographic Database (DHDB now HMIE) solution developed in early 2000. This involves software, hardware and ICT refresh of the various source data receipt, validated information, production, distribution, and workflow sub-systems using an enterprise architecture approach.

(matt.jones1@defence.gov.au)
INTERNATIONAL CENTRE FOR ELECTRONIC NAVIGATIONAL CHARTS (IC-ENC): GLOBAL COLLABORATION, REGIONAL FOCUS

Dr. Mathias Jonas
(VICE PRESIDENT OF FEDERAL MARITIME AND HYDROGRAPHIC AGENCY OF GERMANY, CHAIR OF IC-ENC STEERING COMMITTEE / SEPT. 2014 - SEPT. 2016)

and Mr James Harper
(GENERAL MANAGER OF IC-ENC)

EDITOR’S NOTE: This article was originally written for, and published in, Hydro International (www.hydro-international.com), March 2016. Updated October 2016.

The International Centre for Electronic Navigational Charts - IC-ENC, has an important role in electronic navigation. It supports an ever increasing number of ENC Producers with quality assurance and availability services. During 2016, IC-ENC has launched two more regional offices: one in the United States for North America and another one in Brazil for Latin America, both hosted by the respective national hydrographic offices.

In late 2015, digital navigation reached a significant milestone: the majority of all vessels on international trade routes now sail with ECDIS. This event is a milestone in a long journey. At the end of the 1990s, the first ECDIS achieved legal type approval, generating real euphoria amongst those involved with this breakthrough. But the onboard device is just one side of the coin... the sense of euphoria soon turned to disillusionment when it became clear the required folio of digital sea charts did not exist!

1. Move to Digital Workflows

To achieve the folio that is needed, national Hydrographic Offices have had to move from the traditional methods of nautical cartography into new digital workflows, processes and products. Although this transition is still continuing, today nearly 100% of the main shipping routes, 91% of all coastal areas and 800 major ports of the world are covered by digital cartographic products named Electronic Navigational Charts (ENCs).

Key to this progress has been the International Hydrographic Organization’s (IHO) concept of the Worldwide Electronic Navigation Database (WEND), which obligates each national authority to produce electronic charts of its respective national waters.

The WEND concept consists of the basic principles of national competencies for ENC production and references to the relevant technical standards. A crucial element of WEND is the idea of Regional Centres for ENCs – RENCs. These centres provide a focal point for a range of national ENCs within a particular region. In 2002, the hydro-
graphic offices of the UK, the Netherlands, Spain, Portugal and Germany founded the International Centre for ENCs (IC-ENC). At this stage, the rapid progress of digital technology and data exchange seemed to make the initial idea of regional ENC focal points obsolete. This remained true for the first few years of IC-ENC operation as hydrographic offices from South America, Africa and Middle East joined IC-ENC.

2. The Organisation

IC-ENC is situated in Taunton, UK. A total of 11 people work here for IC-ENC. They include a general manager, and a team of cartographers, geographic information officers and other specialists. The constitution of IC-ENC is defined by the ‘IC-ENC Cooperation Arrangement’, which describes the operational structure of IC-ENC and the “not-for-profit” status of the organisation. This arrangement regulates the nature of the core services which IC-ENC provides for its members, namely:

- ENC Production Support (including capacity building activities)
- ENC Validation
- ENC Distribution
- Revenue Management

The Steering Committee is the governing board of IC-ENC. It comprises all hydrographic office members and its purpose is to oversee the operation of IC-ENC and provide strategic direction. It meets annually and elects its Chair from among the participants for a two-year term. The Chair supervises the general manager’s activities on behalf of the Steering Committee, and is called upon to represent IC-ENC internationally.

Although today’s digital cloud based technology is common-place, experience has shown IC-ENC that instigating a regional approach (the original RENC concept) offers many advantages. Multi time-zone operation, local language, regional knowledge and local support improve performance and cooperation. For these reasons, IC-ENC has maintained a regional office in Australia since 2005, and during 2016 established a further two offices, one in Niteroi in Brazil, and one in Washington, USA. The validators of these two new offices completed their training at the IC-ENC UK office.

Figure 1: The IC-ENC Validation team members from Brazil, UK and US
3. Quality Assurance

Whichever IC-ENC office serves a particular hydrographic office member, the quality assurance process is harmonised through the IC-ENC global operating framework – making best use of the opportunities ‘cloud technology’ brings. IC-ENC’s quality assurance process is not fully automated, nor should it be. Key elements benefit hugely from the ‘human touch’ from the expert IC-ENC validators. ENCs are uploaded to real ECDIS machines; inconsistencies are meticulously recorded and assessed by the trained international team. All judgements made by the validators are based on the impact the issue will have on the navigator. This will vary according to the primary purpose of the ENC, the location of the issue, and other chart-specific and navigation factors. The resulting validation reports, including suggested improvement action, are provided to the producer as part of an iterative process for quality improvement. Only when the ENC is as good as it can be, will it be released by the hydrographic office for onward distribution.

IC-ENC continues to attract a growing number of ENC producers into the organisation. Within the last two years, the number of members has grown by eleven to now stand at 39 – almost two thirds of the ENC producers worldwide. With the launch of the IC-ENC North America office, and inclusion of over 1100 US ENCs, the IC-ENC folio exceeds 7000..... about half of the world’s ENCs. IC-ENC supplies this folio to its distribution partners, the Value Added Reseller (VARs), who have developed end user ENC distribution services, including full customer support processes.

![Figure 2: IC-ENC’s 40 Hydrographic Office members](image)

One of the key fundamental principles of IC-ENC’s operation is to be cost efficient. Each member sets its wholesale price for its ENCs, and the Steering Committee sets the amount that IC-ENC will retain to cover its operating costs. This figure has been set to USD1.00. All other ENC revenue is returned to the appropriate ENC producer, through approved and audited IC-ENC financial processes.
IC-ENC continues to work to improve its services to members. Over the last year, IC-ENC delivered three specialist training courses to over 40 attendees from all over the globe. The courses were completely financed from the approved IC-ENC budget and should be understood to be a proactive contribution to the capacity building strategy of IHO. IC-ENC held its first Technical Conference for members in order to develop IC-ENC’s roadmap for the future ENC technical standard, S-101. These will be repeated to new delegates during 2016. IC-ENC will also hold a technical conference for members in order to develop IC-ENC’s roadmap for the future ENC technical standard, S-101. Further opportunities are ahead within the industry resulting from IHO’s new standards and the series of S-100 compatible products. It is up to IC-ENC member states to decide the direction IC-ENC will go on their behalf, but whatever the answer will be, IC-ENC’s motto will prevail: ‘Global ENC collaboration, with a regional focus’.

Figure 3: The IC-ENC Steering Committee as convened in 2015
COPYRIGHT CASE LAW: A MAP IS A DATABASE

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It is a long-established principle that maps (including nautical charts) benefit from the protection of artistic and literary works under the Berne Convention. Enforcing copyright was relatively straightforward in the paper world. The emergence and uptake of digital maps, such as Electronic Navigational Chart, make it much more difficult to monitor the unauthorized use and reproduction of elements of information contained in the relevant databases. Noting that databases should be accorded an appropriate level of protection so as to create an attractive environment for investment while safeguarding users’ interests, the European Parliament and the Council of the European Union established Directive 96/9/EC of 11 March 1996 on the legal protection of databases. The Directive harmonizes the provision of copyright protection for the intellectual creation involved in the selection and arrangement of materials and introduces a sui generis right for the creators of databases which do not qualify for copyright, in order to protect the investment (financial and in terms of human resources, effort and energy) in the obtaining, verification or presentation of the contents of a database.

Almost twenty years later, it was an ironic twist of events that on 29 October 2015, a ruling of the Court of Justice of the European Union (CJEU) would conclude that extracting information from a paper topographic map is subject to the protection provided by the database directive.

The ruling originated from a dispute between an Austrian publisher and the Land (State) of Bavaria, Germany. The Land of Bavaria considered that the publisher made unlawful use of its topographic maps and underlying data in order to produce the material for its own maps. In that specific case, the publisher used scanning techniques to extract geographical information about tracks appropriate for cyclists, mountain bikers and inline skaters from the Land of Bavaria’s topographic maps.

As the case made its way through the German court system, the Land of Bavaria referred to the rights laid down by the database directive and the German Federal Court of Justice requested guidance from the CJEU on whether topographic maps could be considered as databases.

In its ruling [1], the CJEU notes in particular:

*The analog nature of the topographic maps at issue in the main proceedings, which required them to be scanned using a scanner so that they could be utilised individually using a graphics programme does not preclude them from being recognised as a ‘database’ within the meaning of that directive.*
It is settled case-law, first of all, that not only an individual piece of information, but also a combination of pieces of information can constitute ‘independent material’ within the meaning of Article 1(2) of Directive 96/9 [2].

(…) the Court has held that the informative value of material from a collection is not affected within the meaning of that case-law if it has autonomous informative value after being extracted from the collection concerned.

In addition to the difficulties involved in determining a principal intended use or typical user of a collection such as a topographic map, the application of such a criterion for the assessment of the autonomous informative value of the materials making up a collection would run counter to the intention of the EU legislature to give broad scope to the definition of the term ‘database’.

Consequently, the conclusion of the Court is:

Article 1(2) of Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases must be interpreted as meaning that geographical information extracted from a topographic map by a third party so that that information may be used to produce and market another map retains, following its extraction, sufficient informative value to be classified as ‘independent materials’ of a ‘database’ within the meaning of that provision.

This means that the elements of information contained in a map are protected under the database directive, independently of the copyright protection of the map itself.

Hydrographic Offices should welcome a ruling that adapts the traditional copyright protection of maps to the digital era.


[2] Article 1(2) of Directive 96/9: For the purposes of this Directive, ‘database’ shall mean a collection of independent works, data or other materials arranged in a systematic or methodical way and individually accessible by electronic or other means.
BOOK REVIEW

Charting Polar Seas
The Life, careers and interests of Adam Kerr—Chartmaker, sailor and fisherman

Self published by Adam Kerr, ISBN 978-1-326-57316-4,

Adam Kerr, previous editor of the International Hydrographic Review, Director at the International Hydrographic Bureau, Regional Director in the Canadian Hydrographic Service, Hydrographic Surveyor and Mariner, has committed his varied and inspiring career to paper in an autobiography that chronicles his early childhood, his progression through the Merchant Navy – in ships both ancient and modern, and his gravitation toward hydrography at an exciting time when innovation and new technology were waiting to be exploited.

As the title of his book suggests, Adam’s practical hydrographic career took place mainly in polar regions, firstly in the south in the Falkland Islands and then to the Arctic and northern Canadian waters, but prior to that he had an extensive sea-going career that took him around the world and provided some interesting tales and insights, which he shares in his book.

Ashore, he continued, as he had done in the field, promoting and encouraging technical innovation and the use of the latest technology, both for improved data gathering and for the presentation of the results as digital nautical charts. It was no surprise that after he was elected as one of the three international Co-directors of the IHO Secretariat in Monaco, he led most aspects of the technical programme. It is where your reviewer first made contact with Adam – little knowing that many years later, I would occupy the same position.

Sprinkled through the text are Adam’s own candid observations on various decisions and situations that have affected him and on personalities met.

Adam provides a tale that many of my generation will recall – starting from a traditional nautical and surveying background and then confronting changes occurring at an increasing pace. Rather than being daunted by it, Adam embraced it, such that he has left a lasting legacy for us all. It is good that he has taken the time to describe, from his perspective, how it all happened.

Reviewed by Robert Ward
It was with great sadness that the Directing Committee of the International Hydrographic Bureau (IHB), announced the death of Adam J. KERR (former Director), who passed away in his home in Lamorna (United Kingdom) on 8 August 2016.

Adam Kerr a “chart maker, fisherman and sailor”. This is how he defined himself at the end of his autobiography. To this I would add:… and a true gentleman of the sea.

I met Adam for the first time in Genova (Italy) in my office as Director of the Italian Navy Hydrographic Institute (IIM). It was 1988 and he had come to ask for the cooperation of the IIM to support the creation of a Hydrographic School in Trieste (Italy) as part of a project, agreed between IMO and Italy, to establish a Maritime Academy. The hydrographic school was established and has operated for many years thereafter. Adam was, at the time, a brand new Director of the International Hydrographic Bureau, the secretariat of the International Hydrographic Organization (IHO), based in Monaco. Listening to him that day I had the immediate impression of having in front of me a dedicated and enthusiastic hydrographer and sound and experienced seaman who had the clear vision that organizations are made up of people who, when inspired and properly guided, achieve great things. Adam was definitely the man to both inspire and to guide.

I was fortunate that only a few years later, in 1992, I was elected as a fellow Director of the IHB alongside Adam and Rear Admiral Christian Andreasen as the President of the Directing Committee in Monaco.

This was the beginning of five years of intense cooperation. It was the period of developing the now well established IHO electronic chart standards, increasing the number of Member States of the IHO, increasing technical cooperation and assistance to developing hydrographic services and strengthening ties with the relevant United Nations Specialized Agencies. Adam worked intensely and helped me greatly.

I admired in particular his efficiency and capacity for work. His desk was always tidy, there were no files piling up waiting to be dispatched. His writing was extremely clear and direct: no doubt about the meaning and the intention. A quality that he had not only inherited from his father, a reputed writer, but also from his long seagoing experience: sailors do not need many words to develop a concept and to get to the point.

Surveying and charting inhospitable waters as he did in British (claimed) Antarctica and in the Canadian Arctic made him a very knowledgeable and experienced hydrographer and an expert seaman. Before joining the IHO, he served in the Canadian Hydrographic Service (CHS) for thirty years during which time many novel surveying techniques were trialed and some implemented. On his desk at the IHB, was a model of the famous Dolphin: a torpedo shaped craft with a snorkel and fitted with an echo sounder. Its purpose was to increase a ship’s survey output by cruising in parallel to the track of its mother survey ship.
Adam had a clear vision of the advantages of fostering close cooperation between Government Hydrographic Offices, Industry and Academia. He narrates, in his book, how successful was the cooperation of the Canadian Hydrographic Service (CHS) with the enterprise CARIS and the University of New Brunswick in the collection and subsequent processing of digital survey data.

Adam also tried to overcome the skepticism and sometimes hostility of Government HOs towards private industry that had been producing electronic charts since the early eighties. In his book, he says “I was of the opinion that some of the most innovative work was being done by commercial companies such as C-Map and Navionics”.

When I passed on the sad news of his death to the President of Navionics and to the former owner of C-Map, they wrote:

“We remember Adam as a most brilliant civil servant, one who could see very far - without being drawn into small matters, and a master at using his superior charisma and diplomatic skills to resolve conflicts that looked like unstoppable forest fires.

We also like to celebrate Adam as a great example of how to enjoy life: the party at his home and his curriculum as a boater have always been a great inspiration for us.”

In fact, Adam contributed significantly to the social life of the IHB. At IHO Conferences and meetings, we, the three Directors, used to invite the delegates to our homes. I remember that the guests at Adam’s receptions, coming from all over the world, deeply appreciated his kindness as well as that of his wife Judith and his sons Andrew and Timothy. A charming family indeed.

I do not want to close these few lines without mentioning that Adam was a fine watercolor painter who was capable of catching the most emotional moments of his life at sea. After he retired from the IHB he used to send watercolor Christmas cards to his many friends and colleagues.

In conclusion, those who had the pleasure to work with and alongside him had the chance to experience a remarkable person. We miss you deeply Adam, have a nice navigation in the eternity’s ocean!


Giuseppe Angrisano