LIGHTHOUSE

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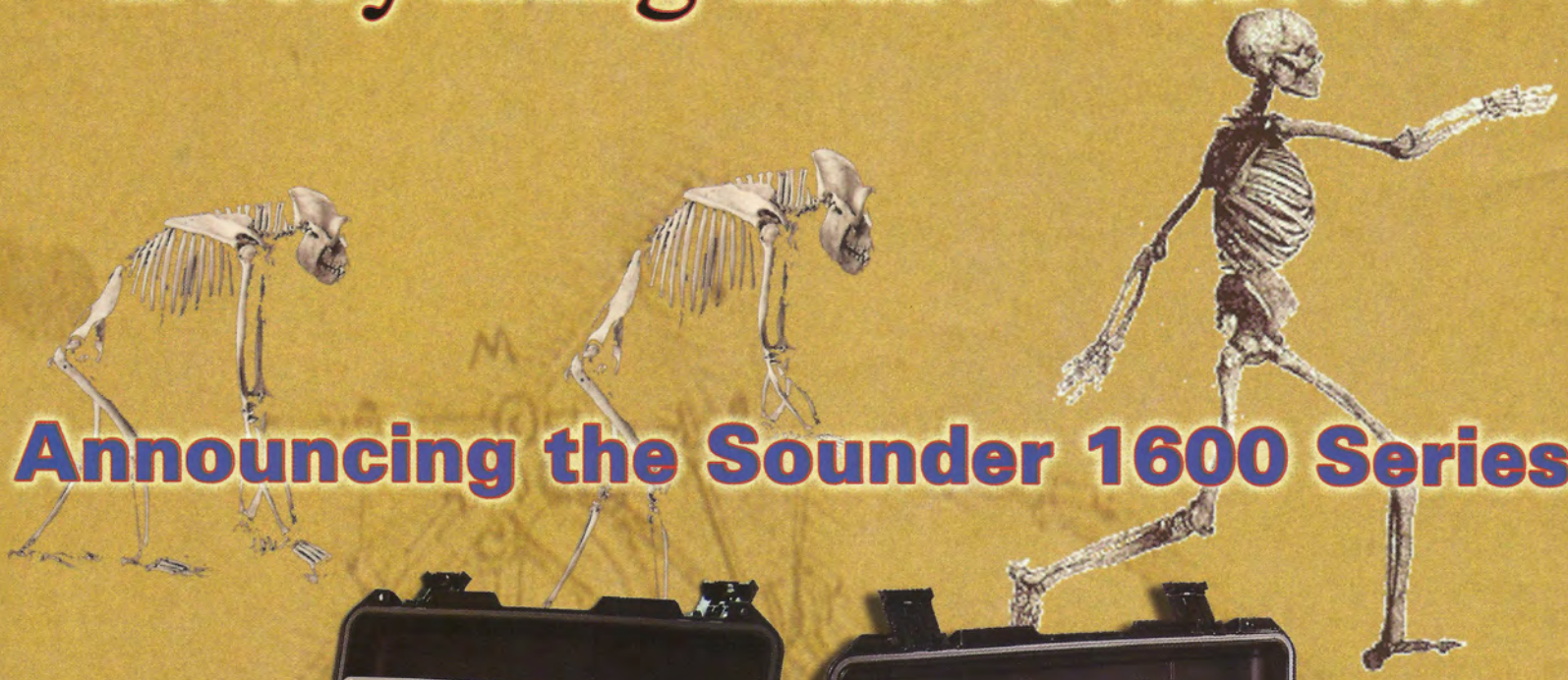
Everything must evolve...



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contents contenu

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Thames River Lighthouse
Lighthouse Cove, Ontario
Photograph credit: Jim Weedon

Thames River Lighthouse

Built: 1818; expanded 1867; rebuilt 1973-75
Height: 55 feet (17m)
Location: Mouth of the Thames River, Lighthouse Cove, Ontario, Canada

The Thames River Lighthouse is the second oldest lighthouse in Ontario. Built in 1818 after the original wooden structure was burned during the War of 1812. Constructed of limestone with a base measuring 4 feet (1.22m) thick and tapering to 2 feet (0.61m) thick at the top. The lighthouse lantern room was raised in 1867 to its current height of 55 feet (17m). The stone ring about halfway up marks the original height.

By the 1970's the foundation was sinking and the stone structure had developed severe cracks. From 1973-75 the lighthouse was carefully dismantled and catalogued, the foundation strengthened with steel supports and then reconstructed.

directors/directeurs

Editor's Note / Note du rédacteur

The leafless trees and lifeless grass remind us that the summer has passed and we are on the cusp of winter. At the CHS, the field season has run its course, the field parties have returned with disks chock a block with data, notebooks full of observations and forms filled with the records of their toil. The winter's work awaits – to submit, assemble, compile, update and publish what has been discovered and observed. Now is the time to settle in and prepare for the long Canadian winter and perhaps to share cheers with friends new and old -a time for fresh hellos and long goodbyes.

Here at Lighthouse we are putting the finishing touches on Edition 69. It follows the conference edition and it contains some of the best papers from CHC2006.The theme of conference was "Bridging Disciplines – The Power of a Shared Approach". Wendy Woodford, the conference co-chair gives us a summary of this successful event. As well, Gary Bugden has graciously allowed us to publish his paper on the effects of tidal barriers in high energy environments. Phillip MacAulay has given us an updated version of his paper on developing a real time water level system for Atlantic Canada. Dick MacDougall's paper on Canada's approach to preparing a submission to the United Nations Convention on the Law of the Sea provides us with insight into a topic that is bound to have increasing resonance in the near future. On the whole, these works are a good (but small) sampling of the papers presented at the conference.

Conferences are more than papers. Conferences are about people coming together and exchanging ideas. They are also about companies exhibiting their wares. It was great to see all of the sponsors at CHC2006 and it is heartening to see how well their products are received from customers around the world. The breadth and depth of the attendees serve to remind us that we should not be surprised that hydrography is a global concern. As if to stress that, and to move beyond our borders, we are pleased to present a terrific paper by Sara and Monty Lewis on their charting ventures in the Caribbean. It is a refreshing and inspiring look at a thriving entrepreneurial team whose products are very well received.

Lastly, it should be noted that as the CHA wraps up it's conference, the USHC is approaching, as the poster herein advises in further detail. The seasons progress and the cycle continues. The CHC2006 conference organizers thought long and hard before coming up with their fresh theme. They wryly observed that many previous programs focused on the future; what is new and how things may change. It was time for a fresh theme – and they picked a great one. It seemed ironic then that the summary remarks by Dave Wells touched on the themes of conferences past and noted that working together was a recurring theme. Perhaps it is no great wisdom to know that hydrography is a team sport. Hopefully such relaxed wisdom is balanced by the youthful exuberance of tomorrow's hydrographers. The release of this issue was shifted towards the winter because some of our irreplaceable volunteers were involved in professional training. As one wave of hydrographers head off toward the horizon another wave prepares to step forward, to hopefully ask with wisdom and wonder, "Now, how does that sound?"

Craig Zeller

Message from the National President
Mot du Président national

I have recently returned to the office after working at sea and then taking some time to sail my own yacht down to the Thousand Islands where Lake Ontario meets the St. Lawrence River. Both experiences, as Hydrographer and "Joe Sailor" have contributed to my ongoing appreciation for nautical charting ,whether on paper or in digital cartography. While working in Arctic waters we found ourselves in and mostly out of small scale digital chart coverage, hence our reason to be surveying there. When we did have digital coverage, the experience of leaving it behind was somewhat akin to sailing off the edge of the world. However, when the $10K ECDIS system ran out of official digital data we could always rely on $200 recreational charting software to help us scan and rectify our small scale paper charts on the fly as needed. It was ironic and somewhat embarrassing to find that a low cost, off-the-shelf charting software package could meet the immediate needs of an icebreaker's master while government budget constraints and 3rd party copyright issues have restricted our access to much needed digital cartography.

On my own boat, I run a somewhat old yet effective GPS chart plotter which runs 3rd party digital cartography. I do not fully rely on this system and still double check my navigation using paper charts and occasional visual fixing. Old boat-old chart plotter, what can I say? As a user of both official nautical publications and 3rd party digital cartography, I find the two complement one another but, for route planning, querying distance/time calculations and quick and dirty navigation in close quarters, you cannot beat the power of a value-added digital chart product. The system that I use goes beyond a simple raster image and incorporates flashing symbols for navigational aids and conspicuous features, assigns levels of depiction for soundings, line-work and other features so as not to clutter the screen at small scales and furthermore, it allows me to toggle on/off specific types of information. Not bad for 12-year old technology. So while slightly on the archaic side (with only a 6 channel GPS receiver) and with pricey cartography, the charting is seamless, simple and easy to understand albeit on a monochrome display. What's more, the world-wide product catalogue (which includes the Arctic) is very extensive.

As you might guess, this message is all about setting priorities, overcoming publication obstacles and at the end of the day, fulfilling the needs of users of digital hydrographic data. It is clear that until our political masters take a real turn behind the wheel, access to modern digital hydrography in Canadian waters will continue to be an issue in the years to come.

Récemment, après avoir travaillé en mer, j'ai pris un peu de temps pour naviguer sur mon voilier dans les Mille Îles où le lac Ontario rencontre le fleuve Saint-Laurent. Mes expériences d'hydrographe et de marin d'eau douce ont contribué à l'appréciation des cartes marines papier et électroniques. Pendant le travail dans les eaux de l'Arctique, nous nous sommes retrouvés souvent sans couverture cartographique même à petites échelles, d'où notre raison de faire des relevés là-bas. Quand nous avions une couverture numérique, l'expérience de la laisser derrière était un peu comme naviguer aux confins du monde. Cependant, quand le système ECDIS à $10K n'avait plus de données officielles nous devions utiliser à système récréatif à $200 pour nous aider au besoin à corriger sur le champ notre carte à petite échelle. Il était ironique et assez embarrassant de trouver un système de navigation standard bon marché qui rencontrait les besoins immédiats des officiers d'un brise-glace pendant que les contraintes gouvernementales et les droits d'auteur d'une tierce partie ont restreint notre accès à plusieurs données numériques nécessaires.

Sur mon bateau, j'utilise encore un vieux traceur de navigation GPS lequel utilise des cartes numériques d'un tiers. Je ne me fie pas entièrement sur ce système mais je vérifie ma navigation sur carte papier et occasionnellement un relevé visuel. Vieux bateau, vieux traceur de navigation, que puis-je dire? En tant qu'utilisateur des publications nautiques officielles et de cartes numériques d'un tiers, je les trouve complémentaire mais pour une planification de route, une requête de calcul de distance/temps et une navigation sommaire en endroits resserrés vous ne pouvez battre la puissance d'une carte électronique de navigation. Le système que j'utilise se superpose à une image de carte numérisée qui incorpore des symboles voyants pour les aides à la navigation et les objets remarquables, assigne des niveaux de représentation pour les sondages, des lignes et autres entités pour ne pas encombrer l'écran à petites échelles et, de plus, permet d'afficher ou non certaines informations. Pas mal pour une vieille technologie de 12 ans. Tout en étant un peu archaïque (avec un receveur GPS à 6 canaux) et avec une cartographie chère, la navigation est sans accroc, simple et facile à comprendre même sur un écran monochrome. Que demander de plus, le catalogue des produits du monde entier (incluant l'Arctique) est très considérable.

Comme vous pouvez le deviner, ce message concerne tout à propos des propriétés d'ajustement, des obstacles d'affichages à surmonter et finalement de la rencontre des besoins des usagers en données hydrographiques numériques. Il est clair, à moins que nos autorités politiques donnent un vrai coup de barre, que l'accès à une hydrographie numérique moderne dans les eaux du Canada continuera d'être un problème pour les années à venir.

Andrew Leyzack

Canadian Hydrographic Conference 2006:
A Conspectus

By: Wendy Woodford, Carrie MacIsaac and Bruce Anderson, Canadian Hydrographic Conference (CHC) 2006 Committee

Canadian Hydrographic Conference 2006
June 5 – 9, 2006
Westin Nova Scotian Hotel
Halifax, Nova Scotia, Canada

Bridging Disciplines - The Power of a Shared Approach

The highly successful 2006 Canadian Hydrographic Conference (CHC 2006) - *Bridging Disciplines: The Power of a Shared Approach* - welcomed over 440 delegates and 42 exhibitors from 16 countries to the Westin Nova Scotian Hotel, in Halifax, Nova Scotia, Canada from June 5-9, 2006.

Reflecting the conference theme, presenters focused not only on hydrographic techniques and technology, but also on the application of our discipline and data to every aspect of ocean science and ocean resource management. A diverse group of delegates, including many from outside the Hydrography field, provided CHC 2006 with a broad cross-section of scientists and professionals active in all aspects of ocean science and governance.

Conference co-chairs for CHC 2006, Michael Lamplugh and Wendy Woodford, are both with the Canadian Hydrographic Service (CHS), which, together with the Canadian Hydrographic Association, acted as joint conference hosts. Proud sponsors of CHC2006: Canadian Hydrographic Service, Canadian Hydrographic Association, Kongsberg Maritime, ESRI Canada, ROMOR Atlantic Ltd, Brooke Ocean Technology Ltd, Caris, IVS3D, Cubewerx and Hydro International.

Workshops/Training

Approximately 100 delegates participated in the various technical workshops and discussions offered on Monday, June 5th.

Technical Sessions

Technical sessions commenced on Tuesday June 6th, with the Keynote address by Captain Julian Goodyear of the Department of Fisheries and Oceans Canada (DFO) and opening remarks from DFO Deputy Minister Larry Murray, CHS Dominion Hydrographer Savi Narayanan, and Captain Steven Barnum of Natiaonal Oceanic & Atmospheric Administration (NOAA). The program resumed with papers presented in the following sessions:

Sovereignty: Law of the Sea (Chair: Dr. Richard Haworth, Natural Resources Canada (NRCAN) retired)
Ocean Management: Application of Seafloor Mapping (Chair: Dr. Dick Pickrill, NRCAN)
Products and Services: 21st Century Products and Data (Chair: Dr. Wyn Williams, United Kingdom Hydrographic Office)
Security: Marine, Ports & Harbours (Chair: Dr. Ross Graham, Defence Research & Development Canada)
Transportation: Modern Charting Requirements (including the Arctic) (Chair: Captain Julian Goodyear, DFO)
Hazards: Emergency Response to Environmental Events (Commander Wayne Hamilton, Canadian Navy retired)
Oceanography: Water Levels and Ocean Modeling (Chair: Dr. Savi Narayanan, CHS)
Fisheries: Seabed Classification & Habitat Mapping using Multibeam Methodologies (Chair: Dr. John Anderson, DFO)
Marine Archaeology: The Application of Hydrographic Techniques to Historical and Paleo-research (Chair: Ken McMillan, McQuest Marine Sciences)
Technology: Selected Advances in Hardware and Software (Chair: Andrew Armstrong, NOAA / University of New Hampshire)

These sessions concluded on Friday June 9th with closing remarks by Dr. Dave Wells.

Papers and presentations are available on the CHC 2006 website; visit *www.chc2006.ca* for details.

Exhibitors

Our sold-out and popular exhibition area provided knowledgeable exhibitor representatives, relevant information and the latest in technology and equipment. We are pleased to acknowledge that we had over 40 exhibitors.

Co-chair Mike Lamplugh previews the technical sessions while Captain Julian Goodyear, DFO; Dr. Savi Narayanan, Dominion Hydrographer CHS; Larry Murray, Deputy Minister DFO; Captain Steve Barnum, NOAA; Pat Murphy, HRM Ward 11 Councilor and co-chair Wendy Woodford look on.

Colleen Tuttle happily staffs the Seaforth Engineering booth.

Dancing, charting and music - it was pure clean fun.

Social Events

That famous Maritime hospitality and cuisine were in evidence throughout our social events, to the delight of our many hungry and thirsty delegates, exhibitors and their guests.

The CCGS Matthew hosted visitors to the technical demonstrations.

Kongsberg Maritime sponsored the CHC 2006 Icebreaker event on Monday, June 5th at the Maritime Museum of the Atlantic. During the evening, delegates browsed through the Museum, experienced the Halifax waterfront and participated in tours on the CSS *Acadia* and CCGS *Matthew*.

Sessions concluded at noon on Wednesday, June 7th in order to encourage delegates to visit our exhibit area. The well attended tradeshow was followed by the always popular Exhibitors' Beer Social which featured a live band and draw for prizes donated by exhibitors and local merchants.

On Thursday, June 8th, delegates and their guests attended a Reception and Nova Scotia Lobster Supper at historic Pier 21 and Pier 22 on the Halifax harbourfront, with a live band and dancing.

Closing

The CHC 2006 Committee extends its sincere gratitude to all delegates and exhibitors who attended and participated in CHC 2006 and helped make CHC 2006 a huge success. We look forward to seeing you all again in Victoria, B.C. for CHC 2008, May 4-8, and in Norfolk, Virginia for US Hydro 2007, May 14-17.

The Effects of Tidal Barriers in High Energy Environments: "Out of Sight, Out of Mind"

By: G. Bugden, Fisheries and Oceans Canada, Dartmouth, NS
K. Butler, University of New Brunswick, Fredericton, NB
T.G. Milligan, Fisheries and Oceans Canada, Dartmouth, NS
D. van Proosdij, Saint Mary's University, Halifax, NS

Throughout history, anthropogenic modifications have caused extensive changes in the hydrological and geological characteristics of tidal rivers in many parts of the world. These changes often extend over larger space and time scales than are immediately apparent. The full spatial extent of the impacts is often not appreciated and the altered systems may not reach equilibrium for many decades, if at all. Some local examples of tidal river modification are the causeways constructed in the late 1960s in the Petitcodiac River, New Brunswick and the Avon River, Nova Scotia. In both of these estuaries the construction resulted in rapid, readily apparent, sediment accumulation on the immediate downstream side of the barriers. However, in the case of the Petitcodiac, recent analysis indicates that the consequences of causeway construction extend nearly 34km downstream of the causeway. There is also evidence that the system has not yet reached equilibrium, more than three decades after causeway completion. The large space and time scales of these effects and the fact that they are not immediately visible to the eye prevented their detection for many years. While changes in the lower Avon River Estuary do not appear to be as severe, some intriguing patterns are emerging here as well. The primary means for studying the long term effects of causeway construction in these estuaries was comparison of historical and modern hydrographic surveys. Documenting the effect of tidal barriers is just one example of the importance of maintaining temporally superseded data as well as current hydrographic data within archives for analytical purposes.

Introduction

In June 1948, the Canadian Parliament passed an act creating the Maritime Marshland Rehabilitation Administration (MMRA) which embarked on several major construction projects intended to preserve Atlantic Canada's dykelands. Based in Amherst, Nova Scotia, the 70-member staff of the MMRA began applying modern engineering techniques to the traditional problems of dykeland construction and maintenance. Draglines and steam shovels replaced dyking spades and draft animals. Over the next 20 years, the MMRA ensured the protection of 18,000 hectares of tidal farmland in Nova Scotia and 15,000 hectares in New Brunswick, building 373 kilometres of dyke in the process.

The construction of large tidal dams in the Shepody, Annapolis, Avon, Tantramar, Petitcodiac and Memramcook Rivers were seen as major accomplishments of the MMRA. These giant concrete and steel aboiteaux, completed by the late 1960s and early 1970s, were designed to prevent tidal inundation of marshlands upstream, thus eliminating the need for many kilometres of dyke and smaller aboiteaux. At the same time, the causeways provided cheap alternatives to costly bridges. Unfortunately, the benefits of these control structures did not come without a price.

The upper reaches of the Bay of Fundy have some of the highest tides in the world with ranges exceeding 12 metres. Also found there are some of the world's highest concentrations of suspended sediment. Sediment concentrations regularly exceed 10kg m^{-3} and can reach 400kg m^{-3} near features such as tidal bores. Following the construction of the Petitcodiac Causeway these unusual conditions combined to produce far-reaching changes to the environment. The disruption of tidal flow resulted in sedimentation rates downstream of the structure that were so high that new mudflats were created almost as fast as the causeway was closed (Figure 1). The extent of the resulting mudflats and the speed with which they were formed was unexpected. Within a year of completion, the cross sectional area of the Petitcodiac River at Moncton, near the causeway, shrank by up to 80% as the entire system started to fill with sediment (Figure 2).

This accumulation of sediment has raised the potential for flooding associated with storm surges and high tides in the city of Moncton and has caused difficulty in the operation of sewage outfalls that may eventually need to be moved and/or elevated in order to function properly. These factors, together with the priority of rehabilitating the river with the objective of restoring fish migration, have recently motivated the New Brunswick Provincial Government to initiate an Environmental Impact Assessment of four possible options for modifying the causeway. Studies of historical trends in sediment accumulation and hydrodynamic modeling of sediment transport formed one part of that study (AMEC Earth and Environmental, 2005).

Figure 1: The Petitcodiac River Causeway under construction. Downstream is to the left. The mudflat is growing at the same rate as the causeway is extended.

Methods

In August 2003, an acoustic sub-bottom profiling survey was carried out by the University of New Brunswick at the mouth of the Petitcodiac. The objectives of this survey were to determine the depositional styles and internal architectures of the modern sediment deposits. Depths of penetration for the high resolution IKB Seistec profiler, (Simpkin, P.G. and Davis, A., 1993), were limited by the presence of shallow gas over most parts of the intertidal flats surveyed along the river's edge, but exceeded 10m where gas was not present, particularly along the outer edges of the mud flats.

Water level data from a temporary Environment Canada tide gauge that was operating near the mouth of the river during the survey enabled the reference of data to Geodetic datum (mean sea level). As a result, it was possible to produce bathymetric maps that could be compared to bathymetry data that were collected by the Canadian Hydrographic Service (CHS) in 1965, two years prior to the completion of the Petitcodiac Causeway.

The results of the 1965 CHS survey (Figure 3), which was conducted to support the development of a marine terminal at the mouth of the Memramcook River, were obtained from the CHS archives as a Tif image file scanned from the original mylar fieldsheets. The Tif image was georeferenced using datum information printed on the sheet. Vertical datum was established with the assistance of Charlie O'Reily (personal communication). Selected depth annotations were then digitized by assigning the noted depth to the geographic position of the optical centre of the hand written digits.

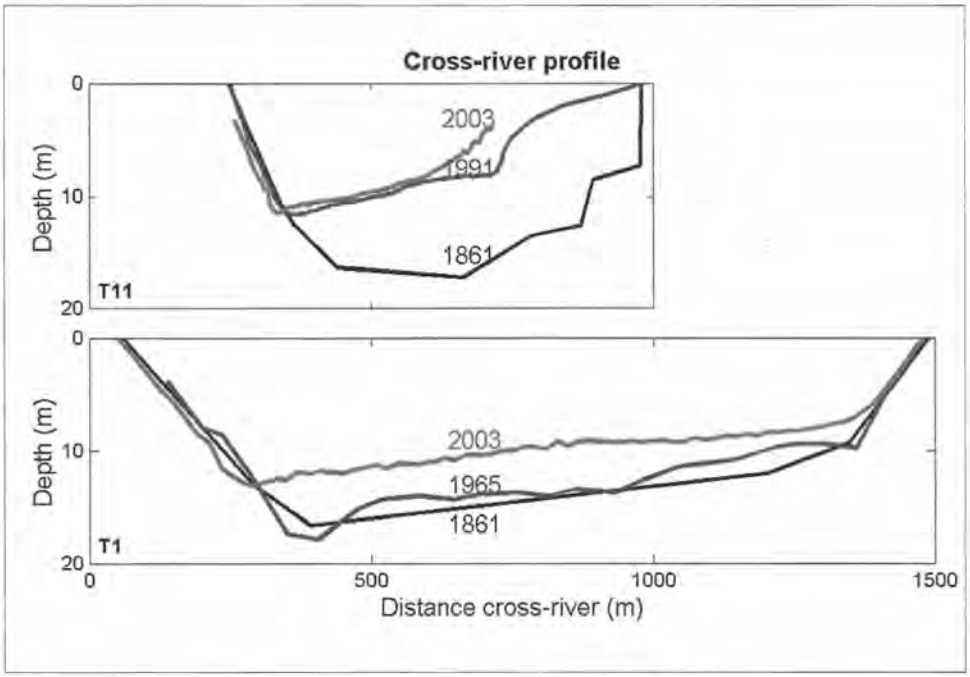

Figure 2: Cross channel depth profiles from a section 15km downstream of the causeway (T11) and at the moth of the Petitcodiac River (T1). Shown is the large change in channel cross section since causeway construction and the smaller continuing change. Also shown is the correspondence between the 1861 and 1965 channel profiles.

Results

The 1965-2003 bathymetry comparison reveals that the Calhoun Flats region, located at the mouth of the river, adjacent to the village of Hopewell Cape, exhibited areas of net deposition (up to ~7m) as well as a well-defined area of net erosion (up to ~2m). The presence of a bedrock knoll on the riverbed, which was detected by both surveys, allowed confirmation that the treatment of the two vertical datums was correct. These results differ from comparisons that have been completed by others along several transects located upstream of the river mouth which show that the river channel has been aggrading since installation of the causeway at Moncton (AMEC Earth and Environmental, 2005). The zone of net erosion at Calhoun Flats

therefore represents the most proximal source of net sediment supply that has been discovered to date in the effort to determine where sediment has been removed from the floor of the Bay of Fundy and transported into the Petitcodiac system.

In most locations, the 1965 bathymetry aligned with a gas layer shown in the sub-bottom profiler data, suggesting that the sediment deposition following causeway construction occurred so quickly that benthic flora and fauna were buried and subsequently decayed. The 1965 bathymetry also aligned with sparse data obtained from a hydrographic chart of the area based on a British Admiralty survey conducted in 1861 indicating that the channel morphology had been stable for more than a century prior to causeway construction (Figure 2).

Conclusions

The primary means of carrying out this study of the effects of causeway construction was the comparison of historical and current hydrographic surveys. These historical surveys had been conducted for traditional purposes, such as port development and safe navigation. When this data was collected, the eventual application would not been foreseen. Often, when such data is extracted from a navigational chart, an unfortunate bias toward shallow depths, which represent navigational dangers, results. This bias can result in subsequent distortions of scientific research results.

Documenting the undesirable effects of tidal barriers is just one example of a study utilizing historical hydrographic data. These studies illustrate the importance of maintaining unbiased, temporally superseded, data as well as current hydrographic data within digital archives for analytical purposes.

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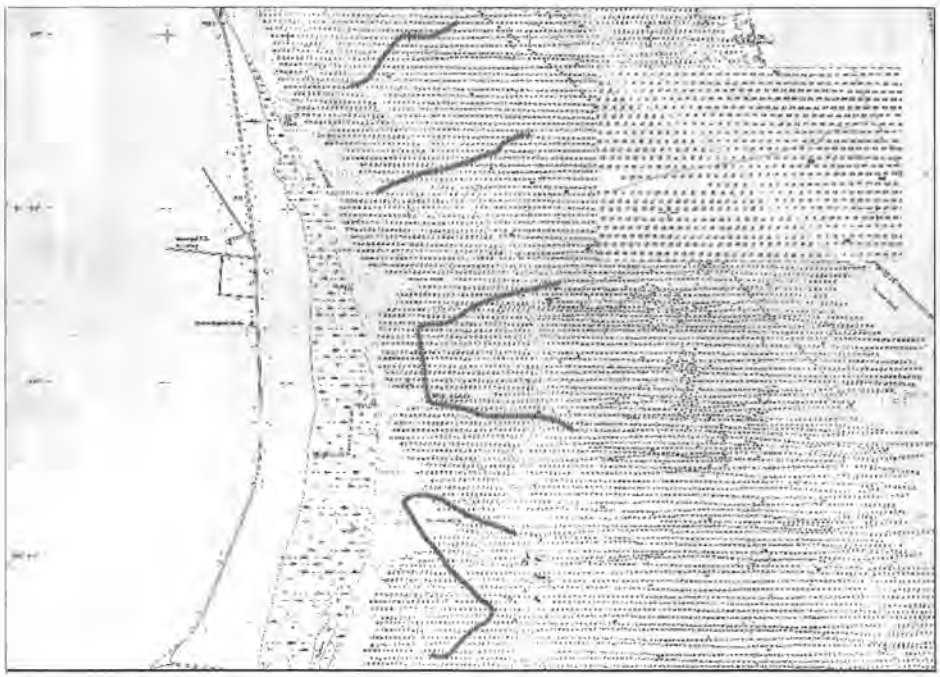

Figure 3: Portion of Canadian Hydrographic Service field sheet from 1965 survey showing sample sub-bottom profiler lines. Inset shows preliminary digitization points for one of the lines.

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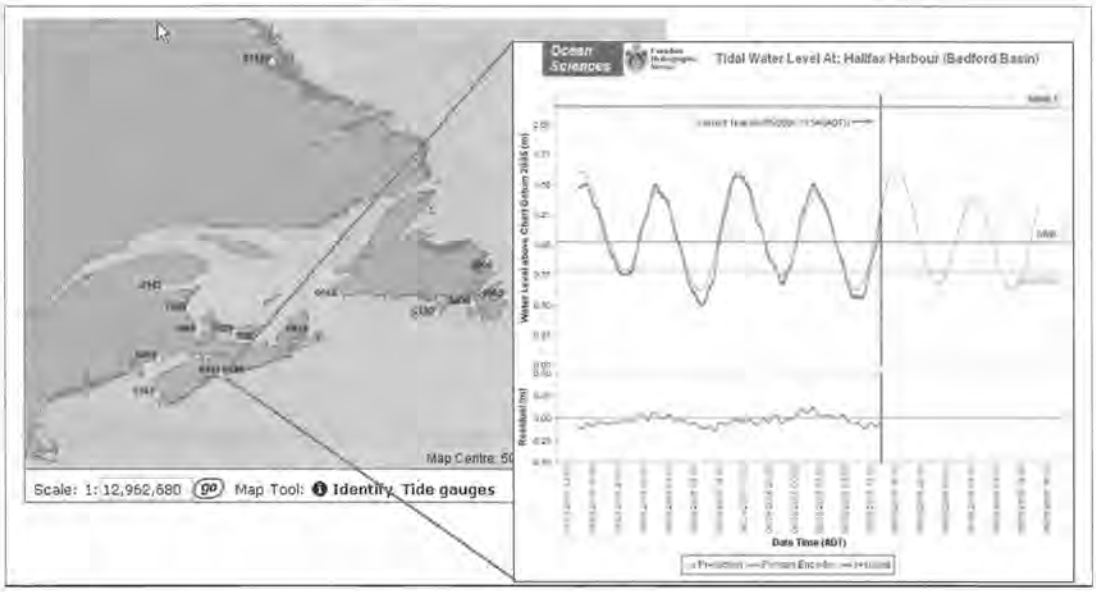
Developing a Real-time Water Level (RTWL) System for Atlantic Canada

By: Phillip MacAulay and Charles O'Reilly, Canadian Hydrographic Service (Atlantic), Bedford Institute of Oceanography, Dartmouth, NS



In Canada, the Canadian Hydrographic Service (CHS) is responsible for the collection of water level data and the publication of water level predictions. Shipping and navigation interests have long been well served by these basic CHS water level activities. However, over recent years it has become increasingly clear that water level observations, predictions and "now" forecasting can and will serve a wider clientele. In response, CHS has initiated a set of regional Permanent Water Level Network (PWLN) revitalization programs. This article outlines CHS Atlantic's efforts to update its systems and activities to provide the appropriate level of services now expected by both existing and new water level interests. Particular attention will be given to the recent developments of CHS Atlantic's data acquisition, management and dissemination systems that were required in order to provide timely water level data to the new Interim Atlantic Tsunami / Storm Surge Warning system.

The Atlantic PWLN Network

CHS Atlantic's PWLN consists of 16 operational tide gauge stations (Figure 1). Three sites have been designated as long term sea level stations of the Global Sea Level Observing System (GLOSS) and six have been designated as storm surge stations (based on the frequency and severity of storm surges). Most recently, six others have been assigned duty as tsunami warning stations because the combination of their locations and the bathymetry of the continental shelf conspire to make them first strike points for tsunamis propagating into Atlantic Canadian waters from various deep water directions.

Prior to CHS Atlantic's recent revitalization program, each station in the PWLN consisted of: i) a gauge hut (or box shelter for those stations with only temporary status); ii) a connection to line power plus battery backup; iii) a local telephone connection; iv) one or more stilling wells; v) a reference tape drop; vi) a Sutron 8210 datalogger; vii) a primary water level sensor (rotary encoder with float and pulley); and viii) a backup pressure or bubbler sensor (Figure 2).

Until recently, water level data was acquired and logged every 15 minutes at each site and all stations were polled once a day for their data via modem by the Marine Environmental Data Service (MEDS). In this system, MEDS also conducted primary quality control and provided the majority of water level data to interested clients. It was also possible for anyone with a modem to download data directly from any of the tide gauge stations. If and when problems with water level data arose, CHS tidal personnel were contacted and would troubleshoot the affected gauge(s), and if necessary, dispatch a repair team at the earliest feasible opportunity. They would also, as part of normal CHS activities, and often upon ad-hoc demand, independently provide quality assurance of water level data.

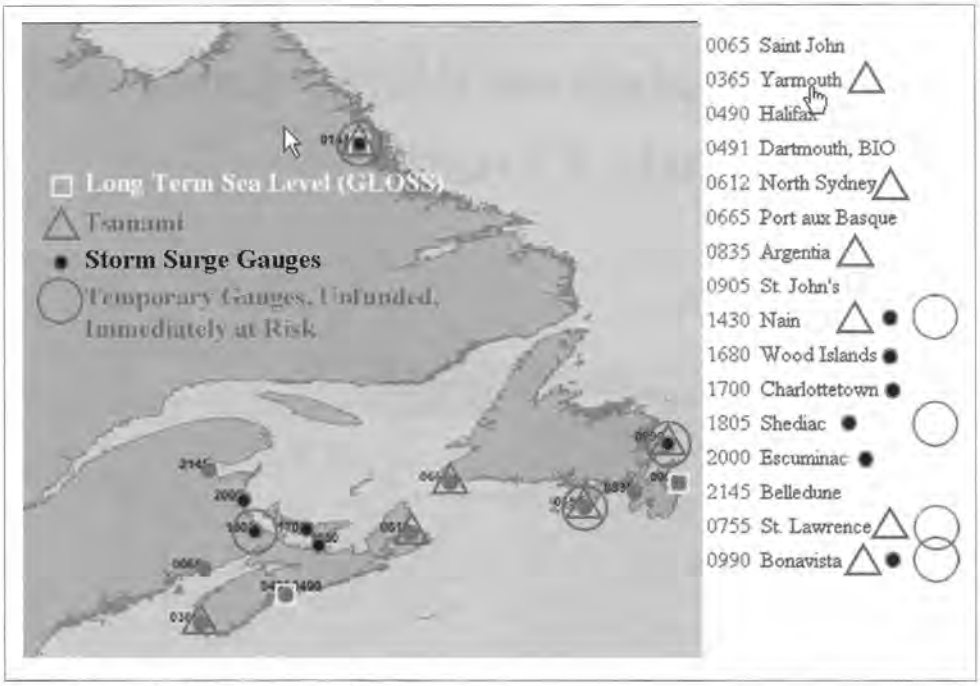


Figure 1: CHS Atlantic's PWLN.

In the past, delays of hours, days or even weeks between the collection and dissemination of water level data frequently occurred. These delays were acceptable for basic tidal analysis, traditional hydrographic survey work and for long term sea level monitoring purposes. However, new water level missions pertaining to storm surge, tsunami warning systems and harbour clearances, require more timely data collection, primary quality control and data dissemination. In other words, these applications require quality assured data available in 'real-time' i.e. within the last few minutes. For example, to meet the needs of the new Interim Atlantic Tsunami Warning System, CHS Atlantic must be able to collect, quality-assure and deliver accurate water level data within 10 minutes of the present. In addition, this data must be available to geographically distant emergency measures organizations, such as Environment Canada's Atlantic Storm Prediction Center (ASPC) and the West Coast and Alaska Tsunami Warning Center (WCATWC) in Palmer, Alaska.

Examples of Contemporary Real-Time Water Level Systems

In the Atlantic Region, a minimal system for delivery of real-time water levels to single users had long been available from some gauges based on a 'talking tide gauge'. The client would phone up the gauge and receive the latest water level observation and perhaps, some recent water level statistics. However, this system only provided a verbal 'now' measurement and only one user could access any one gauge at a time. Quebec's more capable telephone SERVOX system is similar in concept, except that it is based on centralized data collection and a computer controlled database attached to multiple call-in phone lines. Again, data content is limited. Refer:

(http://www.waterlevels.gc.ca/english/WaterLevelsAtYourFingerTips.shtml).

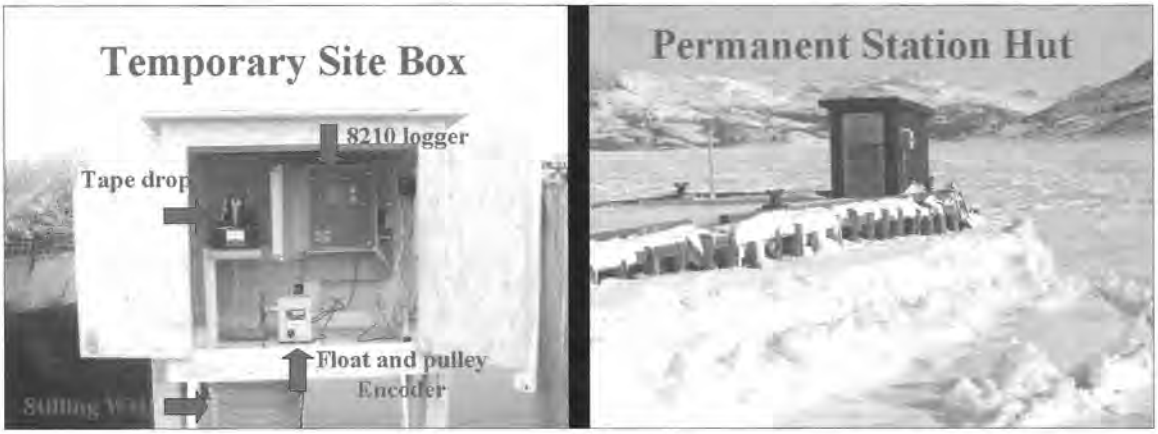


Figure 2: Temporary and permanent gauge stations.

Quebec's SINECO system is an example of a more sophisticated strategy (*http://tides-marees.gc.ca/english/DataAvailable.shtml*). SINECO provides quality assured, real-time water level observation time-series at multiple water level stations simultaneously. It also compares these observations with water level predictions and with forecasts generated using a numerical hydrodynamic model of the St. Lawrence estuary. Although a very capable system, in its current configuration, SINECO is not easily transportable as it was developed as a cost-recovery solution designed to serve shipping and navigation interests and requires proprietary licensed software at the user end. However, in recent months, 15 minute real-time water level data has been made publicly available from Quebec's water level gauges on the St. Lawrence through the DFO Tides, Currents and Water Levels website. Refer: (*http://www.waterlevels.gc.ca/english/Canada.shtml*).

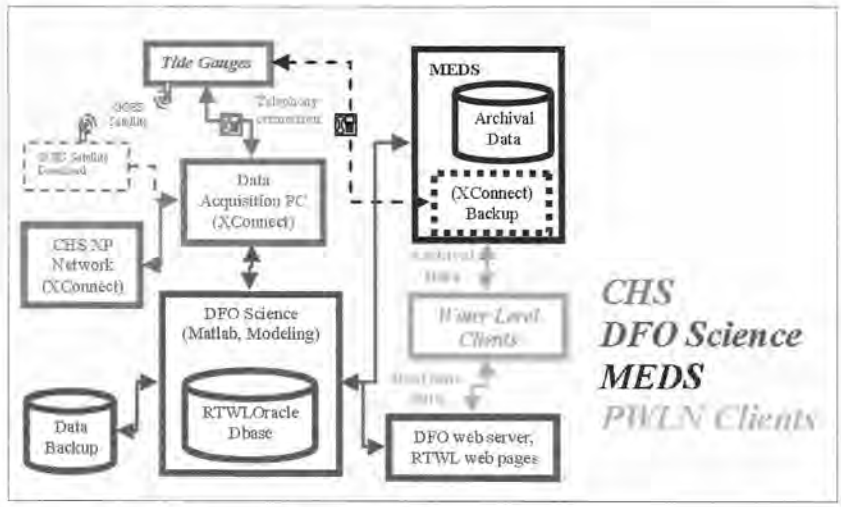


Figure 3: CHS Atlantic's RTWL solution.

Similarly, the CHS Central and Arctic Region website *http://biachss.car.dfo-mpo.gc.ca/danp/gs_selection_e.html* and the CHS Pacific Region website *http://www-sci.pac.dfo-mpo.gc.ca/charts/Tides/OWI/OWL_e.htm* provide free internet-based water level data access. However, neither of the last two systems provides real-time water level data at present.

Other nations have developed (or are developing) free internet-based applications that provide real-time or near real-time water level data. For example, the US has the National Oceanographic and Atmospheric Administration's (NOAA) Tides and Currents website *http://tidesandcurrents.noaa.gov/* and its associated Physical Oceanographic Real-Time System (PORTS) website *http://tidesandcurrents.noaa.gov/ports.html*. The UK has developed internet access to water level data through the National Tidal and Sea Level Facility (NTSLF) website *http://www.pol.ac.uk/ntslf/networks.html*. In Europe similar services are available through the European Sea Level Service (ESEAS) website *http://www.eseas.org/products/?page=real_time_data* and the Monitoring Network System for Systematic Sea Level Measurements in the Mediterranean and Black Sea (MedGLOSS) website *http://medgloss.ocean.org.il/*.

Although there were many example systems available to provide guidance, the challenge for CHS Atlantic was not only to develop its own real-time system, but to do so in just several months. This required, at least initially, making use of as much existing infrastructure as possible.

CHS Atlantic's Real-Time Water Level Solution

Figure 3 shows a schematic of the basic elements of CHS Atlantic's Real Time Water Level (RTWL) solution. The solution is inter-departmental and collaborative and has made use of as much existing Department of Fisheries and Oceans (DFO) infrastructure as possible, in both CHS and Ocean Sciences Atlantic. In the figure, red* [medium gray] identifies new and pre-existing CHS Atlantic elements, blue [dark gray] pre-existing DFO systems, and black pre-existing and future potential elements (dotted) at MEDS. *[*Ed. Note: Due to printing requirements the colour images were reproduced in grayscale].*

CHS Atlantic chose to use Sutron's XConnect software for initial data acquisition because it was a commercial turn-key system and it possessed all the necessary data acquisition and basic data management requirements. Most importantly, it could be quickly interfaced to all of CHS Atlantic's existing Sutron 8210 tide gauge equipment. In the Atlantic RTWL solution, once data is acquired and downloaded from the gauges using XConnect, it is immediately piped to a RTWL database attached to DFO Science's Oracle database sever.

Although the XConnect software has quality control and web based data presentation modules, CHS Atlantic has chosen not to employ them. Access to the real-time water level data is instead provided through password protected web pages on Bluefin, an Atlantic DFO Science web server. Gauge stations are selected using an Environmental Systems Research Institute (ESRI) Map interface (see this document's preliminary figure) and data is displayed using SQL that was written in-house and Java routines (by Kohila Thana, DFO Science Informatics). In this way, CHS Atlantic has more comprehensive and flexible control over how water level data and value added content is presented.

At present, the RTWL web pages have only been made available to selected emergency measures water level clients. However, some form of public free access to Atlantic RTWL data is planned. As previously indicated, a system providing 15 minute observations already exists for the Quebec water level stations. Nonetheless, water level clients should expect to continue to obtain the bulk of their archival data from MEDS.

Under the new system, only CHS Atlantic has direct access to its tide gauge stations, which are all password protected. Unfortunately, the new Atlantic system presently has no data acquisition redundancy, although a backup capacity is contemplated at MEDS (Figure 3, dotted in black).

To meet the needs of the Interim Atlantic Tsunami Warning System, water levels at PWLN stations are now measured every 10 seconds, averaged and logged every minute, and new data is uploaded to the RTWL database and available to the web pages every 10 minutes. Thus, one minute water level data is now available on the web, up-to-date and on average to within 5 minutes of the present.

Web Page Presentation of Atlantic RTWL Data

Figure 4 shows RTWL data from the gauge station at Halifax as presented (following tide gauge station selection via the ESRI map interface) by the RTWL emergency measures web pages. Data from the primary encoder is compared to water level predictions in the top panel; below is the residual (i.e. observations-predictions). The vertical blue line in both panels shows the time the data was requested i.e. the present time. Two tidal datums, Higher High Water Large Tide (HHWLT) and Mean Water Level (MWL), and a GEODETIC reference are included in the upper panel. HHWLT is loosely representative of the flood level threshold.

At the user's discretion, data from additional sensors may be added to the graphs using the dialog box below the legend (i.e. selection of TIDE1). In addition, the user may also opt to: i) alter the time range of data displayed from up to 2 months into the past to up to one month into the future; ii) change the time zone for data display; or iii) download data and predictions in either 1, 5, 15 or 60 minute interval formats.

Revitalization of Atlantic PWLN Infrastructure

As part of its water level revitalization program, CHS Atlantic is in the process of installing a full complement of: i) new Sutron Xpert dataloggers to replace the existing aging 8210s, and ii) new Sutron rapid sampling bubbler sensors to act as the secondary sensors at each gauge site. It is also testing new Esterline 550 pressure sensors. When installation is complete, each PWLN station will have an Xpert datalogger and three independent water level sensors: an encoder float and pulley, a bubbler, and a pressure sensor.

The new model 550 pressure sensors are noteworthy because they simultaneously output data and log it internally. They also have onboard battery backup power available in the case of data acquisition system power failure. These units have been installed in their own small protective wells (with minimal stilling) at tsunami designated stations (Figure 1). Because all gauge huts and boxes are located within a few meters of HHWLT, a tsunami or storm surge of appreciable size can flood them. This could result in either failure of the primary encoder and secondary bubbler, and/or failure of the station's datalogger. In such an event, the 550 pressure sensors should still continue to log internally. Thus, assuming the physical structure to which the hut is attached survives and the pressure sensor can be recovered, a record of the event may still be available.

CHS Atlantic has also acquired Sutron Satlink Geostationary Operational Environmental Satellites (GOES) hardware. These units are intended to be used as backup communications systems at storm surge and tsunami

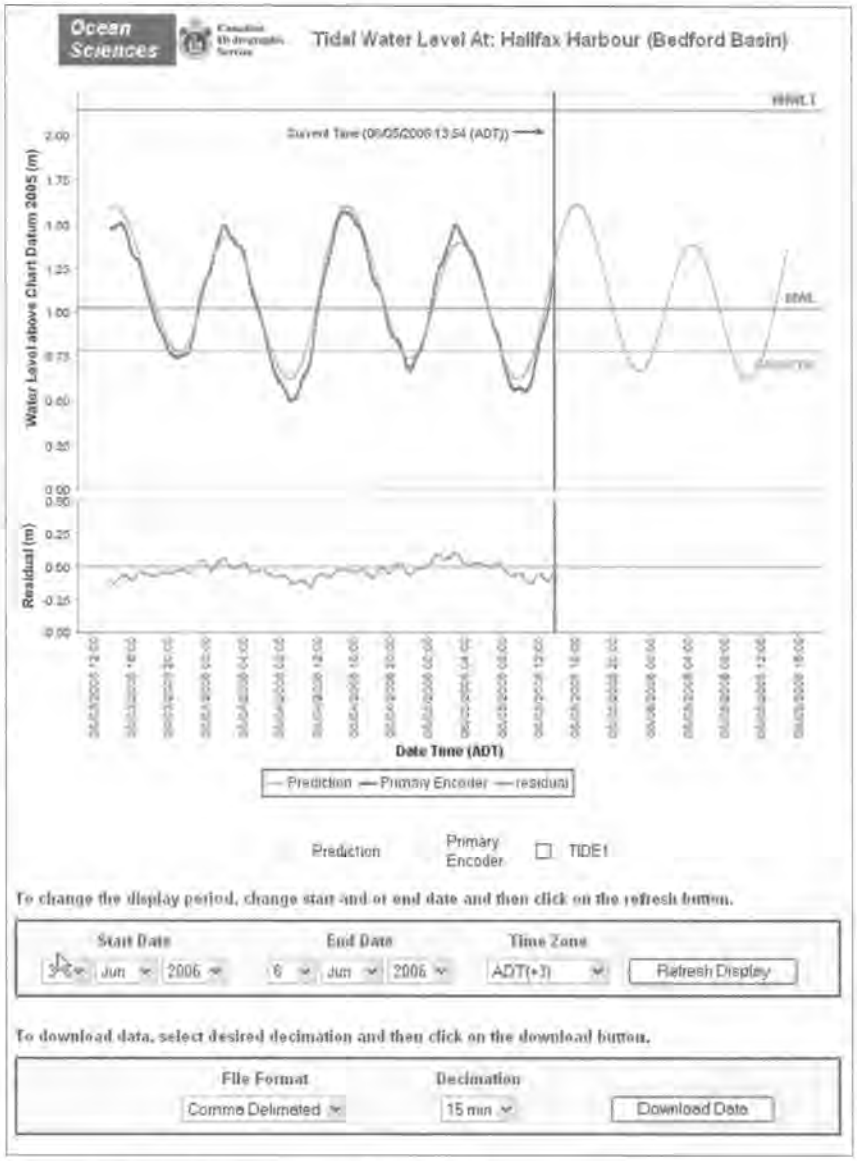


Figure 4: RTWL Observations from Halifax.

warning gauge stations. However, their installation awaits the necessary funding and the appropriate permission from the NOAAGOES Data Collection System (DCS) authorities for the required data transmission cycle. For the GOES systems to be functional in a real-time emergency measures sense, a ten minute GOES report timing permission is necessary.

New Atlantic RTWL System Initiatives

Two interrelated projects to incorporate Real Time Quality Control (RTQC) and model generated water level forecasts into CHS Atlantic's RTWL solution are also underway. Both should be implemented in the spring of 2007. Automated 24/7 RTQC is necessary to provide both RTWL clients and CHS personnel with a measure of primary data quality assurance. Incorporation of water level forecasts into the Atlantic RTWL system will provide water level clients with some warning of upcoming weather generated water level variability, and will provide an opportunity for increased measures of quality assurance.

Atlantic's RTQC will include: i) initial data cleaning and removal of data spikes; ii) inter-comparison of data streams from all three sensors; iii) comparison of water level data with predictions; iv) comparison of water level data with water level forecasts derived from the meteorologically driven shelf-scale Dalcoast II model, through an arrangement with Dr. Keith Thompson, Dalhousie University, Department of Oceanography (websites *http://www.phys.ocean.dal.ca/people/po/Thompson/Thompson_Keith.html*, *http://www.phys.ocean.dal.ca/~dalcoast/Dalcoast1/exper/index.html*) and potentially v) Tsunami detection algorithms.

As indicated earlier, the XConnect software does have some quality assurance capability. However, to permit greater flexibility and to employ a wide range of real-time time-series analysis techniques, CHS Atlantic has linked the RTWL database to the technical computing software MATLAB using MATLAB's database toolbox. MATLAB is commonly used in engineering and scientific institutions and was already available to CHS Atlantic via DFO Science at the Bedford Institute of Oceanography.

A Proposed RTWL System Enhancement

Tsunami warnings are initiated based on seismic activity, but only direct observations of the wave itself confirms the existence and magnitude of a tsunami. The Atlantic RTWL solution is unfortunately limited from a tsunami warning perspective. It will only provide observational based warning/verification on a sacrificial basis. That is, the first tsunami land arrival site is sacrificed for the benefit of the rest. Under this system, little useful warning can be achieved for nearby areas. If the wave is large enough to take down the first landfall station, then no wave amplitude information will be available for assessment of the likely impact at future landfall locations. Finally, because the wave has already reached land, little opportunity for impact assessment prior to wave landfall at other locations can be achieved, including the socio-economic benefits that might be available from the ability to 'stand down' or reduce warning levels based on the observation that an approaching wave is of limited amplitude.

To address these limitations, CHS Atlantic proposes an offshore observation-based early tsunami detection and warning solution based on installation of downward looking radar water level gauges situated on the production platforms at both the Sable Island and Hibernia oil and gas fields (Figure 5). Initial communications with Exxon-Mobil suggest they are amenable to the idea.

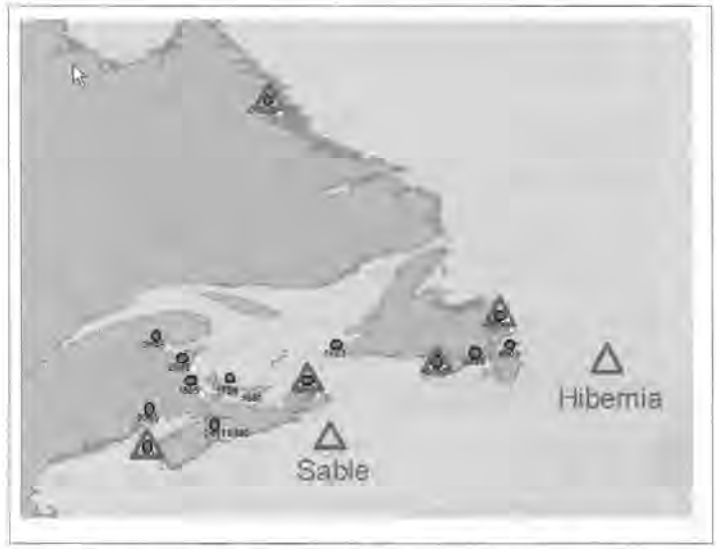


Figure 5: Proposed offshore early warning guage sites.

Gauges at these locations would provide early detection/verification of wave amplitude at a minimum of 1-2 hours before landfall. Dr. Zhigang Xu at the Institut Maurice-Lamontagne (IML) has developed a prototype Green's function based numerical tsunami prediction methodology (publication in preparation) that, once given the seismic source location and an observed wave amplitude time-series (in this case, data from Sable or Hibernia), can provide estimates within seconds of the resulting wave height time-series at any number of selected landfall sites. CHS Atlantic regards Dr. Xu's methods, combined with offshore observations, as a significant improvement on the existing role played in the Interim Atlantic Tsunami Warning System by the present RTWL solution.

Figure 6 shows storm surges caused by a winter storm at Shediac NB and St. Lawrence NL in early Feb. 2006. The graphs show that the 1+ metre surge at Shediac and the near 1 metre surge at St Lawrence, both raised water levels significantly above the local HHWLT datums. Local flooding is likely to have occurred. It is the combination of the storm surge and a high spring tide that most often results in flooding, particularly in regions with low tidal ranges.

The implications of the increase in temporal resolution realized by the switch from 15 to 1 minute sampling

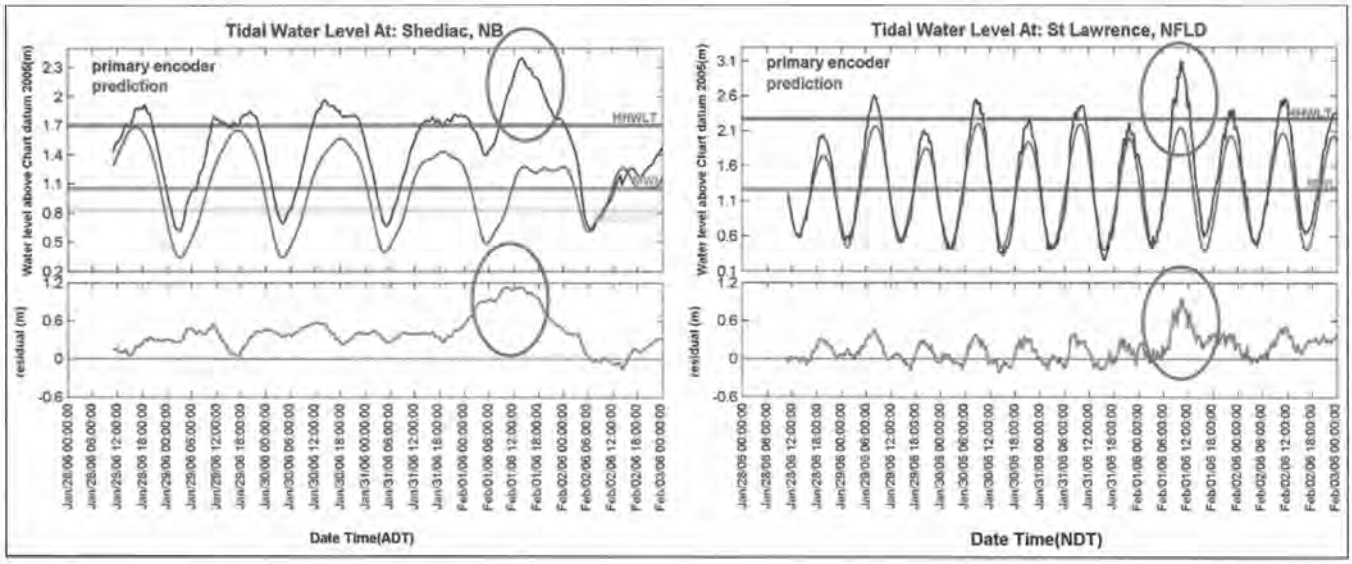


Figure 6: Storm surges at Shediac NB and St. Lawrence NL, Feb 1, 2006 (15 min. sampling).

are clearly shown in the right panel of Figure 7 when compared with the right panel of Figure 6 (both show data from St. Lawrence, NL). Low frequency (infra-gravity) wave activity is clearly present in the 1 minute data of Figure 7, but similar activity is under-resolved in the 15 minute data of Figure 6. St. Lawrence often displays strong seiches at near 17 minute periods, a fact that was not apparent in earlier 15 minute data sets. Many Atlantic harbours display similar behaviour. The left panel of Figure 7 shows North Sydney's seiche at about 2+ hour period. Both observations of seiches agree well with theory based on harbour dimensions and average depths. During stormy conditions with strong infra-gravity forcing, seiche amplitudes (peak to peak) have been observed to reach nearly 1 metre. In some cases, these seiches, like storm surges, combined with high tide have resulted in local flooding. An implication for tsunami warning emergency measures personnel is that during stormy conditions, they must be able to distinguish between a seiche and the arrival of a tsunami of similar amplitude.

Figure 8 presents a time-series of images simulating the arrival of a 0.5m amplitude tsunami at St. Lawrence NL. The first 6 images (left to right then down) are presented with 10 minute spacing (recall that 10 minutes is the new station upload period). The last 2 images show wave arrival over the following 2hrs. This is how emergency measures decision makers will be presented with observations of a tsunami arrival through time. The incoming waveform (a scaled-down version of a simulated wave from the 1929

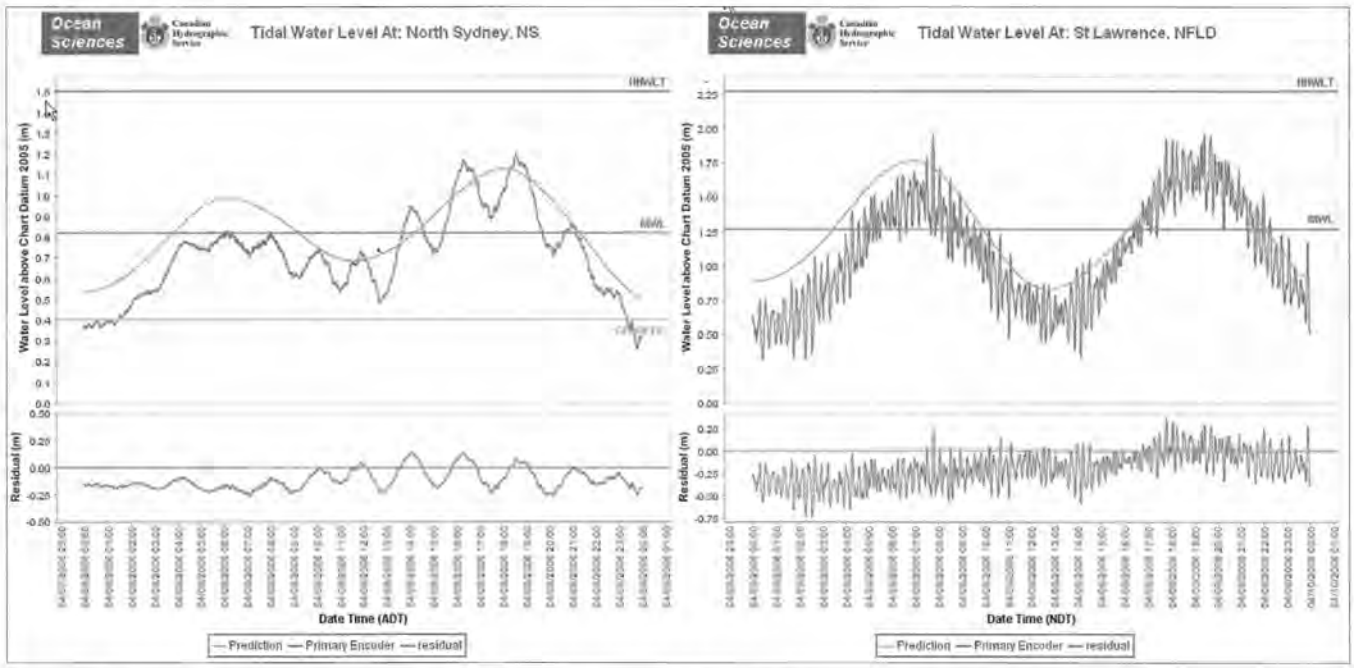


Figure 7: Low Frequency wave activity at North Sydney NS and St. Lawrence, NL, April 8, 2006 (1 min. sampling).

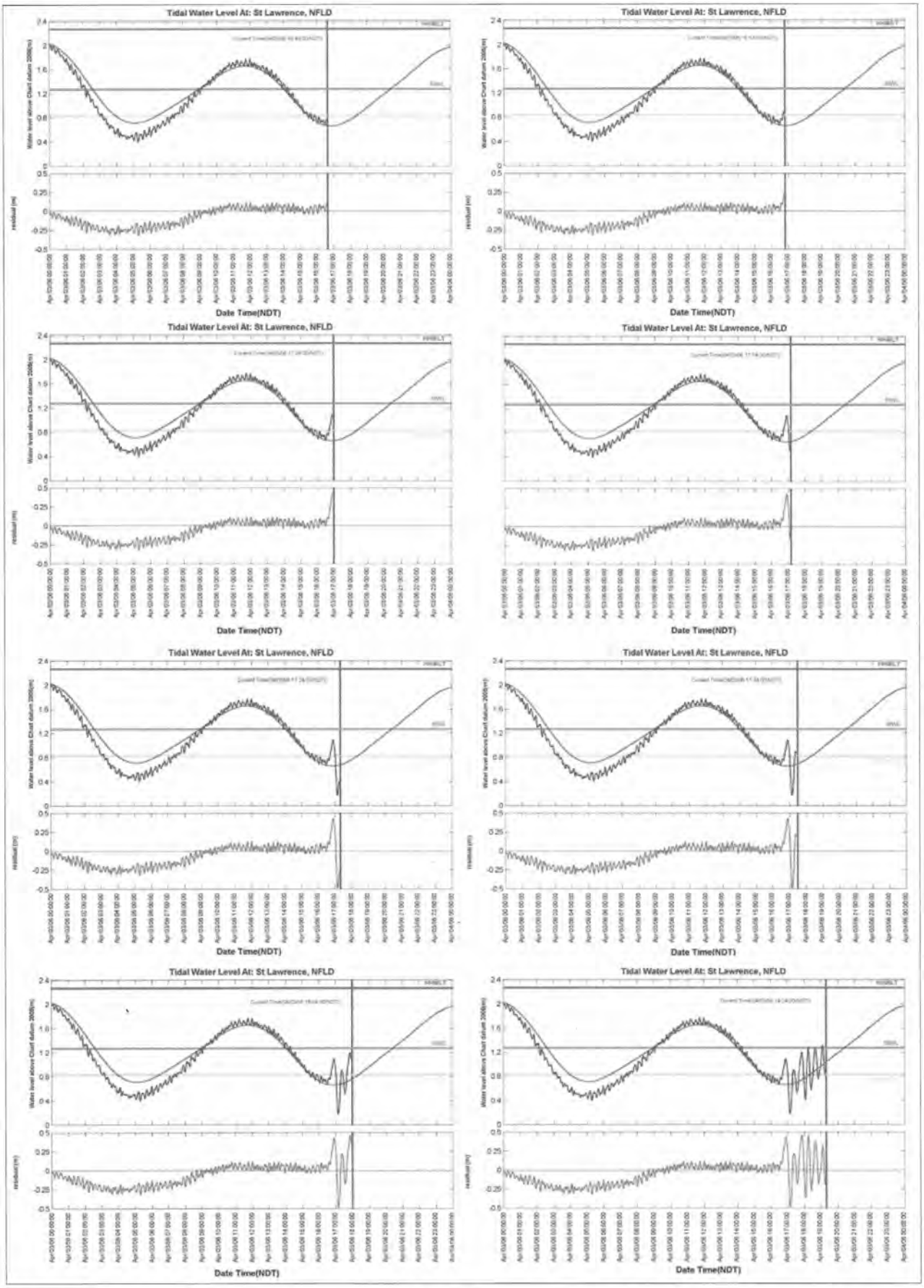


Figure 8: Simulation of a 0.5m tsunami arriving at St Lawrence. The top 6 panels show how the event would appear to emergency measures personnel at ASPC and ATWC tracking its arrival, given the system's 10 minute data upload cycle (10 min. elapsed time between panels). Bottom panels present wave arrival over the following 2hrs.

Burin Tsunami, courtesy of Zhigang Zu) has about a 30 minute period. Clearly, 15 minute sampling would have significantly under-resolved the wave and might result in an additional time delay of 10 to 20 minutes before the wave could be properly identified.

A 0.5 metre tsunami at St. Lawrence could be problematic, particularly at high tide, but would be unlikely to cause catastrophic damage. However, wave amplitudes at other coastal locations could be significantly greater, particularly if the tsunami was not a local event, but had propagated in from deep water. What Figure 8 demonstrates is that a delay of at least 20-30 minutes is likely following the initial arrival of the wave front before identification and a preliminary estimate of initial wave height could be made. This shows that land based detection is unlikely to provide appreciable warning for locations along the adjacent coastline.

Conclusion

CHS Atlantic's RTWL system is a work in progress. Much remains to be done. Implementation of RTQC and incorporation of water level forecasts incorporating weather forcing effects is underway and the results should be available in the spring of 2007. Access to GOES transmission windows and deployment of the GOES hardware are still pressing issues. However, RTWL access is now a reality in Atlantic Canada and CHS Atlantic has come a long way in a short time towards achieving its PWLN revitalization goals.

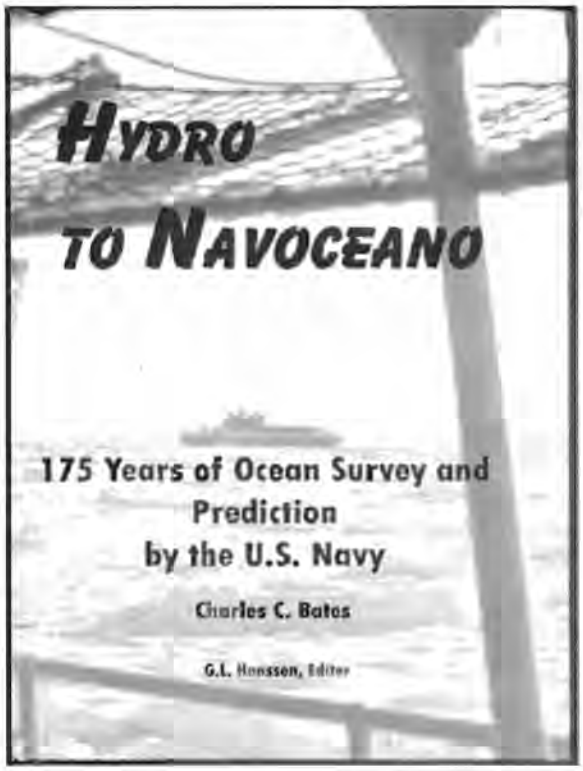
Acknowledgments

We would like to thank many individuals who have played significant roles in development of the RTWL system - a truly collaborative effort. Particular thanks go to Dr. Savi Narayanan for direction, and for assisting with the necessary funding. To Richard MacDougall and Douglas Bancroft for their direction, to John Loder for expertise and advice on tsunami warning gauge locations, to John O'Neill and Kohila Thana for system and web design, to Douglas Gregory and Richard Eisner for providing the web infrastructure necessary for quick development of the RTWL web pages, to Mike Ruxton, Craig Wright, Larry Norton and Mark McCracken for Geomatics IT assistance, to Dave Blaney, Chris Coolen and Fred Carmichael for extensive field work, and to other CHS personnel who have at times provided assistance and advice.

About The Authors...

Phillip MacAulay is newly with the Canadian Hydrographic Service, Atlantic region. He has degrees in Mechanical Engineering from DalTech (BEng) and the University of British Columbia (MSc), and in Physical Oceanography from Dalhousie University (PhD). His present interests are operational oceanography and the development of operational tools for Hydrographic applications.

Charles O'Reilly graduated in 1975 with a BSc (Honours) in Geology and Physics from Dalhousie University, Halifax, Nova Scotia. He worked for three years in exploration geophysics for Texaco and Union Oil in Alberta. In 1978, he joined the Canadian Hydrographic Service where he has been working in the Tides, Currents and Water Levels Section to the present. His current position is Chief of Tidal Analysis and Prediction (CHS/Atlantic), and he was recently Acting/National CHS Tidal Projects Coordinator. He has been active in coastal zone management issues, remote sensing and the establishment of 3-D vertical datum transforms. He has also been very active in researching the impacts of rising sea levels and storm surges. He is a past Branch Vice-President of the Canadian Hydrographic Association, and is a member of the Canadian Meterological and Oceanographic Society and the Canadian Geophysical Union.



HYDRO TO NAVOCEANO

175 Years of Ocean Survey and Prediction by the U.S. Navy

Written by Dr. Charles C. Bates. Lt Col., USAF (Ret.)

Review contributed to *Lighthouse* by Craig Zeller

Published by Corn Field Press, Rockton, Illinois 2005
ISBN: 0-9774144-0-X Hardcover, 330 pages

This book is a chronicle of the people, the technology, works, and events that have shaped American naval oceanographics (hydrography, oceanography and geophysics) from the inception of the naval hydrographic office in the capital region of 1830 to the post hurricane Katrina era in Mississippi in 2005. It is a fascinating look at the workings and the evolution of a service that both parallels and contrasts with that of their Canadian friends.

As the book's title implies, the book moves chronologically through the better parts of the last two centuries. We learn about the technologies and challenges of the day and also about the ever shifting focus of the department in response to national requirements, political necessities and the will of its leaders. Throughout, the book is peppered with anecdotes that make it a captivating read. Some involve the dominant figures of the day and sometimes the more colourful. As well, many of the key world events in the last century are viewed from the perspective and involvement of the office - be it supporting military campaigns such as World War Two, Korea and Vietnam or support ventures such as the space program, the establishment of the DEW line, or anti-submarine warfare. There are many lists and tables of facts; the tours of duty of ships and personnel and there are many citations and references to further works. Therefore, it is a must read for those interested in American hydrography (and ocean science),be it naval or civilian.

The Canadian reader will recognize many references - in people, in missions and technology. Surveys of the north are depicted in word and picture. There is even a photo of a submarine being used for science at the north pole in 1962. The contrast between the Canadian and American experience is interesting both in terms of scope and range. The projects, the fleet, the theatre of operations and the budget are astounding compared to similar work in Canada.

Dr. Bates has put together a nice mix of storytelling, scientific descriptions and archival research and insight into the bureaucratic and political worlds. In some ways, it is a glimpse at both our past and future. Moreover, it is a worthwhile and enjoyable read. The author invites interested parties to investigate further at: *http://patriot.net/~eastlnd2/bates.htm.*

THE CANADIAN HYDROGRAPHIC ASSOCIATION AWARD
LA BOURSE DE L'ASSOCIATION CANADIENNE D'HYDROGRAPHIE

(Established, 1992 / Établie en 1992)

Deserving Student $2,000 / 2000$ Pour un étudiant méritant

Application Criteria

1. The applicant must be a full time student in an accredited survey science program (the program must have a Hydrographic Survey or a Geographic Information Systems, Cartographic or Land Survey component) in a university or technological college anywhere in Canada. Environmental studies only will not be eligible. The Manager of this award will determine the eligibility of the program for the award.

2. The award will be available to undergraduate students in a degree or diploma program that conforms to the basic subject topic. The applicant will be required to submit a transcript of his/her most recent post secondary marks at the time of application. The marks must indicate an upper level standing in the class and under no condition less than 70%.

3. The award will be presented to an applicant who can demonstrate a bona fide financial need, coupled with an above average academic performance as stated above.

4. The applicant will be required to write a short paragraph explaining his/her financial need in a clear, concise manner on the application form or, if necessary, attached piece of paper. The importance of this aspect of the application is emphasized.

5. The award application will be submitted to the Canadian Hydrographic Association by June 30 each year and to the address in item 11 below.

6. The value of the award is $2,000. There is one award only each calendar year. Only the winner will be notified.

7. The successful applicant will be issued with a special Hydrographic Association Certificate, duly framed, at the time the award is made. He/she will also receive a medallion with the Hydrographic Association Crest and have his/her name mounted on a perpetual winner's plaque. A picture of the plaque, duly inscribed will be mailed to the winner along with the $2,000 cheque during the second week of July.

8. The applicant must submit one letter of reference from an official of the university or college where the applicant spent the previous year. This letter of reference must include the address and phone number of this official.

9. An individual student may receive the award once only.

10. The successful applicant's letter of appreciation will be published in the next issue of our professional journal "Lighthouse".

11. Application will be made on the form supplied or preferably down loaded from the official CHA web site at *www.hydrography.ca* and sent to:

Critères d'admissibilité:

1. Le candidat ou la candidate doit être un étudiant ou une étudiante inscrit à plein temps à un programme reconnu en sciences géodésiques (ce programme doit inclure les levés hydrographiques ou un contenu des systèmes d'informations géographiques, de cartographie ou des levés terrestres) par une université ou un collège situé au Canada. Un programme en environnement seulement ne sera pas éligible. L'administrateur de cette bourse déterminera l'admissibilité du programme pour la bourse d'études.

2. La bourse s'adresse aux étudiants et étudiantes inscrits dans un programme menant à un diplôme collégial ou de premier cycle universitaire conforme aux disciplines de base. Le candidat doit soumettre une copie de son dernier relevé de notes post-secondaire avec sa demande. Les notes doivent être au-dessus de la moyenne de sa classe et être obligatoirement supérieures à 70 %.

3. La bourse sera remise au candidat ou à la candidate qui, de bonne foi, peut démontrer ses besoins financiers et qui respecte les exigences académiques mentionnées ci-haut.

4. Le candidat ou à la candidate devra écrire un court texte clair et concis, démontrant ses besoins financiers sur le formulaire de la demande ou, si nécessaire, sur une lettre jointe. Une grande importance est accordée à cet aspect de la demande.

5. La demande doit être soumise à l'Association canadienne d'hydrographie au plus tard le 30 juin de chaque année à l'adresse mentionnée à l'article 11 ci-bas.

6. La valeur de la bourse est de 2000 $. Il n'y a qu'une seule bourse remise par année civile. Il n'y aura que le gagnant qui sera avisé.

7. Le récipiendaire recevra un certificat spécial de l'Association canadienne d'hydrographie, dûment encadré. Il ou elle recevra aussi un médaillon à l'effigie de l'Association canadienne d'hydrographie et verra son nom ajouté sur la plaque des gagnants. Une photo de la plaque, dûment gravée sera postée au gagnant avec un chèque de 2000 $ au cours de la deuxième semaine de juillet.

8. Le candidat ou la candidate doit soumettre une lettre de référence d'un représentant de l'université ou du collège où il a suivi son cours l'année précédente. Cette lettre de référence doit inclure l'adresse et le numéro de téléphone de ce représentant

9. Un étudiant ne peut recevoir la bourse qu'une seule fois.

10. Une lettre d'appréciation du récipiendaire sera publiée dans l'édition suivante de notre revue professionnelle « Lighthouse ».

11. La demande devra être faite en se servant du formulaire prescrit ou préférablement téléchargée à partir du site internet officiel de l'ACH « www.hydrography.ca » et envoyée à :

Barry M. Lusk, Manager / Administrateur
Canadian Hydrographic Association Award Program / Bourse de l'Association canadienne d'hydrographie
4719 Amblewood Drive, Victoria, BC V8Y 2S2
luskbm@telus.net FAX / Télécopieur: (250) 658-2036 *www.hydrography.ca*

Challenges in Delineating Canada's Continental Shelf Under the United Nations Convention on the Law of the Sea

By: Richard MacDougall, Department of Fisheries and Oceans
Louis Simard, Department of Foreign Affairs and International Trade
Jacob Verhoef, Natural Resources Canada

Introduction

The United Nations Convention on the Law of the Sea (UNCLOS) establishes a comprehensive regime for the regulation of those marine areas that are outside the internal waters of "States." The development of the treaty was a long and complicated negotiating process. The third conference, convened in 1973 and lasting until 1982, involved representatives from over 160 sovereign States and culminated in what has often been called a "constitution for the oceans." UNCLOS required ratification by a certain number of countries before it came into force. This happened on November 16, 1994, one year after receiving its 60th ratification. At the end of 2005, a total of 157 countries had signed the treaty and 149 had ratified, making UNCLOS one of the most successful treaties in the history of the United Nations.

Canada has been a strong and consistent proponent of UNCLOS and Canadian diplomats were recognized for their activities during the negotiation of the treaty. Canada was among the signing countries in 1982 and ratified UNCLOS in December 2003.

Main Provisions of UNCLOS

The Convention is a comprehensive attempt by the international community to regulate all activities in the world's oceans, including all aspects of the resources of the sea and all uses of the ocean. For this, UNCLOS divides the seafloor into zones of national and international jurisdiction, with each coastal State's authority diminishing seawards. It recognizes the right of a coastal State to the seabed and water column offshore to 200 nautical miles (nm)—the Exclusive Economic Zone (EEZ) —and to the seabed beyond 200nm under special circumstances. The part of the world's oceans outside national jurisdictions, the *High Seas* and the *AREA* (Figure 1), is defined as the "common heritage of mankind", and the International Seabed Authority was established to oversee its use.

In addition, the more than 300 articles of the Convention include provisions for marine research, the protection and preservation of the marine environment, and the settlement of disputes. A complete overview of UNCLOS is beyond the scope of this paper that will focus only on

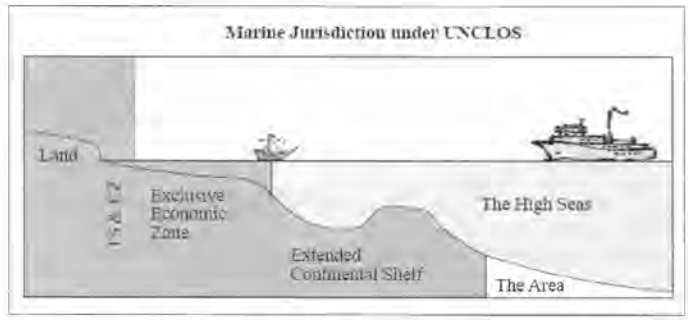


Figure 1: Territorial jurisdiction under UNCLOS: Darker gray areas are under the jurisdiction of the coastal State; lighter gray areas are the High Seas and the Area.

Article 76 which defines the circumstances whereby a coastal State can extend its jurisdiction beyond the 200nm EEZ. This is an important Article for Canada, since, under the treaty, a coastal State has "the sovereign rights for the purpose of exploring and exploiting its natural resources" in that extended area. However, these rights are only with respect to resources on and below the seabed, including sedentary species. (This is in contrast to the EEZ where the coastal State also has exclusive rights to the biological resources in the water column.)

Article 76

Article 76 is relatively short, about one page of text. However, its interpretation is not straightforward and has already generated a large number of discussion papers. It is important to realize that Article 76 describes the definition of coordinates of a legal offshore limit that are based upon geological and geo-morphological characteristics of the seafloor. Its implementation requires the analysis and interpretation of the shape of the seabed, depth of seafloor, and thickness of the underlying sedimentary layer. These measurements result in a preliminary outer limit obtained by the application of distance formulas outlined in Article 76.

There are two formulae and a country can choose whichever formula maximizes the extension of jurisdiction over their extended continental shelf. Both formulae begin at the Foot of the Slope (FOS) of the continental shelf.

The FOS is defined as the point of maximum deflection between the slope and the Abyssal plain. A nation can establish a preliminary outer limit using the distance formula - 60nm from the FOS. or a nation can choose to use the sediment thickness formula and define the preliminary outer limit as the point where the sediment thickness is 1% of the distance from the FOS (Figure 2). These two formulae "enable" a nation to extend their jurisdiction beyond 200nm.

Outer Limit

measured from the "Foot of the Slope" options:

a) a distance of 60nm, or

b) to a point where thickness of sedimentary rocks is 1% of the distance to the foot of the slope

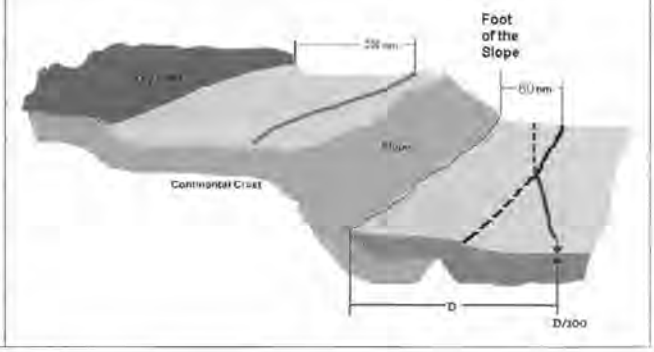


Figure 2: Outer Limits.

Article 76 also defines a so-called constraining line, beyond which the offshore limit cannot extend. The constraining lines only apply if the preliminary outer limit established using either formulae falls further offshore than the constraining line. As with the preliminary outer limit, a nation can choose the constraining line formula that maximizes the extension of jurisdiction beyond 200nm. One constraining line is 350nm from the baselines used to define the Territorial Sea. The second is 100nm from the 2500m depth contour (Figure 3).

Constraints

Continental Shelves are constrained by the most seaward of:

a) a line 350nm from the baselines
or

b) a line 100nm seawards of the 2500m depth contour

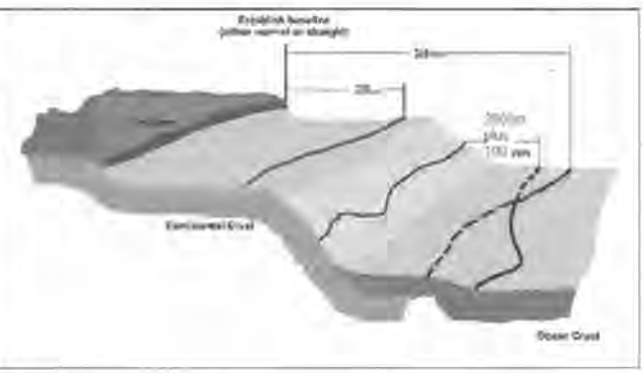


Figure 3: Constraint Lines.

To construct the final outer limit, a coastal State chooses at each point the most landward line from the preliminary outer limit and constraining lines. The final outer limit is defined by straight line segments connecting the points, which cannot be farther apart than 60nm.

Based upon an application of Article 76 to generalized global data sets, it is expected that 40-60 nations may have a possible claim for extending their outer limits beyond 200nm. The jurisdiction in the extended area has to be actively claimed. A coastal State has to submit a claim, with substantiating information outlining its case, within ten years from the time that it ratified the Convention. By May of 2006, five countries had submitted their entire or partial claims (Russia, Brazil, Australia, Ireland and New Zealand).

Commission on the Limits of the Continental Shelf (CLCS)

Under Article 76 of UNCLOS, coastal States can submit claims for an extended continental shelf to the Commission on the Limits of the Continental Shelf (CLCS). The 21 commission members, elected exclusively from states that have ratified the Convention, are experts in the field of geology, geophysics, or hydrography. They serve a five-year term and are eligible for re-election.

To assist coastal States in the preparation of their submissions, the CLCS has produced a set of technical guidelines outlining the information to be submitted, including supporting material. The CLCS reviews the submission and makes appropriate recommendations to the coastal State. Only the coastal State can establish the final and binding limits of its continental shelf. The main role of the CLCS is to ensure that claims are within terms of Article 76. This review process and the recommendations of the CLCS lends legitimacy to a State's claim. It is important to note that the CLCS cannot pronounce on disputed areas between neighbouring States. These disputes have to be resolved by the parties through negotiations or mutually agreed dispute settlement.

Canada's Case

Canada is a coastal State bordering three oceans, and a significant part of its territory is submerged land in the 200nm Exclusive Economic Zone (Figure 4). However, Canada is also a "broad-margin" State, i.e., a coastal State whose continental margin extends beyond 200nm. Therefore, the provisions of Article 76 allow Canada to formally extend its outer limits beyond 200nm.

In 1994, the Geological Survey of Canada (GSC) and the Canadian Hydrographic Service (CHS) performed a desk-top study of Canada's offshore areas in the context of Article 76. For this study, all bathymetric and geological data were compiled and analyzed to establish the provisional outer limits of the continental shelf. The results (Figure 4) demonstrated that Canada could possibly extend seabed jurisdiction over regions in both the Atlantic and Arctic oceans. (The narrow margin in the Pacific Ocean provided no clear prospects for extension.) The study found that the size of the area

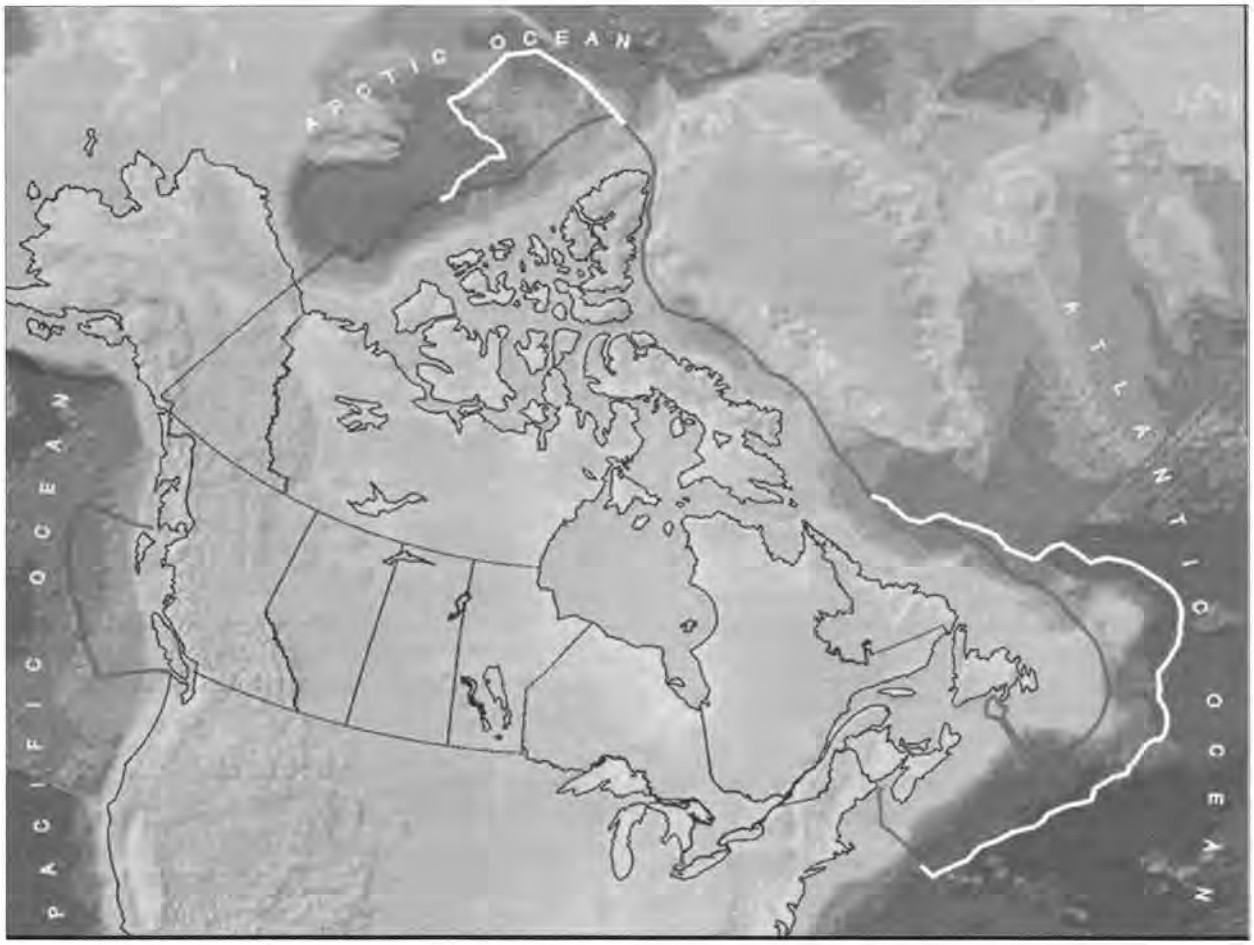


Figure 4: Map shows the Canadian case: current and prospective offshore jurisdiction. Gray line represents the EEZ of ~ 4 million square kilometres. White lines indicate areas outside of EEZ: Atlantic Ocean ~ 1 million square kilometres; Arctic Ocean ~ ¾ million kilometres; Pacific Ocean - not certain.

beyond 200nm could be as large as 1.75 million square kilometres, or as is often quoted, "an area about equal the size of the three Prairie Provinces."

It should be noted that the amount and quality of the existing data used in this preliminary analysis was deemed insufficient to substantiate the claim to the CLCS. The majority of the data collected by the GSC and CHS lies within Canada's EEZ. The application of Article 76 requires data outside the 200nm zone and this is where Canada is lacking the information required for a submission.

Canada's UNCLOS Program

The 2004 Federal Budget announced funding of $70 million over 10 years for the survey work that is required to conclusively establish the limits of Canada's entire continental shelf off its Atlantic and Arctic coasts. This would secure international recognition of Canadian jurisdiction over the resources on and under Canada's continental shelf beyond the customary EEZ in the Atlantic and Arctic oceans.

The delivery of the UNCLOS program is the joint responsibility of three federal departments: the GSC (NRCan) is responsible for seismic surveys; CHS (DFO) is responsible for bathymetric surveys; and Foreign Affairs Canada (FAC) will provide legal advice on UNCLOS and the CLCS and will lead in the preparation and presentation of the submission.

The scientific component of the UNCLOS program will be directed by an inter-departmental Management Board consisting of one Director each from the GSC, FAC and CHS. This Management Board reports to a Steering Committee made up of three Assistant Deputy Ministers (Earth Science Sector (NRCan), Science (DFO) and Oceans and Environmental Law Division (FAC). A small program office has been established at the Bedford Institute of Oceanography to oversee and coordinate the mapping effort. Since both the GSC and CHS already have offices at BIO, this location allows an efficient delivery of the program. In addition, scientific staff from both organizations will be recruited / seconded to work on the program for various projects such as specifying data collection, monitoring contracts, performing quality assurance, and analyzing the information that will result in the establishment of the coordinates of the outer limit.

Based on the analysis of existing data, a survey program has been designed to collect the minimum amount of

new data necessary to produce a scientifically sound and defensible claim, which maximizes Canada's claim. About 85% of the funding will be utilized for the acquisition of new data, and approximately two-thirds of the cost of the program will be in the Arctic, where limited data exists and conditions are more challenging.

Work to be Done

The following is a list of major tasks that are included in the Canadian UNCLOS plan:

- Mapping baselines from which the breadth of the territorial sea is measured
- Mapping the 2500m depth contour
- Mapping the Foot of the Slope
- Mapping sediment thickness
- Determining the geological nature of isolated elevations
- Deciding on the case for 'evidence to the contrary'
- Environmental Assessments for survey methodologies
- Creating lines at calculated distances (60, 100, 200 and 350 nautical miles)
- Preparing data bases of the above
- Preparing output in the form of charts, maps and diagrams
- Consultation / negotiation / dispute settlement

A number of these tasks will occur in parallel. Some are more general and apply to the whole submission while others are specific to one area. Some will have more impact on the critical path than others, for example, data collection.

Baselines

The coordinates of the turning points for the straight line baselines used for the Canadian Territorial Sea are proclaimed by Orders in Council and refer to specific CHS nautical charts. Those nautical charts contain the official limits of the Territorial Sea and the Exclusive Economic Zone for Canada. In the 20 - 30 years that have passed since these Orders in Council for the baselines of the territorial Sea were established, surveys have discovered changes that impact chosen points. In addition, the majority of CHS charts are now referenced to North American Datum 1983 (NAD1983) which is equivalent to World Geodetic Datum (WGD)84 and a number of charts referenced in the Orders in Council have been cancelled. Therefore, not only do baselines have to be mapped in areas of change where they affect the 350nm constraint line, the Orders in Council that publish the coordinates must be updated.

2500m depth contour

In areas where the 2500m depth contour plus 100nm constraint line is to be used, the 2500m contour must be mapped. Trials conducted by the University of New Hampshire have shown that having multibeam bathymetry of the 2500m depth contour allows selection of points less than 60nm apart that are most advantageous to maximizing the outer limits of an extended continental shelf.

Foot of Slope

The foot of the slope is the key starting point in either formula used to establish the preliminary outer limits of the continental shelf. It must be determined from bathymetric data that covers a significant portion of the slope to be able to select the point of maximum deflection. While the stylized diagrams show a pronounced foot of the slope, without vertical exaggeration the difference in deflection is in the range of 1%. The present plan in Canada for mapping FOS is to supplement existing bathymetric data with selected profiles, and as time and budget allows, refine in areas where analysis of data shows the advantage of doing so.

Sediment Thickness

Based on preliminary analysis of existing data, areas where it is believed that only sediment thickness will extend the claim beyond 200nm have been identified as candidates for seismic surveys. The major areas where these surveys will be needed are the Labrador Sea, Scotian Shelf and the western Arctic. It is planned to run reflection seismic profiles from the continental shelf to a point beyond the point where sediment thickness is 1% of the distance to FOS at a maximum spacing of 60nm. The locations for the profiles will be selected using the best available bathymetry and seismic data.

Isolated Elevations

Refraction seismic surveys will be required to confirm that elevations are prolongations of the continental shelf. This applies to features such as Orphan Knoll, Flemish Cap and the Arctic ridges (Lomonosov and Alpha-Mendeleev). The results of these surveys will have a significant impact on the area of the extended continental shelf and on the plans for additional survey work to collect the data needed to apply the most advantageous combination of formulae for the outer limit and the constraint conditions.

Evidence to the Contrary

It may be necessary to collect evidence to the contrary to substantiate a claim. For example, this could occur where there is not a clearly defined FOS based on bathymetry alone and it is necessary to support an interpretation with geological information concerning sediment or crustal structures. If, where and how often evidence to the contrary will need to be collected will not be known until data is collected and analysed.

Environmental Assessments

Because significant energy is required to collect seismic data and these surveys could operate in environmentally sensitive areas where both the survey activity and the methodology are not normal occurrences, the impact on the environment must be reviewed, the appropriate consultations held and permissions obtained. This is particularly true in the Arctic and, to date, a part of the Environmental Assessment has included explaining the program to various local communities and including a local observer on the 2006 Arctic winter survey.

Creating Lines

It is necessary to determine and draw a number of lines based on different requirements

- the baselines of the Territorial Sea
- the 200nm EEZ
- the 350nm constraint line
- the 2500m depth contour
- the 2500m depth contour plus 100nm line
- the FOS
- the FOS plus 60nm
- the FOS plus the distance to the point where sediment is 1% of the distance to the FOS.

Canada is using the CARIS LOTS software to analyse the data and to calculate and draw these various lines.

Creating Data Bases

A large amount of existing data must be assembled, analysed, documented and stored. It is in multiple formats - with varying accuracies - documented in different ways - containing public domain, proprietary, confidential and possibly classified data. Framework documents synthesizing the current state of knowledge and research about such things as the geology of an area will be prepared and catalogued. This will be supplemented by newly collected data to prove or disprove particular hypotheses. All must be properly stored so that it can be assembled into reports and maps, supporting data can be re-examined on-demand, etc. Canada expects to be managing a significant volume of data based on information that the Australian submission totalled some 37,000 pages. A data base is required to normalize and manage these data sets.

Consultation / Negotiation / Dispute Settlement

While this is not a race between countries to claim new territory before someone else lays claim to it, there are bound to be overlapping claims and bilateral boundaries to resolve in addition to the establishment of the outer limits of the continental shelf. The CLCS does not have a mandate to resolve overlapping claims, so the countries need to indicate that the over lap has been addressed, is being addressed, is not being addressed, or will be addressed by other means if the CLCS makes recommendations with respect to the outer limit of the continental shelf. This will require bilateral effort on the part of Canada with her neighbours. Canada and Denmark have signed a collaborative Memorandum Of Understanding (MOU) to cooperate in the collection and analysis of data in the Arctic and in the Labrador Sea. Should the data support an entitlement to an extended continental shelf, further agreement will be required with respect to extending the median line between Denmark and Canada. There are also extended boundaries to be resolved with the United States of America. The French Exclusive Economic Zone around St Pierre et Miquelon lies entirely within the Canadian EEZ.

Prepare Reports and Maps

Canada will need an estimated minimum of 175 points to define the outer limit of the continental shelf. In addition to framework documents about the geology, etc., each point will need to be supported by scientific evidence as to why this point was chosen. This will require documentation of the data collected, its accuracy and reliability, the analysis and interpretation of the data, and the representation of the evidence in report and map form. The output will need to be organized for presentation to the CLCS and for the Commissioners of the sub- committee examining the Canadian claim to follow the logic used, and to follow the thread between data, analysis and interpretation to conclusion.

Schedule

The work and budget are scheduled over the period to 2013. Major reviews are scheduled for November 2007 and November 2010 to determine if there needs to be adjustments of work plans and / or budgets.

- Set-up phase (prior to 2005):
  - Design survey plan with costing
  - Prepare Memorandum to Cabinet and Treasury Board Secretariat submission
- Initial Phase (2005-November 2007):
  - Establish CLCS Submission Office and Teams
  - Risk Analysis
  - Initiate data collection in Atlantic
  - Initiate data collection in Arctic
  - Review Pacific situation
  - Commence background activities in parallel (Baselines, Framework, bilaterals, etc)
  - **November 2007: Review of Program: change direction?**
- **Middle Phase (2008-November 2010)**
  - finalize data collection and analysis in Atlantic and initiate preparing of submission
  - continue data collection in Arctic
  - Continue background work in parallel (Baselines, Framework, bilaterals, etc)
  - **November 2010 - Review of program: Atlantic OK?; Arctic issues?**

- **Final Phase (2011- November 2013)**
  - Finalize Arctic data collection
  - Finalize claim preparation
  - Documentation of the status of bilateral issues with respect to overlapping claims
  - Submit claim (November 2013)

- **Support / Defend Submission as required (2014-2015)**

The Atlantic Program

The continental shelf in the Atlantic Ocean encompasses a broad shelf and therefore, the application of Article 76 could allow Canada to extend its limits beyond 200nm. (Figure 5 shows the results of the desk-top study). Depending on the structure of the margin, the application of either the sediment formula (mainly along the Nova Scotia and Labrador margins) or the distance formula (along the Grand Banks margin) will provide Canada with the maximum extension beyond 200nm. The outer limit shown in Figure 5 is the most advantageous combination of the application of these two formulae.

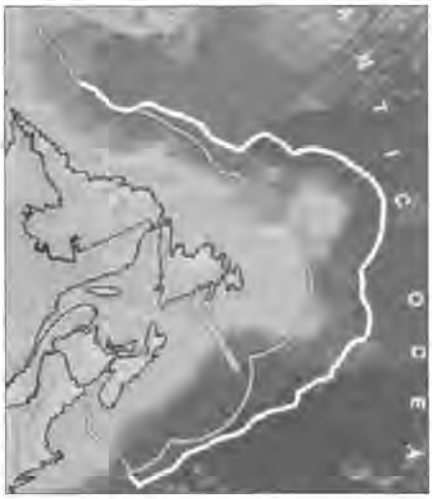


Figure 5: The Atlantic Program.

The Atlantic program will collect bathymetry information focused along the Grand Banks margin running selective profiles to supplement the existing data and confirm FOS points. Once the analysis of the 2006 data is completed, additional bathymetry may be required to more clearly define the FOS and maximize the outer limits. Seismic data (using standard industry type multi-channel seismic) will focus along the Nova Scotia and Labrador margins. Bathymetry will also be collected on each seismic profile to supplement existing bathymetric profiles to define the FOS. As with the Grand Banks, additional bathymetry may be required in future years to refine the FOS and maximize the outer limits.

A significant amount of seismic data has already been collected along the Scotian margin, mainly by the oil and gas industry. That information has been reviewed to see if it could be used to substantiate Canada's claim. Unfortunately, most of the data is located along the shelf break, inside the 200nm limits (gray line in Figure 5). In contrast, the information required for the application of the sediment formula requires information extending into the area outside 200nm. (the region between the red and white lines).

It is anticipated that the data collection in the Atlantic Ocean will take three-four field seasons, depending on weather conditions and availability of suitable vessels. Establishing Canada's outer limits in the Atlantic Ocean has some urgency, as petroleum exploration is already taking place near and outside the 200nm EEZ on the Grand Banks. For instance, the Hibernia field is located only about 30nm inside the EEZ, and in a recent land-lease in Orphan Basin, the majority of the parcels are located outside our EEZ. Canada could be the first country to produce oil and gas beyond 200nm, and establishing the outer limits under UNCLOS would provide certainty for industry.

The Atlantic program does not pose extraordinary challenges. There is a reasonable weather window each year and the program can be delivered using standard platforms and equipment.

The Arctic Program

The Arctic program is not straightforward, as the Arctic Ocean has complicated seafloor geology and circumstances for data collection in that area are much more difficult. The amount of existing data is small and the accuracy of much of it is less than ideal. At present the data consists of through-ice spot soundings taken over several decades in the last half of the twentieth century, data that was assembled for the International Bathymetric Chart of the Arctic Ocean (IBACO), declassified submarine data and in the western Arctic a small amount of ship data.

Data acquisition in the Arctic region will be technologically challenging, mainly due to the harsh environment (ice conditions, weather windows, suitable platforms). The complicated seafloor geology focuses on the two submarine ridges that extend north of Ellesmere Island (the Lomonosov and Alpha-Mendeleev ridges). The first requirement is to establish whether or not those ridges are a natural prolongation of the Canadian landmass. If this is the case, the possible extension of Canada beyond 200nm is outlined by the white area in Figure 6. Therefore, the first phase of the Arctic program addresses the prolongation question by measuring crustal seismic velocities on the Lomonosov Ridge and comparing them to those on the adjacent continent.

Because of technical challenges of data collection in the remote ice-covered areas of the Arctic Ocean, the GSC (in consultation with Foreign Affairs Canada) has negotiated with the Geological Survey of Denmark and Greenland (GEUS) to collaborate on surveys in the area north of Ellesmere Island and the Labrador Sea. This

will not only reduce the cost for both countries, but also lead to a joint interpretation of the collected information, thereby reducing the possibility of overlapping claims and disputes. An agreement was developed for a joint Canada-Denmark Arctic field program on the ice, starting in March 2006 based out of Canadian Forces Station Alert.

The area in which the second phase of the Arctic program will focus will be impacted by the results of the first phase. If Lomonosov and Alpha-Mendeleev Ridges are natural prolongations of the continental shelf, bathymetry will be required in a larger area to determine FOS and the 2500m depth contour on the west of Lomonosov Ridge and the north and west of Alpha- Mendeleev Ridge.

The desktop study indicated that much like Atlantic Canada, both the distance and the sediment formulae will be required to maximize extension of the continental shelf beyond the 200nm EEZ. In the western Arctic bathymetry will be required to refine the FOS but seismic data will be required to extend beyond 200nm. In this area the 350nm constraint line will be applied. By contrast, in the eastern Arctic there is little sediment so once seismic determines the prolongation of the continental shelf, bathymetry will be required to define both the FOS and the 2500m depth contour.

The current plan calls for the collection of seismic information using an icebreaker as the survey platform and probably another icebreaker as escort. Bathymetry can be collected on each seismic profile at the same time. Canada hopes to test this approach in the western Arctic on the Canadian Coast Guard Ship (CCGS) *Louis S. St-Laurent* during the 2006 season. The plan for bathymetry in the eastern Arctic also calls for a two-icebreaker operation. It is estimated that two icebreakers will be required for more than 2 months per year for 5-6 years to complete the bathymetric and seismic profiles.

To mitigate risk should ice conditions limit the icebreaker operations, a Plan B and Plan C have been developed.

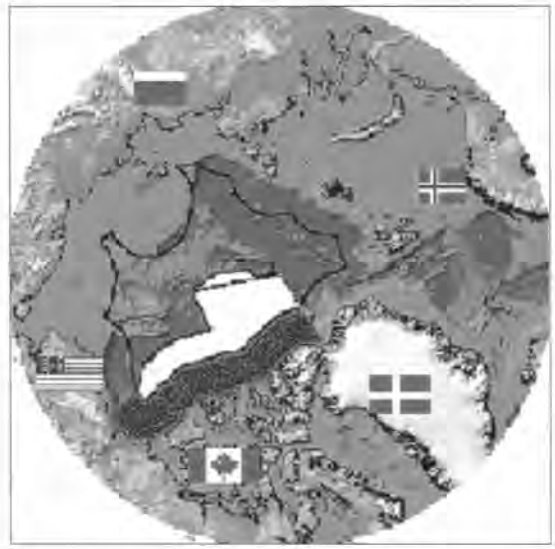


Figure 6: Canada's Arctic UNCLOS Program: dark gray section indicates Canada's EEZ, white section is where Canada hopes to obtain jurisdiction. Flags indicate other nations which may have Arctic claims.

Plan B would see the icebreaker approach used in the western Arctic where seismic is required to extend beyond the 200nm EEZ and the bathymetry needed for the eastern Arctic would be profiles of spot soundings collected by on-ice helicopter surveys from ice camps. Plan C would also see the western Arctic seismic and bathymetry profiles collected by on-ice helicopter surveys from ice camps.

Alternative options are being considered for bathymetry. Submarines, Autonomous Underwater Vehicles (AUV), a hovercraft and gliders have been proposed to the team but there is no proven approach that is currently operational and can deliver the needed data in the necessary timeframe. However, there may be opportunities to test alternate solutions during the planned projects.

Canada and Denmark collaborating in Arctic Data collection - Photo courtesy of Trine Dahl-Jensen, Geological Survey of Denmark and Greenland.

Challenges include the unpredictable ice and weather conditions which might make it difficult to collect information during some of the short "seasonal windows" available over the next several years. The on-ice surveys can only operate from mid March until early May. The icebreaker operational window is August and September. There is also competition for heavy Arctic icebreakers to support the International Polar Year. Therefore, the Arctic data collection will take advantage of data collection opportunities whenever they arise.

Pacific

The Pacific coast has a narrow continental shelf and it is not obvious that there is sufficient sediment to extend beyond the 200nm EEZ. It has been suggested that an extension might be possible if the Bay of Bengal clause could be applied in that area. Canada is seeking a legal opinion as to whether the Bay of Bengal clause, which was added to deal with a specific situation, could be applied to other areas in the world. A desktop analysis of what extension might be possible if the clause was applied is also planned. At this time no survey work is planned for the Pacific coast.

Conclusions

The ratification of UNCLOS in 2003 by Canada has started the ten-year period in which Canada must submit a claim for its extended continental shelf. Doing so could potentially give Canada the jurisdiction over resources on and below the seafloor in an additional area in the Atlantic and Arctic oceans that might be as large as the three Canadian Prairie Provinces. Through the collaborative CHS-GSC program at the Bedford Institute of Oceanography, the application of UNCLOS provides a unique opportunity for geoscientific and geomorphological data of the seafloor to be used to define the legal outer limit of the Canadian territory. The project is underway and will evolve as challenges are encountered and overcome.

Acknowledgements

The authors thank Richard Haworth, David Monahan, and Ron Macnab, who played a key role in the early development of the program.

Typical Ice Landscape.

About the Authors...

Richard (Dick) MacDougall is the Director of the Atlantic Region of the Canadian Hydrographic Service (CHS). In 2004 he added the leadership of the bathymetric program to establish the outer limits of the continental shelf under article 76 of the United Nations Convention on the Law of the Sea to his tasks. He is a graduate of the Surveying Engineering program at the University of New Brunswick. He is a professional Engineer and holds Commissions as NB Lands Surveyor and a Canada Land Surveyor. In his 36 years with the CHS he has worked in Atlantic, Central and Arctic Region and Headquarters in Ottawa and has held a number of positions including field hydrographer, Hydrographer in Charge, Data Base Engineer, Manager of Chart Maintenance, Distribution, Nautical Geodesy and Tides and Acting Director Marine Cartography. Dick is also the lead for the Department of Fisheries and Oceans on the UNCLOS project.

Dr. Jacob Verhoef is the Director of the Geological Survey of Canada-Atlantic/Natural Resources Canada in Dartmouth, NS. After completing his Ph.D. in The Netherlands, he joined GSC Atlantic in 1986, and was appointed to his current position in 1996. He was the principal investigator on a project to compile all magnetic data for the North Atlantic and Arctic Oceans, chaired an international committee for the compilation of geophysical data in the Arctic, and was a member of several international working groups. Dr. Verhoef is the lead for Natural Resources Canada on the UNCLOS project, and has responsibility as the GSC liaison with provincial geological surveys in the Atlantic Provinces.

Louis Simard, Director, Oceans and Environmental Law Division, Foreign Affairs Canada.

The Explorer Chartbook Series : A Work in Progress

By: Sara Lewis, Lewis Offshore Ltd

Introduction by Steve Grant,

When I was asked to write a brief introduction to Sara Lewis' paper on the Explorer Chartbooks I was delighted, having used both the earlier 'green land' version and the latest full colour version. These are truly remarkable products! I won't rave on about their many innovative features, and steal Sara's thunder, but I will say that Hydrographic Offices should take note – these types of charts could (should?) be the way of the future. Not only are they a convenient size (12in. x 17in.) and of sturdy construction (ring bound, waterproof, tear proof) but they are also a one stop shop for virtually everything the mariner needs to know to safely and easily travel in the areas covered. They would be equally at home in the cockpit of a small sailboat or on the bridge of a large commercial vessel. They are very accurate; I have used them to thread my way into some of the many truly spectacular anchorages found throughout the Bahamas. And, best of all, they cost a fraction of what traditional hydrographic office charts, tide tables and sailing directions would cost for a similar area and include a free update service via their web page: *http://www.explorercharts.com/.*

[Editor's note: Steve Grant is an engineer, a retired CHS employee, a member of the CHA Atlantic and a cruiser. He spends his winter months with his wife Karen cruising the Bahamas aboard their 36' Catalina, Sea Echo]

Background

"So... how did you get into making charts?" This is a question Monty and I often get, given our respective backgrounds as state policeman and English teacher. Certainly, the question is warranted. Early in our Bahamas cruising, we wanted to go places where there were no detailed charts. Simply said, we began creating charts for our own use.

Back in the '70s and '80s, what was available for piloting the cays and corals of the Bahamas was limited. For navigational charts, we used the Defense Mapping Agency (DMA) charts and large-spread book put out by the Better Boating Association (BBA). For other local information, the Yachtsman's Guide, with Harry Klein's sketch charts, was helpful. Most of the charts were based on ancient surveys with many inaccuracies in various places. There was no GPS and no electronic charts. We still carried our sextant even into the '90s and relied on a hand-bearing compass for fixes and standard methods of offshore navigation and inshore piloting, as well as a Radio Direction Finder (RDF). Our Loran provided marginally correct information if tweaked and pampered, except that the farther south we traveled, the more positions varied and the less reliable it became.

So... how did we get into making charts? Wanting to go on a high adventure trip to Crooked/Acklins in the '80s, we borrowed personal sketches from a long-time sailing visitor to the area. Where the existing charts had only deep-water data for getting ships through the Crooked Island Passage, they were inadequate to get us in to shore and sheltered places. Shallow-water data was scanty and often erroneous. Our tissue paper tracings from our friend's notations, along with information from local Bahamian lobster fishermen, gave us the courage to step out into the virtual unknown. We got braver and braver and used the same type of information to travel down to the Ragged Island chain. The high adventure continued.

One thing led to another. Several of our cruising friends saw some of the rudimentary charts that we were beginning

Motor Vessel Saranade.

to create and asked to photocopy or trace them to broaden their own cruising grounds. Since an eager audience was being developed, we purchased the topographical maps of the Bahamas at the Lands and Surveys Office in Nassau. These topographical maps, created from an aerial survey in the late '60s, had been produced by the British government just before the Bahamas became an independent nation. We were amazed to find that the land was basically drawn correctly and the elevations were accurate as well. Compared to the charts on hand, they presented the most precise topographical data. Our main job was to locate the land on the earth's grid without the aid of GPS. The topos presented us with virginal space between the islands and cays and rocks to make our chart notations once we applied latitude and longitude precisely.

One fellow cruiser suggested that we publish our findings. That led to our first set of 20 black-and-white placemat-sized drawings of the Exuma Cays, our most familiar cruising territory. Our cruising buddies became our "guinea pigs" and tried them out for a season. We even managed to sell a few to folks who heard about them. Our next step was to add color (green land) to the black drawings. Demand for the charts increased and we included a small separate guidebook of necessary information for cruising the Bahamas. This was our First Edition (1995).

Bluewater Books and Charts, founded by Milt Baker, an avid Bahamas vacation cruiser himself, was the first large retailer to recognize the value of our chart data. As one of the world's largest chart dealers, Bluewater sold our charts in great quantity after Milt had used them himself and found them to be the best thing on the market. Milt became a wonderful mentor for us and encouraged us to bind the information into a real book, not just a packet of loose-leaf chart-placemats. The result was the 1996 Second Edition of the Explorer Chartbook Exumas. It turned out to be a hit with yachtsmen looking for accurate data. Word of mouth was our best advertiser.

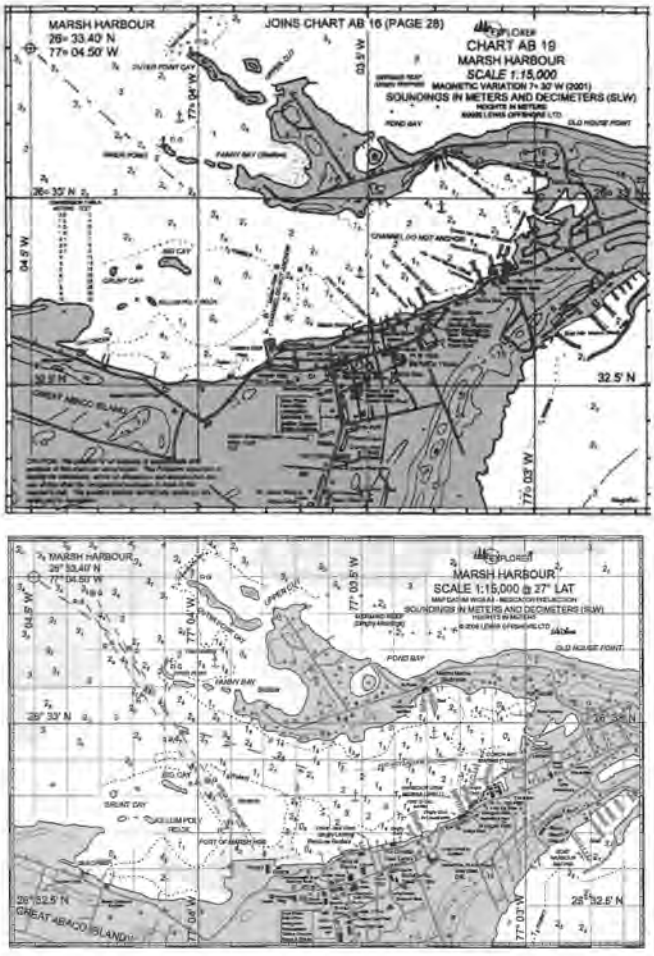
Milt continued to encourage us to publish data for the rest of the Bahamas, so the next logical area was our coverage of the islands closest to Florida which brought about the Explorer Chartbook Near Bahamas (First Edition 1997), covering Bimini, the Berrys, Grand Bahama, the Abacos, Andros and New Providence. This book also became a true "guidebook" as well as chartbook with extensive information on crossing the Gulf Stream, clearing Customs, reading the weather and the water, anchoring, and even an abbreviated history of the Bahamas, plus the "Need-to-Know Info" of facilities and services available to yachtsmen in the various settlements.

Of course, after that it was logical to complete the survey of the rest of the 700+ islands of this archipelago and publish the Explorer Chartbook Far Bahamas (First Edition 1999), covering Eleuthera, Cat Island, Long Island, Conception Island, Rum Cay, San Salvador, Samana Cay, the Plana Cays, Mayaguana, and Inagua.

The Evolution of Our Hydrographic Surveying and Charting Experiences

So...how did we actually make the charts? Picture our first efforts under full sail in our Carter 35, Vivacious, tacking and jibing while taking soundings and making notes on the topographical maps. Our 2 ½-foot draft allowed us to go where the water shifted from pale turquoise to almost white. Sometimes we pushed the envelope too far and found ourselves waiting for the tide to lift us off a sandbar that we abruptly discovered. Occasionally, we would use the dinghy and a hand-held GPS (not in the early days) to map an unexplored shoreline or shallow area, but most of our soundings were taken in Vivacious, and later in our motor vessel Saranade.

The evolution of our cartography has taken us from the twentieth century into the twenty-first century. Looking back, we wonder how we created the first editions of the charts with the aid of GPS selective availability and without DGPS and WAAS and without accurate verification using



This figure compares the earlier 'green chart' with the latest edition of the same area. Note that the color scheme is the reverse of traditional hydrographic charts. However, it corresponds more closely to the color of the water in the Bahamas and makes them almost photographic in nature. We have also included a lot of cultural detail to make it easier for cruisers to get around and find the services they need such as banks, grocery stores, etc.

aerial photographs. From the beginning, we considered how to make the charts easy to use, or as we call it, "cruiser-friendly." Studying all obtainable charts, we tried to eliminate "conventions" that were cumbersome or difficult to work with; for instance, notes and references in obscure places on the chart. Navigating offshore and piloting a small boat inshore, we tried to improve on some of the major faults of older charts. In doing so, we created our own system and sought to develop uniformity throughout our three publications. Even now, we are still open to improvement when a better way presents itself. For example, recent aerial photographs are used as templates to check for accurate drawing of land features. Also, we are in the process of converting all the chartbooks to waterproof material. With the publication of the 5th edition of the Explorer Chartbook Exumas in early 2007, all three chartbooks will be waterproof/tearproof. A welcome enhancement for yachtsmen, the new material makes the books nearly indestructible.

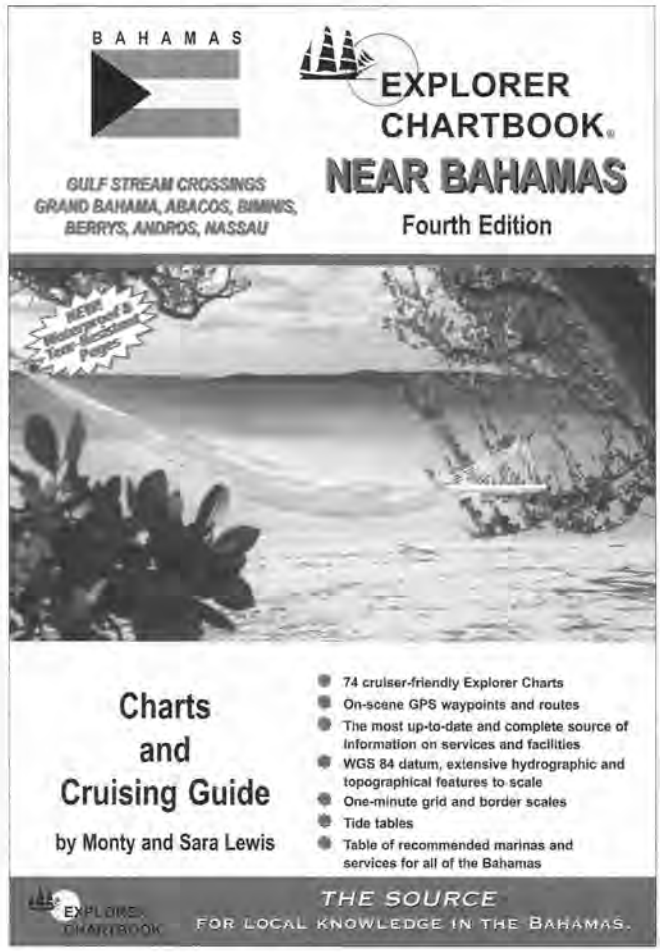
The original charts were drawn on a drawing board and all pages of both charts and text were made "camera ready" to be shot for printing. Pre-press corrections involved either "patching" a mistake or redoing an entire page. With Monty starting out as a non-computer person, it was a huge shock when our printing company moved to its new high-tech building and did not take its camera. That forced us to move into creating digital charts and brought us from Monty the Illustrator to Adobe Illustrator, an Everest of a learning curve for both of us. It also meant that all of the original hand-drawn charts had to be redrawn digitally, a project that took several years to complete, but forever making corrections and changes a much simpler process.

As the drawing techniques were refined, gradually more colors were added to the charts (seven shades of blue intuitively labeling the graduated depths of the water and three shades of yellow indicating the shallows, etc.) so that the Explorer charts have come to be almost photographic in appearance.

Explorer Chartbook Design Considerations

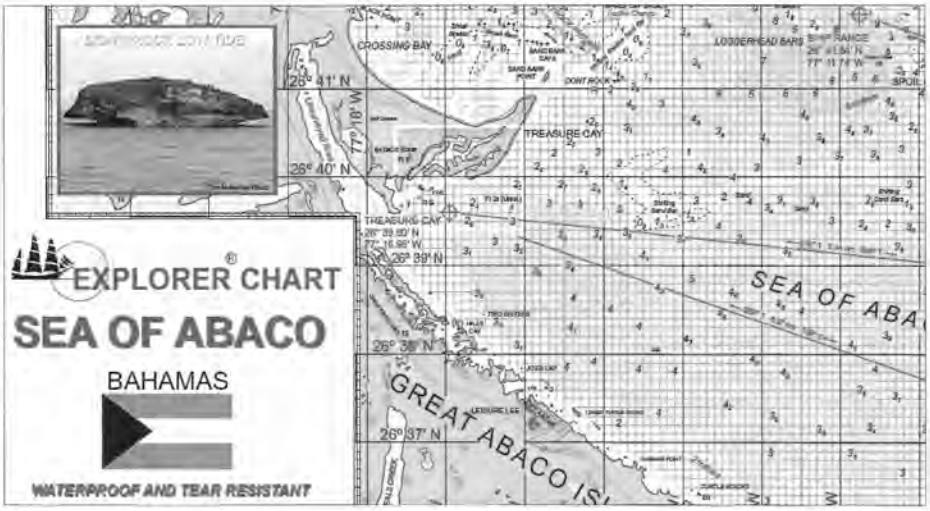
"So...how did you go about making the Explorer chartbooks?" The answer to that is, "very selfishly, to suit our own needs." The 12"x17"size of the book was designed not for large ships with banquet tables for navigation stations but for our smaller vessel with limited nav station and open cockpit or flying bridge. In other words, we wanted a book we could hold in one hand while piloting, one with all the information we needed for the particular area we were transiting on one or two pages. We didn't want to have several charts and guidebooks in use at one time but rather everything at our fingertips in a single publication.

Basically, our early audience was 30-40 foot sailboats and power vessels. (Today, of course, the picture has changed with larger and larger boats cruising the Bahamian waters.) We developed standardized notations for GPS



The 12"x 17" Explorer Chartbooks were designed to be used on small sail and power vessels but are equally at home on the bridge of larger pleasure or commercial vessels. We have tried to include all the information the cruiser will need such as tide tables, sailing directions, various customs and other regulations as well as the necessary chart information. A table of recommended marinas and services for all the Bahamas is also included.

waypoints not universally used before. With the lack of physical aids to navigation in the Bahamas, waypoints and routes became necessary to mark the main straight-line passages. Our waypoints were derived from on-scene surveys, pinpointing the best locations to enter cuts, change course, and avoid hazards. An Accu-grid™ (one minute or one-tenth of a minute) and border scales for "finger-walking" navigation eliminated the need for parallel rules and dividers while under way. We added small-scale planning charts and large-scale and closeup charts for actual piloting. Originally, the large-scale charts were all 1:25,000, but currently multiple scales are used to fit the page format. The larger scale was needed in important areas of close piloting, making it easy to zoom out and refer from large to small scale as needed. Tide tables were included at the back of each book so that another tide publication was made unnecessary. The goal was to make our chartbooks as "cruiser-friendly" as possible with everything at our fingertips. Even the Need-to-Know Info for each settlement was placed on



Where appropriate we include photographs of features. We also add waypoints with latitudes and longitudes and recommended routes complete with true bearings, reciprocals and distances. Areas where larger scale charts are available are outlined in yellow with a note indicating where that inset can be found.

the same page as the chart of the area. And of course, the charts became the "pictures worth a thousand words," without text description of getting into an anchorage or through a cut. The chart was designed to "say" it all. The text was an adjunct for you find what you need ashore once you get there.

We get a lot of questions about our use of metric soundings. When we first started creating the charts, the whole world was encouraged to move to the metric system with its simplicity and usefulness. The United States was going in that direction at the time. Today metric measurements are the international standard all over the globe, except perhaps for the United States. We chose to go with the international standard for measurement. When we are challenged on this issue, we remind people that their depth sounder can be set to read in metric, so there should be no problem of conversion. Even so, a conversion table from metric to feet appears on every chart.

Another area of questions comes from our use of true, rather than magnetic, compass headings. Early guidebooks came out with magnetic headings to make it easy for the casual cruising yacht. Initially, the Explorer charts used magnetic courses, but we soon changed to true courses since magnetic variation constantly changes. With GPS becoming the primary navigation system, its default is true. Thus, there is no reason to continue with seemingly convenient, but incorrect, method of labeling courses. It is easy to set a GPS to read in true, and it is also more accurate in calculating courses. Still, the variation on each chart's compass rose is updated with every new edition so you know what the variation should be.

Often, folks will ask us, "What publication do you use for a cruising guide?" Our response is that our own Explorer Chartbooks contain all the "need-to-know" information you will be looking for. If you want some of the "nice-to-know" stuff, like history and flora and fauna or even tall tales and opinion pieces, you can pick up one of the other guidebooks.

All in all, what started out to be an effort just for ourselves has grown into a project that benefits many others. It gives us a certain satisfaction to know that, as we were able to realize our dream of cruising the Bahamas, we have made it easier for others to do the same.

[*Editor's Note: See the inside back cover for a colour example of the Explorer Chart series.*]

About the Author...

Monty and Sara Lewis cruise the Bahamas in their motor vessel *Saranade*. With a love for the Bahamas and with the help of their shallow-draft boat and GPS technology, they have spent many winter seasons cruising the Bahamas to create these charts and cruising guides to make it easier and more pleasant for yachtsmen to enjoy a taste of paradise so close to mainland North America. Monty grew up by the waters around Ocean City, Maryland. He and Sara conducted summer day-sailing trips there for 12 years for shore side visitors in their sloop *Vivacious*. Monty has held a United States Coast guard Captain's License for over 35 years and is past commodore of the Eastern Shore Sailing Association, a member of the Delaware Capes Sailing Club, and a retired Maryland State Police Sergeant. Sara's background in English and journalism have helped her in preparing the cruising guide text and information articles.

This regular feature provides information and current news from the International Federation of Surveyors (FIG) with emphasis on FIG Commission 4 (Hydrography).

At the time of this writing, the 2006 FIG Quadrennial Congress and Working Week which will be held in Munich are but one month away. Among other things, this event will serve as a venue to wrap up our 2002-2006 Commission work plans and to introduce the next round of work which will take us through 2010. Final publications from working groups 4.2, A Vertical Reference Surface for Hydrography, co-chaired by Ruth Adams and Dr. Ahmed El-Rabbany and 4.3, Administering Marine Spaces (Coastal Zone Management), chaired by Dr. Michael Sutherland will be presented. I will be taking over the helm as chair of the Commission from Adam Greenland and with input from our delegates, the International Hydrographic Organisation (IHO) and International Federation of Hydrographic Societies (IFHS) a 2007-2010 work plan for Commission 4 has been developed. An overview of our 2007-2010 work plan is as follows:

Working Group 4.1 – Hydrographic Surveying in Practice

- Monitor and report on new directions in Hydrographic surveying.
- Develop good practice recommendations for project management and as well the delivery of Hydrographic products and services.
- Respond to opportunities to offer continuing professional development at regional meetings.
- Respond to direction from FIG Council to address emerging issues on an ad-hoc basis.

Working Group 4.2 – Standards and Guidelines

- Assist in the development of standards affecting Hydrographic data acquisition systems, competency and methodology, in collaboration with the FIG standards network and the IHO as they cooperate with the relevant technical committees of the International Standards Organisation (ISO) and other appropriate bodies.
- Cooperate with other Commissions where common applications exist.

Working Group 4.3 – Capacity Building and Economic Benefits of Hydrography

- Clearly identify the benefits (versus costs) associated with Hydrographic Survey products given that the technology and expertise required to deliver high quality Hydrographic Survey products can represent a significant expenditure.
- Promote Hydrographic Surveying as an investment in infrastructure and good project management.
- Market the Profession and the need to utilize qualified personnel.
- Provide support for the IHO Capacity Building Committee (CBC) initiatives.
- Coordinate efforts both within the Commission (WG 4.1) and externally to focus professional development where required.
- Investigate low cost alternatives for the delivery of Hydrographic services and training.

Working Group 4.4 – Administering Marine Spaces

- Focus on land management within the near-shore, land/sea interface of a Coastal Zone.

Through our recent agreements with the IHO and the IFHS we have an opportunity to cooperate with these organizations to fulfill the objectives of our task forces and working groups. We believe our "sister" organizations can help us fulfill of our mission in developing guidelines and standards that will assist Hydrographers in the provision of their services. To this end, our outlook for the next 5 years will include continued involvement with the IHO in the areas of Capacity Building and standards. If you are interested in learning more about FIG or specifically Commission 4, Commission 4 CD or log on to *www.fig.net* for more information.

Cont'd

Au moment d'écrire, le congrès quadriennal 2006 de la FIG et la semaine d'ateliers qui se sera tenue à Munich sont passés depuis un mois. L'événement servira, parmi tant d'autres, de rendez-vous pour conclure nos plans de travail 2002-2006 de la Commission et introduire la prochaine ronde de travail qui nous mènera en 2010. Les publications finales des groupes de travail 4.2 (A Vertical Reference Surface for Hydrography, coprésidés par Ruth Adams et Dr. Ahmed El-Rabbany) et 4.3 (Administering Marine Spaces (Coastal Zone Management), présidé par Dr. Michael Sutherland) seront présentées. Je prendrai la barre en tant que président de la Commission 4 de Adam Greenland et du plan de travail 2007-2010 élaboré avec l'intrant de nos délégués de Organisation hydrographique internationale (OHI) et de la Fédération internationale des sociétés hydrographiques (IFHS). Voici un apercu de notre plan de travail 2007-2010 :

Groupe de travail 4.1 – Pratique de l'hydrographie

- Suivre et rapporter les nouvelles tendances en arpentage hydrographique.
- Développer des recommandations pratiques en gestion de projets et dans la délivrance des produits et services hydrographiques.
- Répondre aux opportunités d'offrir des formations continues professionnelles aux rencontres régionales.
- Répondre aux directives du Conseil de la FIG concernant des sujets émergents sur une base ad hoc.

Groupe de travail 4.2 – Normes et guides

- Assister au développement de normes touchant les systèmes d'acquisition de données hydrographiques, compétence et méthodologie, en collaboration avec le groupe des normes de la FIG et de l'OHI puisqu'ils coopèrent avec les comités techniques de l'« International Standards Organisation (ISO) » et d'autres gens appropriées.
- Coopérer avec d'autres Commissions où des applications communes existent.

Groupe de travail 4.3 – Developpement des ressources at bénéfices économiques de l'hydrographie

- Identifier clairement les bénéfices (versus les coûts) associés avec des produits hydrographiques donnés que la technologie et l'expertise requises à délivrer des produits hydrographiques de haute qualité peut représenter des dépenses importantes.
- Promouvoir l'arpentage hydrographique comme un investissement en gestion de projets d'infrastructure et de biens.
- Vendre la Profession et le besoin d'utiliser du personnel qualifié.
- Donner le support aux initiatives du Comité du développement des ressources de l'OHI.
- Coordonner les efforts entre la Commission (WG 4.1) et d'autres groupes concernant le développement professionnel lorsque requis.
- Investiguer des solutions bon marché dans la délivrance de services hydrographiques et de formation.

Groupe de travail 4.4 – Gestion des zones côtières

- Se concentrer sur la gestion des terres et l'interface terre/mer d'une zone côtière.

Depuis nos derniers accords avec l'OHI et la IFHS nous avons une opportunité de coopérer avec ces organisations pour remplir les objectifs de nos ateliers et groupes de travail. Nous croyons que nos organisations « sœurs » peuvent nous aider à remplir notre mission dans le développement de guides et normes qui assisteront les hydrographes dans la prestation de leurs services. À cette fin, notre vision pour les cinq prochaines années inclura une participation continue avec l'OHI dans les domaines du développement des ressources et des normes. Si vous êtes intéressés à en apprendre davantage sur la FIG, la Commission 4 et la Commission 4 CD, visitez *www.fig.net* pour plus d'informations.

Andrew

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C & C Technologies

C & C Technologies (C & C), an international hydrographic surveying company, headquartered in Lafayette, Louisiana, has approximately 170 employees and four offices worldwide.

As of January 2003, eighty percent of C & C's revenues were derived from survey work for the oil and gas industry and the other twenty percent are derived from US government contracts. The oil industry work includes high-resolution marine geophysics for hazard studies and pipeline route surveys, rig and barge positioning, acoustic positioning for ROV's, as well as satellite navigation services. The company has separate offshore oil industry survey departments for geophysical work, marine construction, and navigation.

C & C Technologies has performed hydrographic survey work for various Government groups including NOAA, the US Geological Survey, and the Corps of Engineers. In 1994, C & C was contracted by the U.S. Naval Research Labs to perform research and development work on semi-submersible autonomous underwater vehicles (AUV's) for hydrographic surveying purposes. In January 2000, C & C and Kongsberg Simrad began working on C & C's new commercial AUV rated for water depths up to 3000 meters. The AUV's sensor payload included multibeam swath high resolution bathymetry and imagery, chirp side-scan sonar and sub-bottom profiler, differential GPS integrated with acoustic / inertial navigation and acoustic communications. Since delivery in January 2001, C & C's AUV has completed over 11,000 nautical miles of survey lines for a variety of worldwide clients.

Additional services offered by C & C include: C-Navä, the highest accuracy worldwide Gc-GPS differential correction service available, deep water jumbo coring (up to 30m) collected in water depths to 3000m, in-house state-of-the-art soil analysis lab, and 3 D hazard assessment reporting for MMS deep water site clearances.

For more information regarding C & C Technologies services please contact:

Mr. Mike Dupuis, Mr. Jeff Fortenberry, Mr. Art Kleiner, or Mr. Frank Lipari
at (337) 261-0660 email to info@cctechnol.com or
visit C & C's Website at *www.cctechnol.com*

ESRI Canada Limited

Since its establishment in 1984, ESRI Canada has made a commitment to promote, support, and implement GIS technologies in different areas and fields. ESRI Canada has dedicated itself to providing superior products, outstanding client support, and contributing technical knowledge, people, and expertise to the collection, analysis, and communication of geographic information.

As a member of the international ESRI family, ESRI Canada is one of 91 international distributors and consulting firms (totalling over 2,300 employees) that provide ESRI software and services around the world. Headquartered in Toronto, Ontario, ESRI Canada has regional offices and training centres in major urban areas, coast to coast, providing a complete range of GIS services to Canadian clients. With over 200 employees and 20 years of experience, ESRI Canada has built a highly coordinated and innovative team of engineers, information technology specialists, GIS specialists, and resource professionals.

ESRI Canada provides complete, GIS-oriented, business solutions to our valued customers, building an excellent reputation for the application of information technology within both private and public sectors. To accomplish this, we have organized ourselves to deliver both GIS software solutions and professional customer services.

For further information please contact:

ESRI Canada Limited
Tel: (416) 441-6035 FAX: (416) 441-6838 E-mail: info@esricanada.ca
Website: *www.esricanada.com*

The Helical Corporation

Helical has been providing complete data management and processing solutions for the integration, visualization, archiving and validation of very large (terabyte) multi-dimensional Hydrographic and LIDAR spatial data sets since 1966.

Their unique standards based architecture using Helical Hyperspatial Code (HHCode) and SDS (self Defining Structure) – the Helical engine, is the source of power of the Helical Toolkit. It is multi-spatial, multi-temporal, multi-resolution, multi-dimensional, multi-schema, and has the flexibility to work with any complementary technologies. A number of international companies view the HHCode/SDS architecture as an enabling technology and have implemented parts of it within their own software suites.

A complete set of Hydrographic processing utilities including automatic area based cleaning/validation, variable sized tiling (dynamic multi-resolution gridding), contouring, sounding select and differencing tools are available along with 4-D visualization and advanced data management tools that can automatically flag or replace data as a result of revisory surveys.

Recent additions to the helical Product suite include an ESRI SDS Extension that allows ESRI users to efficiently manipulate and work with Hydrographic and LIDAR data, with no limitation on the data set size, and import it directly into ArcGIS and a distributed data warehouse (HHArchive) designed to handle massive quantities of multi-dimensional data. The HHArchive can be a standalone data warehousing solution, a large-scale distributed system or directly linked to an enterprise RDBMS such as Oracle.

For further information please contact:

Mr. John Burton
The Helical Corporation
Tel: (902) 429-1785 FAX: (902) 492-2242 Website: *www.helical.ns.ca*

HydroService AS

HydroService AS is a Norwegian company with a strong technological base and a thorough understanding of requirements needed to establish and operate an effective Hydrographic Office.

Being the originators of the acclaimed dKart Inspector S-57/ENC QC/Validation software the company has additionally developed and has in service a complete range of modular COTS tools offering all the system functionality required by a Hydrographic Office.

With the introduction of S-57 International Standard of Cartographic Data Exchange, the nautical cartographic world (HOs) faced the problem of digital data production, as it required double work - to produce traditional paper charts and to establish and support ENC production.

In response to this challenge, HydroService AS developed dKart Office, a family of dedicated COTS software tools. The modular system comprises a fully integrated production environment aimed at:

- Electronic charts production and updating (S-57/ ENC, AML, Inland ENC, etc.).
- Paper charts production and maintenance (INT1, INT2, M4, etc.).
- Notices to Mariners and other nautical publications compilation and design.
- On-line Data Services (charts, publications, catalogues on the Internet, automated NtM delivery, etc.).

dKart Office can be smoothly integrated into any existing production environment either via independent modules or as a complete Digital Hydrographic Office solution. It will assist in building and improving production performance by reducing costs, expanding the product range and raising your office's overall effectiveness.

HydroService AS also conducts basic and advanced training of system operators and managers in S-57, QC and ENC/Paper Chart production.

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Interactive Visualization Systems (IVS)

Interactive Visualization Systems (IVS) with its world class, scientific 3D visualization and analysis software, Fledermaus, provides innovative, interactive and client-driven solutions and knowledge for surveying, mapping and research. Fledermaus presents intuitive insight into massive geographic data sets of numerous data types promoting professional interaction and collaboration.

Fledermaus has been developed to allow our clients to explore, analyze, manipulate and gain knowledge from their data by representing very large complex information in the best possible way - in an intuitive fashion - in the way that we perceive the real world everyday. This virtual reality allows new insight to be rapidly gained and more information to be extracted from the underlying data. This results in Fledermaus providing our clients with added value in efficiency, accuracy, completeness, integration, and communication.

IVS has a dynamic and creative team of professionals that are committed to advancing visualization technology; and dedicated to unveiling opportunities to develop and improve visualization and interpretation software in ways that will provide our clients with first-rate software tools to ensure success of their business or research endeavours.

IVS is headquartered in Fredericton, New Brunswick, Canada with an office in Portsmouth, New Hampshire. Both offices provide full support, worldwide in association with a number of alliance partners.

If you would like to receive further information about IVS and its services please contact:

Interactive Visualization Systems
Tel: (506) 454-4487 FAX: (506) 453-4510 E-mail: info@ivs3d.com
Website: *www.ivs3d.com*

Kongsberg Maritime

Kongsberg Maritime, a company in the Kongsberg Group, is a leading supplier of advanced multibeam and single beam echosounders and instrumentation systems.

With its strong application knowledge and trend-setting quality products, Kongsberg Maritim is able to offer unique and complete solutions for ROVs, AUVs, positioning systems and sea bed surveying and mapping.

Kongsberg Maritime has about 980 employees with subsidiaries world wide. Canadian operations include a sales office in Halifax and a factory in Port Coquitlam, British Colombia.The Headquarters are located in Kongsberg, Norway. Kongsberg Maritime exports its products to all of the world's major markets.

For more information regarding Kongsberg Maritime please contact:

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Survey & Underwater Vehicle Instrumentation
Tel: (902) 468-2268 FAX: (902) 468-2217 E-mail: john.gillis@kongsberg.com
or visit Offshore: *www.km.kongsberg.com* and Marine: *www.simrad.no*

NetSurvey Limited

NetSurvey is one of the leading multibeam service solution providers worldwide. We provide a specialist service to survey companies, ports and harbor authorities and research and government organizations. We are at the forefront of multibeam technology, combining the latest equipment and software to give unrivalled results in new and complex areas, such as ROV based surveys, fisheries habitat mapping, detailed wreck investigation and many others.

We can supply any portable multibeam system suitable for vessel, ROV or AUV deployment and all ancillary sensors installed, operated and processed by a team of highly trained multibeam surveyors and engineers. Our specialist personnel are also available to supplement your offshore teams or to act as client representatives.

We offer an in-house data processing service that can range from simple swath bathymetry cleaning to full 3D Visualization and fly-through using Fledermaus software. NetSurvey also offers bespoke training courses with a practical emphasis.

All of our surveyors/engineers are trained up on Reson, ELAC, Simrad and GeoAcoustics multibeams; Applanix, TSS, Kongsberg-Seatex and CODAOctopus motion sensors; QPS, Eiva, CARIS HIPS/SIPS and Fledermaus software.

With our large equipment pool available for hire and some of the most experienced multibeam specialist personnel, NetSurvey can provide you with peace of mind and the complete multibeam solution at a very competitive rate.

If you would like to receive further information about NetSurvey and its services contact Duncan Mallace or visit *www.netsurvey.co.uk*

If you would like to receive further information about NetSurvey and its services please contact:

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RESON Inc.

Established in 1976, RESON has grown steadily and is now one of the world's leading companies in the field of underwater acoustics and high-power ultrasonics. In addition, RESON is the leading company in the design, manufacture, delivery, and support of integrated multibeam echo sounder systems. RESON also designs and manufactures specialty Transducers, Hydrophones, and complete Sonar Systems.

RESON is an international corporation with offices in Denmark, Scotland, Germany, South Africa, Singapore, the Netherlands, Italy and the United States.

We have assembled a team of highly skilled engineers committed to advanced engineering and to the design of sonar and acoustic systems. In addition, RESON employs a team of more than one hundred professionals dedicated to such disciplines as Program Management, Quality Assurance, Manufacturing, Software Development, Security, and Administration. The resulting corporation, RESON, is renowned for providing innovative solutions to complex underwater surveying and military problems.

To date, RESON has delivered over 700 multibeam systems, more than all our competitors combined.

In summary, RESON is involved in the following application areas:

- Seafloor Mapping and Inspection
- Offshore and Construction
- Acoustic Calibration
- Acoustic Test Range
- Surveillance and Security
- Mine Counter Measures, MCM
- Anti-Submarine Warfare, ASW
- Systems Performance Modeling
- High-Speed Signal Processing Hardware and Software
- Image Processing.

For further information please contact:

RESON Inc.
Tel: (805) 964-6260 FAX: (805) 964-7537 E-mail:sales@reson.com
Website: *www.reson.com*

Triton Imaging Inc.

Triton Imaging, Inc. is a leading software and hardware provider of multi-component data acquisition systems and advanced data processing solutions for hydrographic charting, seafloor search and survey, port security, and marine military applications.

FULLY-INTEGRATED SYSTEMS. Triton offers complete search/survey solutions: acquisition, processing, data fusion, visualization, and analysis of multibeam echo sounder, sidescan sonar, synthetic aperture sonar, high-resolution seismic, and magnetometer data. The power of Triton technology lies in its "intelligent connectivity" – the ability to acquire and fuse data from disparate sensors and supporting systems, and present the results in an intuitive manner. Recent advanced technology developments include interfaces to the Reson 7125 single and dual-head multibeam sonars, the Edgetech MPX multiping sonar, and the Benthos C3D 3D imaging sonar as well as incorporation of S-57 electronic charting into its navigation and GIS products.

For further information please contact:

Triton Imaging Inc.
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August 20, 2006

Dear Members of CHA,

It gives me tremendous pleasure and gratitude in accepting the 2006 Canadian Hydrographic Association Student Award! I am currently a Cartography-Digital Mapping student at the Centre of Geographic Sciences in Lawrencetown, Nova Scotia with future intentions to complete an advanced diploma in Marine Geomatics in the following 2007/08 school year.

Before making the Annapolis Valley my permanent home, I was raised on the shores of Lake Erie and Niagara's infamous Welland Canal. I gained much respect for the water later as I was easily enticed to be out on its waves, volunteering for the Coast Guard Auxiliary and learning the ropes as an amateur cook on my first tugboat experience. As any sailor knows, that never leaves your blood and mine yearned for a taste of salt. I volunterred to work abroad for a year on the high seas. This is where the point of no return begins. After experiencing the wonders of the open sea, one can no longer ignore the importance of our most precious natural resource and the impact it has.

With the graciousness of the CHA, my educational goals will now be more readily attainable. In the future, I plan to use this education to map and preserve our delicate oceanic ecosystems. As the waters to our north open themselves in the midst of our changing climate, all Canadians must agree that we have a prompt need to exercise our sovereignty and it is organizations such as the CHA, which will be the leaders in this arena. Thank you to all members of CHA for maintaining the annual student award, of which I am able to greatly benefit from. Thank you also for advancing the development of hydrography, marine cartography and associated activities within Canada and developing countries.

Sincerely,

Monica Beaton

Monica M. Beaton
South Tremont, NS

DID YOU KNOW...

Most Popular Chart on the West Coast of Canada
If most popular is defined by the number of sales then it is 3512 Strait of Georgia, Central Portion. Sales last year were 3105 copies of the chart. [Source: Al Schofield, CHS Pacific]

An Update from the ACLS

ACLS Associate Members
You do not have to be a Canada Lands Surveyor to become a member of the ACLS. Anyone with an interest in the surveying profession which includes hydrography can register as an Associate Member and have all the rights and privileges of a regular member (discount on seminars, access to the members only section of the Web site, etc.) except the right to vote. The membership fee is only $75 (plus taxes). E-mail or call us for an application form.

Canadian Board of Examiners for Professional Surveyors (CBEPS)
The Association is proud to have facilitated, in the Fall of 2005 and Winter of 2006, the formation of the Canadian Board of Examiners for Professional Surveyors (CBEPS) which is responsible for establishing, assessing and certifying the academic qualifications of individuals applying to become professional surveyors and/or geomatics professionals. CBEPS began its operations on May 8th, 2006. The ACLS is also proud to be a member, and to provide registrar and administrative services for CBEPS. The Web site address is: *www.cbeps-cceag.ca*

Offshore Initiatives
The ACLS is committed to raising awareness of the responsibilities and concerns of respective stakeholders in offshore Canada lands, and to find a common strategy to move this industry sector forward for the betterment of all.

The ACLS has been very active in promoting the Marine Cadastre concept. A Marine Cadastre is a system that enables the boundaries of maritime rights and interests to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighbouring or underlying rights and interests. Thus, a CLS would have an important role, as he or she has the expertise to deal with legal boundaries and ensure that public interest is protected.

Recognizing an opportunity to fulfill a need for a national certification program for hydrographers and with an aim to protect the public from unqualified service providers the ACLS and the Canadian Hydrographic Association (CHA) formed a joint task force to prepare recommendations to implement a certification program. In October 2004, the Task Force presented its findings to the ACLS Offshore Issues Committee. There are two tiers to the proposed national certification model. While one is aimed at establishing professional qualifications and the other at a technical designation, both require specific levels of training and experience in hydrographic surveying. The distinction between the two is that the professional tier requires a candidate to obtain his/her Canada Lands Surveyors Commission while the technical tier requires the candidate to obtain a basic level of training and experience in hydrographic surveying.

Another initiative that is worth mentioning is the publication of the new book entitled "Canada's Offshore: Jurisdiction, Rights, and Management". We believe it to be a high-quality publication and a much needed resource for the offshore industry as a whole. In addition to being an invaluable tool to train new Canada Lands Surveyors, it will help promote the role of the CLS in the offshore industry. Copies can be purchased from: *www.acls-aatc.ca* or *www.trafford.com*

ACLS Scholarship
The scholarship program was introduced in 2003. Two $500 scholarships were awarded in 2004 and 2005. After three years of operation, the ACLS Foundation decided to increase the scholarship amounts from $500 to $1,500. Last summer, three $1,500 scholarships were awarded. The Foundation Board had a hard time selecting the winners because of the large quantity of impressive candidate files received. To obtain an application form and further information on the ACLS Foundation Scholarship Program, visit the ACLS Website at: *www.acls-aatc.ca*. Deadline for application is May 15 of each year. The Association of Canada Lands Scholarship Foundation Inc. is now registered as a charitable organisation so it is authorized to issue tax receipts.

National Surveyors' Conferences
In June of 2005, the ACLS held the first National Surveyors' Conference in conjunction with its Annual General Meeting in Cardigan, Prince Edward Island. The second National Surveyors' Conference and 22nd ACLS Annual General Meeting were held during the week of June 19 at the world famous Grand Okanagan Lakefront Resort and Conference Centre, Kelowna, BC. The Conference was again a huge success with more than 120 surveyors in attendance. The third National Surveyors Conference will be held between June 19 and 22, 2007 in the Loews Le Concorde Hotel in Québec City. All Surveyors and Geomatics Professionals are welcomed. Visit *www.acls-aatc.ca* for details.

Jean-Claude Tétreault
Executive Director

Brooke Ocean Technology Ltd. Acquired by ODIM Inc.

Dartmouth, Nova Scotia, October 27, 2006 – Brooke Ocean Technology Ltd. (BOT) is pleased to announce that it has signed an agreement with ODIM Inc., a subsidiary of ODIM ASA and has sold all its shares in the company to ODIM. ODIM expects the acquisition to strengthen North American operations, with BOT representing the platform for growth in Eastern Canada and the Northeast United States.

Currently with 33 employees, BOT has been in operation for more than 20 years, and has customers worldwide in such countries as the USA, Australia, the UK, China, Japan, Korea and Norway. BOT is a reputable specialist in designing and developing advanced data collection platforms and automated handling equipment for naval, offshore and oceanographic research vessels. The list of clients includes such names as the Royal Australian Navy, the Japanese Navy, the US Naval Oceanographic Office, the US National Oceanic and Atmospheric Administration and the Danish Navy. Headquartered in Dartmouth/ Halifax in Nova Scotia, BOT also has a subsidiary in New Bedford, Massachusetts.

ODIM ASA is a fast-expanding Norwegian technology company which develops and sells advanced automated handling solutions, primarily cable handling systems and winches for use on offshore and naval vessels. The company occupies a leading position in selected market segments, such as seismic surveying and offshore supply. Through its ODIM Spectrum subsidiary in Canada, it is also solidly rooted in the defence sector. In addition to its established market segments, ODIM will be making a heavy commitment to the very promising deepwater market.

'We know BOT as a respected and able competitor, and it will provide a very good complement to our existing business,' says Mr. Jogier Romestrand, CEO of ODIM ASA, 'Acquiring BOT gives us a broader product portfolio, increased market access and even greater opportunities for scaling operations in this region. Taken together, these considerations will put us in an even better position to develop value for our shareholders.'

Brooke Ocean Technology Ltd., an ODIM Company, will continue to be managed by former shareholders, Arnold Furlong and Geoff Lebans, under the direction of ODIM. BOT will remain at its current location and all contact information will remain the same.

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DID YOU KNOW...

Irregular Bottom Feature
During the voyage of the MV *Manhatten* through the Northwest Passage in 1969, irregular bottom features were noted by Ken Williams, a hydrographer on board the Coast Guard Icebreaker *John A. MacDonald*. The feature of an abrupt rise in the ocean floor are known as pingos. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

IXSEA - The Launch of the revamped SV John Lethbridge

The SV John Lethbridge survey vessel.

IXSEA is pleased to advise that it has recently completed work on the SV John Lethbridge on behalf of Comex Deep Sea Salvage Limited (a wholly owned subsidiary of Subsea Resources PLC). The refit was undertaken by H2X shipyard in cooperation with IXSEA and COMEX SA. The vessel is currently in the Atlantic working on a number of projects including the MIRANDA project (4,500 tonnes nickel) and the Ella project (a 19th Century bullion cargo).

The survey ship is equipped with top of the range sonar equipment, fitted by IXSEA, which is capable of surveying depths to 6000 m as well as a COMANCHE Sub-Atlantic ROV, which can reach similar depths.

The ROV has two work manipulators, HMI lights, digital cameras and flash and 100kgf/ 200 lbf DC Thrusters.

The SV John Lethbridge is also equipped with an IXSEA positioning system including POSIDONIA USBL positioning system, PHINS 6000 subsea inertial navigation system and an OCTANS gyrocompass and full motion sensor.

COMEX SA, supervised the integration of the survey equipment with the ROV and also supervised the refit of the salvage ship. The refit was carried out by H2X, shipyard specialists in building, refitting and refurbishing oceanographic ships. This Mediterranean coast, bureau veritas certified shipyard has over 10 000 sqm facilities,1500 m of quays with dry docks, and up to 2000 tonnes lifting capacity.

The SV John Lethbridge will have a crew of twenty as well as a ten-man survey crew.

IXSEA - Belgian Navy awards integrated survey solution contract to IXSEA

IXSEA announced the signing of a contract with the Belgian Navy to provide an integrated survey solution for their mine warfare data center (MWDC), the company announced in Paris today 15 november 2006.

The purpose of the MWDC is to collect hydrographic data and to produce electronic and paper charts with additional military layers.

IXSEA's integrated survey solution (ISS) will be used onboard minehunters for route survey, homeland security and REA (rapid environment assessment). The ISS includes state of the art imagery sensors : COTS IXSEA's Synthetic Aperture Sonar (SHADOWS), IXSEA's new Gradiometer, Kongsberg's Multibeam Echosounder, and IXSEA's GAPS, a positioning and motion sensor. A comprehensive PC based exploitation software solution is included, allowing survey management and joint display and interpretation of all the data collected. This solution integrates the QPS and CARIS software to meet the customer specific requirements.

IXSEA already has a long and successful relationship with the Belgian Navy: PHINS, IXSEA's PHotonic Inertial Navigation System has been the main INS onboard their minehunters for a number of years.

About IXSEA and Solutions
At IXSEA, we combine smart technology and experience with marine know-how to provide our customers with the most efficient and user-friendly navigation, positioning and imagery solutions.

We strive to exceed our customers' expectations every time with our high-performance technology, our international sales network, installation and round-the-clock customer support.

To sail. To sound. To analyze.

Further information:

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Triton Imaging and Reson Sign OEM Agreement

Watsonville, California , USA , October 19, 2006 - Triton Imaging, Inc. and Reson A/S announced today that they have signed an OEM agreement under which Reson will resell Triton software bundled with Reson multibeam sonars. The Triton software available under the OEM agreement is the new Triton *HydroBundle*™, a comprehensive hydrographic package that includes survey planning, real-time navigation, multibeam data acquisition, quality control (QC), data processing, map-based display, data fusion, and final product preparation and output. Real-time QC is performed by the unique Triton IntelliMon™, an easy-to-understand panel showing four statistical parameters: Along-Track Coverage, Effective Swath Width, Sound Velocity, and Rate of Change for attitude as shown across the top of the image below. The fully integrated system of Triton software and Reson hardware offers unsurpassed accuracy, reliability, and simplicity for multibeam operations.

Triton Imaging, Inc. develops seafloor search and survey products that acquire, process, visualize and interpret data from a wide array of sensors, including side scan sonar, forward-looking sonar, synthetic aperture sonar, multibeam sonar, interferometric sonar, sub-bottom profiler, and scan based information streams. For more information visit www.tritonimaginginc.com or contact us at (831) 722-7373 or sales@tritonimaginginc.com.

DID YOU KNOW...

Charts and Publications Regulations

Following the wreck of the *Tanker Arrow* on the coast of Cape Breton Island, the Government of Canada, in 1972, introduced the Charts and Publications Regulations, which requires all vessels sailing in Canadian waters to carry and use approved charts and related publications. Related publications include Canadian Tide and Current Tables, Chart Catalogues, Sailing Directions and others. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

DID YOU KNOW...

Negative Engraving

In 1953, CHS produced the first chart in the world using a new technique known as negative engraving. Cartographers drawing Chart 4368, St. Anns Bay, Nova Scotia, scribed hydrographic data on an emulsion-coated polyester sheet, instead of drafting on paper. The advantage of this technique is that no intermediate photographic steps are required to produce printing plates. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

ANNOUNCEMENTS / ANNONCES

The purpose of this column is not to provide an all-encompassing calendar of hydrographic-related events but to provide you with information on events sponsored by organizations or individuals to whom CHA is connected. Input comes from organizations such as the CHS, ACLS, FIG, CIG, THSoA and the International Federation of Hydrographic Societies.

DID YOU KNOW...

First Chart For Newfoundland

The first Canadian chart for Newfoundland was actually surveyed and produced a few years before Newfoundland joined Canada. The harbour at Mortier Bay was secretly chosen as an anchorage for the World War II meeting of British Prime Minister Winston Churchill and President Franklin Roosevelt of the United States. The meeting was actually held elsewhere in Newfoundland, but the chart was produced in record time. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

Norman Gerald Gray

1906 - 2005

It will be the rare few that will mark the passing of a major contributor to hydrography in Canada. It is not because that he was unliked, or egotistical but rather he outlived his contemporaries and even outlasted the next generation of Canadian Hydrographic Service staff. Norman Gerald Gray lived into his 100th year keeping a clear mind until the last six months or so.

"Norm" as he was usually called, was born in Yarmouth, Nova Scotia into a family of seafarers and boat-builders. He obtained a B.Sc. in mining engineering from Nova Scotia Technical College in 1929. By then, he had had four seasons with the Topographic Survey of the Canadian government and had already passed the preliminary examinations to become a Dominion Land Surveyor.

Soon the Depression hit and jobs were hard to come by, but Norm was able to get short assignments with mining companies in Newfoundland (not yet part of Canada) and Quebec. Times being tough, he was fortunate to get a junior hydrographer position with the Canadian Hydrographic Service in 1930. His career there lasted 37 years. His first survey was on the old steamer *Bayfield (2)* as she investigated a recently reported pinnacle rock in the middle of deepest section of Lake Superior almost beyond sight of land. The rock, a danger to navigation, is now known as Superior Shoal.

By 1939, he was senior assistant on the steamer *Cartier* working in the Cape Breton area of Nova Scotia. He became hydrographer-in-charge of a shore-based field party on the Gaspé Coast in 1941 (the Navy had commandeered all the Atlantic Coast hydrographic ships). In 1944, he made a detailed hydrographic survey across Northumberland Strait for a possible causeway to join Prince Edward Island with the mainland, a dream that did not come true until the completion of the 13-kilometre long Confederation Bridge in 1997. In 1948, after outfitting the new *Cartier (2)* (a converted, wooden hulled, minesweeper) in Georgian Bay, he was Her first Hydrographer-in Charge. He is the only hydrographer of his day who served in all pre-war ships on the East Coast: *Acadia*, *Bayfield* and *Cartier*.

He has left his survey markers from the Atlantic seaboard to the shores of Lake Winnipeg. He is also believed to be the last hydrographer to use a four-oared sailing gig for inshore sounding on Canada's coasts when he worked in the Magdalen Islands (Îles de la Madeleine) in the early 1930s. His last field season was in 1951 as Hydrographer-in-Charge of the *Kapuskasing* (a converted frigate), working in Newfoundland and the Strait of Canso.

In 1951, Norm was assigned to assist with post-war ship replacement program and in 1953, he became Marine Superintendent. His outstanding achievement was the management of the design and construction of CSS *Baffin*, Canada's first hydrographic-oceanographic ship capable of working in the Arctic. Almost 50 years later, *Baffin* still holds the record as the largest hydrographic ship in the CHS, although she was sold out of government service several years ago.

In 1957, Mr. Gray was appointed Dominion Hydrographer, a post that he held for a decade. He was head of the Canadian delegation to the International Hydrographic Bureau Conferences in 1957, 1962 and 1967 and brought honour to Canada by being elected vice-president of the 1967 conference. The leather-bound copy of the 1967 Conference proceedings that he had been presented upon his retirement was recently returned to CHS when their house had to be sold.

In the last ten years as Dominion Hydrographer, he travelled widely; from Istanbul, where he was given a copy of Piri Reis' 1513 map of the Atlantic, to Hawaii and from the Caribbean to the Arctic Ocean.

He died September 27, 2005 with his son Geoff at his side. Norm and his wife, Marjorie, have lived in their small Ottawa house or on their farm 100km from Ottawa until about six months ago, when their health took a turn for the worse. She died three weeks later. They are survived by their son and two grandchildren.

David H. Gray

PACIFIC REGION

Hydrographic Surveys Division, CHS Pacific Region

Staff have been very busy both in the office and in the field so far this year.

Two new fast-response vessels arrived in March: one 18' and one 22' Lifetimer named (by contest) the *Echo* and the *Shoal Seeker* respectively. These vessels are being outfitted to respond to reported hazards to navigation and for Chart Revisory and Sailing Directions updating.

The EM3002 on the *Otter Bay* was upgraded to log full water-column backscatter. This was used on several projects in collaboration with John Hughes Clarke and the Ocean Mapping Group at UNB. The Squamish estuary,

the mill at Woodfibre and Britannia Beach were surveyed in early April. A repeat survey of Squamish will be done this fall. A 30,000 litre bunker sea spill in August may challenge the EM3002 to detect subtle changes in seafloor backscatter. The GB Church artificial reef dive site was also imaged as were eel grass beds in Bazan Bay.

A SwathPlus bathymetric sidescan sonar, on loan from Geological Survey of Canada, was interfaced with the POS/MV on the *Otter Bay* and used on several projects in very shallow water to extend the coverage capability. The data have proved to be extremely noisy in depths less than 5 metres, requiring many extra hours of data cleaning in HIPS before integration with the EM3002 data.

The 2006 training survey was held in April, with the main focus on using Total Propagated Error (TPE) and the Combined Uncertainty and Bathymetry Estimator (CUBE) engine in the latest version of HIPS. 2006 surveys have been using CUBE to perform automated data cleaning with much success.

The first of two surveys of the Fraser River delta front failure complex was carried out in May. A second trip is planned for September in order to monitor the motion of the seabed before and after freshet. The EM3002 was used with RTK GPS for precise co-registration of the two datasets.

The remainder of the spring Otter Bay surveys were spent filling in holes on Mapsheet 92B14 in the Southern Gulf Islands. After that, the *Otter Bay*, with the *Echo* in tow, headed north to conduct GPS control survey checks in support of field sheet conversion and to examine reported hazards to navigation up the Inside Passage to Prince Rupert.

Revisory and Sailing Directions surveys were carried out in support of a New Chart of Sidney.

The *Vector* departed IOS in late June for a 10 week survey in PNCIMA (the Pacific North Coast Integrated Management Area), in support of Canada' Oceans Action Plan (OAP). EM1002 multibeam bathymetry and backscatter was collected along with regular sound speed profiles taken with the MVP-30, sub-bottom profiles and towed magnetometer readings. Areas surveyed so far include: Cook Bank, Pisces Canyon, Queen Charlotte shelf break, Hecate Strait, approaches to Caamaño Sound, Principe Channel, Wright Sound, Ogden Channel and Arthur Passage. These surveys support both the OAP and another CHS priority, the Kitimat Gateway project. The Gateway project will see two pipelines from the Alberta tar sands to Kitimat and very large crude carriers (VLCC), with under-way drafts approaching 26 metres, by 2010. A series of New Charts and ENCs are being developed in consultation with the BC Pilots. Much of the data collected this year will support decisions about the routes for these tankers and navigational aids modernization in this area. Several other areas of opportunity, during bad weather, have also been surveyed including some areas on the Queen Charlotte Islands within the Gwaii Haanas National Marine Conservation Area (NCMA).

The *Otter Bay* has been surveying the shallow areas to support these *Vector* projects, with hydrographers doing shifts aboard for periods of 3-5 days before changing off with the *Vector*. Numerous new shoals have been discovered during these surveys, some of which have resulted in Notices to Mariners being issued.

Meanwhile, our tidal group has been very busy making much needed upgrades to several of the Permanent Water Level Network (PWLN) gauges. Failure of the cross-bracing beams at Campbell River resulted in all three wells coming loose and being swept away. The gauge has since been completely refurbished and is performing well. Other gauges have been installed to support various field survey operations. We have also provided some much needed field support to our colleagues in Central and Arctic Region, helping to maintain the Arctic gauges in Alert, Tuktoyaktuk and Holman.

Nautical Publications Division, CHS Pacific Region

The two major activities in Nautical Publications up to September 2006 have been the initial planning and production of the Gateway Charting Project and the Hydrographic Product Database (HPD) development.

The Gateway Charting Project comes as a result of changes to shipping which are expected to occur on the British Columbia Coast in the near future. The Kitimat area of B.C. is seeing development from a variety of companies that are involved in the shipping of crude oil from Alberta, the importation of condensate for oil sands production, the development of liquid natural gas facilities and the extraction of vast amounts of aggregate from the area. Several new charts will be produced for this area, which will incorporate recently acquired Multibeam Survey information. The Very Large Crude Carriers (VLCC), exporting resources to markets in China, Asia Pacific and California, from Kitimat are expected to begin in 2010.

A development team has also been working hard at getting the Hydrographic Product Database (HPD) running. HPD is an object based Geographic Information System (GIS) with all objects stored in database tables. The development team has completed an initial evaluation of this new tool

and have submitted a report titled "A New Way Forward". The report outlines key benefits, makes recommendations for implementation and starts the development of process documentation. Production has begun using this new tool in Pacific Region.

Additional production in 2006/07 will focus on the Vancouver and Sidney areas. A New Edition is currently underway in Pacific Region for the cruising atlas Jervis Inlet and Desolation Sound.

It has been a busy year for Notices to Mariners. Lots of Aids to Navigation changes have been identified early in the year. A number of rocks were reported by mariners and shoal depths were discovered through Multibeam surveys.

PAC200 Sailing Directions has undergone extensive writing for a New Edition completed in the Region and production is being finalized in Ottawa. Trips by helicopter to enhance and replace old photographs will be undertaken which will provide the first new pictures since 1999. Planning and writing is underway for 2 new volumes of the South Coast. These will offer an updated format and data content based on client input.

Close co-operation with Canadian Power Squadron continues with a number of tours of CHS operations at IOS. The MAREP program is being revitalized and 2 training cruises have taken place. Our aim is to use this program to get a small quantity of high quality feedback from mariners themselves and to use this as an education tool to promote safe navigation and use of CHS publications.

Nautical Publications staff participated in Health and Safety Week and Hydrographic Survey Division Training Week. We are also actively involved in the planning of CHC 2008.

We have hired a new University of Victoria CO OP student. Pacific Region welcomes Greg Dixon.

This year also saw the retirement of Ardene Philp who was most recently the Nautical Publications Quality Control Officer. We would like to wish Ardene all the best in his retirement.

Nautical Publications staff will soon be returning from a variety of well deserved summer vacations and in the coming months. Construction on new workspace and workstations will be completed soon and this effort will bring Nautical Publications, Geomatics and the Hydrographic Data Centre into a more centralized location.

Client Liaison and Support Division

Sea Floor Classification

A sea floor composition survey of user needs was completed. About 40 replies to the questionnaire were received and included commercial fisher organizations, researchers, university staff, municipalities, marine consultants, and First Nations peoples. It revealed a broad focus area on the central BC coast, with diminishing demand toward the north and south. Primary depth areas were less than 30 metres, with secondary demand for the 30-200m range. The results may help focus our acquisition work, although CHS does not yet have the proper tools to efficiently produce information in depths less than 30 metres.

Still on the subject of sea floor composition, the decision has been made to restrict CHS classification results to five classes, based upon the results from processing backscatter results for a large area in the Strait of Georgia (equivalent to chart 3463). This "IOS seabed catalogue" will be used for supervised classification of future areas. Under production are the classified areas for 3462 and 3512. The advantage of supervised classification is that datasets will be able to be mosaiced. Upon request, it will still be possible to reprocess the backscatter data in unsupervised mode for maximum classification resolution of specific areas.

Hydrographic and Oceanographic Support

Technical support was provided to the field surveys. This involved mobilization for the surveys, and participating in the expeditions. The Moving Vessel Profiler had a variety of small problems that are being addressed.

There is ongoing support for the upgraded water level network.

The two new Hydrographic launches – *Shoal Seeker* and *Echo* – were fitted out for survey duties. These launches were funded by Coast Guard, on the condition that CHS handle the subsequent maintenance.

New echosounders for the CCGS *Tully* were installed, primarily for fishery purposes. The acoustic calibration system was rebuilt, and then used during a companion cruise with the CCGS *Ricker*.

Data Management

There was much activity in the data management area. Our CHS data acquisition rate in now in the vicinity of two terabytes per year, and this places strains on our computing networks, our software and hardware processing systems, and our organizational ability. A major effort has been made to document each survey with FGDC metadata,

such that we are more or less current. We are working with Informatics to addressing data bottlenecks; a key bottleneck presently appears to be disk I/O access.

Administratively, Terry is part of a national science team to look at information management, and similarly for a regional science group. It has been agreed that GeoPortal will be the key repository for metadata, but the impact upon other metadata managers (like CHSDir) and how the actual data stores will be managed is unclear.

Much of the chart sources for the low water coastline have been located, but there are significant issues in the central BC coast area. Together with the two high water coastlines, these will be important to the habitat and land use community. Reports have been received that users will switch to the low water coastline for their map-making once it is available.

Liaison Activities

The summer months are typically the time when visits to local advanced technology companies occur. Several companies were visited, and all seem to be doing extremely well.

Assistance was provided to a consortium of public and private sector individuals to test an Ocean Glider. This unmanned and untethered research vehicle generates forward motion through the water column by altering its density by expanding or contracting its volume via an oil-filled bladder. Small wings affixed to the sides force the motion into a sawtooth pattern. It is equipped with a CTD and dissolved oxygen sensor. It will undergo local tests in the Fall, and then go on a mission to Bowie Seamount next summer, which is located 95nm offshore.

Pete Wills continues to work closely with Parks Canada and the DFO Oceans and Habitat groups, amongst others. Pete did a presentation on our multibeam data acquisition status and our holdings to interested park staff. The Fledermaus tool is producing spectacular results.

David Fisher spent two weeks at CHS headquarters assisting with Distribution activities. Not unexpectedly, we received numerous reports that his presence and influence was greatly appreciated. He was able to identify and remedy several distribution items.

We continue to deal with local consequences of the closing of the regional distribution centre.

Two students from the National Oceanographic Centre at the University of Southampton arrived for seven weeks of unpaid work experience – this is the seventh year. One student participated in the Hydrographic surveying, then was involved with a scientific study that involved restraining seals while scientific samples and measurements were taken, then another cruise where standard biological oceanography was performed. The other student participated in two major ecological research cruises. During one of these, the student assisted in the capture of megabyte images at a 30x per second rate from a towed camera – the first time the camera had worked.

DID YOU KNOW...

Egg Route Charts

During World War II, the CHS produced special confidential charts for defence purposes. "Egg route charts' showed the areas of coldest water, so that a ship carrying perishable goods could keep its cargo fresh without the need for costly refrigeration equipment. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

ATLANTIC BRANCH

The Canadian Hydrographic Association's Atlantic Branch is well into its second year, and can't stop growing! There are over 30 individual and student members, and 4 corporate members. The Atlantic Branch is slowly emerging from the post-conference phase and the summer slowdown. By most measures, it was a successful conference, with delegates and commercial attendees pleased with the event. The joint CHA-CHS (Canadian Hydrographic Service) social event held during the conference week was a success, with a good time had by all.

The conference website is still 'live', [http://www.chc2006.ca], and will be so until the next Canadian conference in 2008. Those interested may still download papers, proceedings and pictures from CHC 2006 in Halifax. Seed money has also been forwarded to the CHC 2008 conference organizing committee, in order to help ensure that the Victoria B.C. conference in 2008 is a success.

PACIFIC BRANCH

We have had a quiet summer in CHA on the west coast as the majority of our members and executive were away in the field. We did manage to have a couple of events though. On June 21 we hosted a potluck lunch at the Institute of Ocean Sciences (IOS) to celebrate World Hydrography Day. The event included a cake to help us celebrate.

In mid Sept we had a brown bag lunch seminar from Fred Stephenson, CHS, on the status and future developments of the Indian Ocean Tsunami Warning System (IOTWS). Fred is the Chair ICG/IOTWS working group for Tsunami hazard identification and characterisation, including modelling, prediction and scenario development. The talk included a bit of a travel show for his recent trip to Bali to discuss the state of the IOTWS. We wish Fred well on his next trip to Laos.

We look forward too upcoming events and talks in the fall [2006] that include Jim Galloway presenting a talk on seafloor classification. The Branch is also planning the AGM for December [2006].

We here in Pacific Branch are pleased to welcome Willie Rapatz as a life member of Pacific Branch. Willie has been a member of the CHA since its inception. Willie has had a long career working in numerous oceans of the world. Willie obtained his Bachelor of Science, in Mathematics from the University of Victoria. He went on to obtain his Canada Lands Surveyor. Willie started working in the Canadian Hydrographic Service in 1955 as a seaman and coxswain. He soon became a hydrographer. That would prove to be short lived as within a few years he would become a Tidal Officer. This is where he would spend his next 30 years. He worked as a tidal officer and a tidal superintendent. In these capacities he would work on tidal and current surveys on the Pacific and Western Arctic. He was responsible for directing the establishment of permanent and temporary tide gauges as well as tsunami warning gauges. He would go on to represent Canada on the International Coordination Group for the Tsunami Warning System in the Pacific (ITSU). After spending the previous 30 years in the field he went on to become the Acting Regional Director, Hydrography, Pacific Region, Canadian Hydrographic Service. Willie retired from the CHS in 1990. This did not stop him from continuing to work in the field of hydrography. He went on to work for the Canadian International Development Agency, teaching Hydrography and Tidal Analysis and Prediction in Jamaica. However he could not stay away from the IOS and returned to become the Executive Secretary of PICES (North Pacific Marine Science Organization.) This office correlates scientific research carried out in the Pacific Ocean and is funded by Russia, Japan, United States, Canada, Korea, and China. Willie retired again in 1993. He remains active in the hydrographic community. He has performed various small consulting services including; compiling material for an electronic tidal manual for the Canadian Hydrographic Service, a description of tides and tidal currents in Northern British Columbia and the development of a PC based tidal analysis and prediction program. It is with pleasure that we here in Pacific Branch welcome Willie as a life member.

QUÉBEC BRANCH

La Section du Québec a publié sa 15e édition du Carnet de bord en 2006. Ce carnet contient un journal de bord et une foule d'informations utiles pour les plaisanciers comme les services offerts par les marinas et les signaux conventionnels utilisés lors d'une plongée. Le niveau des ventes de cette publication est toujours en croissance mais exige encore besoin de travail pour atteindre son plein développement.

Le magasin de vente de cartes marines et topographiques est aussi en croissance mais exige aussi un travail soutenu pour garder un à son plus bas niveau les dépenses. Il faut profiter au maximum des opportunités de faire connaître notre magasin lors de foires locales.

Malgré l'augmentation des ventes du magasin et du Carnet de bord, la Section a dû faire un plan quinquennal pour restructurer l'aspect financier. Il faudra aussi établir des partenariats pour réaliser de nouveaux projets. Les défis sont grands mais la Section les relève un à un et le tout s'enligne vers la bonne direction. Dans les projets à venir, il faut voir ce qu'il pourrait être fait pour les 400 ans de fondation de la ville de Québec en 2008.

CENTRAL BRANCH

Since our last posting Central Branch sponsored a GPS course in May, delivered by Pierre Sauvé of NRCan in Ottawa. Most folks in attendance were CHS employees from Central & Arctic Region but the course also attracted Environment Canada and folks from private industry from as far away as London, Ontario: it was a pleasure to meet Dean Denniss, an external member from that city.

Members of Central Branch participated in World Hydrography Day (WHD) at the Canada Marine Discovery Centre in Hamilton, Ontario. The *Surveyor* was set up as a static display and Brian Power, pictured below, and Fred Oliff were there in period costume to interpret the early days of hydrography. Andrew Leyzack and Fred Oliff spoke to an enthusiastic crowd gathered to celebrate the inaugural WHD.

Surveyor's Brian Power in period uniform during WHD activities.

Members of Central Branch attended the Canadian Hydrographic Conference 2006 in Halifax, Nova Scotia. Apparently the CHA social event was the hit of the week!

Attendees of the inaugural World Hydrography Day at the Canada Marine Discover Centre.

Brad Tinney hosted the annual summer barbecue in Ancaster. The weather was terrific but numbers were down to in the mid-20s. Too bad for those who could not attend as we enjoyed some amazing organic sausages and hamburgers. And some antics from the host!

Brad Tinney entertaining Central Branch members at the annual BBQ.

Surveys Central Branch members participated in included the Great Lakes Revisory survey, Fathom Five and Lake Erie multibeam surveys, Andrew Leyzack and Scott Youngblut were on the *Terry Fox* in the Eastern Arctic surveying numerous small Nunavut communities. Paola Travaglini and Jim Weedon were aboard the *Nabidik* on the Western Arctic survey based out of Tuktoyaktuk and Inuvik, NWT. Roger Cameron and Fred Oliff had stints on Revisory survey based out of Cornwall, Ontario.

Rates / Tarifs

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LIGHTHOUSE est publiée deux fois par année, au printemps et à l'automne. Les dates de tombée sont le 15 mars et le 15 septembre respectivement.

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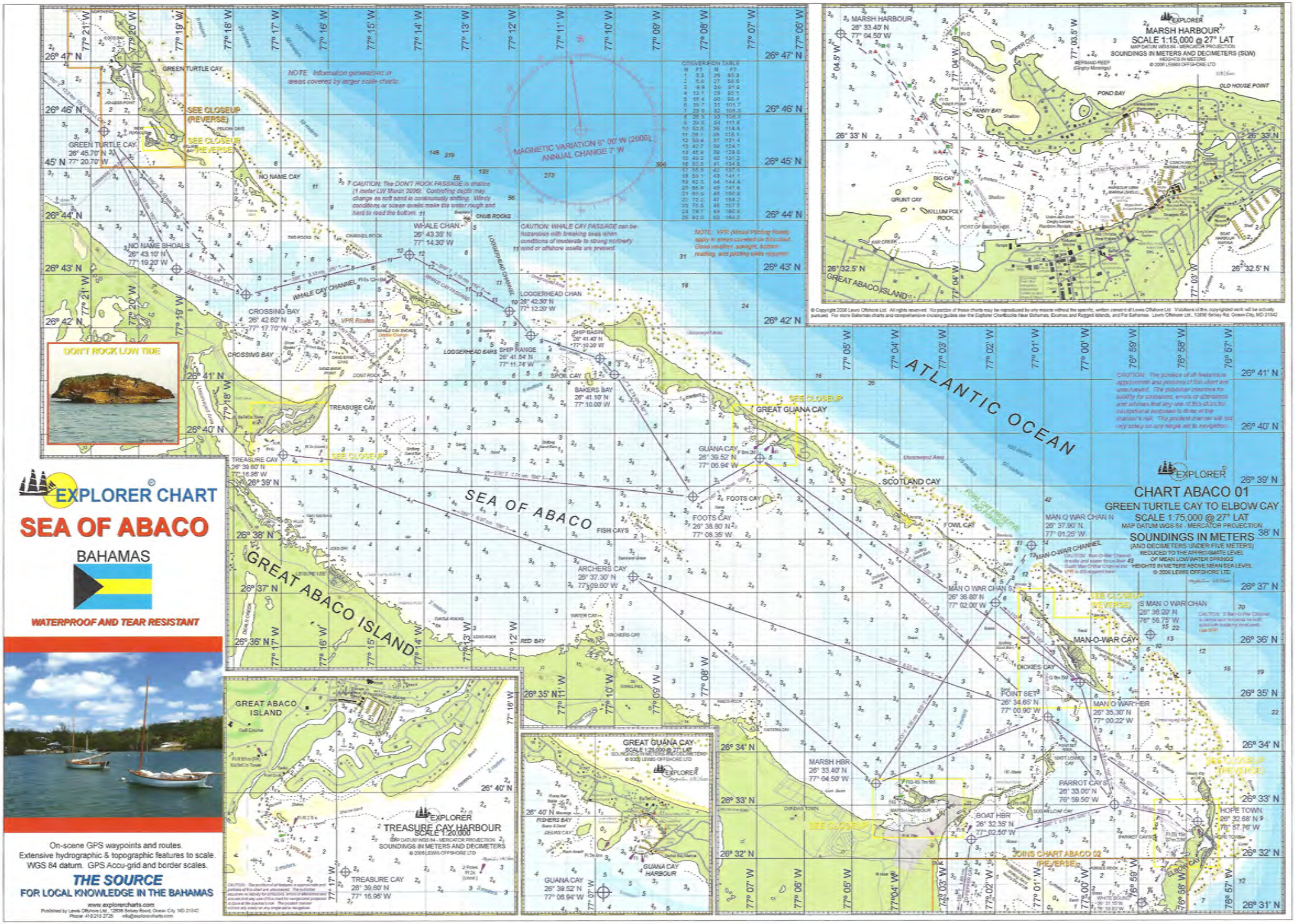

An example of the Explorer Chart Series - See page 29 for the complete article. Copyright 2006 Lewis Offshore Ltd. No portion of this chart may be reproduced by any means without the specific written consent of Lewis Offshore Ltd.

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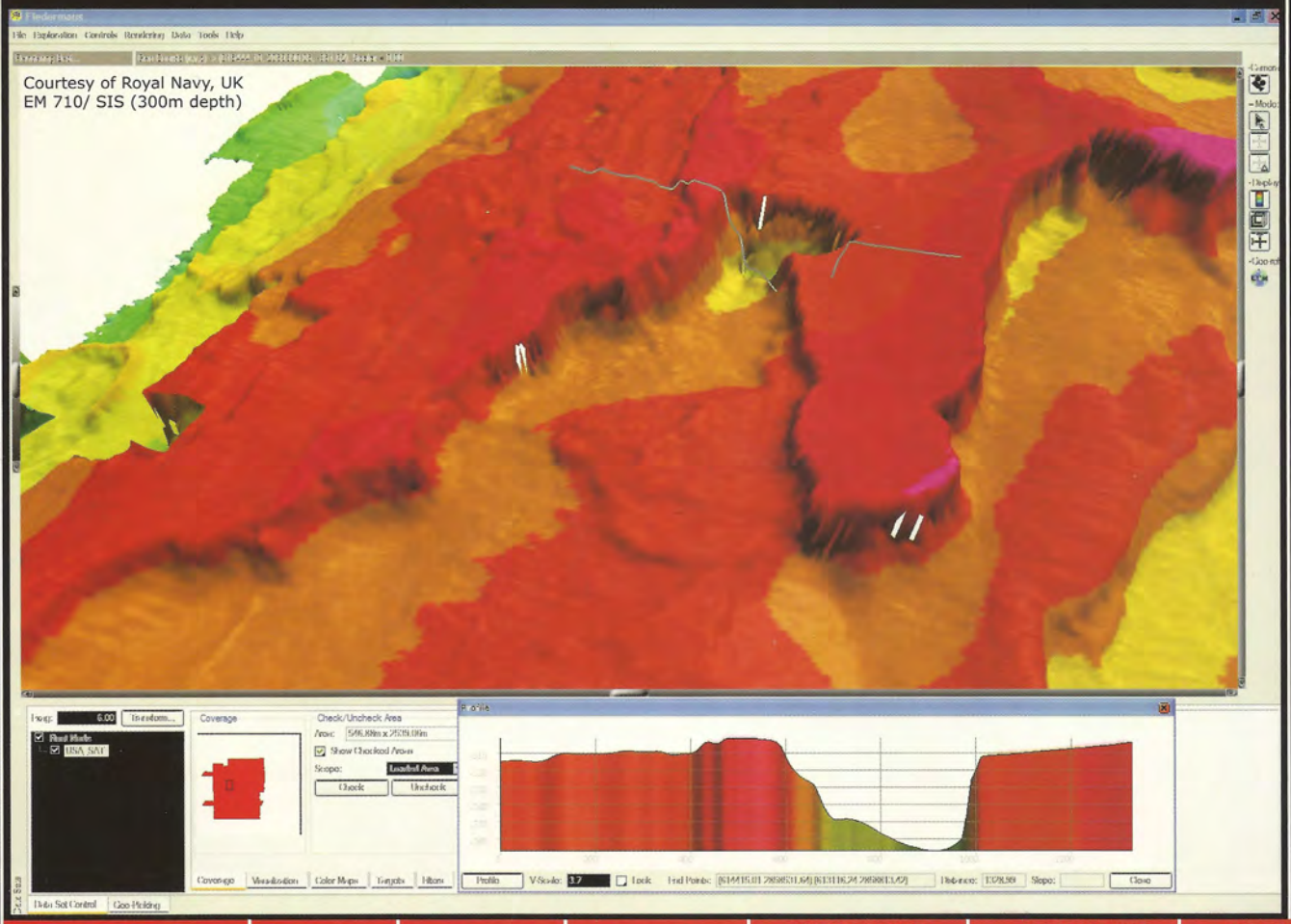

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