LIGHTHOUSE

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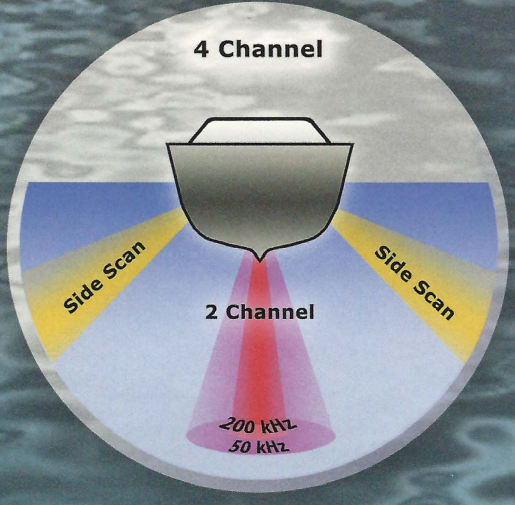

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LIGHTHOUSE

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regular features / chroniques

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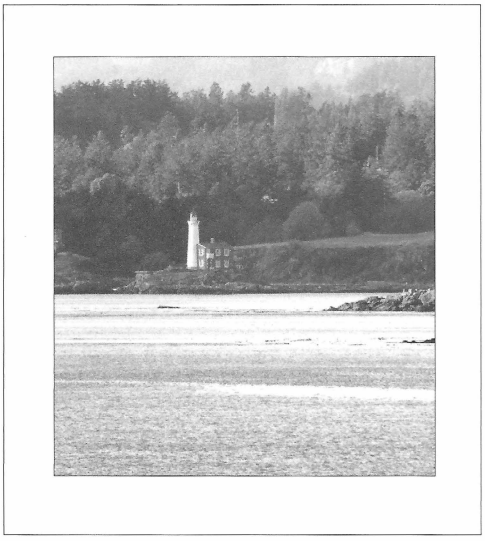

Fisgard Light

Fisgard Light

Fisgard Light is located on Fisgard Island. First lit on November 16th, 1860, Fisgard Light is said to be the first permanent lighthouse on what is now Canada's West Coast.

Coupled with Fort Rodd Hill, it is part of a National Historic site that both marked the entrance to and served to protect the naval fleet in Esquimalt Harbour.

List of Lights: 197.0
Chart 3419
Position: 48 25 49.40N 123 26 51.2W
Characteristics: ISO WR 2s Sector Light
(Sources: Canadian Coast Guard SIPA Database and Parks Canada website http://www.pc.gc.ca/lhn-nhs/bc/fortroddhill/index.aspx)

Photograph credit: Ken Halcro, Canadian Hydrographic Service - Pacific Region

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Editor's Note / Note du rédacteur

It is time for a change. This is a phrase that I have heard often of late. In the past, I have been gently taken to task for beginning this column with something like "It is winter. The launches sit stoically on blocks ..". Ok, it can be a little grandiose. Nonetheless, the goal is legitimate: to set the scene by juxtaposing the season with the activities, to give a sense of the enduring traditions, or at least the repeatability, in the tasks that shape our careers. Now, I look around and everywhere I see change: in what we do, how we do it, the tools that we use, in the places that we survey, and in the lives of the people that we share these experiences with. Such are the opportunities, challenges, and blessings that are scattered before and around us. I find comfort in the fact that we pass through these together, in a group of professionals. I also am encouraged to know that it has all been done before; in this life, change is constant.

I recently had the good fortune to be in attendance at a meeting prior to a certification audit. The auditor was trying to impress upon us that incremental change often happens without the participants being aware of the changing circumstances. To illustrate this he used the analogy of a frog who will avoid scalding water but will sit still in water that is slowly warmed up to the boil. I hope that this is an oft quoted and seldom repeated experiment. The auditor then contrasted this episode of slow continual unnoticed change with something unchanging, the rotational speed of the earth upon its axis. He was immediately challenged – the earth is slowing down. We will accept the bizarre biology but don`t try to school us on the earth science stuff. I take from this that the perception of change is relative. The recent workshop on e-navigation in Montreal showed me that shippers and software developers are doing some amazing work to maximize their service while working with government to maximize safety. Change is being driven by opportunity. One developer gave a talk on how his firm could monitor and retrieve shipboard data from land. This prompted some discussion. When he mentioned that his firm had a free application for showing charts on an I-Pad, half the audience took out their pen to scratch down the web address. Change can be sweeping.

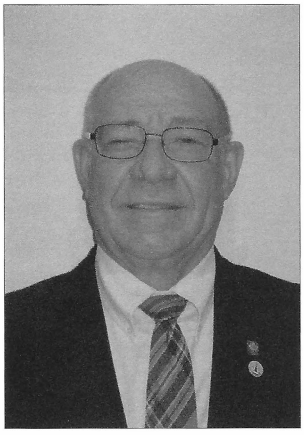
I have never been as impressed with the quality of the material in this publication as I am with what has been sent to us for this edition. My editorial style can be said to be minimalist – save for a comma here and there, I am content to run it as delivered. Occasionally, one has to lend a hand to let the author`s points come across better - but not lately. The last two editions have been first class stuff, in my humble opinion. That is not a boast on my part. As I say, I have done little but implore and compile. The scholarship lies in the papers, the artistry in the layout. When you find a typographical error here and there – it is mine by omission. I should say that there is something wonderfully Canadian in these papers in that the authors come from all over the world. We have been fortunate to attract the most able folks; that are both our past and our future, a worthy topic for another day.

The topics are not so much about change but they do reflect the way that our business is changing – and not changing. Craig Brown, Herman Varma and Kian Fadaie have given us their paper on emerging developments with backscatter data. It is a new way of using data that we have been collecting for a while now. Andrew Leyzack has done a great job, making the economic case for the benefits of hydrography in a changing Arctic environment. Steve Grant, Steve Forbes and Richard Palmer provide us with some sobering thoughts and potential solutions for dealing with an old problem, the charting of historical wrecks. There is also a conference wrap up from the very successful CHC 2010 in Quebec City by Robert Dorais. It serves as precursor to the upcoming USHC 2011 in Tampa. There is also a very old piece that came from C.D. Brown via THSOA. It is a whimsical look at the people we meet while in the field; light to be sure, but a wonderful reminder of the constancy of human relations and the magic of mirthful observation. As usual, there are contributions from many, all across the land as well as a new feature, highlighting some peers from beyond our shores.

Let me close by saying that I was greatly impressed with correspondence that I exchanged with Michael Ward. He brought me up to date on the CHA on the west coast – the retirements of the Sherri Willis and Carol Nowak, the educational sabbaticals of Brian Port and Leanna Quon-Turple, the struggles and tribulations of many, including himself. I found out that he is an artist and has been the model for some prominent works or art. The things one learns! What struck me most was his belief that the CHA is more than instruments and surveys. It is about the people who we meet and collaborate with, celebrate and endure with. Hydrography is a serious business with critical impacts on navigational safety, sovereignty, commerce and infrastructure. It is also our life. If I may take such a liberty, I would say that the best stories aren't always about the instrument but also about the guy who let it drop into the water. I am mindful that this journal is a voice of the CHA, whose stated purpose if the professional development of hydrographers. I have become aware that, as a publication, it has a certain persistence. The past issues begin to serve as markers of the way we were and the directions we took. In that, I look at us as a few soundings along the first tracks of the rough manuscript of a vast frontier. Long may we run and bear testament to change and progress.

Craig Zeller

Message from the National President
Mot du Président national



Greetings,

CHC 2010 Conference, held recently in Quebec City, was a huge success. Congratulations to the Conference Committee and in particular to the Chair Robert Dorais on a job very well done.

We can now shift our attention to April 2011 and the U.S. Hydro conference to be held in Tampa, Florida where I am told a special treat is being planned for attendees.

At the end of October I represented the CHA at the Face to Face Council Meeting and the 103rd Annual General Meeting of the Canadian Institute of Geomatics (CIG) held in Fredericton, NB in conjunction with this year's Geomatics Atlantic Conference.

Congratulations to the new CIG Executive – President Matthew Tait, President Elect Anthony Sani and Immediate Past President Simon Lanoix. They face a challenging year ahead as they cope with decreased Government assistance and increased operational costs. We wish them well in their endeavours as they tackle these challenges.

We also wish to thank our hard working committees on their dedicated efforts in support of our organization and the advancement of hydrography in Canada. We also congratulate Marc-André Barbeau, a Geomatics' Engineering student at University Laval, Quebec, the winner of this year's Canadian Hydrographic Association Award and look forward to his continued involvement with the CHA.

Our best wishes to the Professional Surveyors of Canada on the launch on November 15th, of their new association to showcase our professional surveying community.

As the year ends and the Branches have their Annual General meetings we expect some new faces to join the National Executive. While we look forward to this infusion of new ideas and new energies, we extend our sincere appreciation to the current members of the executive for their hard work and dedication throughout this past year.

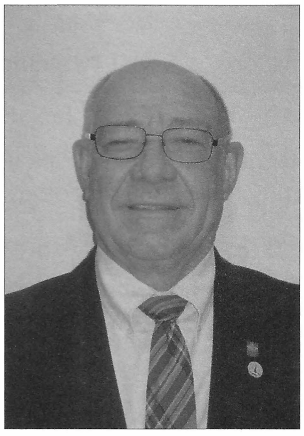
Congratulations also to Dr. Michael Sunderland as he assumes his post as Chair of FIG Commission 4 – Hydrography. I am sure Michael's contribution will make us all proud.

Our condolences to the van Dyck family and the Friends of Hydrography fraternity on the sudden and unexpected passing of Sid van Dyke.

We close by extending warm wishes for a Happy Holiday Season to all our members, their families and our colleagues in the Surveying and Hydrographic community.

George McFarlane, National President

Message from the National President
Mot du Président national



Salutations,

La CHC2010 qui s'est tenue récemment à Québec a été un énorme succès. Félicitations au comité organisateur et en particulier au président Robert Dorais pour un travail très bien fait.

Nous pouvons maintenant porter notre attention sur la conférence U.S. Hydro qui se tiendra à Tampa en Floride en avril 2011 où un traitement spécial est prévu pour les participants.

À la fin octobre, j'ai représenté l'ACH à la réunion du Comité exécutif et à la 103e assemblée générale annuelle de l'Institut canadien des sciences géomatiques (ACSG) qui s'est tenue à Frédéricton au Nouveau-Brunswick conjointement avec la Conférence de la « Geomatics Atlantic ».

Félicitations au nouvel exécutif de l'ACSG, au président Matthew Tait, au président élu Anthony Sani et au président sortant Simon Lanoix. Ils font face à une année difficile avec une diminution de l'aide gouvernementale et à une augmentation des coûts d'opération. Nous leur souhaitons bonne chance dans leurs efforts pour relever ces défis.

Nous tenons également à remercier nos comités pour leur travail assidu et leur dévouement à l'organisation pour la promotion de l'hydrographie au Canada. Nous félicitons aussi le lauréat 2010 de la bourse de l'Association canadienne d'hydrographie Marc-André Barbeau, étudiant en génie géomatique de l'Université Laval à Québec, et nous espérons qu'il poursuivre son implication avec à l'ACH.

Nos meilleurs vœux aux Géomètres professionnels du Canada pour le lancement de leur nouvelle association le 15 novembre qui mettra en valeur notre communauté professionnelle d'arpentage.

Comme l'année se termine et que les sections tiendront leurs assemblées générales annuelles, nous espérons que de nouveaux candidats se joindront à l'exécutif national. Pendant que nous espérons utiliser cette infusion d'idées et d'énergies nouvelles, nous adressons nos sincères remerciements aux membres actuels de l'exécutif pour leur travail acharné et leur dévouement pendant l'année.

Félicitations aussi au Dr Michael Sunderland qui assume la présidence de la Commission 4 (hydrographie) de la FIG. Je suis sûr que la contribution de Michael va nous rendre tous fiers.

Nos condoléances à la famille van Dyck et à la fraternité Des amis de l'hydrographie suite à la mort soudaine et inattendue de Sid van Dyke.

Nous terminons par nos vœux les plus chaleureux pour un joyeux temps des Fêtes à tous nos membres, leurs familles et nos collègues de la communauté hydrographique et d'arpentage.

George McFarlane, président national

U.S. HYDRO 2011 - TAMPA - FLORIDA

The U.S. Hydro 2011 Conference (www.thosa.org), sponsored by The Hydrographic Society of America, will be held at the Marriott Waterside Hotel in Tampa, Florida on April 25-28, 2011. U.S. Hydro 2011 is a continuation of the series of hydrographic conferences that alternate between the United States and Canada. This is the thirteenth U.S. Hydrographic conference and follows on the very successful U.S. Hydro 2009, held in Norfolk, Virginia.

In addition to the technical papers, the conference will feature an extensive series of Workshops, a Social Program, Exhibition Hall, a Student Outreach program, and a Accompanying Persons Program.

The conference will include technical sessions and a poster session on the latest developments and applications in hydrographic surveying, multibeam and side scan sonar, data management, electronic charting, marine archaeology, and related topics.

The conference registration fee includes admission to technical sessions, workshops, exhibit hall, two hosted receptions (Monday evening Registration Icebreaker and Tuesday evening Exhibitor's Social), and the traditional Wednesday evening hosted social at Tampa's Columbia Restaurant in Ybor City.

The Full/One day Conference registration for Members is $375/$175 and for Non-Members $500/ $250. Students of 'Member' organizations may register for $50 (excludes Wednesday Banquet).

A 'Member' is an Individual Member in good standing as of February 1, 2011, in The Hydrographic Society of America or the Canadian Hydrographic Association.

CALENDAR OF EVENTS

- United States Hydrographic Conference, Tampa, Florida, April 25-28, 2011
- F.I.G. Working Week and General Assembly, Marrakech, Moroccoo, May 18-22, 2011
- ACLS 7th National Surveyors Conference, Yellowknife, Northwest Territories, June 22-24, 2011
- CIG AGM will take place during "GEOMATICS 2011", Montréal, Quebéc, October 12-13, 2011
- Canadian Hydrographic Conference (CHC) 2012, Niagara Falls, Ontario, May 2012

Au revoir de Québec

Au revoir from Québec!

By: CHC2010

La Conférence hydrographique du Canada 2010 (CHC 2010) qui s'est tenue au Centre des congrès de Québec du 21 au 23 juin 2010 a permis de rassembler près de 400 personnes provenant de 16 pays qui ont échangé sous le thème **« L'hydrographie : une science, des technologies et des gens au service du monde maritime »**.

Le conférencier invité aux cérémonies d'ouverture, le professeur Donald W. Olson, de l'Université Texas State, a su captiver l'audience en nous rappelant l'importance de la connaissance des sciences et l'impact majeur qu'elle peut avoir sur les événements historiques. Il a démontré que l'observation du phénomène des marées et du passage de la lune a contribué au succès de l'invasion britannique en 1759 à Québec. C'est à l'aide de la modélisation des courants et d'une mission sur le Saint-Laurent qu'il a pu démontrer son hypothèse et corriger certains faits historiques rapportés. Il a dédié sa conférence à la mémoire de l'océanographe-physicien François Saucier avec qui il avait obtenu une excellente collaboration.

The Canadian Hydrographic Conference 2010 (CHC 2010) held in Quebec City Convention Centre from 21 to 23 June 2010 brought together nearly 400 people from 16 countries who exchanged under the theme "**Hydrography: science, technology and people dedicated to the maritime world.**"

The guest speaker at the opening ceremonies, Dr. Donald W. Olson of Texas State University, captivated the audience by reminding us of the importance of science literacy and the major impact it can have on historical events. He demonstrated that the observation of tides and the passage of the moon have contributed to the success of the British invasion in 1759. With the help of currents modeling and a mission on the St. Lawrence River in front of Quebec City, he could prove his hypothesis and correct some historical facts. He dedicated his lecture to the memory of the oceanographer, physicist François Saucier, with whom he had received excellent cooperation.

Opening Ceremonies for the Trade Show

First Row: *Savithri Naranayan, Dominion Hydrographer; Siddika Mithani, Associate Deputy Minister, Sciences, Fisheries and Oceans Canada; Richard Nadeau, regional Director General Québec Region, Fisheries and Oceans Canada; Capt. John Lowell, US Chief Hydrographer, National Oceanic Atmospheric Association; Robert Dorais, CHC 2010 Chairman;* Second Row: *George McFarlane, National President, Canadian Hydrographic Association; George's wife Hope.*

The Organizing Committee

La CHC 2010 débutant le 21 juin fut l'occasion de souligner la **Journée mondiale de l'hydrographie** en invitant le grand public à visiter les bateaux hydrographiques ainsi que l'exposition commerciale par l'entremise des communiqués de presse et d'entrevues médias. La thématique des deux événements convergeait parfaitement pour promouvoir l'importance de l'hydrographie et expliquer que les services hydrographiques sont un élément essentiel au commerce maritime. D'ailleurs, la session traitant de navigation moderne a été l'occasion de démontrer l'apport

CHC2010 opening on June 21 was an opportunity to highlight **World Hydrography Day** by inviting the public to tour the hydrographic vessels and the trade show. The theme of the two events converged perfectly to promote the importance of hydrography and explain that hydrographic offices are essential to maritime trade. Moreover, the session dealing with modern navigation was an opportunity to demonstrate the vital contribution of hydrography to this evolving field. The various radio interviews helped promote hydrography to a large

The Heritage launch Surveyor proudly displayed at the main entrance of the Convention Centre

indéniable de l'hydrographie à ce domaine en pleine évolution. Les différentes entrevues radio ont permis de promouvoir l'hydrographie à un large auditoire (400 000 impression médias) selon le rapport de la firme de la relation de presse de l'événement.

L'équilibre du programme technique, qui a bien couvert la thématique de la conférence, a permis aux participants de trouver leur compte entre les conférences, les séances d'affichage, les ateliers et une exposition commerciale complète et très diversifiée. À tout ceci, il faut ajouter les visites des navires hydrographiques et du Centre de simulation et d'expertise maritime, de même que les activités sociales à la Réserve Navale et le banquet à bord du bateau *Louis-Jolliet* ainsi que la soirée des exposants avec ses artistes de cirque qui ont complété de belle façon un programme déjà bien rempli. Tout cela a contribué à un réseautage des plus prolifiques.

La CHC 2010, 36e édition de cet événement international bisannuel qui alterne avec la conférence hydrographique organisée aux États-Unis, a été une franc succès. En effet, 48 exposants commerciaux se sont partagés le hall d'exposition, 49 présentations orales se sont déroulées lors de 9 sessions techniques, 5 ateliers ont été offerts aux 376 participants, une session d'affichage composée de 30 affiches scientifiques a été organisée, et ce, en plus des activités sociales qui ont connu un achalandage considérable.

audience (400,000 print media) according to the firm's press relations report for the event.

The balance of the technical program, which covered the themes of the conference, allowed participants to find their account between conferences, poster sessions, workshops and a complete and very diverse trade show. In all this we must add the visits to the hydrographic surveys vessels and the Maritime Simulation and Resource Center, as well as social activities in the Naval Reserve, the banquet on board the cruising vessel *Louis Jolliet* and the exhibitors evening with the exquisite circus performers who topped of an already jam-packed program. All this contributed to a most prolific networking.

CHC 2010, 36th edition of this biennial international event which alternates with the US Hydro, was a resounding success. Indeed, 48 commercial exhibitors shared the exhibition hall, 49 oral presentations were held during 9 technical sessions, 5 workshops were offered to 376 participants, a poster session consisting of 30 scientific posters were organized and this, in addition to social activities that have experienced significant attendance.

All this was possible thanks to the participation of speakers and session chairs, and the support of our generous partners and collaborators: Kongsberg, ESRI, Caris, Seafloor Technologies, IIC Technologies, Fugro, the Association of Canada Land Surveyors, Ordre des

The speakers from the Modern Navigation (e-Navigation) session chaired by Capt Robert Ward, International Hydrographic Bureau (first row left)

Hydrographers on the bridge at the Maritime Simulation and Resource Centre

Tout ceci est possible grâce à la participation des conférenciers et des présidents de sessions, au soutien de nos généreux partenaires et collaborateurs: Kongsberg, ESRI, Caris, Seafloor Technologies, IIC Technologies, Fugro, l'Association des arpenteurs des terres du Canada, l'Ordre des arpenteurs du Québec, CIDCO, la Corporation des pilotes du Bas-Saint-Laurent, la Garde côtière canadienne, THSOA et les nombreux médias et au support soutenu du Service hydrographique du Canada et de l'Association canadienne d'hydrographie.

À la lumière des commentaires recueillis lors du sondage d'opinion suivant l'événement, l'enthousiasme et l'énergie déployée des organisateurs de la CHC2010 fut récompensés et ils peuvent confirmer: mission accomplie. Il ne reste plus qu'à vous convier à US Hydro 2011 qui se tiendra en Floride dans la ville de Tampa du 25 au 28 avril 2011 ainsi qu'à la prochaine Conférence hydrographique canadienne à Niagara Falls du 12 au 14 mai 2012.

Pour consulter les présentations, affiches, articles et photographies de la CHC2010, visitez le site www.hydrography.ca ou directement sur l'adresse ftp suivante : ftp://chc2010visitor:visitor@ftp.chc2010.ca/public/

arpenteurs du Québec, CIDCO, the Corporation of Lower St. Lawrence Pilots, Canadian Coast Guard, THSOA and many media and the continued support of the Canadian Hydrographic Service and the Canadian Hydrographic Association.

In light of comments received during the public opinion survey following the event, the enthusiasm and the energy of the organizers of the CHC2010 was rewarded and they can confirm: mission accomplished. It remains only to invite you at U.S. Hydro 2011 to be held in Tampa, Florida 25 to 28 April 2011 and the next Canadian Hydrographic Conference in Niagara Falls from 12 to 14 May 2012.

To view the papers, presentations, posters, and photographs of CHC2010 visit www.hydrography.ca or directly on the following ftp address: ftp://chc2010visitor:visitor@ftp.chc2010.ca/public/

Resection to Enhance GPS Positioning

By: Nick Stuifbergen, Canadian Hydrographic Service, Atlantic Region

A description is provided of using theodolite resection measurements to overcome the limitations of an inadequate GPS site, affected by blocked signals and/or reflected signal paths. Theodolite resection solved by Collins' method. Mathematical formulae are included. Key Words/Index Terms 1. Global Positioning System 2. Surveying by GPS 3. Signal Blockage Problem 4. GPS Enhancement by Resection 5. Theodolite resection 6. Three-point Fix 7. Collins' solution.

1.1 Introduction

This article describes the use of resection, for solving the 3-point fix, to overcome a limitation of fixing by GPS at an obstructed site, i.e. affected by signal blockage and/or reflections.

The idea is to fix three target stations on nearby clear sites by GPS, and then to fix the desired point by theodolite resection.

Among a number of existing methods of resection, the Collins method is the most suitable for resection by a computer solution.

The method most often shown in survey textbooks, by trigonometry, is awkward and error-prone in a programed solution. Perhaps this is the reason for the conventional method being rarely applied in survey practice.

A method of error evaluation is described, by applying small changes to the measured angles, and observing the changes in computed position.

1.2 Notation and Sign Conventions

1.2.1 Notation

Stations
L ··· station on the left
R ··· station on the right
M ··· middle station
H ··· auxiliary Collins point
P ··· solution point by resection

Symbols
α_l, α_r ··· observed angle left and right
Z_{ab} ··· plane azimuth A to B
X_p, Y_p ··· plane coordinates of solution point P
ϕ_p, λ_p ··· geodetic latitude & longitude of P
λ'_p ··· shifted geodetic longitude of P
qatn ··· full-circle arc-tangent function `ATAN2 in Fortran`

1.2.2 Sign Conventions

Azimuths reckoned positive clock-wise from North-up.
Angles taken positive clockwise.

ϕ – North latitudes positive
λ – East longitudes positive

In the western hemisphere, it is common practice to enter and display longitudes as positive quantities, and convert to negative values in the computer to conform with mathematical convention.

This saves print of numerous minus signs in data processing.

Presentation of Angular Units

1. Inside the software, all angles and azimuths are in radian units.
2. In geodetic work, angular units shown in degrees, minutes and seconds, DDD MM-SS.ffff
3. For checks with hand calculators, decimal degrees are convenient. DDD.ffff ffff
4. Marine navigators prefer degrees and decimal minutes, DDD MM.ff, standard practice for convenience in plotting positions on the nautical chart. Having to convert every displayed value in degrees, minutes and seconds before plotting is a nuisance on the ships' bridge.
5. Full format display example: Lat 45 20.12 N, Long 63 32.15 E

This is the preferable form of display for electronic positioning systems

2.1 Procedure Steps

This section describes the process by resection, the 3-point fix, to overcome the limitation of fixing by GPS at an obstructed site, i.e. affected by signal blockage and/or reflections.

The idea is to fix three resection target stations on nearby clear sites by GPS, and position the perturbed GPS site by theodolite angles, taken on the targets.

More than three targets can yield overdetermined solutions.

Steps:

1. Position 3 or more resection targets by GPS, clear sites nearby that are not affected by reflections or blocked signal reception.
2. Shift the longitudes of the project to straddle the Central Meridian of the UTM zone. Thus to minimize and disregard the t-T (arc to chord) correction for measured angles.
3. Convert latitude and longitude of shifted targets to local UTM.
4. Compute the resection co-ordinates for point P in local UTM plane co-ordinates.
5. Convert UTM of point P back to latitude and local longitude.
6. Shift the longitude of resolved point P back to original site.
7. Now we have the lat-long co-ordinates of solution point P, not affected by a poor GPS site location.

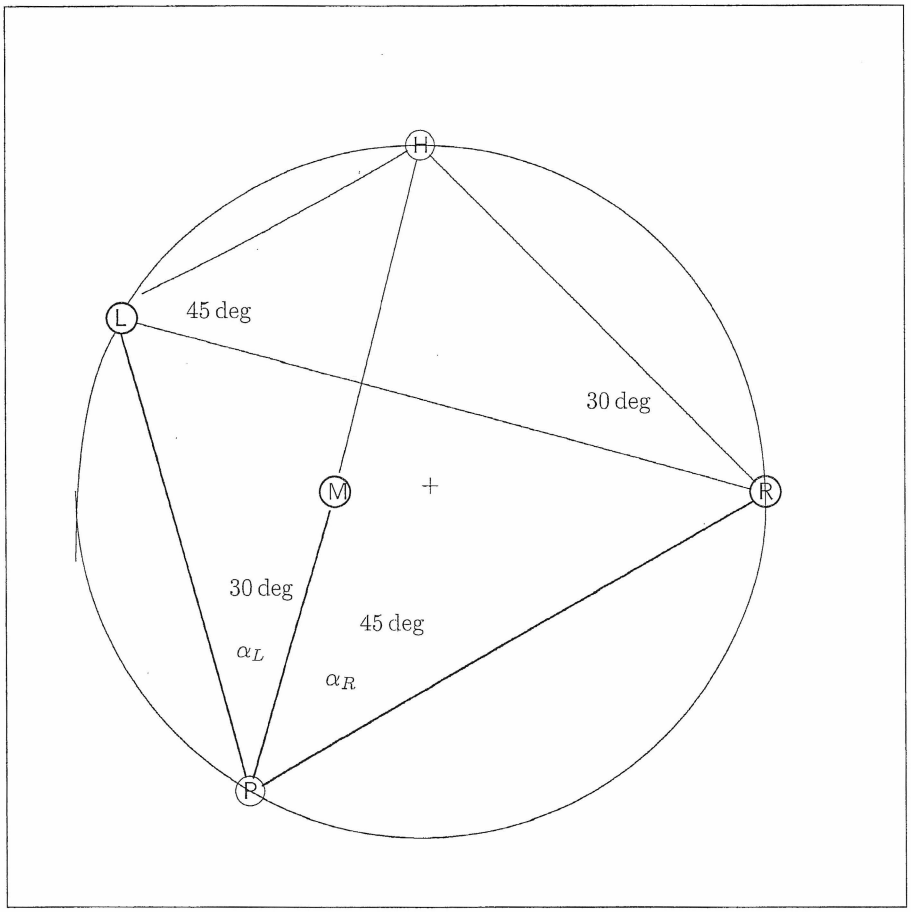
3.1 Resection by Collins' Method

This article describes the solution of resection by the algorithm devised by Collins (in 1742). Among others, this is the most suitable method for computer implementation.

Principle

Arc LH subtends the observed angle α_L and also the angle at R.
Similarly, the arc HR subtends the observed angle α_R and the angle at L.

3.1.1 Collins' Method Diagram



3.1.2 Collins' Method Solution

Equations in Computation Sequence

1. Azimuth $Z_{LR} = \text{qatn}(X_R - X_L, Y_R - Y_L)$ [= 105 deg]
   $Z_{LH} = Z_{LR} - \alpha_R$ [= 60 deg]
   $Z_{RH} = Z_{LR} + \alpha_L + \pi$ [= 315 deg]

2. Intersection for point H by azimuths Z_{LH} and Z_{RH}

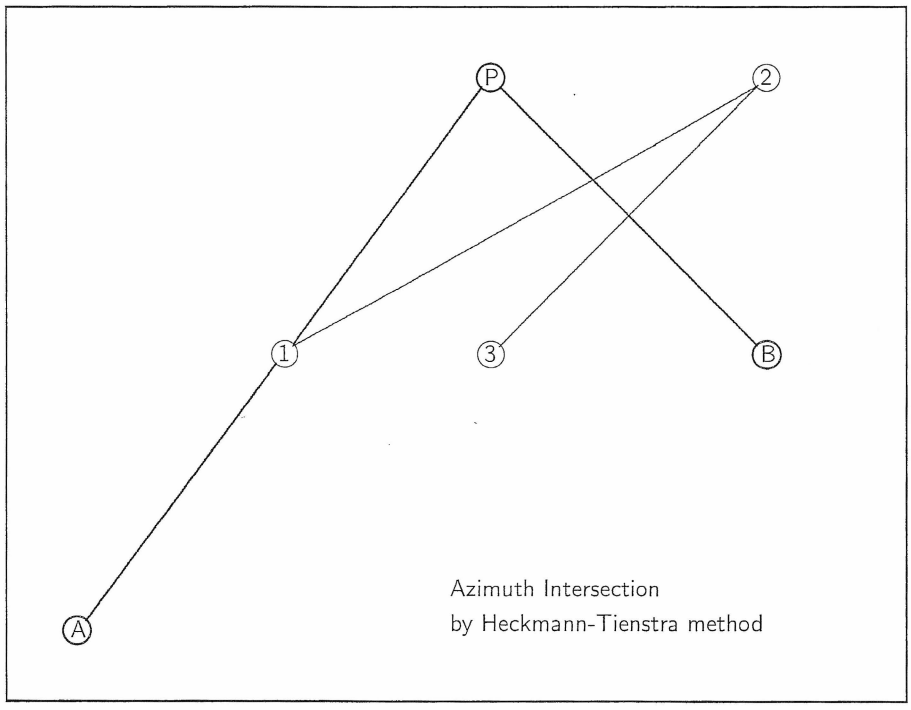
3.Azimuth $Z_{HP} = Z_{HM} = \text{qatn}(X_M - X_H, Y_M - Y_H)$ [= 195 deg]
   $Z_{LP} = Z_{HM} - \alpha_L$ [= 165 deg]
   $Z_{RP} = Z_{HM} + \alpha_R$ [= 240 deg]

4. Intersection for point P by azimuths Z_{LP} and Z_{RP}

5. The distance ratio, C = d_{HP}/d_{HM} [= 1.87],
may be used as a "condition number"
to indicate the strength of the fix, a fix quality indicator.
C = between 1 and 3 for a strong fix.
C > 10 indicates a weakness in the fix.

Intersection by azimuths is shown in section 3.1.3

3.1.3 Azimuth Intersection



Equations in Computation Sequence

Given: Base station plane coordinates (X_A, Y_A) and (X_B, Y_B)
and plane azimuths Z_{AP} and Z_{BP}.
To find: Plane coordinates at intersection P (X_P, Y_P).

$X_1 = X_A + (Y_B - Y_A) \tan Z_{AP}$
$Y_2 = Y_b + (X_B - X_1)/(\tan Z_{AP} - \tan Z_{BP}) = Y_P$
$X_3 = X_B - (Y_P - Y_B) \tan Z_{BP} = X_p$

Exceptions: When $\tan Z_{AP}$ equals $\tan Z_{BP}$, then
parallel rays do not intersect, i.e. no fix possible.
Special case when azimuth Z equals $\pm$ 90 degrees.

4.1 Error Evaluation

A simple basic method of error evaluation may be found by perturbing the input angles α by a small increment δ and observe the displacement in position of P. The amount $\delta = 1\sigma$, of about 3 arc-seconds, is a realistic value.

Pos'n	Angles	
P_1	α_L	α_R
P_2	$\alpha_L + \delta$	α_R
P_3	α_L	$\alpha_R + \delta$
P_4	$\alpha_L + \delta$	$\alpha_R + \delta$

The four positions P plot as a parallelogram; the largest diagonal length is an indication of the maximum geometric displacement. The figure is also known as the "error diamond".

A newer method of error presentation is by error ellipses, derived from covariance calculations, methods to be found in modern surveying textbooks.

5.1 Discussion

Successful implementation depends on having reliable software available to the surveyor, for Lat-Long to UTM (and vice-versa) conversions, and for solving resection by Collins' method. It is most helpful to have the software accessible at the field site.

The Collins method, dating from the year 1742, is the most suitable method for modern computer implementation, among the number of other solutions available. These are a reflection that historically the three-point fix was a geometers delight, a geometric problem that continued to fascinate mathematicians.

The solution shown in surveying textbooks, based on trigonometry, is awkward for programming. Perhaps this is why resection has been seldom used by surveyors in the computer age.

6.1 Conclusion

Collins' method, very well suited to computer solution of resection, is presented, for the application of dealing with poorly sited GPS stations.

6.2 Acknowledgement

Acknowledged and appreciated is the work experience in the Navigation Group, at the Bedford Institute of Oceanography, headed by Mr. R.M. Eaton.

Appreciation is also due to co-workers in the Canadian Hydrographic Service, including Geomatics Support, and to BIO library staff.

This work was done in the Canadian Hydrographic Service, under the alumnus/emeritus provisions of the Department of Fisheries and Oceans (Canada).

7.1 Disclaimer

Statutory Disclaimer

Neither the author, nor the Canadian Hydrographic Service, nor the Crown, accept any legal liability for the accuracy of this software, or legal liability for the results obtained by the use and/or application of this software formulation.

8.1 Literature Sources

1. Surveying: Theory and Practice (sixth edition, 1981)
   R.E. Davis,F.S.Foote, J.Andersen & E.Mikhail
   McGraw-Hill, Inc ISBN 0-07-016 790-1
   TA 545.D45 1981
   A complete handbook of surveying. Part III, chapter 9, p 370 ff covers intersection and resection methods of traditional practice. Trigonometric solutions not well suited to computer application.

2. Surveying for Civil Engineers (1956)
   Phillip Kissam McGraw-Hill Inc
   Library of Congress Catalog # 55-6158
   Chapter 6, Sections 33-36 covers resection by the trigonometric solution and also illustrates a semi-graphical method. Good examples of practice pre-dating the advent of desktop computers.

3. GPS Satellite Surveying (second edition, 1995)
   Alfred Leick, University of Maine, Orono, Maine
   Wiley-Interscience Publication.
   ISBN 0-471-30626-6 TA595.5.L45 1994
   A comprehensive text for survey applications of GPS.

The Canadian Hydrographic Association Award - Letter From 2010 Recipient - Marc-André Barbeau

Cher éditeur de Ligthhouse,

Je voulais remercier l'Association canadienne d'hydrographie de m'avoir choisi comme récipiendaire de leur bourse étudiante. Cette aide est très appréciée et elle me permettra d'être plus à l'aise financièrement pour réaliser mon objectif de carrière en géomatique.

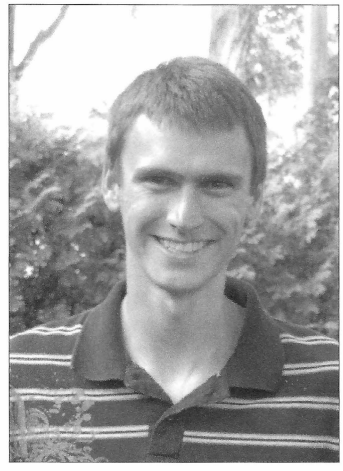
Je commencerai, en septembre, ma troisième année sur quatre en génie géomatique à l'Université Laval située dans la ville de Québec. Jusqu'à présent, j'ai réalisé deux stages professionnels liés à la géomatique. L'été dernier, j'ai travaillé dans le département de géomatique du Ministère de la Défense nationale du Canada. Lors de ce stage, j'ai effectué la gestion de bases de données ainsi que la cartographie pour des projets d'ingénierie.

Cet été, j'ai réalisé mon stage au Ministère des Pêches et Océans du Canada, plus précisément au sein du Service hydrographique. J'ai fait partie de l'équipe de support technique de la région du Québec. J'ai alors approfondi les logiciels et la technologie utilisés en hydrographie, ce qui m'aidera grandement dans mon cours universitaire d'hydrographie à l'hiver prochain. Ce stage s'étant déroulé loin de chez moi, de nombreuses dépenses supplémentaires se sont ajoutées à mon budget d'étudiant.

Merci encore pour votre générosité.

Marc-André Barbeau

Marc-André Barbeau



Dear Editor of Lighthouse

I would thank the Canadian Hydrographic Association for considering me for the student award. This help is really appreciated; it will help me financially to achieve my career goal in geomatics.

This September, I will begin my third of four years of Geomatics Engineering at the Université Laval in Quebec City. Up to now, I have completed two internships related to geomatics. Last summer, I worked in the geomatics division of the Department of National Defence. During this internship, I managed the database and mapped engineering projects.

This summer, I have made internship at the Department of Fisheries and Oceans of Canada within the Hydrographic Service. I was part of the support team of the Quebec region. I tested the software used in hydrography and survey procedures, which will help me greatly in my university course of hydrography this winter. This internship was far from home; many additional expenses were added to my student budget.

Thank you again for your generosity.

Marc-André Barbeau

Marc-André Barbeau

See page 18 for Award information

Feature Matching of Digital Images

By: Nick Stuifbergen, Canadian Hydrographic Service, Atlantic Region

This note is a brief pointer to an ingenious solution of matching features in a pair of digital images.

Said to be a landmark paper, the article by authors Scott & Longuet-Higgins (SLH) describes a new versatile method of finding corresponding features common to a pair of digital map objects.

A significant component of the process is the "Singular Value Decomposition" (SVD), a matrix factorization method of numerical linear algebra. If a pair of images is able to be linked by an approximate transformation, and with a common orientation (within 5 degrees), then a match is feasible.

For example, one application would be for features of a source map of unknown scale and projection to be matched and made to fit to a standard topographical map. This for the purpose of updating the topo map with new information.

Implementation would be a major research task in cartography at a post-graduate level.

The literature sources given below are not readily found in the mainstream of cartographic literature, and are only partly and vaguely understood by this writer.

Sources

1. Guy L. Scott & H. Christopher Longuet-Higgins
An algorithm for associating the features of two images
Dept of Engineering Science, Univ of Oxford, Oxford OX1 3PJ, U.K.
Proceedings Royal Society of London, Series B
Vol 244, No. 1309, April 1991, pp 21-26
...This the original source paper, a brilliant finding

2. M.Pilu & A. Lorusso
Uncalibrated Stereo Correspondence by Singular Value Decomposition
Hewlett-Packard Research Labs, Bristol BS12 6QZ (U.K.)
http://www.bmva.ac.uk/bmvc/1997/papers/081/index.html
...This application of SLH to mapping by photogrammetry, contains a step-by-step process description.

3. Nicholas J. Higham
The Singular Value Decomposition and Jacobi's Method
Section 5, pp 70-74
The Graduate Students's Guide to Numerical Analysis '98
ISBN 3-540-65752-5 Springer-Verlag
... Contains a solution to SVD by the simpler Jacobi's method.

Erratum - A Five-Star Solution For The GPS Fix

The Editors wish to apologies for, and correct, an error in the listing of subroutine A2R on page 17 printed in Edition 76 - Spring/Summer of *Lighthouse*.

The error occurs approximately three quarters into the subroutine.

The line `DO 120 K=1,I1`

should read `DO 120 K=1, I-1`

The error was brought to the attention of the Editor by Nick Stuifbergen.

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 post secondary program in the field of Geomatics (the program must have a Hydrographic Survey or Ocean Science component) in a university or technological college anywhere in Canada. Other programs may be deemed eligible at the discretion of the Manager of this 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 inscrit à plein temps à un programme reconnu en sciences géomatiques (ce programme doit inclure l'hydrographie ou un contenu en sciences de la mer) par une université ou un collège situé au Canada. D'autres programmes peuvent être jugés éligibles à la discrétion de l'administrateur de cette bourse.

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 :

Manager / Administrateur
Canadian Hydrographic Association Award Program / Bourse de l'Association canadienne d'hydrographie
6420 Edenwood Drive, Mississauga, ON L5N 3H3
FAX / Télécopieur: (416) 512-5803 geomac66@sympatico.ca *www.hydrography.ca*

Economic Benefits of Hydrography in the Canadian Arctic - A Case Study

By: Andrew Leyzack, Canadian Hydrographic Service ,Central & Arctic Region

[***Publication Note***: *This paper was previously presented at the 7th Regional FIG Meeting in Hanoi, Vietnam, 19-20 October 2009 and has been published in the FIG online Surveyors Reference Library. It has since been updated to include statistics to December 2010 and FIG has kindly extended permission to reprint this document.*]

Remote communities in the Canadian Arctic are accessed and re-supplied by air and by sea. The latter mode of transportation presents a more cost-effective solution for re-supply and in recent years, an extended navigation season has seen an increase in both cargo and passenger vessel traffic. Traditionally, communities in the Western Canadian Arctic have been re-supplied by barge and tug however deep draught ocean-going vessels are now starting to compete for service to these same communities. The cost savings realised from deep draft vessel re-supply are significant and modern hydrographic surveys are an enabling factor for deep draft access to Arctic trade routes, for both cargo and passenger liners, especially where under keel clearance is a concern. Citing case studies, this paper will endeavour to illustrate the economic benefits of hydrography in the Canadian Arctic, with focus on reducing the costs associated with shipping goods and materials

1. FORWARD- The Case for Arctic Hydrography

Communities throughout the Canadian Arctic are continually growing[1]. This is clearly evident when we compare the cultural information on hydrographic field sheets and charts compiled from the 1960's through to the 1980's with what we see upon returning to update hydrography some 20 to 40 years later. Within the Kitikmeot Region of Nunavut Territory, Cambridge Bay is the largest community and serves as the region's administrative centre. This community has seen a population growth of 12.8% during the 5-year period between the last two census counts. As of 2006, its population was 1477 and presently it is unofficially over 1800, a 22% increase in just 4 years. It has become the regional hub for both air and sea lift cargo service for this part of the Canadian Arctic, the latter made possible by deep water access (greater than 9m) and modern charting. With a decade of relatively ice-free navigation throughout the Northwest Passage, Cambridge Bay has harboured the greatest number of sea-going vessels of all other communities within the Kitikmeot Region (see Figure 1). "'Sealift' is a strategic and vital link for all Nunavut communities and their residents to obtain their annual re-supply of goods and materials needed throughout the year. It remains the most economical way to transport bulk goods to the Arctic. Each year, ocean going ships travel from several southern Canada Ports with a variety of goods ranging from construction materials, vehicles, heavy equipment, house wares and non-perishable items".[2] Since these

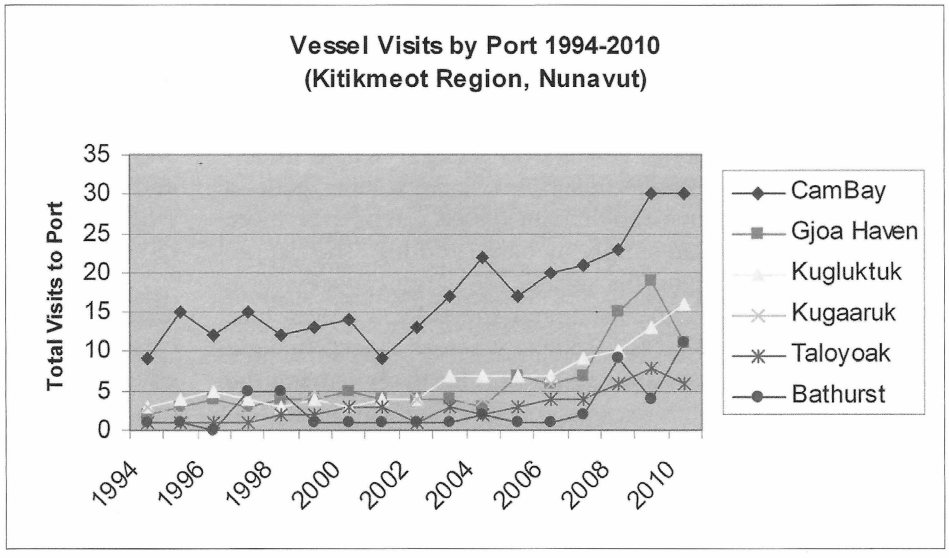


Figure 1: Vessel Traffic by Port (Kitikmeot region, NU)

[1] The exception is Bathurst Inlet whose population decreased to 0 in 2006, from 5 in 2001. However with modern charting supporting sealift to a number of mining operations in this area and speculation of the contruction of a winter road to connect the inlet with mining operations to the south, there is strong potential for the community of Bathurst Inlet to re-establish in support of a potential terminus.

[2] Nunavut, Department of Community and Government Services, Dry Cargo Resupply Program, Activity Year 2007, Government of Nunavut, 2008.

communities use diesel generators to produce electricity, the need for bulk diesel to be shipped by barge and tanker is significant. It wasn't until the first large-scale modern chart, Pelly Bay, was published in 1993 that ice-breaking ships could deliver fuel to Kugaaruk. Prior to this time, the only way for fuel to be shipped in was by air freight. Here, the cost savings were considerable.

1.1 Population Growth in Kitikmeot Region

Communities are listed in order of population as of the last census in 2006. The percentage of growth is based on a five year period between 2001 and 2006:

Community	Population	Growth
Cambridge Bay	1477	12.8%
Kugluktuk (Coppermine)	1302	7.4%
Gjoa Haven	1064	10%
Taloyoak (Spence Bay)	809	8.6%
Kugaaruk (Pelly Bay)	688	13.7%

Table 1: Growth by Community (Kitikmeot Region, NU)

This growth has placed an increased emphasis on efficient and cost effective Arctic resupply. Anyone who has travelled the Canadian Arctic will be aware of the high cost of goods and services in the North. For example 4 litres of milk can cost upwards of $14.00 CDN dollars[4], about 3 times the price of southern markets. This is primarily due to the cost of transporting freight to the North. In 2007, Nunavut households spent nearly twice the national average on food ($14K vs $7K)[5] and this coupled with low income has created food insecurity in the North. A 2003 study on food insecurity found that 5 out of 6 households in Kugaaruk were classified as "food insecure."[6]

Resupply by sea provides a less expensive alternative to air freight ($0.80/kg versus over $9/kg)[7]. Where under-keel clearance permits, resupply of large volume, general cargo and fuel by deep draught vessels can be even more cost efficient than supply by barge and tug. The deeper the vessel draught, the greater the cargo capacity for a single trip. Also, the maximum speed for a typical tug/barge combination is 5-7 knots whereas a deep draught vessel can cruise at 10-15 knots, effectively halving the delivery time.

1.2 Cost-Effective Transportation

Sample Freight Tariffs (in Canadian Dollars) for a metric tonne (1000kg) of general cargo from Montreal, QC to Cambridge Bay, NU):

Mode of Transportation	Vessel	Cost
Airfreight	737	$9080.00
Overland + Sealift	Tug and Barge	$1200.00[8]
Sealift	Deep Draught General Cargo	$510.00[9]

Table 2: Cost of Freight by Mode of Transportation

In view of the above data, the cost savings realized from deep draught sealift can be up to $8500.00 per tonne when compared to air freight. It must be noted when comparing the two types of sealift tariffs (tug and barge vs. deep draught) the overall cost of sealift by tug and barge will more than double that of deep draught because of the additional cost to truck cargo overland from Montreal, QC to the inland port of Hay River, NWT.

These tariffs demonstrate the overall cost effectiveness of transportation by deep draught (ocean-going) vessels. However, deep draught transportation to and from the Arctic depends upon reliable information including ice conditions, meteorology and most importantly hydrography. Under keel clearance is an issue for deep draught transportation in the Kitikmeot Region, perhaps more than any other region in the Arctic. Almost all northern ports do not have deep sea docking facilities and ships are required to anchor as close to shore as possible to transfer cargo to the beach (above the high water line) using self-contained barges and tugs. Fuel is transferred by large diameter hoses, floated ashore to a supply manifold on beach. Large-scale modern charting is needed to not only enable close, inshore access to northern communities and other commercial destinations such as mining or oil and gas sites but to provide alternate routes in situations where ice navigation is neither practical nor cost effective or should be avoided.

Where alternate routing to avoid ice navigation does not exist, the cost of icebreaker escort support may apply, effectively reducing the overall cost effectiveness of deep draught transportation. In southern waters, this cost

[3] Nunavut Bureau of Statistics, 2008.

[4] Author's observation from visit to community market store in Taloyoak, 2009.

[5] Statistics Canada, Spending Patterns in Canada 2008, Catalogue no. 62-202-X, Minister of Industry, 2009.

[6] Judith Lawn and Dan Harvey, Nutrition and Food Security in Kugaaruk, Nunavut. Ottawa: INAC, 2003.

[7] First Air, Domestic Cargo Tariff, Montreal, QC to Cambridge Bay, NU, 25 June, 2009.

[8] Northern Transportation Company Ltd., 2009 Mackenzie-Western Arctic General Cargo Rates, Originating at Hay River, NWT, 8 April, 2009. Rate is the sum of the cost of overland shipping from Montreal, QC to Hay River (approximately $340.00/tonne) plus sealift from Hay River, NWT to Cambridge Bay, NU ($859.00/tonne).

[9] Nunavut Eastern Arctic Shipping Ltd., Freight Rates for the 2009 Season, 7 April, 2009.

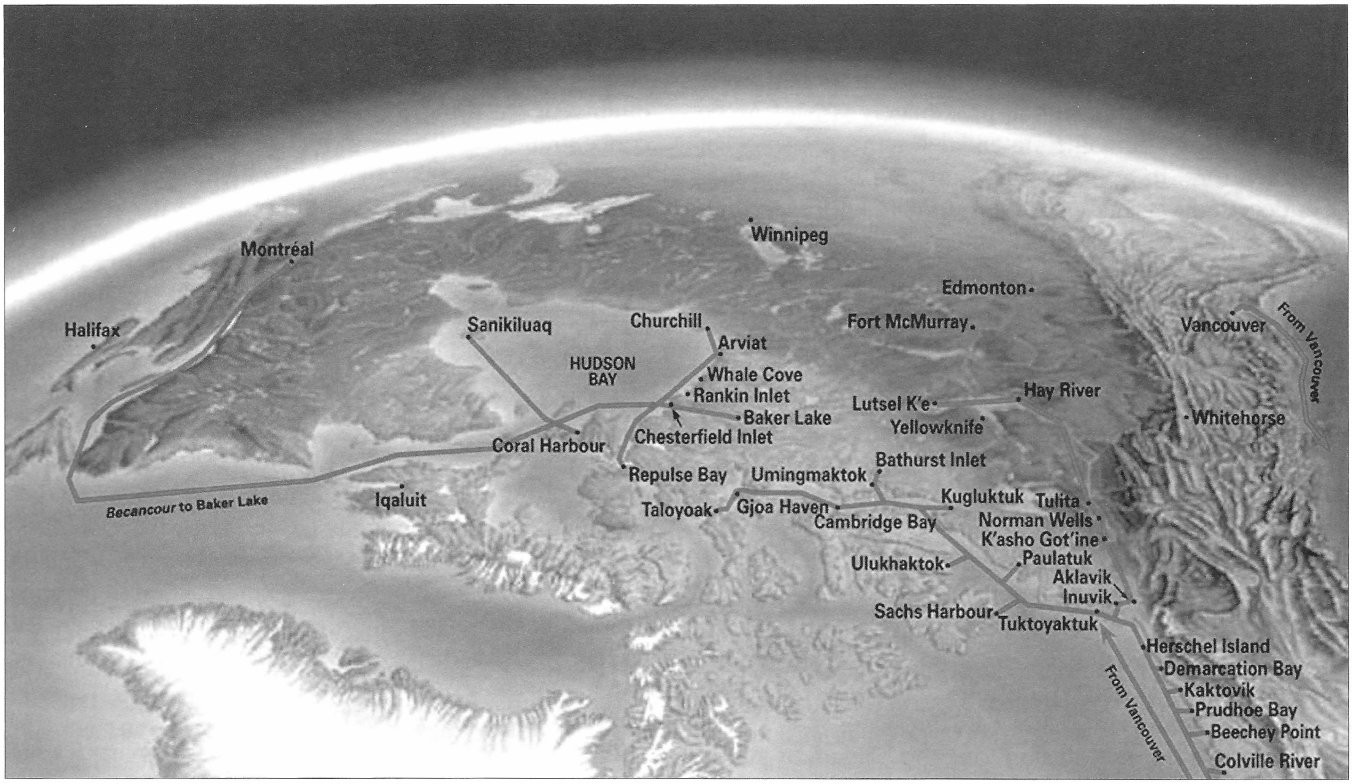


Figure 2: An Arctic Perspective (Source: Northern Transportation Company Ltd.)

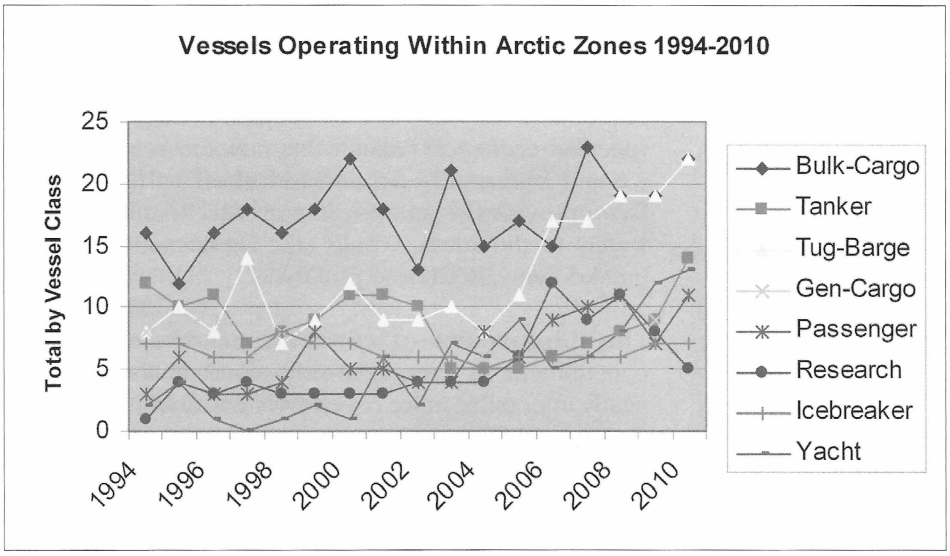


Figure 3: (Note: Bulk Cargo includes grain carriers to Port of Churchill, Hudson Bay)

is recovered through an Icebreaking Service Fee (ISF) administered by the Canadian Coast Guard. Presently in Arctic waters (north of latitude 60 degrees) this fee has been waived as part of the Canadian Government's Northern Strategy which promotes actions that support economic and social development in Canada's Arctic[10] and is subsidized by the public purse. Therefore, the cost of icebreaking as a hidden cost should be considered a government subsidy for shipping freight by sea. Icebreaker operating costs will vary depending on the area of operation and may range between $25,000 to $90,000 CDN/per 24 hour period.

2. ACCESS TO ARCTIC WATERS

Over the past decade, relatively "ice-free" conditions throughout the Northwest Passage have resulted in an extended navigation season, a season which during summer months can exceed 3 months in duration. This is attracting more vessel traffic (commercial passenger and cargo ships as well as pleasure craft) to the Canadian Arctic. In response to this, federal, provincial and territorial governments are investing in port infrastructure for northern communities to better support transportation by sea.[11] However, unlike

[10] Fisheries and Oceans, Canadian Coast Guard, Marine Service Fees – Information Bulletin, Number 23, 2008. http://www.ccg-gcc.gc.ca/eng/CCG/Marine_Services_Fees.

[11] Canada's Economic Action Plan, Government of Canada, August, 2009.

southern trade routes and passages, navigation in the Canadian Arctic can be a far more complex affair. This is due to the large expanse of uncharted or incompletely charted waters (comprising approximately 90% of Arctic waters) and the ongoing potential for the presence of ice. Therefore, to access Arctic ports, an understanding of anticipated ice regimes with up-to-date information on sea ice conditions is essential. Likewise, modern nautical charts enable the mariner to determine the most efficient routing as well an alternate route(s) to take when ice is present. Often, when a potential route around the ice edge appears, there is an absence of hydrography to support safe navigation.[12] As will be demonstrated in the following cases, where local ice regimes exceed the limitations of vessel and no adequately charted alternative route(s) exist, the requirement for an icebreaker escort arises.

2.1 Ice Navigation and Charting

Charting a corridor centered about a recommended or preferred track of 2 to 5 nautical miles width may be an acceptable practice for ice-free waters, however, this approach will not hold true in areas where ice may be present. Transport Canada's Zone/Date system has established 16 zones throughout the Canadian Arctic related to the probable ice conditions at specific times of year.[13] While experts in ice forecasting have been able to take into account prevailing environmental factors to develop models of the concentration, type and form of sea ice,[14] local variations in weather will introduce sufficient variables to seriously affect the accuracy of ice forecasts. Continued and on-going ice surveillance, whether by aircraft or satellite remote sensing,[15] is therefore required.

In consideration of the uncertainty of ice movement, one must consider the need for alternate routes outside the preferred track in order to avoid ice. Depending on vessel draught and the quality of hydrographic information, a passage closer to shore may be taken in shallow water where ice keels will cause the pack to find ground thus leaving a corridor of open water skirting the shoreline.[16] Furthermore, not all ice-strengthened vessels or vessels designed to break ice are capable of navigation through all ice conditions and therefore must seek alternate routes while breaking ice. For example, icebreakers rated as Arctic class 2 will be capable of navigation through first-year ice up to 1 metre in thickness versus Arctic class 4 vessels which are capable of navigation through tougher multi-year ice up to 3 metres in thickness. Whereas the concentration, thickness and/or type of ice will affect the speed of vessel transit, limitations in hydrographic charting may further increase ice-breaking costs as the availability of alternate "lighter-ice" routing for the icebreaker will not be available. In simple terms, the greater the concentration and thickness of the ice, the greater the power requirement vis a vis fuel consumption required to make way.

The Kitikmeot region is serviced by a class 2 ice breaker, *CCGS Sir Wilfrid Laurier*, whose operating cost is $28,000 per day.[17] Where transit to and from the escort area plus the execution of icebreaking may take upwards of 2-3 days of ship time, the cost per day has the potential to multiply accordingly. Furthermore where analysis indicates that the local ice regime[18] exceeds vessel construction limitations, ice-breaking costs could further escalate if the specific ice-regime warrants the use of a heavier-classed icebreaker.

2.2 Environmental Concerns

There is a greater potential in the Arctic for environmental damage due to spills resulting from groundings or ice damage. This is primarily due to limited spill response assets, the magnitude of the distance required to deploy these limited resources within the extreme weather conditions of the Arctic environment, and the nature of the Arctic ecosystem. Canada's Arctic Waters Pollution Prevention Act asserts our obligation to preserve the "peculiar ecological balance that now exists in the water, ice and land areas of the Canadian arctic."[19] The latter factor provides for an environment which, unlike warmer waters to the south, would take significantly longer to breakdown water-borne pollutants.

The deployment of conventional booms for the containment of even relatively minor spills would be nearly impossible in ice covered waters. Adequate nautical charts serve first as a preventative measure, however, used with relevant tidal and current information, they provide a "base-map" for emergency response to threats to the environment and the safety of life at sea (SOLAS). Without adequate nautical information, authorities charged

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[12] Leyzack, Weaver , Hydrographic Capacity for Maritime Navigation and Coastal Protection in the Canadian Arctic, Proceedings from The First Northern Watch Conference, Department of National Defense, 2007.

[13] Transport Canada, Arctic Ice Regime Shipping System (AIRSS), Ottawa.

[14] Environment Canada, Canadian Ice Service, Egg Code Symbols for Visual and Radar observations, Ottawa.

[15] Canada's RADARSAT, space-borne Synthetic Aperture Radar (SAR) is a proven technology for the near real-time monitoring of sea ice conditions.

[16] Interview with Capt. Mark Taylor, Canadian Coast Guard.

[17] Canadian Coast Guard, Pacific Regional Operations Centre Ship Costing 2009.

[18] Transport Canada, Arctic Ice Regime Shipping System (AIRSS),

[19] Minister of Justice, Canada, Arctic Waters Pollution Prevention Act, (R.S., 1985, c. A-12), p. 1 http://laws-lois.justice.gc.ca

with mitigating environmental damage caused by vessel groundings and/or collisions (with ice or other vessels) and search and subsequent rescue operations would be severely challenged to model the movement and extent of pollutants.

3. CASE STUDIES in Cost/Savings in Icebreaking Escort

The following examples are based on the author's observations while at sea aboard *CCGS Sir Wilfrid Laurier* (Aug-Sept. 2009). In all cases, interviews were conducted with vessel captains to discuss both their navigation preferences and limitations. Mariner feedback has been instrumental in developing a new charting scheme for the region.

3.1 M/V Camilla Desgagnes

- A Canadian-flagged, general cargo carrier, with lightering capabilities servicing Kitikmeot Region ports.
- This vessel did not require icebreaker escort as it was able to transit an alternative ice-free route through James Ross Strait using GPS waypoints derived from preliminary (unpublished) hydrographic data.
- The estimated escort savings: $56,000 (2- days combined transit and escort time).
- Since the ice-free routing also provided the most direct route to market ports, the vessel saved an estimated 1.5 days transit time.

Figure 4: M/V Camilla Desgagnes (Desgagnes Transarctik) in James Ross Strait

3.2 Akademik Ioffe

- A Russian-flagged, research vessel engaged in Arctic passenger trade.
- This vessel required icebreaker escort to reach Cambridge Bay.
- The ship's owner did not authorize use of GPS waypoints in the absence of large scale published hydrographic data.
- Furthermore, the ship's captain wasvreluctant to venture off adequately surveyed route while under escort despite heavier ice cover.
- The estimated escort costs: $125,000 (4-days combined transit and escort time).

Figure 5: Escorting Akedemik Ioffe out of the ice

3.3 Lyobov Orlova

- A Russian-flagged, passenger vessel enroute to Gjoa Haven.
- This vessel did not require icebreaker escort as it was able to transit an alternative ice-free route through James Ross Strait using GPS waypoints derived from preliminary (unpublished) hydrographic data.
- The estimated escort savings: $125,000 (4- days combined transit and escort time).

3.4 M/V Umiavut (Nunavut Eastern Arctic Shipping Ltd.)

- A Canadian-flagged, general cargo carrier, with lightering capabilities servicing Kitikmeot Region ports.
- The ship's captain was reluctant to transit James Ross Strait with GPS waypoints derived from preliminary hydrographic data until their load was first discharged at Kugluktuk and Cambridge Bay (thus reducing draught).
- Estimated escort savings: $56,000 (2-days combined transit and escort time).

Figure 6: M/V Umiavut

The above-mentioned examples cite cases where only preliminary hydrographic data was available. Remarkably, in view of these limitations, those vessels engaged in the cargo trade were still willing to assume a certain level of risk in reaching their destinations.

Figure 7: Tug and Barges

Deep draught vessels have been servicing eastern Arctic ports for many years. Recent large-scale port surveys and electronic nautical charts (ENCs- see figure 8) have been published for the Nunavik region of Northern Quebec, Ungava and Hudson Bays. 2008 was the first year a deep draught cargo vessel serviced the ports within the Kitikmeot region and that number doubled to two in 2009. A program is currently underway to publish a number of new, large-scale charts for the Nunavut, Kitikmeot Region.

4. CONCLUSION

Worldwide, hydrography enables cost effective transportation by sea, particularly sealift by deep draught ocean-going vessels with access to world markets. There is an economic benefit to having deep draft access to Arctic ports in that freight costs and transit times are significantly reduced. In 2007 "the three carriers which were contracted to the GN [government of Nunavut] for community re-supply are estimated to have delivered in excess of 500,000 m^3".[20] Assuming a modest weight of 100kg per m^3 of cargo, the estimated savings over air freight would be $425,000,000 and $60,000,000 if shipped by deep draught sealift versus tug and barge alone. The requirement for adequate charting as an enabling factor for deep draught cargo access and increased water-borne tourism by passenger liner gives evidence of the *Economic Benefits of Hydrography* in the Arctic.

Additionally, improvements to nautical charting in the Canadian Arctic will enable vessels to find alternate routes to avoid ice thus reducing the cost to the Canadian public for icebreaker escort. From the examples given for 2009, the estimated savings in ice escort costs alone would be $360,000 within the Kitikmeot Region. Simply stated, with modern hydrography (surveys, sea level monitoring and charting), complementing modern aids to navigation and improvements to marine infrastructure, hydrographers are playing a significant role in attracting and enabling more cost-effective means of transportation to support freight, passenger traffic and tourism in the Arctic.

The cost for conducting modern hydrographic surveying and charting must be considered an investment to build capacity in many facets of economic development in Arctic coastal communities. While this paper has focused on hydrography's beneficial impact on costs and accessibility for marine transportation it would probably require a second edition to justify hydrography as a significant investment in support of mineral and oil and gas development, fishing, national sovereignty, national defence and coastal zone management. The concept of hydrography as an investment not only applies to economic development in Canadian Arctic but to other developing lands worldwide.

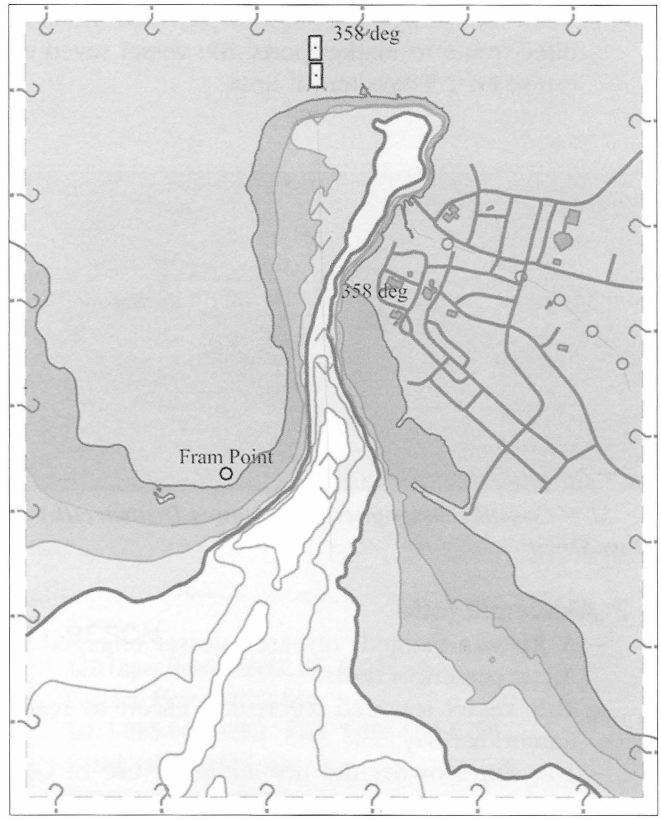

Figure 8: S-57 ENC of Gjoa Haven[21]

[20] Nunavut, Department of Community and Government Services, Dry Cargo Resupply Program, Activity Year 2007, Government of Nunavut, 2008.

[21] Canadian Hydrographic Service, Western Arctic Survey- Kitikmeot Region, 2009

Figure 9: Hydrographic surveys and sea level monitoring

5. ACKNOWLEDGEMENTS

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About the Author...

Andrew Leyzack is a graduate of Humber College's Hydrographic and Land Survey Technologist program, Andrew has been surveying for over 20 years, with varied experience in topographic, cadastral, offshore/industrial and hydrographic surveys for nautical charting. He is a Canada Lands Surveyor, employed as an Engineering Project Supervisor with the Canadian Hydrographic Service, Central and Arctic Region (Federal Department of Fisheries and Oceans Canada). He is currently assigned as Hydrographer-in-Charge of the Western Arctic Survey, Kitikmeot Region. He is past president of the Canadian Hydrographic Association and the immediate past-chair of FIG Commission 4.

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Report from the CHA-CIG Hydrographer Certification Committee*

By: CHA-CIG Committee on Hydrographer Certification

Further to IHO ratification of the revised terms of reference for the FIG/IHO/ICA International Board (IB) on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers, Individual Recognition Guidelines will soon be published as part of the next edition of the Standards of Competence for Hydrographic Surveyors (IHO Publication S-5, edition 10). The committee acknowledges that considerable research has been performed by the former CHA-ACLS task force on certification in developing a model for Canadian hydrographers and seeks to leverage the work of the task force in preparing a certification model in accordance with the guidelines prescribed by the International Board. Our committee members agree that following international guidelines on hydrographic competencies is the way to proceed in developing a credible certification model and hence progress in this regard has hinged on the publication of the revised Standards.

The committee agrees with the underpinning philosophy of the IB in that Competency equals Education plus Experience and furthermore that hydrographic surveying and cartographic technologies are constantly advancing and that in order to maintain competence, individuals must pursue continued professional development (CPD) and education. It is our opinion that a national hydrographer certification scheme would foster CPD and reintroduce the development of IB-accredited courses in Canada. Thus recognition for individuals should be based on completion of specific curricula, a programme or recognition scheme, experience, a methodology to demonstrate and document competencies, continuing professional development (CPD) and training.

In advance of the new Standards the following criteria were made available to the committee and are significant to the successful implementation of a national certification program:

- *The Board shall normally recognise only one Scheme per country or identifiable region.*
- *It must include endorsements from the appropriate National Focal Points which in turn must describe and authenticate with evidence the status of the Scheme submitted.*
- *This shall include, where appropriate, the endorsement of academic institutions, government bodies and professional associations.*

In short, this means that our certification model will have to meet with the approval of all academic, government and professional stakeholders and not the sole direction of but one organization with hydrographic interests.

The members of the CHA-CIG committee on Hydrographer Certification are: Andrew Leyzack, Ken McMillan and George Zarzycki

**President's Note: The above article is a CIG Committee report on which CHA has representation, but does NOT necessarily reflect the opinion of the Canadian Hydrographic Association (CHA).*

Go **F.I.G.**ure

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

Go FIGure - Oct 2010

At the time of this newsletter, two FIG Commission 4 publications are nearing completion. They are products resulting from the efforts of two Commission 4 working groups and are as follows:

Guidelines for the Planning, Management and Execution of Hydrographic Surveys in Ports and Harbours. Prepared by Working Group 4.1, Hydrographic Surveying in Practice, this document will be available in print and e-copy and is a contemporary update of the (1994) FIG Publication No. 8, a report entitled Hydrography, Ports and Harbours. Many thanks to Simon Ironsides (New Zealand) and Venessa O'Connell (Australia) for spearheading this work.

The Economic Benefits of Hydrography, a summary document highlighting the work of Working Group 4.4, Capacity Building and the Economic Benefits of Hydrography. Our plan is to release this work as a web-publication only with links to select papers in the FIG Surveyor's Reference Library. Thanks to Gordon Johnston, chair of WG 4.4, we will be able to provide a focal point for information supported by research on this topic. I am certain there are many cases where we are aware of the economic benefits of hydrography and our readers are encouraged to send us feedback in this regard. For example, insurance estimates on the salvage, repair and loss of business costs associated with the recent grounding of a cruise ship in the Canadian Arctic on an uncharted shoal was put at $10 million CDN. If a fraction these funds have could have been directed to proactively support surveys and charting one can speculate the outcome and benefits to commercial shipping would be significant.

The FIG "Handover" Meeting and Ceremony was held on 26 November in Copenhagen. The meeting served as transitioning event for the incoming and outgoing Commission chairs to meet and move forward into the next work term (2011-2014). Although the next Commission 4 Work Plan is well into the planning, delegates are encouraged to contact the Commission with their suggestions for the direction of the next work plan. This is after all your opportunity to make use of the research and networking power of FIG to address various technical and professional challenges for hydrographers.

Economic Benefits of *Proactive* Hydrography

Canadian Hydrographic Service launch *Kinglet* sounding in the vicinity of the grounded liner M/V *Clipper Adventurer.* *Source: Canadian Coast Guard.*

Our next Working Week will be held in Marrakech Morocco, 18-22 May, 2011. The conference theme is *Bridging the Gap Between Cultures* and the event will be co-hosted by the Moroccan Ordre National des Ingenieurs Geometres Topographie (ONIGT).

Commission 4's call for papers has requested work on the following themes:

- Hydrographic surveying in practice
- Administering marine spaces
- Data collection, sea level monitoring and climate change
- Multi sensor systems in hydrography
- Ellipsoidal hydrographic surveying
- Vertical link between different height measurements and height systems
- Monitoring and mapping of the coast and coastal zone management
- Standards and guidelines
- Hydrography enabling world issues (socioeconomic/ environmental issues, benefits, gaps and links etc.)

Readers may recall our previous mention of the upcoming release of new editions of S-5 and S-8, Standards of Competence for Hydrographic Surveyors and Nautical Cartographers respectively. Publication of the new editions has been delayed as an IHB circular on changes to these documents makes the rounds to member states. In particular are the inclusion of cost recovery measures for course accreditation and guidelines for individual recognition (certification) schemes.

There is also some sad news to pass along as David Neale (Trinidad and Tobago) our Vice Chair of Administration and Communications and member of the FIG/IHO/ICA IB was hospitalized last September due to a brain tumor. Our thoughts and prayers go out to David and his family in hopes of a speedy recovery.

Updates to the Commission 4 website are underway so for more information on the Commission or to register for Working Week 2011 please visit www.fig.net.

Andrew Leyzack
Chair FIG Commission 4

Survey Pests*

By: C.D. Brown, President, Manitoba Land Surveyors' Association

[***Publication Note**: This article was originally printed in the Field Engineers Bulletin number 13, U.S. Coast & Geodetic Survey, December 1939, pages 95-97. The Hydrographic Society of America (THSOA) now hosts this on their website and has kindly extended permission to reprint this document.*]

This is a big subject and I shall not attempt to deal with it in all its branches in one short paper.

I shall have very little to say about what might be termed the divinely appointed pests. There is no cure for these. Nothing we can do about them. We have, for example, the mosquito, the blackfly, sand-fly, hornet and wasp. We can't blame them when they sting and bite and probe and burrow. They are only doing their duty,merely carrying out their appointed mission and fulfilling the obscure designs of an inscrutable Providence. Some of you may still cling to the idea that these pests can be fought by mere language. A fallacy I can assure you. I flatter myself that I have at least an average command of certain branches of the English language. After a long series of experiments conducted over many years I have proved beyond doubt that the mosquito does not "give a damn" for a "damn."

There are also the human varieties of the divinely appointed pests. It is with fear and trembling that I refer to these for they include such sacroscant personages as surveyors-general, chief surveyors and engineers, directors of surveys, assistant directors of surveys, chief accountants and all those darlings of the gods who from soft-cushioned chairs in their steam-heated, Persian-rugged and mahogany-desked boudoirs direct our activities in the field. We can't blame them for the shower of letters that descends upon camp every mail day. Tart, sometimes acid, occasionally vitriolic enquiries as to when we will finish. Why was so and so not done and so and so done? When will we finish? How is it that a certain angle appears in the notes as 90° 01' 11-1/2" when it calculates 90° 01' 11-3/4" and again--when do we expect to finish?

Then there is the letter from the chief accountant pointing out that we used form 86390, A-l where we should have used 86390, A-2 and that we only sent 24 copies of the payroll and that 25 are required. He also informs us that he is striking a certain item off our expense account, one appearing on our hotel bill, an item about which we ourselves have only hazy recollections, namely, "6 cocktails served in room." I say we can't blame them. Like the mosquito and black-fly they are merely fulfilling their mission in life.

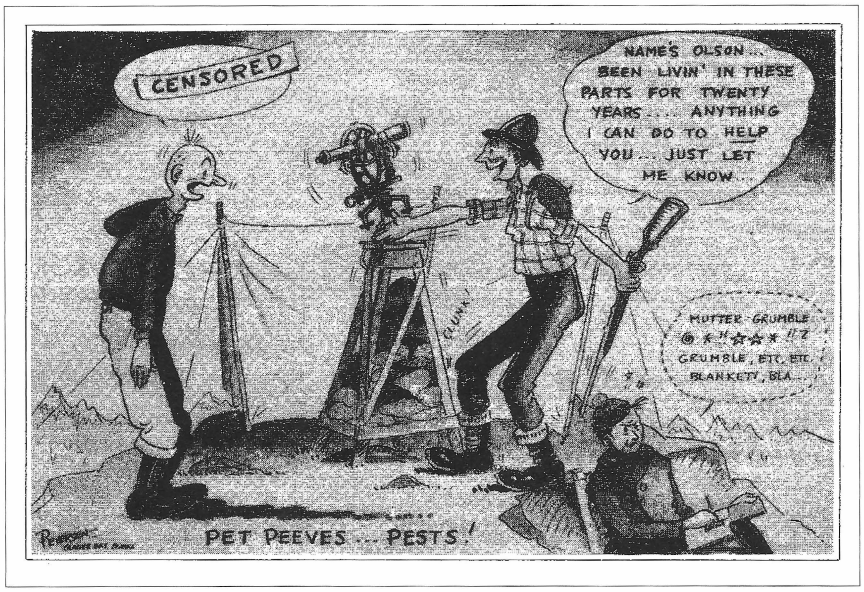
Now we come to the self-appointed or volunteer pests. Let us consider first "the short-cutter." He's usually adolescent. To put it mathematically, his self confidence divided by his knowledge of the bush equals infinity. (If this is beyond any of you, consult Hall and Knights Algebra--for beginners). The party finishes the day's work two or three miles from camp and heads home in Indian file. After a while you miss Bill and are told that he went another way, said he was taking a short cut. Arriving at camp and finding no Bill you begin to suspect that he has been guilty of under-statement. Supper over and still no Bill, you are convinced of it. You have now two choices,--either to let Bill freeze to death or be bitten to death whichever is in season, or to send out search parties. Figuring that Bill will be less of a pest alive than dead, a search is begun. The hour grows late. Just as you are mentally composing a letter of condolence to Bill's mother, citing all his virtues, in he comes staggering at the heels of a disgusted axeman and you are saved from the innocent perjury of that letter. Fortunately the short-cut disease usually carries its own remedy. A few such experiences cure all but the worst cases. There is only one way to deal with these. Some evening call your "short-cutter" into your tent and tell him to figure out a short-cut from camp to his home town and to start early next morning. I did this to one bright lad I had up in the Peace River country. I guess he spent a sleepless night. His home town happened to be Montreal. However, I took pity on him to the extent of having my teamster deliver him to rail-head at the east end of Lesser Slave lake. I never heard what happened to him after that but I suspect that he scorned the indirect railway route and took a short-cut. As this happened about twenty-four years ago he should be due in Montreal any day now.

Next on my list is "The Pessimist." You will agree that a survey is no place for a pessimist. There are too many opportunities for the exercise of his talents. For example, a nice warm sunny day gets lost from May and comes to cheer you in January. "Lovely day" you remark. "Not so bad" he'll reply.--"but we'll have to pay for it later, we'll get some 60 below to make up for it." Tell the pessimist that you want to get two miles done today to save a long walk again next day and he'll retort, "We'll never do it. There's lots of big spruce in that country, 6' through if

* Reprinted through the courtesy of The Canadian Surveyor.

they're an inch. I seen them from that high ridge the day we moved camp." If the freight canoes are a day or two overdue, the pessimist is in his glory. Hints darkly at "Them rapids," "three men drowned there two years ago." "Maybe the freighters got drunk in town and are all in jail and the whole lot of us will starve to death." Gloomier and gloomier grow his forebodings and his face gets so long that if it could be marked off "in feet and decimals thereof" it would serve as a stadia rod. You will be pleased to hear that I have discovered a sure cure for this disease and that is to out-pessimist the pessimist. Always go him one better. If he says it's 40 below retort that it's 60 below and will be 70 before night. If he says you should do two miles today tell him he's crazy, you'll be lucky if you do a mile. No doubt there is an explanation for the effectiveness of this cure but never having explored the mysteries of psychology, (I hope I have spelt that word right)--I am unable to give it. I know it works because after a three weeks' course of treatment I once overheard one of my worst patients remark to another of the party, "The Chief makes me sick. Always looks on the worst side of everything. That's one thing I can't stand." That's what I call a cure. I am a little uneasy about this particular patient. I am afraid I gave him an overdose and have turned him into a dangerous optimist. He now buys wheat on a margin, dabbles in penny mining stocks, in his home town he is president of "The Boosters Club" and-- so I hear-- is now even contemplating matrimony.

Lastly--do I hear sighs of relief at the lastly and are you feeling in your pockets for the offertory nickel, or if plates are used in your church, the offertory quarter. Lastly--as I said before I got off the trail--we will consider the most poisonous and deadly of all our pests,--"The man who has worked for Mr. X". Mr. x being some other surveyor, usually one whom you have not met. This scourge makes his presence felt from the very start. Pitching your first camp he eyes your outfit with scorn. "Mr. X never uses tents like them." "Mr. X doesn't pitch his tents that way." He sizes up your instruments. "Them's not like the ones Mr. X uses." Not wanting to start anything the first day you let this pass in spite of forebodings that worse is to come. Let us say that your scourge-- on account of previous experience--has been appointed picket man. You give him careful instructions as to how you wish hubs to be set which he receives in cold silence. Next day you start running line. Things go wrong when he comes to set his first hub. You chase up the line to ask what the--let us say dickens--he is doing, only to be told, "I was just doing it the way Mr. X does it." What are the consequences of this? First you devote a few minutes to conquering a fierce lust for murder, deterred only by the consideration that the only jury likely to acquit you would be one made up entirely of land surveyors. Secondly, you conceive a violent and undying--so you think—hatred for Mr. X. Thirdly, you tell your scourge to head for camp and to practise packing up his belongings the way Mr. X packs his and that in the morning you'll send him to town by your team and that you are sorry the team is not like Mr. X's. That is what happens if you are acquainted with this type of pest. If you are not and are inclined to be weak-minded you patch things up and carry on and you suffer for it. By the end of the season you are a mere ghostly shadow of yourself, your hatred for Mr. X has developed into a homicidal mania, and on moving days your inferiority complex provides a load for two pack-horses. The only bright side of an affair like this is that when you finally do meet Mr. X you are astonished and delighted to find that he is "one of the best", that is to say he is a "regular land surveyor." 4



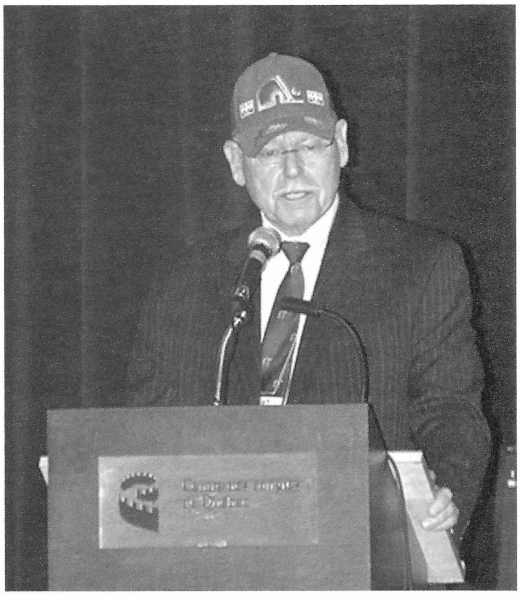
Hydrographic Profiles

This section is set aside to spotlight individuals who are making a difference in the field of hydrography. It is a chance for us to learn about them; their background, interests and passions.

Do know of someone who should be profiled here? If so, please let us know.

Michael Sutherland

Michael Sutherland holds an M.Sc.E. and Ph.D. in Geomatics Engineering from the University of New Brunswick, Canada specializing in land information management and GIS. He is currently a lecturer, and the Programme Coordinator of the Geomatics Programme in the Department of Geomatics Engineering and Land Management, University of the West Indies, St. Augustine, Trinidad and Tobago. He previously held post-doctoral positions at the University of Ottawa, and Dalhousie University, Canada where he did GIS research supporting aquaculture site selection and habitat classification. His academic and professional background includes land and coastal zone management, and ocean governance. Michael is a member of the Canadian Institute of Geomatics, the Canadian Hydrographic Association and the Institute of Surveyors of Trinidad and Tobago. He is also a Chartered Land Surveyor (Royal Institution of Chartered Surveyors). Michael is a Vice-Chair and Chair-Elect (Commission 4, 2011-2014) of the International Federation of Surveyors (FIG).



Karl Wm. Kieninger

THE HYDROGRAPHIC SOCIETY OF AMERICA ELECTED (THSOA) KARL WM. KIENINGER, HAS PRESIDENT FOR 2010-2011

Karl Wm. Kieninger is a founding member of The Hydrographic Society of America. He has served as an officer of THSOA since its inception and has been on the organizing committee of all US HYDRO Conferences and many other national and international conferences. He is member of the Canadian Hydrographic Association, the Hydrographic Society of the UK and also serves as Treasurer of the Maritime Association of the Port of New York/ New Jersey.

He is an ACSM/THSOA Certified Hydrographer having worked his way up from a Survey Officer to Commanding Officer of the NOAA Ships *WHITING*, *FERREL*, and *RUDE*. After he retired from government service he went to work as a private surveyor in the United States and overseas. He is now working as a Consultant and a manufacturer's representative selling hydro-acoustic and navigation equipment.

A Project to Create a Database for the Management of Shipwrecks, Obstructions and Explosive & Hazardous Dumps for the Canadian Hydrographic Service

By: Steve Grant, Electronic Navigation Consulting International
Richard Palmer, Canadian Hydrographic Service, Atlantic Region (retired)
Steve Forbes, Canadian Hydrographic Service, Atlantic Region

Wrecks, obstructions and dump sites are important features to have on nautical charts for safe navigation, protection of the marine environment and many other reasons. This paper describes a project to create a data base of these features for the charts of Atlantic Canada.

Background and Overview

For several years prior to this project, a number of students and staff were tasked with digitizing the wrecks, obstructions and explosives dumping areas on Canadian Hydrographic Service (CHS) charts and tabulating wreck related correspondence and reports from the available sources in the region. This work resulted in several Excel spreadsheets listing wreck/obstruction/dump site positions, chart symbols, etc. CHS Atlantic staff member Nick Stuifbergen combined these various listings and removed duplications. This project started with Nick's listing. The objective of this project was to quality check the work that had already been done and restructure and extend it to produce a comprehensive wrecks/obstructions/dump site database that could be incorporated into the appropriate CHS database(s) to facilitate the ongoing management of this important data in the future.

Why do Hydrographic Offices (HOs) put shipwrecks and obstructions on charts? Some of the reasons are as follows:

- safety of surface and subsurface navigation,
- protection of gear over the side, including fishing gear, survey equipment and anchor cables,
- warning of magnetic anomalies caused by wrecks and other underwater steel structures,
- warning of explosives and dangerous chemicals, in wrecks or dump sites,
- protection of historical wreck sites.

The CHS Chart Specifications state that "As a guide, a wreck not dangerous to surface navigation is a wreck which is thought to have more than 20 metres of water over it." But submarines operate at hundreds of metres and trawls typically operate at 400m and some even to 2000m. At the other extreme, kayakers or small sail or motor boats, cruising along the shore when a long swell is running can get into serious trouble from a large jagged wreck lurking just below the surface. Also, even relatively small projections sticking out of the bottom, such as old boat ribs or engine blocks, can cause considerable difficulty if they snag anchor cables or lobster/crab trap lines. The problem of bottom trawls hanging up on obstructions is well known and captains of trawlers usually keep detailed records of these hang-up points. Further details about what and how to chart wrecks and obstructions can be found in "Regulations of the IHO for International (INT) Charts and Chart Specifications of the IHO, M-4, Edition 3.006, April 2009".

Sometimes wrecks have a positive aspect that needs to be considered:

- wrecks visible on the shore or above the surface on a dangerous shoal can be seen and used by navigators to help them avoid the dangers themselves, and
- wrecks sometimes deliberately or naturally become artificial reefs that encourage marine growth and provide economic benefits to adjacent communities when divers come to dive on them.

However, assuming that they don't pose a hazard to shipping, there may occasionally be a case for not charting wrecks: for national defense reasons (i.e. enemy submarines can use wrecks as 'hiding places') or for the protection of historically significant wrecks from unscrupulous divers. Wrecks with explosives or chemicals onboard or explosives or chemical dump sites can be dangerous for a number of activities and, after careful consideration, it might be determined that it is safer that they are not charted. Finally, wrecks that involve loss of life, particularly naval vessels sunk by enemy action, are considered to be grave sites and should be left undisturbed.

When it is determined that a wreck or obstruction should be shown on a chart, the rules in Chart 1 and the CHS and IHO Chart Specifications describe exactly how it should be portrayed.

Figure 1, extracted from Chart 1, "Symbols, Abbreviations and Terms used on nautical charts", Canadian Hydrographic Service, 2009, shows a few of the symbols used to portray wrecks on CHS charts.

As time passes a wreck portrayed as K-20 will deteriorate and may need to be changed to a K-21 and, eventually to a K-22. Similarly, a K-24 wreck might need to be changed to a K-25 and, eventually, to a K-26.

In addition to the wreck symbols, one sometimes finds qualifiers attached to the wreck symbol as follows:
PA – Position Approximate
PD – Position Doubtful
ED – Existence Doubtful
Rep or Rep (1973) – Reported but not surveyed with or without the year

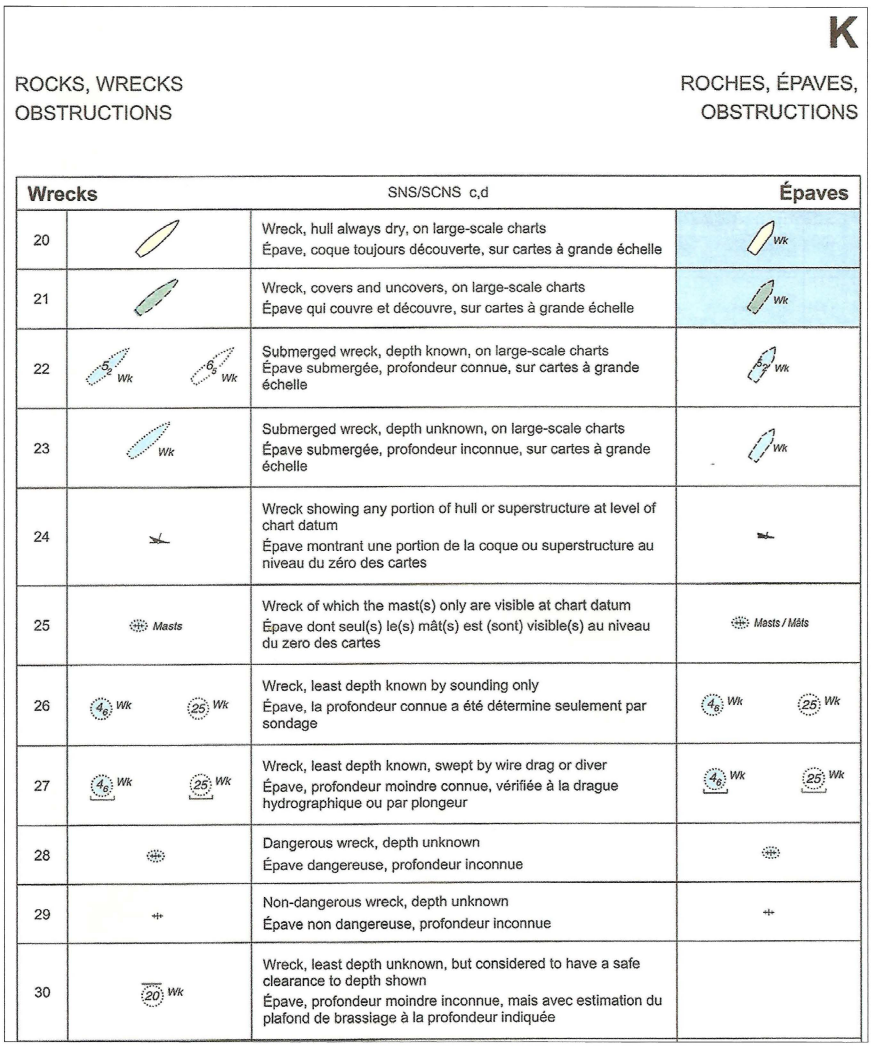
Digitizing and Checking

After a brief review of the Stuifbergen material, it was clear that a quick and efficient means was necessary to plot the wreck positions on the CHS charts. To accomplish this task, a set of CHS BSB chart files were obtained and imported into the OZI Explorer mapping package (http://www.oziexplorer.com). In three cases the BSB files didn't exist but Postscript files did. These were converted to JPG format and, using the geo-registration feature in OZI, were also imported. Then the Stuifbergen consolidated wreck/obstruction/dump list was reformatted and imported into OZI Explorer as a waypoint list. When this waypoint-wreck list was plotted it was a straight forward but very tedious task to compare the digitized data with what was on the charts.

Over a period of 2 to 3 months every digitized wreck from the Stuifbergen list was compared with its corresponding charted symbol. Not only was it compared with the symbol on the chart from which it was originally derived, but the wreck position was also checked on every other chart covering that position; hundreds of new instances of existing digitized wrecks were found. All the charts were also carefully scanned for additional wrecks. The previous workers on this project were very thorough since, on the Canadian charts, only a few dozen new wrecks (about 2%) were found. During this checking phase the majority of wreck positions had to be corrected, some by only tens of metres, others by many kilometres. A few blunders were also corrected – i.e. transposed latitude and longitude and incremental errors in both latitude and longitude of 10 to 30 minutes and 1 to 5 degress of both latitude and longitude.

In addition to checking the wreck positions, the charted symbols were digitized along with any accompanying notes on the chart (e.g. PA, ED, Danger, Explosives, etc.) as were source notes that were included in the earlier lists.

The OZI waypoint file is not appropriate for the management of wreck data. It also has other limitations (e.g. limited number and flexibility of waypoint data fields), so, to extend the capability and facilitate the quality control process the OZI waypoint data was exported back into Microsoft EXCEL. And when additional data sets were found that had to be linked among themselves, and the limitations of EXCEL became apparent, the data sets were transferred into a Microsoft ACCESS database. The final deliverable therefore



K

ROCKS, WRECKS OBSTRUCTIONS

ROCHES, ÉPAVES, OBSTRUCTIONS

Wrecks	SNS/SCNS c,d	Épaves
20	Wreck, hull always dry, on large-scale charts Épave, coque toujours découverte, sur cartes à grande échelle	
21	Wreck, covers and uncovers, on large-scale charts Épave qui couvre et découvre, sur cartes à grande échelle	
22	Submerged wreck, depth known, on large-scale charts Épave submergée, profondeur connue, sur cartes à grande échelle	
23	Submerged wreck, depth unknown, on large-scale charts Épave submergée, profondeur inconnue, sur cartes à grande échelle	
24	Wreck showing any portion of hull or superstructure at level of chart datum Épave montrant une portion de la coque ou superstructure au niveau du zéro des cartes	
25	Wreck of which the mast(s) only are visible at chart datum Épave dont seul(s) le(s) mât(s) est (sont) visible(s) au niveau du zero des cartes	
26	Wreck, least depth known by sounding only Épave, la profondeur connue a été détermine seulement par sondage	
27	Wreck, least depth known, swept by wire drag or diver Épave, profondeur moindre connue, vérifiée à la drague hydrographique ou par plongeur	
28	Dangerous wreck, depth unknown Épave dangereuse, profondeur inconnue	
29	Non-dangerous wreck, depth unknown Épave non dangereuse, profondeur inconnue	
30	Wreck, least depth unknown, but considered to have a safe clearance to depth shown Épave, profondeur moindre inconnue, mais avec estimation du plafond de brassiage à la profondeur indiquée	

Figure 1: Extract from Chart 1

consisted of ACCESS database files, many wreck picture and/or description files and a final report.

Since a number of CHS charts extend south into US waters and a number of US charts extend north, the US BSB charts of the boarder area were downloaded from the NOAA web site and imported into OZI. Wrecks, obstructions and dumps on US charts covered by CHS charts were digitized with the density of the digitizing process decreasing with latitude where the area is only covered by small scale CHS charts.

Approximately 1350 charted wrecks, obstructions and explosive/chemical dumping areas were digitized; many of them are shown on Figures 2 and 3.

The wrecks and dumpsites were given unique numbers. The labels in these figures show the wreck/obstruction number followed by the chart number. Since most wrecks appear on most charts covering that location only one listing is shown; the others are hidden behind or stacked under the one shown. The colour codes are as follows:

Aqua: Charted Wreck with no picture or additional information on file.
Blue: Charted Wreck with picture and/or additional information on file.
Pink: Uncharted Wreck with no picture or additional information.
Purple: Uncharted wreck with picture or additional information on file.
Red: Dangerous wreck or dump site.

[Editor's Note: Above colour codes apply to Figure 2 on this page and Figure 3 on the next page]

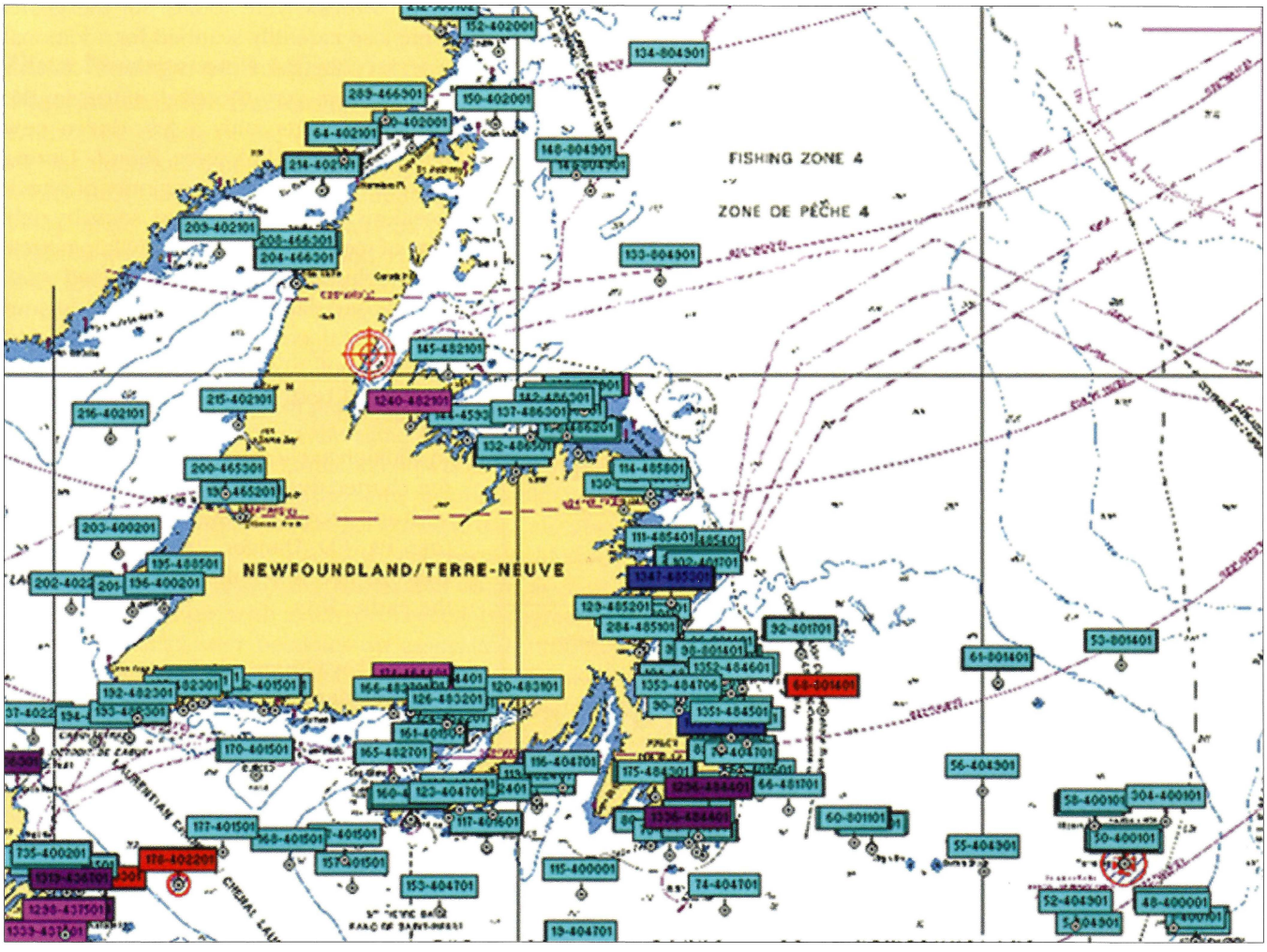


Figure 2: Selection of wrecks, Newfoundland and Labrador

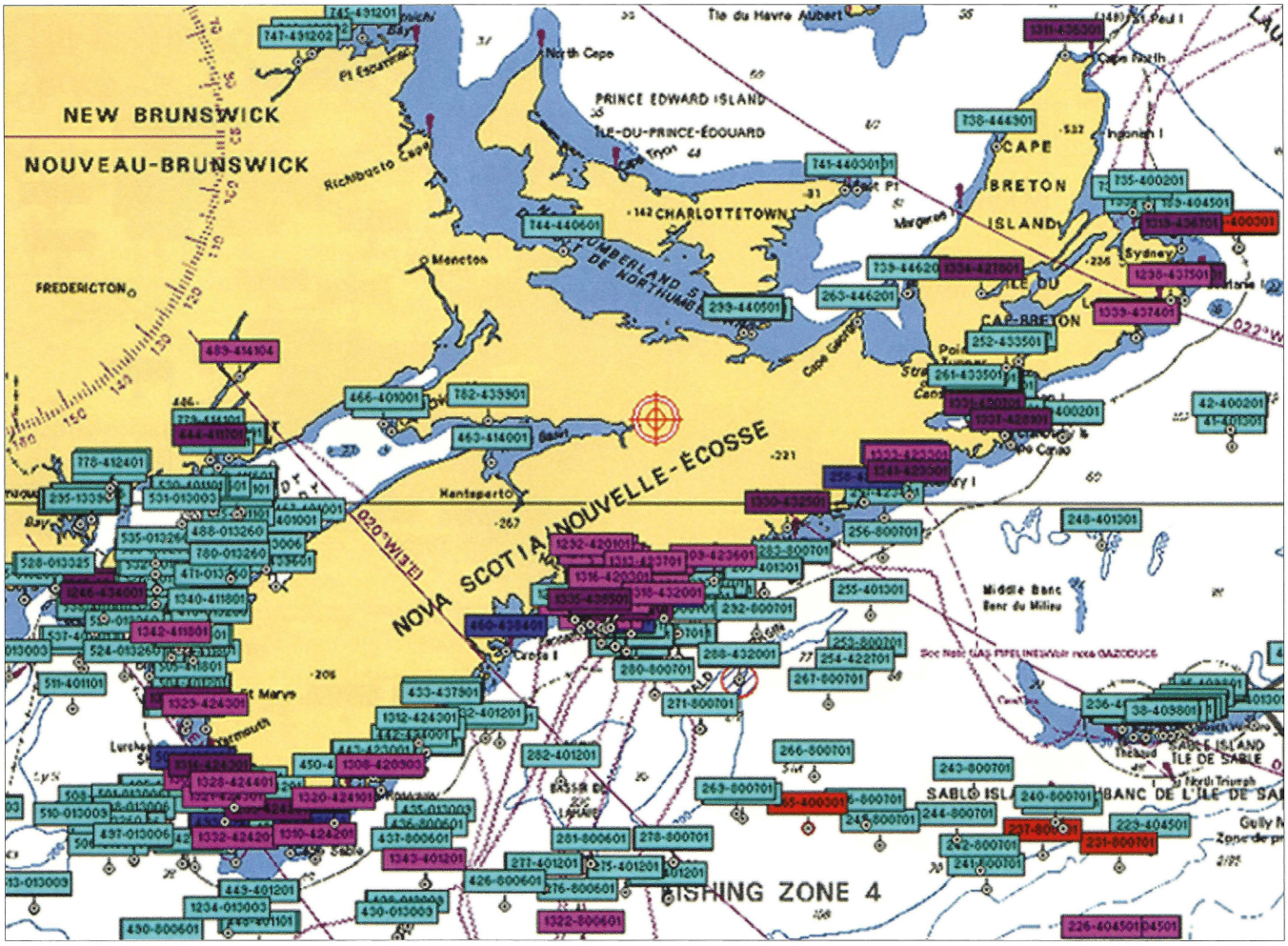


Figure 3: Selection of wrecks, Maritime Canada

Acquisition of Additional Data

It was clear that not all wrecks are shown on CHS charts. Consequently a limited search was done of web sites and books, and colleagues involved with diving and other wreck related activities were contacted. These sources were listed in the wrecks database tables with links to the relevant wrecks. Due to the enormous amount of information available, the wrecks database necessarily only contains details of a few of the more famous wrecks. Here are a few of the web sites consulted:

One of the most useful sources was AWOIS: (http://www.nauticalcharts.noaa.gov/hsd/awois.html)

If the CHS plans to create a national wrecks/obstructions/dump sites database the United States Office of Coast Survey Hydrographic Surveys Division's 'Automated Wreck and Obstruction Information System' (AWOIS) would be an excellent model to base it on.

Wrecks for most of the US charts covered by Canadian charts were downloaded and entered into the ACCESS wrecks database and a table of links to wrecks that were digitized in the first phase of this project was created. Some of the 1400 or so wrecks are shown in Figure 4.

Many of the NOAA data records include the wreck name and description, position and estimated accuracy as well as the date and reason for its loss (e.g. sunk by submarine or enemy action).

Other sources that were checked include:
The Naval Museum of Manitoba: http://www.naval-museum.mb.ca/

The NS Maritime Museum of the Atlantic: http://museum.gov.ns.ca/mma/wrecks/

The NS Wrecks web site: http://nswrecks.net/

Because of its commercial nature The Northern Wrecks Database was not accessed.

Finally, a number of books were checked. There are hundreds of references to wrecks in Atlantic Canada. Time precluded an in depth search of these books although a Books table was added to the database along with a limited links-table linking the wrecks described in the books to wrecks in the database. This is a time consuming task because seldom does the author give the precise position of a wreck, but rather, buried in the text will

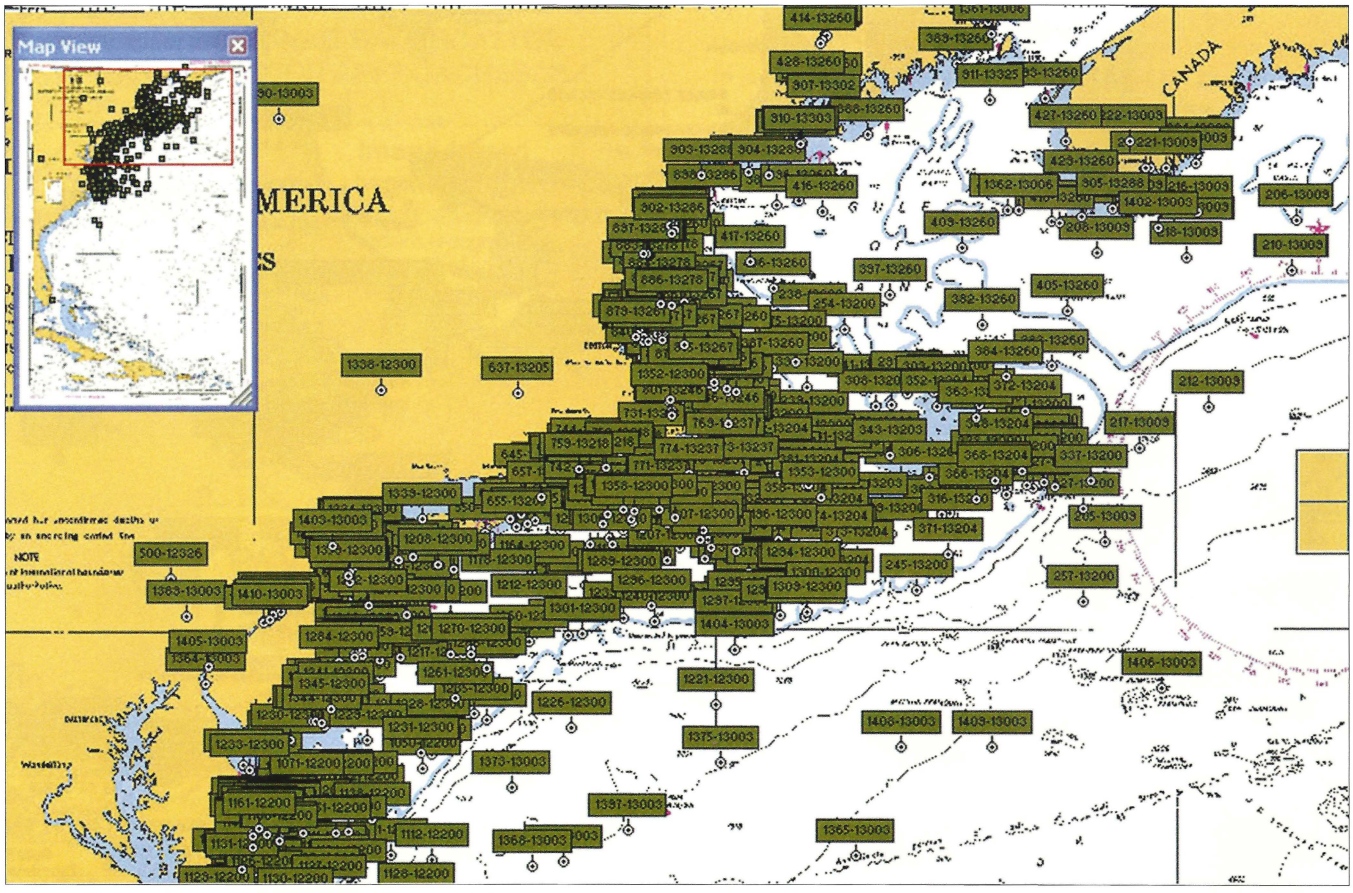


Figure 4: Selection of wrecks from NOAA Database

be a reference to a reef or rock where the wreck finally sank. Another complication is the fact that often the reef or island referred to in the text is not listed on the chart or, in some cases, the name has changed over the years. Despite this, it was a very enjoyable, if time consuming exercise.

Discussion and Recommendations

When this project ended, the database contained 1353 wrecks/obstructions/dump sites which accounted for about 3500 charted symbols on the 290 Atlantic Region charts: each wreck therefore appears on an average of 5 charts, compartments and/or insets. All but 118 of these wrecks in the database are charted. The research suggests that there are hundreds more uncharted wrecks described in the various records. A number of these uncharted wrecks are both large and near shipping and/or fishing areas and the final report recommended that consideration should be given to putting at least some of them on charts.

A number of instances where noted where the symbol used on one chart differed from the symbol for the same wreck or obstruction on other charts: 44 instances were noted on the NOAA charts, 11 instances were noted on the CHS charts and there were 26 cases where the symbol used on the CHS chart differed from the symbol on the NOAA chart. And numerous wrecks were found on US charts that were not shown on CHS charts, and vice versa. The CHS should look more closely at the NOAA Automated Wreck and Obstruction Information System; there is much useful information there about wrecks on CHS charts.

A number of incorrectly charted wrecks were found and a large number of wrecks were found to be missing from overlapping charts at the same scale and/or on larger and smaller scale charts of the same location. And wrecks were often found to have different positions on different charts. To understand some of these sorts of problems and issues, take for example the case of the Armed Yacht HMCS Otter which was destroyed by an accidental explosion and fire off Sambro Island in 1941 with the loss of 19 officers and crew. Figure 5a, taken from the Naval Museum of Manitoba web site shows Otter when she was the private yacht MV Conseco, and Figure 5b is an excerpt from chart

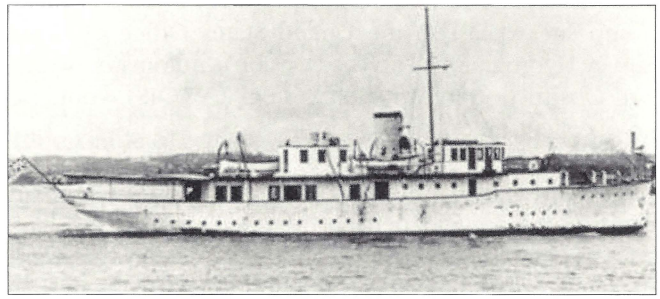


Figure 5a: HMCS Otter

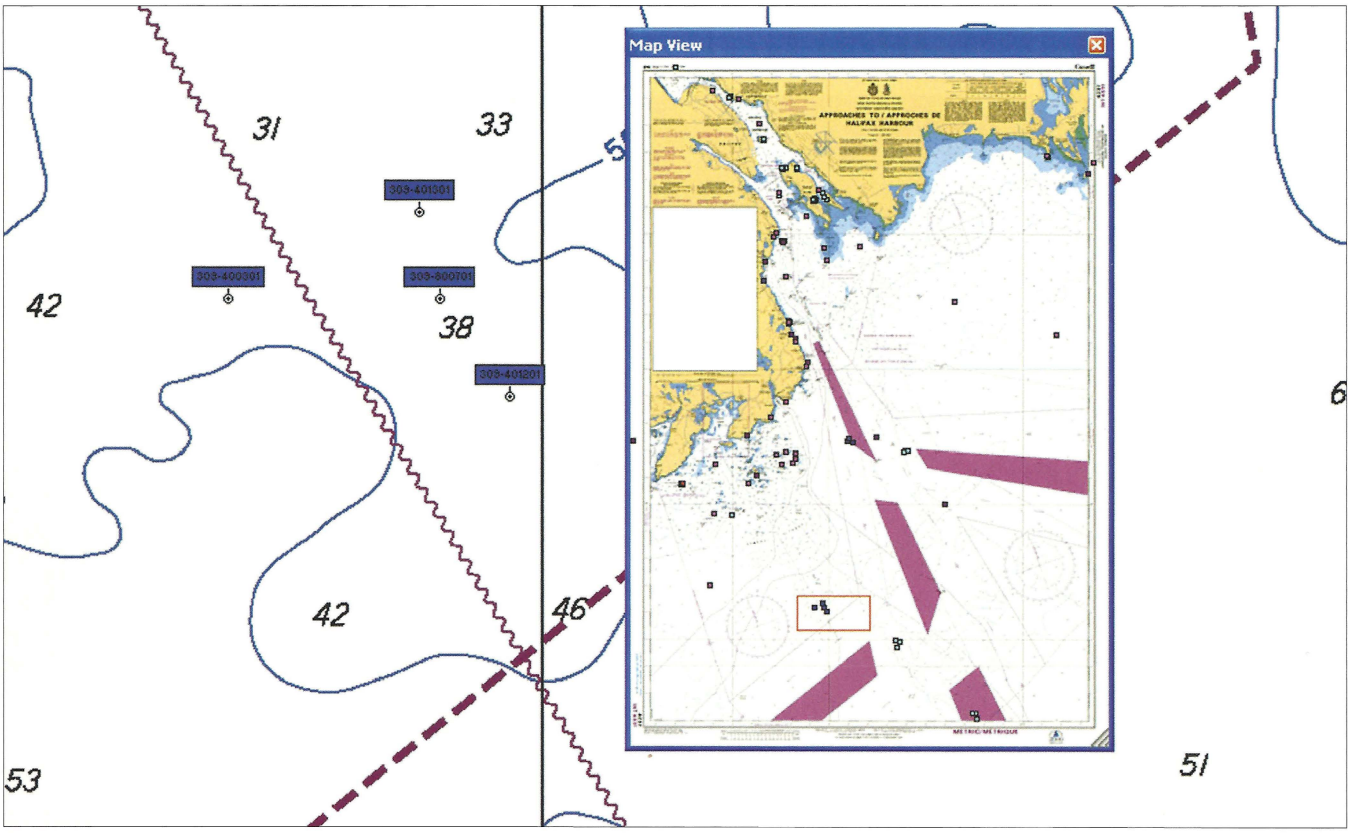


Figure 5b: Varying positions for HMCS Otter

4237 with the positions of the Otter as plotted on charts 4003, 4012, 4013 and 8007. On all four of these charts she is plotted as a K-29 wreck (See Figure 1) "Non-dangerous wreck, depth unknown". Note that her position is not shown on chart 4237, the largest scale chart of the area, nor is she shown on the next largest chart, 4320.

Why are these wreck positions scattered over such a large area of about 500m from the average position and nearly 900m between the two most widely separated points? And why isn't the wreck plotted on the two largest scale charts? Addressing the second question first; without actually checking the original chart construction file (assuming the answer is even there), it is possible that the actual wreck position wasn't known precisely, given the circumstances of the explosion and fire, and the symbol was deliberately omitted from 4237 and 4320 to avoid misleading navigators into believing the wreck position is more accurate than it was really known, although this information could have been conveyed by adding the qualifier PD (Position Doubtful) or PA (Position approximate). Alternatively, perhaps it was omitted from these two larger scale charts to prevent the enemy from using the wreck as a submarine hiding place.

A possible explanation for the widely separated positions on the different charts is the fact that the earlier chart construction accuracy standard was 1mm at the scale of the chart. Given the chart scales as follows: 4003 (1:1,000,000), 4012 (1:300,000), 4013 (1:350,000) and 8007 (1:300,000) one would expect the wreck positions to only be accurate to about 1000m, 300m, 350m and 300m respectively – same as the relative magnitudes of the differences one sees in Figure 5b. Another possible explanation, or at least contributor to the problem, is the fact that all these charts were originally constructed with respect to the NAD27 horizontal datum and each of them was independently shifted to NAD83 with shifts of from tens to hundreds of metres.

The Nautical Geodesy Section at CHS Headquarters maintains a file for every chart. These files contain the best available information on the accuracy of the geographical grid for each chart and they are constantly updated as new information becomes available. When work on a new chart or new edition begins, the information from the file is used to create a "new" and more accurate grid. As a result, wreck positions scaled from the old chart edition are different from positions scaled from the new chart. This effect is smaller than the NAD27 to NAD83 shift and falls within the accuracy standard of 1mm at the scale for the chart but has resulted in multiple "official" positions for each wreck which is unacceptable for database construction. The same difficulty exists for lighthouses, cables, churches, etc. on overlapping CHS charts.

Another consideration when deciding whether or how a wreck symbol should be added to the chart is the fact that the last known position of a wreck 'on the surface' isn't necessarily the final resting place 'on the bottom'. In

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areas of strong currents like the Bay of Fundy, for example, the wreck can be carried a considerable distance before it settles in its final resting place. For example, the British submarine A1 sank in the English Channel off Selsey Bill in 1912. Alison James, a British Maritime Archaeologist, described the sinking of A1 as follows, "The position of her sinking was known and the wreck marked but when recovery operations were commenced the next day the submarine had disappeared. Efforts at the time failed to relocate her and were eventually abandoned. It is likely that the submarine was only partially flooded when she foundered and the residual buoyancy in the hull allowed the strong tides that run around Selsey to move the wreck some five miles away to where she lies today." A local fisherman snagged the wreck by chance in 1989.

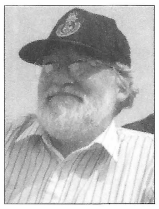
As part of the CHS chart maintenance program, as New Editions and New Charts are compiled, wreck data should be studied to determine if it should be portrayed differently (e.g. a K-20 changed to a K-21 or K-22) or be removed altogether. For example, wooden wrecks deteriorate more quickly than steel vessels and both deteriorate much more quickly along the shore due to wave action than those that sink in deep water.

Well over 100 wrecks, along with relatively accurate positions and descriptions, were discovered by looking briefly at a few web sites and books. Several wreck 'experts' (i.e. divers, archeologists, historians, authors, etc.) were contacted during the project to clarify some of the information already obtained from other sources. It became clear that there are many people 'out there' who could be of enormous assistance to the CHS in the ongoing maintenance of the wreck information on charts. This list should be expanded and the people should be encouraged to contact the CHS when they see that the charted wreck information is missing or inaccurate. Indeed, perhaps a select few could even be formally included in the New Chart/New Edition production stream.

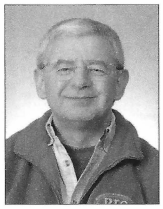
An ongoing program of scanning books, newspaper articles and web sites, talking with knowledgeable people (i.e. divers, historians, fishermen, etc.) and, especially, tasking field staff with checking the chart and the wreck data base contents while in the field, should be initiated if there is any hope of keeping this database up-to-date. The CHS should liaise more closely with DND, Parks Canada and other federal and provincial agencies that have some knowledge of shipwrecks.

Finally, to address the comments and suggestions described in the preceding paragraphs, perhaps the CHS should consider making wrecks the explicit part of someone's ongoing responsibility (i.e. a Wrecks Officer), either regionally or nationally or both.

About the Authors...



Steve Grant retired from the Canadian Hydrographic Service, Atlantic Region, in 1996 after 25 years as a research and development engineer in a variety of positions including Navigation Development, Regional Tidal Officer, and head of Chart Production, Data Management and Field Surveys. After retirement he formed Electronic Navigation Consulting Int'l and has done contract work for a variety of public and private sector organizations including the CHS, CCG, Dalhousie University, Atlantic Pilotage Authority and the IHO.



Richard Palmer gradated from Dalhousie University with a Bachelor of Science degree in Mathematics. Thereafter, he joined the Canadian Hydrographic Service and held various position in field surveys, the tidal section and nautical publications. He retired from the position of Supervisor, Chart Updating, in 2008. He now pursues a variety on interests, including returning to University to further his passion for learning.

Stephen R Forbes graduated from Mount Allison University with a Bachelor of Science in Physics and Math and a Certificate in Engineering. Joined the Canadian Hydrographic Service (CHS) in 1972 and progressed from field hydrographer, CHS geomatics specialist and geomatics supervisor supporting the applications and environment for hydrography and digital cartographic production.

Stephen assumed the position of Manager, Nautical Publications in 2001 and in 2007, he was appointed Director of Hydrography (Atlantic). In January, 2011 he was appointed the Director of the Law of the Sea Project., CHS at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

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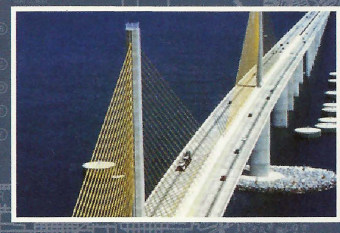

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The Expanding Role of Hydrography: Meeting Demands for Marine Spatial Information Through the Utilization of Multibeam Sonar Backscatter Data

By: Craig J. Brown, Ecosystem Research Division, Fisheries & Oceans, Dartmouth, NS
Herman Varma, Canadian Hydrographic Service, Dartmouth, NS
Kian Fadaie, Canadian Hydrographic Service, Ottawa, ON

Introduction

The Canadian Hydrographic Service (CHS) has a long history of utilizing state-of-the-art survey tools for the production of bathymetric charts. In the 1990s, CHS adopted the use of multibeam sonar technology for field surveys, and today these systems are routinely used for the acquisition of new data sets across Canada. Multibeam echosounders (MBES) offer a technique which allows continuous coverage data of the seafloor to be collected by running parallel survey tracks at appropriate line spacing for the system, and the benefits of this approach for chart production and safer navigation are widely acknowledged.

In addition to bathymetric data, MBES systems are also capable of measuring the signal strength of the return echo from the seafloor, commonly referred to as backscatter data. MBES backscatter imagery is roughly similar to sidescan sonar backscatter imagery, although the backscatter data from a MBES was, until recently, of an inferior quality compared to the imagery from an equivalent sidescan system. This was mainly due to the lower along-track resolution of MBES systems (1–3°) compared to sidescan systems (less than 1°), and the optimal range of incidence angles for backscatter measurement achieved by a towed sidescan sonar system (which has lower grazing angles) compared to a hull-mounted MBES (Brown and Blondel, 2009). However, recent on-going developments in data collection and processing of MBES, combined with the availability of co-registered bathymetry, are dramatically improving the quality of the imagery, giving as much or more information than is available with sidescan sonar alone (Le Bas and Huvenne, 2009).

MBES backscatter data can be used to infer the environmental characteristics of the seafloor (e.g. seafloor hardness, surficial sediment characteristics, benthic habitat characteristics), and over the past decade a vast literature has grown demonstrating the use of this type of data for the production of thematic seafloor maps for a wide variety of management applications. Examples include the production of thematic maps focused on characterizing the geological (i.e. Brown et al., 2010b, Todd et al., 1999), biological (i.e. benthic habitat - McGonigle et al., 2009, Roberts et al., 2005), and/or archaeological (Quinn and Boland, 2010, Quinn et al., 2005) characteristics of the seabed. It is now recognized that establishing an understanding of the spatial characteristics of the benthic environment is an essential first step toward implementing effective management strategies for ocean systems (Cogan et al., 2009, Pickrill and Todd, 2003), and the demand for these types of thematic map products has increased over the past decade to inform and facilitate management decisions.

MBES Backscatter Data: Processing Challenges

Since the 1990s, CHS has routinely logged backscatter data during MBES hydrographic surveys, but the data has not been routinely processed in-house. Recently, several commercially available software packages have been released which offer advanced tools for the creation of backscatter mosaics and for automated seafloor classification (i.e. the process of segmenting the backscatter mosaics into regions of similar seafloor characteristics from which geological/benthic habitat maps can be created when combined with in situ ground-truthing information). These techniques are offering the opportunity for CHS to integrate backscatter analysis into the standard work-flow for processing MBES data sets. These tools allow the production of properly corrected backscatter mosaics through removal of angular range artifacts, which is an essential stage in utilizing this type of data for thematic map production. Using the mosaic imagery, segmentation of the backscatter data has conventionally been done by expert interpretation, whereby the imagery is divided into regions of similar texture or backscatter strength "by eye" (Figure 1). The acoustic segments are then linked to seafloor attributes from ground-truthing samples for subsequent production of thematic maps. This has been the conventional method for the production of seafloor geological maps since the implementation of MBES systems in the 1990s (Pickrill and Todd, 2003).

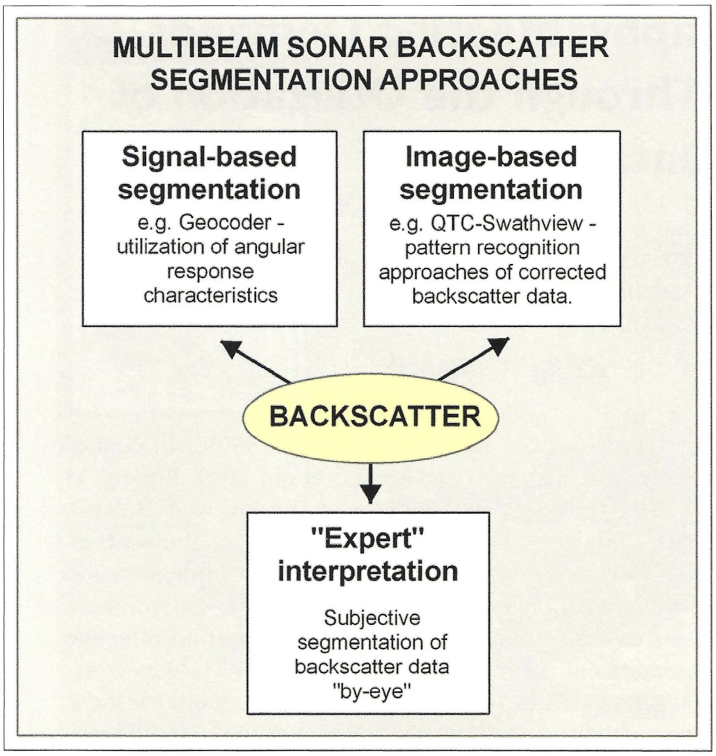

Figure 1: Generalized schematic illustrating the general strategies used to segment MBES backscatter data for the purpose of thematic map production

More recently, automated methods of segmenting MBES backscatter data have been explored, driven largely by the advantages of performing objective classification of the backscatter data and therefore eliminating the subjectivity of the expert segmentation process. Automated segmentation methods can be broadly divided into two types; 1) image-based segmentation based on the division of a backscatter image into regions of similar backscatter characteristics (e.g. surface features, backscatter intensity, textural features etc.); 2) Signal-based segmentation where changes in the backscatter intensity, with increasing grazing angle from nadir, are analyzed to classify the data in some way (Figure 1). In recent years, implementation of both approaches has come about in the form of commercially available software tools for the analysis of backscatter data. Both offer opportunities for the integration of backscatter classification into routine CHS data processing. However, at present no standardized method has been adopted at a national level within CHS to undertake this task.

Image-based classification techniques have recently been tested by CHS-Pacific using *QTC-Multiview*, a software package produced by Quester Tangent, British Columbia, Canada. *QTC-Multiview* operates by extracting 132 features (full feature vectors - FFVs) from rectangular patches of compensated MBES backscatter imagery, based on the length, amplitude, shape and other defining characteristics of each patch for each individual dataset (Preston, 2009). Principal components analysis (PCA) is applied to reduce these 132 FFVs to the three most responsible for variance in any given dataset (Q-values; Q1, Q2 and Q3), after which they are plotted in 3-D vector space (Q-space). The first three principal components typically capture 90% to 95% of the variance because many of the FFVs are correlated (Preston, 2009). Limiting the dimensions to the first three principal components is in some ways arbitrary, but this method allows a way to conveniently plot and visualize the points, whilst still giving realistic and useful class maps (Preston, 2009). The Q-values are then statistically clustered into groups (acoustic classes) with similar identities based on their relative positions. Optimal clustering of points is determined by a simulated k-means algorithm (Preston, 2009). The resulting classified values (acoustic classes) are then appended to the records from each point, and can be displayed in geographic space in 3rd party GIS software (the points representing the centre location of each rectangular patch). Analyzed data sets from the West Coast of Canada have yielded promising results using this approach for the production of generalized substrate maps (Figure 2). The approach has also been applied to data sets on the East Coast of Canada (Brown et al., 2010b), and whilst further testing is required, the approach offers a method of generating classified backscatter data layers for use in subsequent thematic map production

In addition to image-based MBES backscatter analyses approaches, signal-based methods have also been recently commercially implemented in the form of *GeoCoder*, an analysis tool developed by the Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC) at the University of New Hampshire, USA. *GeoCoder* is designed to make fully corrected backscatter mosaics and also analyze the angular response of the backscatter as an approach to remote seafloor characterization (Angular Response Analysis – ARA). The variation of the backscatter strength with the angle of incidence is an intrinsic property of the seafloor, which can be used as a robust method for acoustic seafloor characterization. Although multibeam sonars acquire backscatter over a wide range of incidence angles, the angular information is lost during standard backscatter processing and mosaicking. Signal-based classification (ARA in the case of *GeoCoder*) works by extracting several parameters from stacks of consecutive sonar pings. The average angular response is then compared to formal mathematical models that link acoustic backscatter observations to seafloor properties. The inversion of the model can produces estimates of various seafloor geotechnical properties, which can be used to predict the substrate properties of the seabed (Fonseca et al., 2009, Fonseca and Mayer, 2007). These predicted outputs (i.e. seafloor impedance, roughness and sediment grain size) offer potential benefits for improved thematic map production.

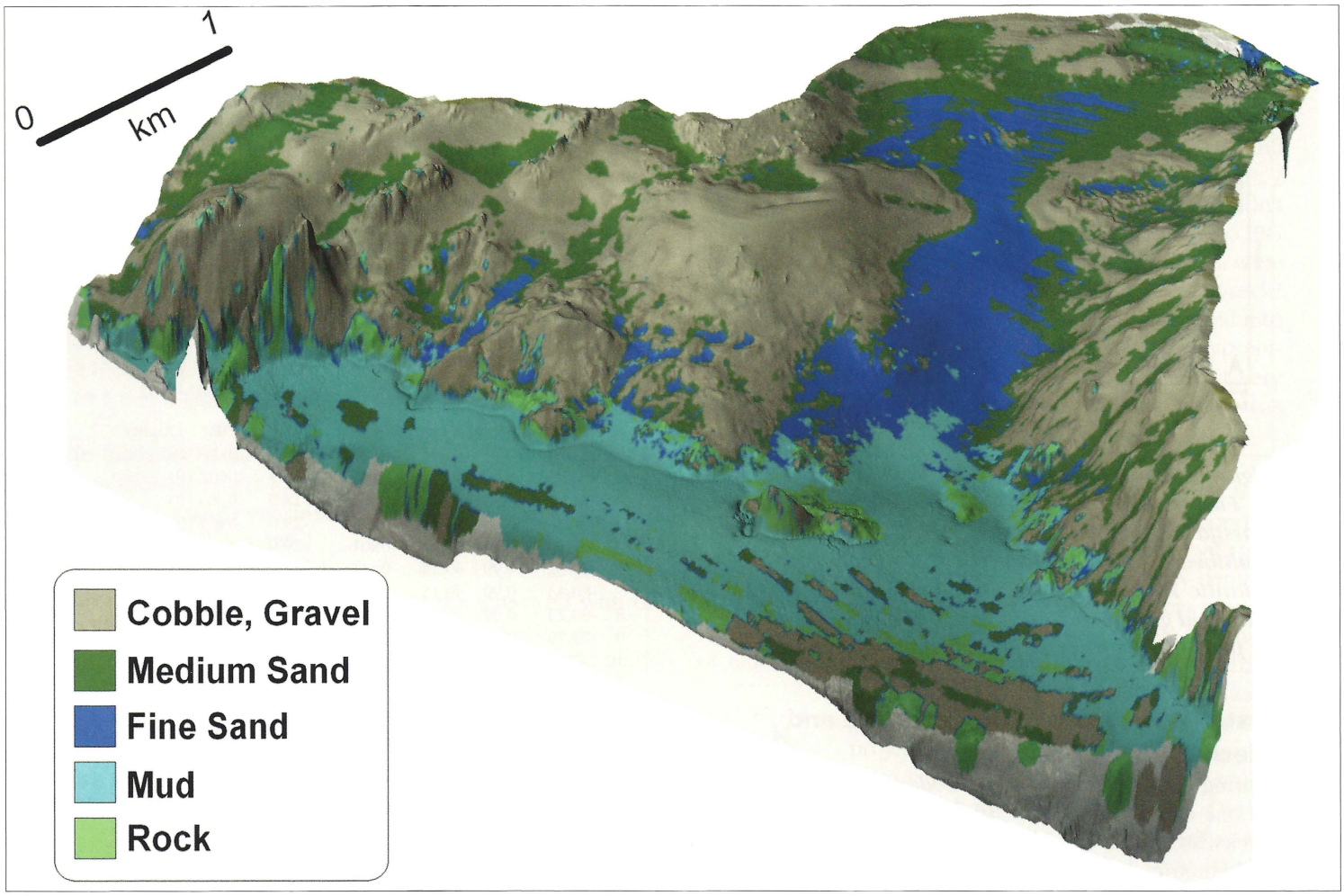

Figure 2: Example of an MBES data set from Patricia Bay, Vancouver Island, BC, classified using image-based backscatter classification methods (QTC Multiview). The Simrad EM3000 multibeam data were acquired and processed by CHS, Pacific Region. The interpolated classification is overlaid on vertically exaggerated bathymetry. The backscatter data has been divided into 5 substrate classes on the basis of the backscatter characteristics.

GeoCoder has been licensed for implementation in a number of hydrographic software packages, and this approach shows a great deal of promise for seafloor characterization based on MBES backscatter characteristics. Recently, CHS-Atlantic has undertaken a preliminary evaluation of the outputs from the *GeoCoder* analysis (particularly the predicted grain size values) for use in the production of "nature of the seabed" layers in S-57 electronic charts. In addition, the *GeoCoder* outputs, along with seafloor morphology layers derived from the MBES bathymetric data (slope, aspect, curvature etc.) are being used in a landscape-scale classification of the seafloor using supervised and unsupervised classification techniques (Brown et al., 2010a).

The methodology was tested using a Kongsberg EM1002 multibeam data set from the Bay of Fundy (Figure 3). Data were processed and cleaned using *GeoCoder* in CARIS HIPS and SIPS v7.0, and a backscatter mosaic was generated (see Brown et al., 2010a). Using the ARA tools within, classified outputs were generated for impedance, roughness and sediment grain size parameters. These data were gridded at a 50m resolution, and grain size data was subsequently binned into classes based on the Wentworth sediment grain size classification (Figure 3). The performance of the grain size classification was evaluated against sediment grain size data from 24 stations collected by the Geological Survey of Canada, with encouraging results (see Brown et al., 2010a). Further testing is required, but the preliminary results are encouraging and lend support to the application of the ARA approach using *GeoCoder* for objective seafloor characterization, with potential applications for generating bottom quality information on charts, and for the generation of thematic seafloor maps.

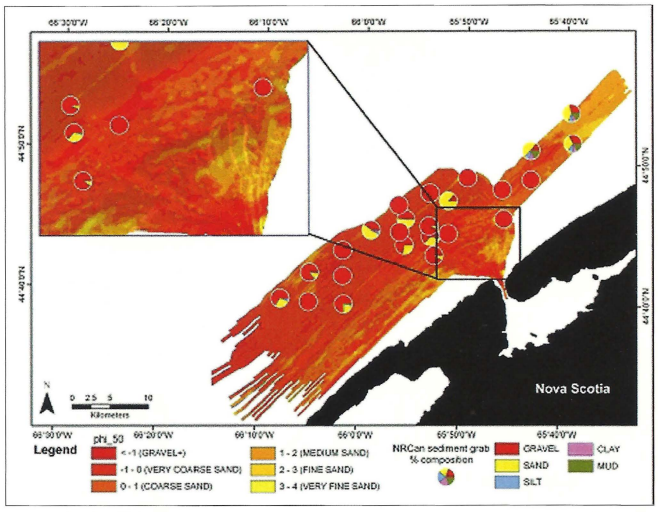

Figure 3: Example of an MBES data set from the Bay of Fundy, classified using signal-based backscatter classification methods (GeoCoder). The Simrad EM1002 multibeam data were acquired and processed by the CHS, Atlantic Region. The classified output is overlaid with sediment grain size data from in situ samples presented as percentage gravel, sand, silt, clay and mud.

Data Management Infrastructure and Mechanisms for Backscatter

During the course of the *GeoCoder* evaluation, it came to our attention that the source meta information for backscatter was fundamentally identical to the source bathymetric information. This implied that the temporal time stamps, positional information, HPR (heave pitch and roll), positional offsets and instrumental errors residing in and obtained from the SIMRAD telegrams (Figure 4), were identical for both bathymetric and backscatter information. Although *GeoCoder* purports to interpolate values to a higher degree of granularity during its secular data processing, it still uses the same original positional values, timestamps and instrumental offsets as bathymetry as a base. This implies that the same instrumental error constraints associated with the bathymetric data are also present in the context of backscatter. It was decided to 'fuse' (Varma, et al 2000) the backscatter as an average interpolated value with each processed bathymetric sounding. Backscatter becomes an associated attribute to bathymetry along with other existing meta data attributes, time, date, tide, vehicle etc. In this manner backscatter piggy backs on the infrastructure designed to accommodate VLDB constructs for dense bathymetric data archival and distribution. The fact that the metadata for both bathymetry and backscatter are identical and that the data is acquired at the same date, time and positional values with the same acquisition equipment collected by the same vehicle and agency further solidifies this decision.

CHS Atlantic has developed an advanced VHC (Very High Compression) geospatial indexing framework called

```
disk loc: 0x1ecc, length 8040, opcode: 0x58
XYZ88 Datagram model:   710  2010-05-13, 48246.752  Depth
Datagram # 1
Number of depths: 400, ping number  55726
Sound velocity: 1470.00
Sampling Rate:  13888.9

disk loc: 0x61da, length 110, opcode: 0x50
EM 3000 Position Datagram # 1
2010/05/13 48246.752
System type: 1  (Active)  Serial number: 102
Lat:  44.68627045  Long:  -63.62581280  Gyro: 271.70
Input: INGGA,132406.985,4441.17641,N,06337.54891,W,2,10,0.8,-
1.22,M,,,3,0330*2E
disk loc: 0x5d04, length 1234, opcode: 0x41

Transducer depth:   4.20
#   Across /  Along /  Depth /  Detection /  Ref. (dB) /  Quality
1   -82.54    0.97    40.03    0x01         -28.8        0x06 (P)
2   -82.23    0.97    40.06    0x01         -28.9        0x02 (P)
3   -81.96    0.98    40.12    0x01         -28.9        0x00 (P)
4   -81.72    0.98    40.19    0x01         -29.0        0x09 (P)
5   -81.15    0.98    40.11    0x01         -29.0        0x0A (P)
6   -80.82    0.99    40.14    0x01         -29.0        0x17 (P)
7   -80.43    0.99    40.15    0x01         -29.1        0x0A (P)
8   -80.22    0.99    40.23    0x01         -29.1        0x09 (P)
9   -79.76    0.99    40.20    0x01         -29.1        0x0A (P)
10  -79.39    1.00    40.22    0x01         -29.1        0x0A (P)
11  -78.89    1.00    40.16    0x01         -29.2        0x04 (P)
12  -78.59    1.00    40.22    0x01         -29.3        0x06 (P)
13  -78.09    1.01    40.16    0x01         -29.4        0x04 (P)
14  -77.78    1.01    40.20    0x01         -29.4        0x03 (P)
15  -77.47    1.01    40.24    0x01         -29.1        0x02 (P)
.
.
.
397  90.63    2.09    44.45    0x01         -32.7        0x07 (P)
398  91.12    2.09    44.48    0x01         -32.7        0x06 (P)
399  91.43    2.09    44.43    0x01         -32.8        0x09 (P)
400  91.93    2.10    44.46    0x01         -32.9        0x05 (P)
```

Figure 4: Simrad Telegram

the NWATL project (Varma et al 2010) for the purpose of data archival and data distribution to clients for non-navigational purposes. Led by CHS Atlantic and the cooperation of headquarters, the 'framework' provides an integrated view of the 'Hydro-space', including variable sized cell structures (Varma 2000).

To achieve this, it became necessary to have a single point of access, from where users would be able to extract data from a single, qualified source resident in the region's HDC (Hydrographic Data Centre). The users could then efficiently extract data from this data store and integrate it into their respective projects and view it at a common scale and projection via any geographic tools at their disposal.

A typical VHC data record associated with mulitbeam data is shown below. This example has 120 hits in one square metre with bathymetric depth statistics and an average backscatter value.

GEOTEMP.LON	-71 32 34.6875
GEOTEMP.LAT	62 22 29.5605
GEOTEMP.TIME	09/23/2005 20:23:34.000
POSACC	5.000
SOUACC	1.020
WL_CORR	-1.314
VDATUM_ADJ	0.000
OBJ_ID	SOUNDG
MIN_DEPTH	334.111
MAX_DEPTH	338.928
AVERAGE_DEPTH	336.882
MEDIAN_DEPTH	337.824
RESOLUTION	23
NUMBER_DEPTHS	120
STD_DEV	1.731
BEAMID	76
SWIN_ID	2400040001
TRACKID	48
BACKSCATTER	-2.8
QUASOU	75
AGY_ID	UNB
PFM_ID	AMUNDSEN
OBJ_CRIT	0
OBJ_DESCR	2
OBJ_TYPE	3
INDIVID_NAME_ROLE	JHCLARKE:HIC
LINEAGE	MB,EM3000:POS/MV320: GPS C&C/TECH,CNAV CORR:OMG MERGED files to VHC:WEBTIDE to MSL 2008:TILED 23:
VERT_REFERENCE	MSL:2008
HORIZ_REFERENCE	NAD83
ABSTRACT	0001_20030913_124610.merged-1526_20031015_082514.merged Files, SCALE-1:500 Amundsen Data from UNB 2003
GROUP_ID	AMUNDSEN2005

Figure 5:VCH Framework Schema

System Architecture:

The architecture employed by the request systems employs a multi-tiered approach built primarily upon enterprise solutions. The current file based archive is to be replaced with a more robust Oracle based CubeSTOR archive, making this an end to end solution for long term data archival and fast data extraction.

The major software components employed on this project are itemized as:

1. VHC data files for data archival
2. ArcIMS (using OGC services) for displaying the bathymetry and backscatter coverage in the request system
3. Apache/Tomcat as the HTTP/Servlet containers
4. Oracle for hosting user authentication and queued requests
5. Departmental FTP/e-mail servers to manage notification e-mails and hosting packaged products.

System Components:

The Archive:

The initial implementation of the bathymetric compilation exists in two forms. Bathymetry from multiple sources is processed into a single archive (multiple terabytes in size), then subsequently aggregated into a single VHC file (< 20 gigabytes in size). The smaller VHC file can be used to generate products of a maximum resolution of 64 metres. It is important to note that the 64m limitation is imposed by CHS on the data (i.e. Use for non-navigational purposes) and not a reflection of the compilation or technology used in its assembly or management.

The long term objective of the project is to migrate the NWATL compilation into an enterprise warehouse solution, such as CubeSTOR, which has a more robust corporate archival system for the multi terabyte storage. The use of an enterprise warehouse may eliminate the need for the two fat and thin versions of the compilation.

The Request System:

A key goal of the project was to make the delivery of data and products from the compilation as easy as possible while supporting access by a large user base. The bathymetry and backscatter request system is comprised of two components; a front end graphical interface used by clients to request data and products; and a non-graphical queuing system used to manage and process client requests.

Both components of the request system are based on Java technologies (Java, Java Server Pages). The graphical interface used by clients employs the Internet Mapping Framework and supports the use of a map window (Figure 6). Use of the graphical interface requires authentication (enabled by the Canadian Hydrographic Service based upon acceptance of a data use agreement) and can be available both internally to DFO and externally via the Internet. The DFO home page provides the access mechanisms to log into the application using credentials supplied by the Canadian Hydrographic Service.

A request application using an OGC compliant web map service is presented, based on the compilation to assist in selecting an area of interest. A bounding box or a polygon is used for the area of interest (red box in map window: Figure 6) and window coordinates are generated. The request is submitted by clicking a "Run" button and the user receives a message stating that processed results will be sent via e-mailed after the job is complete. Users are notified upon completion of their bathymetry request and provided a URL for downloading the products and data in a zipped file.

The queuing system, also written in Java, is based upon an existing application used to manage requests for a number of web based oceanographic query systems.

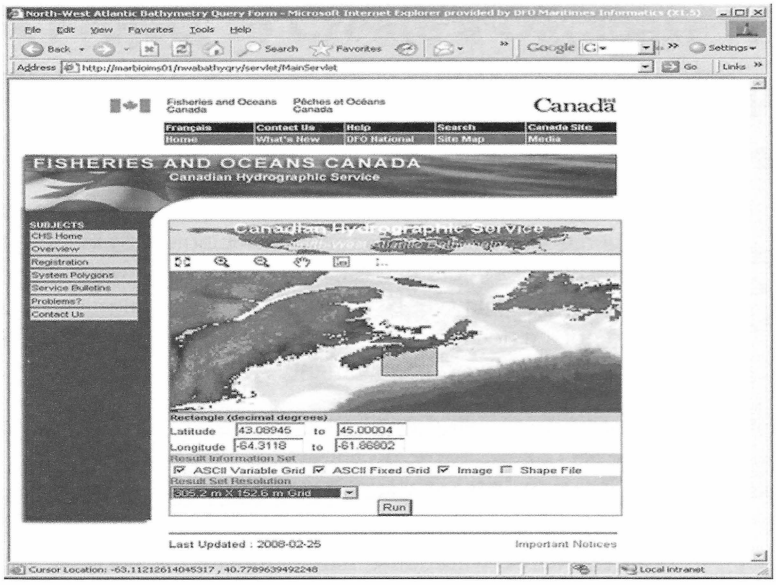

Figure 6: DFO Home Page Access Mechanism

The queuing system is meant to ensure servers are not overloaded by multiple concurrent and/or unconstrained requests for data.

The Extraction Facilities:

Interaction with the bathymetric archive is achieved through a suite of command line utilities, some of which were written specifically to address the needs of this project. These command line utilities are compatible with a CubeSTOR based solution.

The command line utilities provide the following functionality:

1. Extract data from the combined bathymetry, backscatter compilation using a polygon
2. Aggregate the data to desired levels of resolution based on scale
3. Interpolate or grid aggregated data into a fixed grid format or provide the original collected point positions.
4. Export data to comma delimited ASCII format
5. Export as a raster image

The Products:

Products available to the user from the extraction facilities are comprised of ASCII (fixed and irregular grids in comma delimited format) and image files in raster format. ASCII files are produced from the command line utilities used to extract data from the compilation. Raster files are produced by executing a command line Java application which uses the fixed grid ASCII file as input.

The files produced by the extraction facilities can be used in the generation of other value added products, the level of sophistication dependent upon the end use. For example, the ASCII files produced by the extraction process can be used within a geographic information system (GIS) or statistical package in order to generate other products.

Developing a national strategy within CHS for MBES backscatter processing

CHS collects and will continue to collect seabed acoustic backscatter with all multibeam hydrographic surveys. CHS will also collect water column multibeam backscatter as required. Raw backscatter data will be archived, though not necessarily online.

CHS is currently embarking on a comprehensive evaluation of new approaches for backscatter processing for thematic map production, coupled with an initiative to develop a National data processing and management framework for backscatter data within the organization. These will be developed in the coming years, with the long term goal to offer products, services and partnerships for improved map products to meet the growing need for marine spatial information.

Conclusions

With only 5-10% of the world's seafloor mapped at a resolution of similar terrestrial studies, (Wright and Heyman, 2008) adding a spatial dimension to seafloor studies is still a significant challenge. Over the past two decades we have witnessed the nascence of the field of seafloor mapping using high-resolution multibeam survey techniques. As acoustic survey tools have become ever more complex, new methods have been tested to segment, classify and combine these data with *in situ* sample data for thematic map production. We still have a long way to go before we answer many of the outstanding technological, methodological, and theoretical questions that have been raised from recent studies. Nonetheless, the new analysis tools outlined above will undoubtedly help to address the increasing management demands for improved spatial information from marine systems.

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About the Authors...

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Mr. Varma is the inventor of HHCodes (Helical Hyperspatial Codes), an encoding technique for combining data of two or more dimensions into a single value. He headed the design team that implemented HHCodes into the Oracle kernel resulting in Oracle SDO (Spatial Data Option) and Oracle Spatial in later versions of Oracle. VarmaH@mar.dfo-mpo.gc.ca

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Les états côtiers arctiques s'engagent à assurer la sécurité en mer dans l'arctique

L'hydrographe fédérale du Canada : premier président de la Commission hydrographique régionale pour l'Arctique

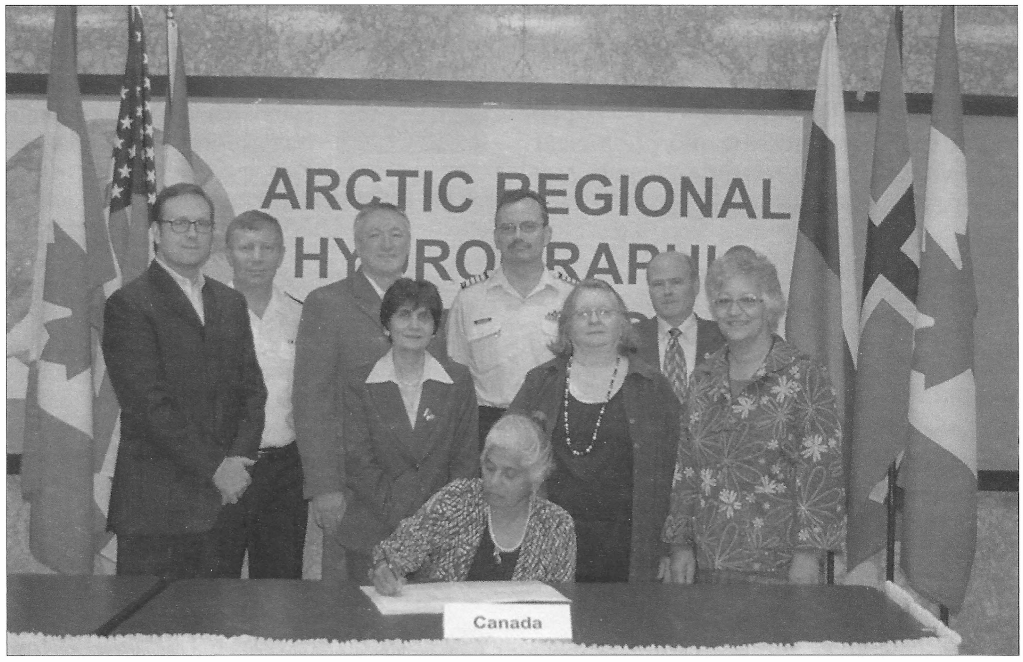
Sous la direction du Canada, les cinq états côtiers arctiques (Canada, Danemark, Norvège, Fédération de Russie et États-Unis d'Amérique) ont créé, à Ottawa et le 6 octobre 2010, la Commission hydrographique régionale pour l'Arctique (CHRA). L'hydrographe fédérale du Canada, Dre. Savithri (Savi) Narayanan sera la première présidente de la commission dont la vice-présidence sera assumée par le Danemark.

La création de la CHRA constitue un événement historique. En effet, depuis l'inauguration de l'Organisation hydrographique internationale en 1921, seules quinze commissions hydrographiques régionales ont été créées de par le monde. L'océan Arctique en était dépourvu jusqu'à aujourd'hui.

Les extraordinaires transformations que l'Arctique subit facilitent l'accroissement de l'exploration et l'exploitation des ressources naturelles, ainsi que le trafic maritime. Toutefois, il n'existe que peu de données fiables sur l'environnement et destinées à la navigation : à ce jour, moins de 10 % des eaux arctiques ont fait l'objet de levés effectués conformément à des normes modernes. Afin de relever les défis actuels et émergents, les États côtiers de l'Arctique, représentés par leurs services hydrographiques, ont reconnu la nécessité d'améliorer la collaboration et la coordination de leurs activités arctiques, ce qui explique la nécessité de créer la CHRA.

En échangeant les connaissances et informations, jumelées à la fourniture de données dont la qualité est assurée, les membres de la CHRA visent à permettre une exploration respectueuse de l'environnement des eaux arctiques et le développement de l'infrastructure marine nécessaire à une navigation sécuritaire dans l'Arctique et de la protection de son environnement.

La CHRA s'emploie à renforcer la coopération avec d'autres organisations intergouvernementales et le monde international maritime et hydrographique, dans le but de faire des percées en matière d'infrastructure arctique qui répondra aux besoins pressants.



Signature des statuts par le Canada. (Hommes G à D): Dion Gaulton, Lieutenant-Commandant Ina Gillis (MDN), Dale Nicholson, Colonel Rob Williams (MDN), Sean Hinds. (Femmes G à D): Siddika Mithani (SMA, Océans & Science), Sheila Acheson, Kian Fadaie et Savithri Narayanan. Exceptés pour les hommes en uniforme, tous les autres sont du MPO.

Arctic Coastal States Committed to Safety at Sea in the Arctic

Dominion Hydrographer of Canada - First Chair of the Arctic Regional Hydrographic Commission

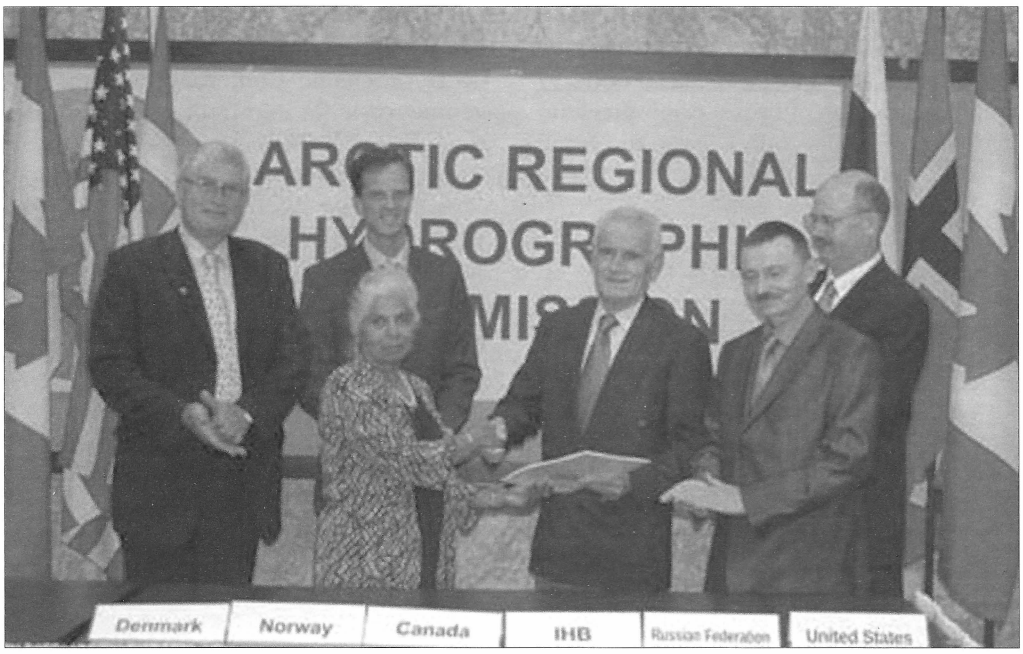
The five Arctic coastal states: Canada, Denmark, Norway, the Russian Federation and the United States, under the leadership of Canada established the Arctic Regional Hydrographic Commission (ARHC) in Ottawa on October 6, 2010. The Dominion Hydrographer of Canada, Dr. Savithri (Savi) Narayanan, will be the first chair of the commission, with Denmark as the Vice Chair.

The establishment of the ARHC is an historic event. Since the establishment of the International Hydrographic Organization in 1921, fifteen regional hydrographic commissions have been established worldwide. The Arctic Ocean remained without such a commission until today.

The Arctic is undergoing extraordinary transformations facilitating increased natural resource development and marine traffic at a time when little reliable navigational and environmental data exists. At present, less than 10% of Arctic waters are charted to modern standards. To meet current and emerging challenges, the Arctic Coastal States, represented by their hydrographic offices, have recognized the need for enhanced collaboration and coordination of their Arctic activities and therefore established the ARHC.

By exchanging knowledge and information and by providing quality assured data, the members of the ARHC aim to facilitate environmentally responsible exploration of Arctic waters and the development of the maritime infrastructure required for safe navigation and protection of the marine environment in the Arctic.

The ARHC is committed to enhancing cooperation with other intergovernmental organizations and the international hydrographic and maritime transportation community with a perspective towards advancing the much needed Arctic maritime infrastructure.



Presenting the new statutes to the International Hydrographic Bureau. Svend Eskildsen, Denmark, Evert Flier, Norway, Alexander Shemetov, Russian Federation, John Lowell, USA, Savithri Narayanan, Canada and Alexandros Maratos, President, International Hydrographic Bureau.

L'Association des Arpenteurs des Terres du Canada

L'Association des Arpenteurs des Terres du Canada (AATC) est une association professionnelle nationale auto réglementée. Elle est composée de 620 membres répartis aux quatre coins du Canada (et du monde) qui ont une expertise en arpentage, en photogrammétrie, en télédétection, en géodésie, en hydrographie et en systèmes d'information foncière à référence spatiale. Seuls les arpenteurs des terres du Canada, qui sont titulaires d'un permis de pratique de l'AATC, sont autorisés à pratiquer l'arpentage foncier sur les terres du Canada et les terres privées dans les territoires qui comprennent essentiellement les réserves autochtones, les parcs fédéraux, toutes les terres dans les trois territoires et la zone extracôtière qui n'est pas sous juridiction provinciale.

Conférence nationale des arpenteurs-géomètres

La dernière Conférence nationale des arpenteurs-géomètres s'est tenue du 6 au 8 mai dernier, à St-Jean, Terre-Neuve et a été un franc succès avec au-dessus de 140 délégués présents. C'est le résultat d'un effort commun de la part de l'A.A.T.C. et de l'Association of Newfoundland Land Surveyors.

Le clou de la conférence a été le lancement de la vidéo promotionnelle produite par l'AATC et l'Association of Ontario Land Surveyors. Plusieurs participants ont été impressionnés après avoir visionné le film. Ça a impliqué un investissement total de près de 60 000$. Pour visionner la vidéo allez à la section « Carrières » du site Web de l'A.A.T.C. à : http://www.acls-aatc.ca/fr/%252Fnode/91 . Des parties du film ont été utilisées pour produire un commercial pour la télévision.qui a parût au réseau Aboriginal Television Network (APTN) au printemps de 2010 et 2011.

La prochaine conférence aura lieu dans le territoire du soleil de minuit, Yellowknife, Territoires du Nord-Ouest du 21 au 24 juin, 2011 à l'hôtel Explorer. La conférence démarre avec un tournoi de golf de minuit avec départ à 20h00 le 21.

Mobilité de la main-d'œuvre

Au cours de l'été 2008, les premiers ministres des provinces et des territoires ont signé une entente visant à réduire encore plus les obstacles à la mobilité de la main-d'œuvre pour tous les métiers et professions. Suite à cet événement, nos associations-sœurs se sont vues pressées de mettre en place la pleine mobilité.

Pour facilité la mobilité de la main-d'œuvre, l'Association a décidé de réduire le nombre d'examens professionnels ATC de trois examens de trois heures à un seul examen de quatre heures pour les candidats autorisés à pratiquer l'arpentage cadastral dans une province canadienne et, qui ont fourni la preuve qu'ils ont suivi un cours portant sur les levés hydrographiques. Afin de réduire le facteur temps que comporte la réussite de cet examen, l'AATC procède à l'implantation d'un système d'examens en ligne sur demande. Si tout se déroule tel que prévu, le système sera prêt au début de l'année 2011.

Prix nationaux de géomatique David Thompson

La troisième remise annuelle des prix nationaux en géomatique David Thompson a eut lieu lors de la soirée gala de la Conférence nationale des arpenteurs-géomètres le 8 mai 2010 à l'hôtel Sheraton Newfoundland, dans la ville de St-Jean, Terre-Neuve.

Le gagnant dans la catégorie "Innovation en Géomatique" était Fugro Jacques Geosurveys Inc. (Patrick Byrne, ATC) pour le projet intitulé "Précision dans 120 mètres d'eau". Dans la catégorie "Apport à la société", le gagnant était Hydrographic and Geodetic Consulting (David Gray, ATC) pour le projet intitulé "Définition géographique de la frontière maritime en Guyane". Dans la catégorie "Applications inhabituelles en matière de géomatique", le gagnant était McElhaney Associates (Jim Christie, BCLS, ATC) pour le projet intitulé "Modélisation terrain à l'aide de LIDAR/GPS pour la conception hydraulique et la planification de l'excavation".

Les prochains prix seront présentés lors du Gala à la fin de la prochaine Conférence nationale des arpenteurs-géomètres le 24 juin 2011 à Yellowknife, Territoires du Nord-Ouest. Tout arpenteur-géomètre breveté, membre d'une association (ou ordre) professionnelle d'arpentage canadien. Date limite de mise en candidature est vendredi le 31 mars 2011. Pour les détails visitez : http://www.acls-aatc.ca/fr/node/159

Bourses d'étude de l'AATC

Le programme de bourses de l'AATC a été introduit en 2003. Trois bourses de 1 500$ sont accordées à des étudiants méritants à tous les ans. Pour obtenir un formulaire d'application et des détails sur le programme de bourses d'étude de la Fondation de l'AATC, visitez le site Web de l'Association à http://www.acls-aatc.ca/fr/%252Fnode/95 . La date limite pour présenter une demande est le 15 mai de chaque année. La Fondation de l'AATC est un organisme charitable vis-à-vis Revenu Canada, alors elle peut émettre des reçu pour fin d'impôt.

Jean-Claude Tétreault, a.-g., ATC, ing., MBA
Directeur exécutif
Association des Arpenteurs des Terres du Canada
www.acls-aatc.ca

Association of Canada Lands Surveyors

The Association of Canada Lands Surveyors (ACLS) is a national self-regulating professional association. It has 620 members located across Canada (and the world), who have expertise in surveying, photogrammetry, remote sensing, geodesy, hydrography and land information systems. Licensed Canada Lands Surveyors (CLS) are the only ones authorized by the Canada Lands Surveyors' Act to perform cadastral surveying on Canada Lands, which are formed by Aboriginal Reserves, Federal Parks, all lands in the three territories and the offshore portion that is not under provincial jurisdiction.

National Surveyors' Conference

The last National Surveyors' Conference was held from May 6th to 8th, 2010 in St. John's, Newfoundland. It was a joint effort by the ACLS and the Association of Newfoundland Land Surveyors. The Conference was a success with over 140 delegates attending.

The highlight of the Conference was the launch of the ACLS-AOLS Promotional Video. Many attendees were in awe after viewing the footage. Total investment in the project was just under $60,000. The video can be seen in the "Careers" section of the ACLS Web site at: http://www.acls-aatc.ca/en/node/43 . Some of the footage from the promotional video has been used to produce a 30 second television commercial which was shown on the Aboriginal Peoples Television Network (APTN) in the springs of 2010 and 2011.

Next year's conference will be held in the land of the midnight sun, Yellowknife, Northwest Territories from June 21st to 24th, 2011 at the Explorer Hotel. The conference kicks off with a midnight golf tournament with tee off at 8:00 PM on the 21st.

Labour Mobility

In the summer of 2008, the Canadian provincial and territorial Premiers signed an agreement to further reduce barriers to Labour Mobility in all trades and professions. Following that event, pressure was applied on all surveying associations to implement full mobility.

In order to facilitate mobility, the ACLS decided to reduce the number of CLS professional examinations from three 3 hour exams to one 4 hour exam for individuals who are authorized to practice cadastral surveying in a Canadian province and who meet the hydrographic surveying education requirement. To eliminate the time barrier for taking this exam, ACLS is proceeding with the implementation of an on-line, on-demand Web based exam system. We hope to have this in place early in the year 2011.

David Thompson National Geomatics Awards

The third annual David Thompson National Geomatics Awards were presented at the Gala Dinner of the National Surveyors' Conference, May 8th in St. John's, Newfoundland.

Winning the "Innovation in Geomatics" category was Fugro Jacques Geosurveys Inc. (Patrick Byrne, CLS) for the project entitled "Accuracy and Precision in 120 metres of water". In the category "Contribution to Society", the winner was Hydrographic and Geodetic Consulting (David Gray, CLS) for the project entitled "Geographic Definition of a Maritime Boundary in Guyana". Winning in the "Unusual Application in Geomatics" category was McElhaney Associates (Jim Christie, BCLS, CLS) for the project entitled "LIDAR/GPS Terrain Modeling for Hydraulic Design and Evacuation Planning".

The next awards will be presented at the Gala Diner at the end of the National Surveyors' Conference on June 24th, 2011 in Yellowknife, Northwest Territories. This awards program is open to all commissioned surveyors who are members of a Canadian surveying association.

The deadline for submissions for this year's awards was March 31st, 2011. For more information and application form, go to: http://www.acls-aatc.ca/en/node/27

ACLS Scholarship

The scholarship program was introduced in 2003. Three $1,500 scholarships are awarded every year to worthy candidates. To obtain an application form and further information on the ACLS Foundation Scholarship Program, visit the ACLS Web site at: www.acls-aatc.ca. Deadline for application is May 15 of each year. The Association of Canada Lands Scholarship Foundation Inc. is a registered charitable organization, and so it is authorized to issue tax receipts.

Jean-Claude Tétreault, a.-g., CLS, P. Eng., MBA
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Association of Canada Lands Surveyors
Association des Arpenteurs des Terres du Canada

The ACLS is a national self-regulating professional association. It has 560 members located across Canada (and the world), who have expertise in surveying, photogrammetry, remote sensing, geodesy, hydrography and land information systems.

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 following is a short list of the current main thrusts:

- Promotion of a Marine Cadastre for Canada
- Promotion of the ACLS national certification program for hydrographers
- Publication and promotion of the new book entitled "Canada's Offshore: Jurisdiction, Rights, and Management". Copies can be purchased from: www.acls-aatc.ca or www.trafford.com

L'A.A.T.C. est une association professionnelle de juridiction fédérale. Elle est composée de 560 membres répartis aux quatre coins du Canada (et du monde) qui ont une expertise en arpentage, en photogrammétrie, en télédétection, en géodésie, en hydrographie et en systèmes d'information foncière à référence spatiale.

L'A.A.T.C. est engagée à l'amélioration de la sensibilisation aux responsabilités et aux préoccupations des intervenants respectifs des terres extracôtières du Canada et de l'adoption d'une stratégie commune pour faire progresser ce secteur de l'industrie en vue de la plus-value pour tous. Voici la liste des activités principales en cours :

- Promotion d'un cadastre marin pour le Canada.
- Promotion du programme national de certification des hydrographes de l'AATC.
- La publication et la promotion du nouveau livre : *Zone extracôtière canadienne : juridiction, droits et gestion*. La version française sera disponible en novembre 2007. Vous pouvez faire l'acquisition de copies en visitant : www.acls-aatc.ca ou www.trafford.com

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Blodgett-Hall Polar Presence LLC

The Blodgett-Hall Polar Presence LLC is a US registered non-profit non-commercial entity set up to promote geomarine research in the Arctic Ocean by combining modern technology with the advantages of working on the drifting sea ice cover. It has built and tested a research hovercraft, the R/H *SABVABAA*, which is based at UNIS, the University in Longyearbyen, Svalbard. The hovercraft, whose Inuit name means "flows swiftly over it", is equipped for work in marine geophysics, marine geology, and oceanography in the most inaccessible parts of the high Arctic. The program intends to put "boots on the ice" for extended periods, using a relatively inexpensive, very habitable platform with a minimum crew of two or three. Whether in motion along leads, or drifting on floes, it can carry out deep and shallow reflection and wide angle seismics, and home in on geological targets for direct coring, dredging, and bottom photography. Oceanographic instrumentation consists of electromagnetic ice thickness measurements every 2sec, CTD casts to 500m, and Acoustic Doppler Current Profiling. The hovercraft was especially designed to investigate the Alpha Ridge, in areas of thick multiyear ice presently inaccessible to icebreakers north of Ellesmere Island and Greenland. In preparation for this the hovercraft has undergone three summers of testing over the Yermak Plateau. More that 10,000nm of travel have been recorded, while dredging, making CTD casts, seismic profiles, and testing autonomous drifting buoys for unattended seismic profiling, echo-sounding, and shallow CHIRP.

For further information please contact:

Website at *www.polarhovercraft.no*

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C & C Technologies, Inc. is a privately-owned international surveying and mapping company specializing in deepwater services. Our cutting-edge technologies, inspiring workplace and "can do" attitude endear our clients and attract the industry's leading innovators. C & C services include autonomous underwater vehicle surveys, C-Nav® globally corrected GNSS, marine construction surveys, geophysical surveys, geosciences services, government services, land and coastal surveys, a free GoM GIS viewer, and geotechnical services.

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

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Fugro GeoSurveys Inc.

Fugro GeoSurveys Inc. (FGI) is Canadian-based and staffed, with offices in St. John's, NL and in Dartmouth, NS and has a large, locally based, inventory of hydrographic, geophysical, geotechnical and positioning equipment. With approximately 75 employees, FGI has established an impressive track record in Canada and on the international stage.

FGI has provided seabed mapping and construction support services for all of Eastern Canada's offshore oil and gas developments and is also actively involved in marine based non-oil and gas projects such as Canada's UNCLOS mapping, hydrographic charting in Canada's North, large area habitat mapping, pipeline and cable route surveys, ice scour studies, wharf investigations and a broad range of engineering and construction support surveys.

FGI's Hydrographic Group operates a wide range of multibeam equipment including Reson 8101, 8111 and 8125 systems. These systems are routinely mobilized by FGI on ocean going vessels, as well as our customized 26 foot inshore survey launch. Systems have also been mobilized on ROVs for detailed oil and gas related infield mapping projects.

Multibeam data are processed in the field and at bases in St. John's and Dartmouth using CARIS HIPS/SIPS, IVS' Fledermaus visualization tools, and Fugro's own Starfix software suite. The resultant multibeam data are commonly integrated with seabed sampling, underwater imagery, geotechnical, seismic, sidescan and sub-bottom profiler data to deliver superior data products for use in seafloor and sub-seafloor assessments.

Throughout each project, FGI is committed to the health and safety of its employees, partners and clients, and to the protection of the environment. This is accomplished through the company's comprehensive HSE policy and Safety Management System which is OHSAS 18001 certified.

If you would like to receive further information about Fugro GeoSurveys Inc. please contact:

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HYPACK, Inc.

HYPACK, Inc develops Windows-based software for the hydrographic and dredging industry. Founded in 1984, HYPACK, inc. (formerly Coastal Oceanographics, inc.) has evolved from a small hydrographic consultancy to one of the most successful worldwide providers of hydrographic and navigation software. HYPACK® is one of the most widely used hydrographic surveying packages in the world, with over 4,000 users. It provides the surveyor with all of the tools needed to design their survey, collect data, process it, reduce it, and generate final products.

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If you would like to receive further information about IVS 3D and its services please contact:

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Jeppesen Norway AS

Jeppesen is a leading provider of solutions that support decision-making in commercial maritime operations. Today we contribute to the smooth operation of thousands of commercial ships and shipping companies around the world.

As a natural extension of our commercial products, we have supported production of charts and publications at national hydrographic offices worldwide for over a decade. Jeppesen dKart Office technology organizes the production and maintenance of traditional paper charts and survey sheets, electronic charts such as ENCs, lists of lights, Notices to Mariners, sailing directions and print-on-demand products.

Our commercial clients rely on us for electronic charts, weather and met-ocean data, weather routing and voyage optimization. We were one of the first companies in the world to offer digital chart data to commercial shipping, and we are fast becoming one of the world's leading suppliers of official chart data (ENCs). In addition, we have developed a vast array of solutions that meet the operational needs of the shipping industry.

Both our national and commercial customers recognize our ability to meet their business needs, for quality assurance, rapid updating, user-friendly operation, flexible procurement, business integration and compatibility.

Recent major projects for national hydrographic offices include one recently concluded with Croatia, and another just underway for the Sultanate of Oman. For each, Jeppesen has been commissioned to supply the countries with its dKart Office suites, including tools, processes and training services. Production and maintenance of ENCs and paper charts and NtM processing have been key. Finally, Jeppesen is finalizing a print-on-demand extension for the Norwegian Hydrographic Service.

For further information please contact:

Egil O. Åarstad
Tel: +47 51 464960 FAX: +47 51 464701 E-mail: dkart@jeppesen.com
Website: *www.jeppesenmarine.com/National-Hydrographic-Services/*

Knudsen Engineering Limited (KEL)

Knudsen, a long-standing corporate member and familiar face to the Canadian hydrographic world, is recognized worldwide for its innovative high performance singlebeam echosounders used in numerous commercial/defence applications including survey, navigation, dredging, sub bottom profiling, and ocean research.

Known for advanced underwater acoustics technology, Knudsen introduced the first 'all-digital' echosounder with its 320M echosounder and followed with the industry's first "blackbox" echosounder, the 320BP. Product innovation has continued and today, a common set of technology components - embedded Digital Signal Processing firmware, Windows application software , and modular hardware design - are bases of the Sounder and Chirp Series of Echosounders that provide leading edge solutions for the world of today and into the future. Digital signal processing is again the key to the performance of these new product lines. Both Sounder and Chirp series systems digitize the entire incoming signal over an exceptionally wide bandwidth and extract the frequency of interest entirely with digital signal processing software. Knudsen Sounder and Chirp echosounders provide stability and selectivity simply not achievable with analog components and offer sufficient processing power to recover the signal from even the noisiest environments.

Knudsen, an ISO certified manufacturer, located in Perth, Ontario Canada, has a current customer base that spans more than 60 countries. Knudsen cornerstones - 'Meeting customer needs through ongoing product innovation and unparalleled customer support' - continue to identify Knudsen products as the established benchmark for performance and accuracy.

For additional information please contact:

Judith Knudsen
Tel: (613) 267-1165 FAX: (613) 267-7085 E-mail: judith@knudsenengineering.com
Website: *www.knudsenengineering.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 Maritime 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:

Mr. John Gillis
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*

Rolls-Royce Naval Undersea Systems (ODIM Brooke Ocean)

ODIM Brooke Ocean, Dartmouth, Nova Scotia, is a world leader in the development and supply of sensor platforms for moored and underway use. The company provides hardware, engineering, repair and overhaul, life cycle support and R&D services to the hydrographic and oceanographic communities as well as to the naval and oil & gas sectors. Products include advanced data collection platforms, instrumentation, cable-handling hardware and launch/recovery systems.

ODIM Brooke Ocean's Moving Vessel Profiler™ (MVP) collects real-time free fall data profiles from ships underway at speeds of up to 12 knots. In addition, the ODIM Free Fall Cone Penetrometer (FFCPT) was developed to collect geotechnical and geophysical data during route location surveys for seabed cable and pipeline installations, bottom classification and acoustic groundtruthing, mine countermeasures and geo-environmental studies.

The ODIM FFCPT can be used either on-station or from a vessel underway at speeds up to 6 knots, using an ODIM MVP. Deployment of the ODIM FFCPT from an ODIM MVP offers a rapid and reliable method for characterizing the seafloor sediment, as well as the sound velocity of the water column.

Another of ODIM Brooke Ocean's primary areas of specialization is in the development of shipboard Launch And Recovery Systems (LARS) to deploy and recover various payloads from a ship at sea. These payloads include Autonomous Underwater Vehicles (AUVs), Unmanned Surface Vehicles (USVs), offboard sensors, oceanographic equipment, and manned submersibles.

If you would like to receive further information about ODIM Brooke Ocean and its services please contact:

Derrick Peyton
Tel: (902) 468-2928 FAX: (902) 468-1388 E-mail: sales@brooke-ocean.com
Website: *www.brooke-ocean.com*

Shark Marine Technologies Inc.

Shark Marine Technologies Inc. was founded in 1984 with a mandate to offer products and services that are innovative, high quality, dependable and cost effective.

Over the years, we have gained global respect for our developments in undersea technology, and the expertise we bring to on-site operations. As a manufacturer we have made significant advancements in underwater imaging equipment, remotely operated vehicles and other survey systems. In our services we have provided consultation, software development, custom manufacture, hydrostatic testing, equipment rentals and location operations.

Shark Marine Technologies Inc. is also a world leader in the development and manufacture of new technologies for maritime security and SAR organizations. Products such as diver detection and deterrent systems, remotely operated inspection and intercept vehicles; diver-held imaging sonar units and ship hull inspection devices, highlight our focus on security. Along with our own manufactured products we are also proud to be the North American representatives for Systems Engineering and Assessment (SEA) Ltd.of the U.K., for their line of SWATHplus bathymetric survey systems.

Our customer base has grown over the years to include gas and oil exploration, commercial diving, various governments, fisheries and undersea research facilties, search and rescue organizations, and survey firms. Our location services have taken us from warm waters to the frozen Arctic, where we have gained international recognition. These include pipeline surveys, locating of sunken vessels and other objects, search and recovery, as well as magnetic and sonar mapping.

Our manufacturing and global sales facilities are located in St.Catharines, Ontario, Canada, with associated sales offices in North Liberty, Iowa, USA and Grenoble, France as well as various sales representatives throughout the world.

Our experience in the diverse aspects of this field allows us the ability to create innovative solutions to often difficult or costly tasks.

For further information about please contact Shark Marine Technologies Inc.:

Jim Garrington
Tel: (905) 687-6672 FAX: (905) 687-9742 E-mail: jim@sharkmarine.com
Website: *www.sharkmarine.com*

SANI-INTERNATIONAL TECHNOLOGY ADVISORS INC. (SANI-ITA)

SANI-INTERNATIONAL TECHNOLOGY ADVISORS INC. (SANI-ITA), an Ontario Corporation, provides services and consulting in geographic information systems, remote sensing, softcopy photogrammetry and hydrography. The Corporation is a Distributor for GeoEye (50 centimetre imagery) LizardTech (MrSID and LiDAR data compressors), Nuvision and TRUE3Di (softcopy photogrammetry hardware) and is also the Authorised Training Centre for the complete suite of ERDAS IMAGINE software products. SANI-ITA is a sister company to Spatial Geo-Link Limited, the sole distributor in for ERDAS softcopy photogrammetry, geographic imaging and enterprise solutions in Canada.

SANI-ITA committed to providing services that meet or exceed approved designs, specifications and accepted industry practices. Our Corporation is technology driven and provides innovative solutions, high quality services and timely deliveries in the field of geomatics. The Corporation is ISO 9001:2008 registered.

Services offered by SANI-ITA include:

- Project Consulting
- Project Management
- Management of airborne and spaceborne data acquisitions missions
- Control surveys in support of geodetic or photogrammetric projects
- Hydrographic surveys
- Aerial triangulation of airborne and satellite data
- Digital Elevation/Terrain collection – automatic or static mode
- Orthoimagery
- Digital topographic mapping
- Digital map revision
- GIS data structuring
- Map conversion and data translation services
- Image compression services - MrSID, ECW and JPEG2000
- Quality assurance services
- Third party audits of mapping and imagery
- 3D Visualisations

For additional information on the Corporation, please visit our website at:

www.sani-ita.com
or contact us at
Tel: (905) 943-7774 FAX: (905) 943-7775

Technopole maritime du Québec

La mission de Technopole Maritime du Québec est de promouvoir et accélérer le développement du créneau des sciences, technologies et biotechnologies marines du Québec en assurant son rayonnement sur les scènes nationale et internationale, en offrant des services à valeur ajoutée aux membres du créneau et en soutenant l'avancement des projets prioritaires à long terme. De plus, Technopole Maritime du Québec a pour objectif de positionner son réseau comme leader au niveau québécois et canadien dans les secteurs d'excellence des sciences marines, des biotechnologies marines et des technologies maritimes afin d'y accélérer la création de richesse par la croissance et les nouveaux investissements dans les entreprises, institutions et organismes. Les actions de Technopole maritime s'inscrivent dans une volonté de mobiliser les forces vives du créneau des sciences et technologies marines, à savoir les institutions d'enseignement, les organismes de transfert, les installations et les laboratoires de recherche et, surtout, bon nombre d'entreprises qui vivent à l'heure de l'innovation technologique.

- Par ses actions de maillage et de réseautage, TMQ est l'animateur par excellence du domaine des sciences de la mer dans la région;
- Par ses actions de représentation, TMQ contribue au développement de liens d'affaires solides entre les acteurs de l'industrie des sciences de la mer au Québec et au Canada;
- Par ses actions de communication et de promotion, TMQ contribue au rayonnement et à la reconnaissance du domaine des sciences de la mer dans la région et à l'extérieure de celle-ci;
- Par son leadership, TMQ est à même d'identifier et de piloter des projets d'envergure qui sont rassembleurs pour la communauté des sciences de la mer de la région.

The mission of the Technopole Maritime du Québec (TMQ) is to promote and advance the development of marine sciences, technology and biotechnology in Quebec by increasing their visibility on both the Canadian and international stages, providing value-added services to the members of this niche sector, and supporting the progress of priority projects over the long term. Furthermore, the goal of the Technopole Maritime du Québec is to position its member network as the provincial and national leader in the marine sciences, biotechnology and technology sectors. Doing so will enhance wealth creation and attract new investments to the sector's industries, institutions and organizations. The Technopole's actions are driven by the will to mobilise the dynamic strength of the marine sciences and technology sector, namely the educational institutions, technology transfer organizations, research laboratories and facilities, and the numerous companies that are currently thriving through technological innovation.

- Through its communication and promotional strategies, TMQ contributes to the reach and recognition of marine sciences in the region, in Canada and around the world ;
- Through its representation work, TMQ contributes to the development of successful business relationships between actors in the marine science industry in Quebec and Canada ;
- Through its networking strategies, TMQ is an outstanding coordinator for the marine sciences sector in the region ;
- Through its leadership, TMQ is well-placed to identify and spearhead major projects that promote joint action in the regional marine sciences community.

For more information regarding technopol maritime du Québec please contact:

Laurent Bellavance
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Website: *www.tmq.ca*

Terra Remote Sensing Inc. (TRSI)

Terra Remote Sensing Inc. (TRSI) is a spatial data organization offering world-class expertise and technology for clients requiring fast, accurate, detailed and cost effective surveys. Our teams specialize in the acquisition and positioning of remotely sensed data in terrestrial and marine environments, and in the transformation of that data into a wide array of products to meet our client's needs.

TRSI was established in 1983 in Sidney, British Columbia as the West Coast subsidiary of Terra Surveys Ltd, based in Ottawa Canada. The company began by providing consulting, engineering, training and technical services in coastal and land-based resource studies, hydrography, marine geophysics and remote sensing. TRSI, a 100% employee-owned venture, was launched in 1999 to allow the company to further develop its technology and processes. Our new sensor technologies and associated applications are testaments to our innovation approach.

TRSI has over 50 dedicated full-time professionals that work on both national and international projects. Senior management is comprised of a core group of professional engineers and business specialists.

A highly qualified permanent staff of Geomatic Engineers, GIS Specialists, Mapping Technicians, Computer Programmers, Electronic Engineers, Hydrographers, Geophysicists and Surveyors comprise TRSI's multi-disciplinary team.

TRSI established a wholly owned subsidiary in Chile in late 2008. The Chile operation maintains a commercial office in Santiago and an operational office located in Carauma near Valpariso, in order to provide access to qualified staff.

Our wholly-owned US entity was established in 2009 as a sales office to provide a US base for our clients. Their focus is the Pacific Northwest region, which is a natural extension from our Sidney head office.

For more information regarding Terra Remote Sensing please contact:

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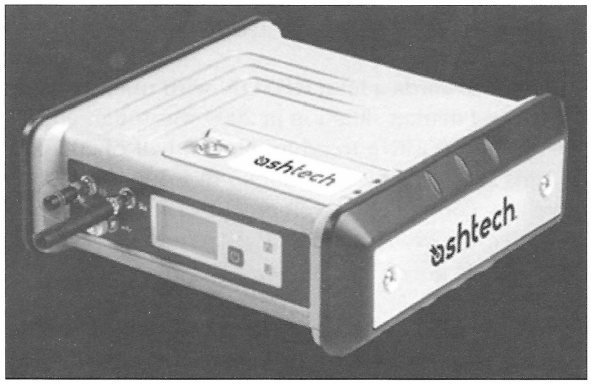
Website: *www.terraremote.com*

GEMINI POSITIONING SYSTEMS LTD

Ashtech Introduces ProFlex 500 Marine

Ashtech Announces the ProFlex™ 500 Marine for Precise Positioning and Coastal Surveying



New flexible rugged high-performance GNSS receiver

Nantes, May 20th, 2010 – Ashtech today announced the availability of the ProFlex 500 Marine, a powerful GNSS receiver for offshore and onshore positioning and surveying. Available in single- and dual-frequency versions, ProFlex 500 Marine delivers real-time precision ranging from the submeter to centimeter level, and is compatible with virtually all marine receivers, including Ashtech's (formerly Thales Navigation) industry-leading Aquarius and Sagitta receivers and third-party receivers.

ProFlex 500 Marine is the ideal solution for companies looking for a single GNSS receiver to perform multiple offshore and onshore applications. Its flexibility and high performance are highly beneficial to hydrography services, dredgers and other demanding marine RTK operations.

Vessel Positioning and Marine Surveying
Embedded BLADE™ technology applies multiple GNSS constellations (GPS, GLONASS, SBAS) to deliver fast real-time centimeter-level precision enabling users to work more accurately and economically. Designed for shipboard use, the ProFlex 500 is made to withstand harsh environments. Its high-impact strength aluminum housing resists harsh conditions, including salt mist, 100 percent condensing humidity, shock and vibration. The floating power input, the earth terminal and the optically isolated input/output signals ensure that your investment is reliable and safe in all conditions. Additionally the fast output rate, up to 20Hz, makes ProFlex 500 the ideal receiver for many types of demanding kinematic applications. The receiver offers long-range RTK capability, the latest Ashtech U-Link radios for dependable UHF communications, and dedicated mounting parts for easy shipboard installation.

On Shore Survey
Because the ProFlex 500 is easily adaptable to most any positioning application, including base station or rover, it is particularly valuable for dredging companies that perform coast and spoil surveying in addition to dredge positioning. Ashore the ProFlex 500 is highly versatile as either a rover or base station. Ashtech provides a backpack kit to make rover surveying with the ProFlex 500 a snap. With its instant real-time multi-data streaming capability, the ProFlex500 as a base station offers easy access to RTK corrections for real-time centimeter accurate survey and mapping. Its Internet connectivity provides NTRIP and Direct IP capabilities enabling users to build their own DGPS and/or RTK corrections server without any additional software or equipment, which can be particularly convenient on a construction site without an available RTN correction network. For more information on the ProFlex 500 Marine, visit www.ashtech.com

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Exclusive Canadian Ashtech Distributor
Gemini Positioning Systems Ltd
(See Corporate Member listing on page 53)

RESON

New Board Lead RESON® Into The Future

High level board of Directors takes over a well-prepared RESON
A recent change in RESON's board of directors will place Mr. Michael Brock as the new Chairman of the Board of Directors. Mr. Brock has a background as M.Sc in acoustics and comes to this position with a wealth of knowledge and experience including terms as CEO of BK medical, a world leader in development and production of diagnostic ultrasound systems, Divisional Director at Brüel & Kjær Sound & Vibration Measurement and President & CEO at GN Otometrics. Mr. Brock heads up an experienced and dedicated team to lead RESON into a bright future.

Final step towards a lean RESON with main focus on customer satisfaction
The general market situation in 2009 was tough on our market and in common with many companies in the industry RESON experience a positive trend in the first half of 2010. Kim Graven-Nielsen, Chairman of the Board until now is handing over the reins to Mr. Brock to continue this positive growth. Mr. Brock will continue to place emphasis on customer satisfaction as well as continuing development of leading edge technology which has placed RESON firmly as the market leader in innovative underwater technology solutions.

RESON A/S
The RESON group of companies consitst of RESON A/S and entities in Germany, US; Singapore, Holland and Scotland. The company is primarily owned by 3 major investors, all Danish private equity investors with solid financial foundation. RESON's CEO Kim Lehmann welcomes the new members of the board. Kim and the entire staff look forward to working with our new team members to ensure a bright future.

For more details contact RESON global marketing manager Mrs. Marianne Heidam: mhi@reson.com

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KONGSBERG

KONGSBERG integrated systems for NERC research vessel 15 October 2010

Delivery integrates hydroacoustics, research, navigation and maneuvering.

The new advanced 100m NERC research vessel, the RRS Discovery.
Kongsberg Maritime signed a contract with Freire Shipyard for supply of integrated systems to an advanced research vessel under construction at Spanish shipbuilder Vigo Yard for the UK's Natural Environment Research Council (NERC).

The new 100 m vessel, called RRS Discovery, was designed by Skipsteknisk, Norway and is due for completion summer 2013, at a total cost of £75 million. Within the scientific community, the new RRS Discovery is seen as state-of-the-art in terms of design and functionality.

Cutting-edge hydroacoustic instruments account for 80% of the Kongsberg systems on the new RRS Discovery. In co-operation with NERC, high levels of integration have been developed across the entire package, which includes:

- **Hydrography** – Deepwater MBES EM122 (1°x1°), medium water EM710 (2°x2°), singlebeam EA600 and sub-bottom profiler SBP120
- **Fishery Research** – EK60 multifrequency echosounder
- **Integration** – K-Sync synchronizing unit
- **Navigation** – K- Bridge Integrated Bridge System
- **Dynamic Positioning** – K-Pos and C-Joy
- **Video** – Marine CCTV

Kongsberg Maritime has also supplied hydrography systems to another research vessel at Freire Shipyard, for owner Qatar University.

Kongsberg Maritime is a supplier of integrated systems to advanced research vessels including NERC's RRS James Cook, the T-AGS 60 class survey vessels operated by US NAVOCEANO, the Alaska Research Vessel (ARRV), R/V Sikuliaq and US Coast Guard icebreaker Healy.

van Dyck, Sidney

On October 23, 2010, the hydrographic community was saddened with the news of the sudden passing of our friend and colleague Sidney van Dyck. Sid, at the age of 83, died peacefully at the Ottawa Civic Hospital after a brief stay following a fall at his residence.

Sid was born in Winnipeg, Manitoba in 1927 and lived in Steinbach, Manitoba until 1938 when his family moved to Germany and there he received his university education. In 1950, Sid returned to Canada and resided in the city of Ottawa.

Sid joined the Canadian Hydrographic Service as a junior hydrographer in January 1953. He did field duty on ships and shore parties on Lake Winnipegosis, Prince Edward Island, Eastern Nova Scotia, St. Lawrence Seaway, parts of Newfoundland, Eastern Arctic and off the island of St. Pierre and Miquelon until 1959.

In 1958 Sid began his involvement with hydrographic training while he continued his duties as a field hydrographer. He was Hydrographer-in-charge of the St Lawrence Seaway Survey in 1960 and 1961.

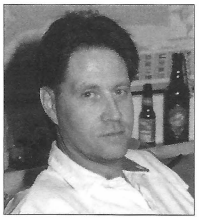
Training of the basic hydrography course became his full time occupation in 1962. This basic training program later became known as the Hydrography I Course. The Hydrography II Course was started in 1966 and this training also fell under Sid's responsibility. Sid remained active with the training section until 1977 when he was offered the opportunity for French language training. In 1978 Sid was transferred to the Nautical Geodesy Section where he remained until 1986 when he transferred to the Department of National Defense. Sid retired from the Public Service in 1988.

Sid was an active member of the Canadian Hydrographic Association for many years and was past Vice-President of the Ottawa Branch.

Sid's contribution to the Canadian Hydrographic Service will be remembered by many through his work in the Training Section. He influenced the lives of many new hydrographers in the classroom and while on training surveys, particularly those that were conducted in the Caribbean.

Sid may, however, be best remembered for his contribution to the Friends of Hydrography, a small group of volunteers dedicated to recording and preserving the historical highlights of Canadian hydrography. Following his retirement, Sid was a co-founder of the Friends of Hydrography web site and continued to maintain an active role in the organization until last year when traveling to and working at 615 Booth Street became somewhat of a challenge. The Friends of Hydrography web site would not exist, as it does today, without Sid's dedication and considerable contributions over many years.

Bockmaster, Steve



BOCKMASTER, Steven Gordon May 17, 1952 - January 17, 2011 Strong in spirit but afflicted by a weak heart, Steven G. Bockmaster passed away in his Grimsby home on January 17, 2011. His love and support will be missed by sons Andrew (spouse Jennie), Shaun (Alexandra) and Adrian (Missy); and Steve's only grandchild and sunshine, Ava. Steve is also survived by friend and mother of his children Michelle. He was the loving son of Marion and the late Gordon Bockmaster, dear brother to Linda Lehman (Mike), Carol Ziegler (Rick), Jan Bockmaster (Harvey Taylor), and Jennifer Karlsen (Mark). Steve will also be missed by best friend of 44 years Edwin Kling, and many nieces and a nephew. As a cartography graduate of Sir Sanford Fleming, Steve worked for the Canadian Hydrographic Service at the Canada Centre for Inland Waters for 33 years. He was an avid Green Bay Packers fan and cyclist who found peace exploring back-country roads and trails.

PACIFIC REGION

Desktop Mapping

I (Terry Curran) am implementing a web map server within the DFO firewall, to understand how the international web mapping standards may apply to CHS for provision of data services. Surprisingly, all of the software is freely available. Tests to date have included

- orthophotos in GeoTiff, MrSID, and ecw format
- coastlines as polygons and as polylines in shape format
- single beam and multibeam bathymetry from Caris in BAG format, and from Oasis montaj in GXF format
- construction of "image pyramids » with layers of increasing resolution as one burrows down to an area

It is possible to include S-57 data and sea floor classified polygons, but these have not been tested yet.

For the multibeam bathymetry and sea floor polygons, the motivation is to present and serve coarse resolution data, but seamlessly provide finer-resolution data upon demand for detailed examinations.

The advantage of the web map server approach is that data selection is via a graphical user interface, so no text identifiers are needed.

Security is often a concern. Inherent in the WMS is a security model based upon product types, services, and layers. It is difficult but not impossible to place a non-standard web page ahead of the WMS, or there is a complex security system that follows another international standard (XACML).

Allan Moore, Mike Sheward, and Ann Ballantyne have helped at critical junctures with programming issues.

Coastline

For the past several years, we have been refining some authoritative coastlines for BC. This was a project begun by Pete Wills. The motivation is that the non-navigation community needs a good detailed coastline that is not too large in file size.

Lately, we have been contracting to LGL Limited for critical quality control. The result to data has been three polygons in shape format – high water, low water, and foreshore. They have been developed as a HW-LW pair, so that the HW and LW lines do not cross.

Sea Floor Classification

Jim Galloway and Jim Parks had systematically processed multibeam acoustic backscatter data from the Strait of Georgia into sea floor type, with the assistance of Quester Tangent. Unfortunately, the two Jims have retired.

Since August, I have been processing some of the data from the north coast of BC, creating two product lines: clean backscatter and classified sea floor polygons. There is still a lot to do, but I have been impressed with the level of sophistication and automation of the software.

In late September, CHS acoustics experts from across the country had a chance to pool their knowledge, show what was being done regionally, and start the development of a national acoustics program with a short term focus on the sea floor and a long term focus on the mid-water. Like the web mapping initiative, this has the possibility of uniting CHS and oceanography for mutual benefit, and could present an enlightened vision of the future.

MVP-200 Procurement and Installation

I am shepherding the acquisition of a long-needed MVP-200 acquisition through the system, for year end delivery. It will be primarily used aboard the *Vector*, our in-shore multi-use vessel also used for surveying. It is expected to be used for science missions as well aboard the *Tully*.

In parallel, we are addressing the non-trivial task of providing a solid mechanical mount, power, and cooling.

Alan Thomson and Ralph Loschiavo have been of enormous assistance.

Metadata for DFO

I am starting a project sponsored by the DFO National Metadata Committee to document our science holdings with metadata. This is exciting because it may be possible to unite the oceanographic and hydrographic parts of DFO Science.

A draft version of the national science documentation was done for the country several years ago, but never came into widespread use. The new initiative on the west coast will start with the IOS Archive (the same system may be used in other regions), and develop comprehensive metadata. The hope is to create web map products, host them on the same desktop mapping server as above, and provide a comprehensive service. The production system may be regional or national.

Marketing Administrative Duties

As well as participation in the monthly teleconferences, we have created draft ISO documentation for the Marketing efforts. The basic need that was foreseen is to have processes for in-season management of activities, together with a more-thoughtful annual analysis of trends.

Significant input also went into the Marketing Annual Report, and into creation of a multiyear planning template.

Southampton Students

For the past decade, we have invited very bright oceanography students from the National Oceanographic Centre (United Kingdom) to visit the Institute of Ocean Sciences for two months, with the goal of gaining unpaid work experience in the ocean sciences.

This year was perhaps the most successful year. Seven students attended, and participated in such activities as tidal lab and field duties, seabed classification

processing, web mapping technology, documentation of oceanographic processes to ISO standards, plankton work, database work, analysis of the long term shallowing of the oxygen minimum in the northeast Pacific, analysis of rock samples from the Northwest Territories, and participating in a Orca awareness program with respect to noise and chemical pollution. All students had a field opportunity aboard the *Ricker* (biology) and the *Tully* (oceanography). Supervisors of all the students provided rave reviews of their performance.

French Coordination at IOS

I have been co-ordinating and participating in French Language training at IOS for a number of years. This is a popular program, in part because we have an excellent contract instructor that makes the 1.5 hours a weekly

CENTRAL REGION

CHS Central & Arctic Region, Data Acquisition Division October, 2010

The 2010 field season was in full swing with the UNCLOS Ice camp at Borden Island (back in Feb-May). HIC, Tim Janzen was accompanied by Jon Biggar to get things setup and operational with a dedicated crew of Mike Black, Gianni Di Franco, Rudy Cutillo, and Aaron Carpenter. Additional hydrographers from the other regions also joined the survey, Knut Lyngberg Pacific, Christian Comtois Quebec, and David Street from Atl/NL. Joe Manning from Atl/NL was also assigned to the camp.

The regular helicopter program collected 122 spot soundings and 60 Gravity readings due to poor weather. The technology feat was the operation of the Autonomous Underwater Vehicle (AUV) an intensely crewed operation by DRDC, ISE and some NRCan staff and contractors. CHS staff provided the infrastructure, remote Arctic experience and support to make the AUV efforts a success and to break new ground in hydrography.

The crew returned south in late May only to observe the Revisory Survey operations being conducted on Lake Ontario near Picton. Jason Bartlett and Tony Natolino integrated and tested the new R2Sonic 2022 multibeam sounder with a pole mount on the CSL *Curlew*. Both the CSL *Merlin* and the CSL *Curlew* were operational and collected data for 2 weeks lead by HIC Scott Youngblut. The program was interrupted by a priority job for CCG, the Waterways (dredging) Survey for areas on the Detroit River, St. Clair River, and St. Mary's River. The survey started May 25 and concluded July 19. August was used to process the data and prepare the plans. Jason received some training on Caris Beams for calculating volumes. TCWL section has provided excellent support for the vertical stepped datums to the survey through the work of David Dodd and for future work with a sloped datum.

A few large-scale surveys for the purpose of creating ENCs for docking facilities are driving this year's Revisory survey. Captain Tom Anderson, Seaway Marine Transport Inc (SMT) had provided client feedback reports, so work was intitated at Essroc, Port Hallowell, Thessalon, Trap Rock/ Bruce Mines, and local investigations will be conducted at Bronte-Oakville (Suncor) and Clarkson as time permits in closing off the season. Fred Oliff took over from Scott by mid-July and complete these final Revisory items and initiated another SMT request for Bowmanville docking facilities. These surveys were followed up by a Science study in Bronte area for Lake Ontario - Ecosystem Research Initiative and testing of the Great Lakes Laboratory for Fisheries and Aquatic Science (GLLFAS) laser optical phytoplankton counter with our Moving Vessel Profiler.

HIC, Andrew Leyzack returned to the Western Arctic aboard the CCGS *Sir Wilfrid Laurier* (*SWL*) working with Roger Cameron, Glenn Macdonald, and Glenn Toldi. Andrew's team (Ryan Battista, and Glenn Toldi) produced 3 ENCs incorporating their previous years survey work for Gjoa Haven, Taloyoak, and James Ross Strait with the help from the Data Integration Unit. This season they collected hydrography on an opportunity basis as secondary mission to *SWL* NavAids program. The crew also assisted Parks Canada on a 6 day mission to search for the Franklin ships *Erebus* and *Terror*. Mid-survey, the ship was re-tasked to address the MV *Clipper Adventurer* grounding. Three weeks of survey data was incorporated into a "Provisional" ENC to help the CCGS *Sir Wilfrid Laurier* and the 4 tugs in the salvage operations.

HIC Jon Biggar had a crew (Marcus Beach and Jim Weedon) on board the CCGS *Louis S. St-Laurent* conducting hydrography for UNCLOS in the Canada Basin. Again this year NRCan also collected seismic data and the ship rendezvoused and worked with the USCGC *Healy*. Over 10,000 line km of soundings were collected with 61 helicopter spot soundings.

Scott Youngblut wrapped up the season with a Science survey in the Bay of Quinte area based out of Kingston, while Jon Biggar completed a Science survey of Nanicoke Shoal, Lake Erie for Ontario Ministry of Natural Resources.

The data from some of these late season surveys was processed by the 2010 DA Course class in preparation of ensuring the students gain their prerequisite knowledge

of CarisHIPS and Notebook software prior to the Fall scheduled course. C&A students include Heidi Yu, Marcus Beach, Erica Vivian, John Mercuri, Natalie Stoveld, and teaching assistant Jason Bartlett.

Long Service Awards were presented to Al Koudys (35 Years), and Dave Willis (25 years) at the National Public Service Week ceremony. Some long standing CHS employees, Larry Toomer, CHS Mechanic, Brent Beale, Manager, Nautical Publications and Chris Gorski, Engineering Project Supervisor retired in May with 29, 32 and 38 year's respectively.

CHS Central & Arctic Region, Nautical Publications Division October, 2010

This year in the Arctic, CHS Central and Arctic produced the following Electronic Navigation Charts:
CA373394 - Dease Strait (7779)
CA373334 - James Ross Strait (7739)
CA573391 - Gjoa Haven (7788)
CA473365 - Broughton Island and Approaches (7184)
CA573335 - Sinclair Creek (7779)
CA573366 - Broughton Harbour and Landing Beach (7184)
CA573393 - Taloyoak (7770)

In addition 27 Notices To Mariners were issued in the Arctic this fiscal year.

In the Southern Region CHS C&A produced:
7 New Edition Charts completed (2205, 6423, 6425, 6426, 6427, 6431, 6432)
15 New Editions in progress (1434, 1550, 2029, 2085, 6408, 6409, 6414, 6433, 6436, 6437, 6438, 6441, 7310, 7950, 7292, 2283)
1 New Edition ENC in progress (473034)
1 patch completed (7685)
1 patch in progress (7777)
34 Notices to Mariners drafted for Paper Charts
6 Notices to Mariners drafted for Sailing Directions

Celebrate...

World Hydrography Day - June 21st

The United Nations, in its General Assembly Resolution A/60/30 of 29 November 2005, "Welcomes the adoption by the International Hydrographic Organization of the "World Hydrography Day", to be celebrated annually on June 21st, with the aim of giving suitable publicity to its work at all levels and of increasing the coverage of hydrographic information on a global basis, and urges all States to work with that organization to promote safe navigation, especially in the areas of international navigation, ports and and where there are vulnerable or protected marine areas."

OTTAWA BRANCH

To date, the Ottawa Branch activities have consisted of the following:

On April 07, a Pizza and Presentation lunchtime seminar was held. The presentation was given by Dr. Thomas Helzel, President of Helzel Messtechnik of Germany, manufacturers of the WERA HF radar system, and Mr. Jan Buermans, ASL Environmental Ltd the Canadian distributors of the WERA HF radar sensor system. The topic for the talk was "*The WERA Remote Ocean Sensing for Hazard Management and Environmental Protection*". This talk was very popular and many people attended this presentation.

On Thursday, June 17, the CHA presented a Brown Bag Lunch Video showing the documentary "*Le Naufrage Du Bernier & Frères*" or "*The Sinking of the Bernier & Frères*". In 1952, the *Bernier & Frères* (BF) sank, taking with her the ten members of her crew. This unique documentary involves many maritime experts, hydrographers, historians and divers. Images of the seabed allow families of the missing to turn the page on this tragic event that has haunted them for over half a century.

On October 18th, CHA sponsored a Science ADM lecture Series presentation by Andrew Lyzak titled, "*Western Arctic Survey - Kitikmeot Region 2010*" highlighting the key accomplishments from establishing the geodetic control points, to seabed surveys to chart production. 35 people attended this presentation. This talk attracted a number of new people from DFO headquarters at 200 Kent St. and from other departments.

Two more talks have been scheduled before the year end for this branch.
We are grateful to all the speakers for their time and efforts.

On October 27th, a potluck was held for all CHA members of the Ottawa branch for teambuilding, branch activity discussions and formulating innovative ideas for the following year.

In 2010, there were three Branch Executive meetings held on January 14th, March 3rd and September 17th.

Ottawa Branch Annual General Meeting

The Ottawa Branch Annual General Meeting was scheduled for Monday, November 29, 2010. The results of the elections for the branch executive members for 2011 were to be announced at this meeting.

ATLANTIC BRANCH

The Atlantic Branch sponsored a lecture in February, 2010. This was given by ODIM Brooke Ocean and it detailed several installation experiences with Moving Vessel Profilers, which are used in hydrography (among other things). June saw the Canadian Hydrographic Conference held in Quebec City. Several members from CHA Atlantic were in attendance. Also a going concern this year was the CHA website, with local vp serving as a member of the CHA web committee, and as a liaison with the web-developer. A formal training course is to be arranged to acquaint the CHA branch web 'reps' with the operation and updating of the site itself. The site was formally launched just prior to the CHC conference. The remainder of the year has been relatively quiet, but will be highlighted by the Annual General Meeting held on December 21, 2010.

SECTION DU QUÉBEC

L'Association canadienne d'hydrographie (ACH), Section du Québec, est constituée en corporation selon la Loi sur les compagnies, partie III du Québec (L.R.Q., chapitre C-38) et est un organisme sans but lucratif ayant pour but la promotion de l'hydrographie et des sciences de la mer s'y rapportant.

L'ACH, Section du Québec, a ses bureaux au local A-203A de l'Institut maritime du Québec (IMQ) à Rimouski. Ce local est offert gratuitement par l'IMQ.

Conseil d'administration

Le conseil d'administration de l'ACH, Section du Québec, élu lors de la dernière assemblée générale annuelle, est composé de Bernard Labrecque, vice-président, Pierre Pagé, trésorier, et Benoît Thibault, directeur.

Membres

La Section du Québec compte 10 membres et 3 membres corporatifs, soit le Centre interdisciplinaire de développement en cartographie des océans (CIDCO), la Technopole maritime du Québec et Reformar pour l'année 2010.

Employées

Madame Linda Grégoire agit à titre d'agente administrative à l'ACH, Section du Québec. Elle assure aussi le suivi quotidien des autres activités de la Section, soit les ventes au magasin de cartes marines et topographiques ainsi que les ventes des placements publicitaires et des copies du Carnet de Bord.

Madame Fannie Bernier a agit à titre de coordonnatrice à l'organisation de la Conférence hydrographique du Canada 2010 (CHC 2010) qui s'est tenue à Québec du 21 au 23 juin 2010. Elle a assuré la réussite de la CHC 2010 par un suivi serré avec les comités sous la responsabilité du Service hydrographique du Canada, le Centre des Congrès de Québec, Hospitalité Québec, les publicitaires et les différents fournisseurs de produits et services. Madame Bernier a terminé son contrat le 30 juillet avec la remise du rapport final de la CHC 2010.

ACH

Les activités annuelles de la Section du Québec ont été principalement concentrées sur la CHC 2010. Cette dernière conférence a permis à la Section du Québec d'accueillir deux nouveaux membres corporatifs (Technopole maritime du Québec et Reformar) et quelques nouveaux membres. Ces nouvelles adhésions seront mises à contribution l'année prochaine pour connaître leur intérêt afin d'élaborer d'un programme d'activités plus diversifiées et suscitées un recrutement éventuel.

La Section du Québec a continué sa collaboration en 2010 avec la revue Québec Yachting en fournissant des chroniques portant sur la CHC 2010 (2 fois) et sur l'ACH.

Une discussion est entreprise avec Québec Yachting inc. pour une collaboration spéciale dans le Guide des marinas qui paraîtra en 2011.

Magasin

La vente de cartes (marines et topographiques) et publications marines est demeuré stable comparativement à l'an passé. La vente des cartes marines est toujours sujette à la parution de cartes nouvelles et de nouvelles éditions dont notre clientèle utilise. On ne remarque aucun changement significatif au niveau des ventes pour les cartes topographiques. Pour augmenter les ventes, il faudra rechercher de nouveaux produits à offrir.

Carnet de Bord

Les revenus du Carnet de Bord 2010 ont légèrement augmenté par rapport à l'an passé. Quelques ventes ont été faites via la CHC 2010 parce que nous en profitions aussi pour présenter en détails l'ACH et son Carnet de bord.

C'était la dernière année d'une entente de trois ans avec le Regroupement des plaisanciers du Québec pour l'achat de 27000 copies à prix spécial et qui étaient distribuées dans leur réseau de publications. ; cela représentait une bonne occasion pour l'ACH de se faire connaître. Cette entente ne sera pas malheureusement renouvelée à cause de contraintes budgétaires de la part du Regroupement des plaisanciers du Québec. Le tirage du Carnet de bord 2011 sera de 2500 copies.

Conférence Hydrographique du Canada

La 36^{e} édition de la CHC 2010 s'est tenue au Centre des congrès de Québec du 21 au 23 juin 2010 et a été un franc succès. Près de 400 personnes provenant de 16 pays et 48 exposants commerciaux se sont rassemblées sous le thème de : « L'hydrographie : une science, des technologies et des gens au service du monde maritime ».

Le 21 juin, la CHC 2010 a souligné la Journée mondiale de l'hydrographie en invitant le grand public à visiter les bateaux hydrographiques amarrés au Bassin Louise ainsi que l'exposition commerciale. Il y a eu aussi un souper-croisière sur le bateau Louis-Jolliet pour les participants dont une présentation par notre invité spécial John Hughes Clark.

En plus d'être un succès au niveau de l'organisation et de la participation, la CHC 2010 a dégagé un surplus financier de 22 000 $ dont 20 000 $ ont été retournés à l'ACH, National, en accord avec l'entente sur l'administration des surplus financiers.

CENTRAL BRANCH

V.P. Roger Cameron will Chair the 2012 Canadian Hydrographic Conference. Planning for the upcoming conference began in June. The venue will be the Niagara Falls Convention and Civic Centre, currently under construction and scheduled to open in early 2011.

Brad Tinney, long time CHA member who spent 20 years with CHS retired after 35 years of service to Government of Canada.

Congratulations to Donald Kalley and wife Christiana who welcomed the arrival of Hudson Donald Kalley on March 3rd, 2010.

From mid Summer to early Fall, Fred Oliff was on assignment in Lake Ontario for CHS multibeam surveys in Clarkson, Bronte, Bowmanville and Kingston. Fred also acted as Client Liaison Officer for CHS Central and Arctic region and represented CHS at the Port Credit In-water Boat Show.

National President and Central Branch member George McFarlane attended the Canadian Institute of Geomatics (CIG) AGM in Fredricton N.B. on October 27th. The CHA is the Hydrography Committee for the CIG

From mid August to late September CHS hydrographers Andrew Leyzack and Roger Cameron were on assignment aboard the CCGS *Sir Wilfrid Laurier* in the Western Arctic. The survey included a joint effort with Parks Canada to search for the lost ships of the 1845 Expedition led by Sir John Franklin. Further information on the search and the team can be found on the Parks Canada website

http://www.pc.gc.ca/eng/culture/expeditions/erebus-terror.aspx

CHS launch *Kinglett* with hydrographer Roger Cameron survey the waters near the grounded *Clipper Adventurer*

The team also charted the waters around the *Clipper Adventurer*, a cruise ship which ran aground in Coronation Gulf. The ship was eventually re-floated and is scheduled to be repaired.

Seminars

Since the last issue of *Lighthouse* Central Branch has held three General Meetings and two Executive Meetings. No meetings were held in July and August as the branch is on hiatus for the summer.

- June: V.P. Roger Cameron gave a recap of CHC 2010, the Canadian Hydrographic Conference held in Quebec City from June 21-23.
- September: V.P. Roger Cameron gave a presentation on the CHS Western Arctic Survey
- October: The meeting was held at the Canada Centre for Inland Waters and focused on Branch business.
- October: Executive Meeting
- November: General Meeting scheduled for November 18th
- December: Annual General Meeting

The Annual General Meeting is scheduled for December 9th at Geraldo's Banquet and Conference Centre in Burlington

Membership

Branch

The Central Branch membership stands at 66. The branch is pleased to welcome new members David Dodd and Marta Krynytzky and Corporate Members Shark Marine Technologies and Blodgett-Hall Polar Presence LLC.

Corporate members are listed in each edition of *Lighthouse*.

Central Branch is honoured to include several special people in its membership: Earl Brown, Tom McCulloch, Ab Rogers and Sam Weller - Life Members; George Macdonald - Honorary Member and Rear Admiral Steve Ritchie - International Life Member.

The membership committee would like to thank all of its members for their continued support.

International

Central Branch of the CHA administers the International Members on behalf of the National Office. This committee helps to maintain contact with the CHA's 9 International members and ensures they have an opportunity to voice opinions and take part in CHA activities.

Surveyor on display at CHC 2010 in Quebec City

We encourage communication between our members abroad and are delighted when we receive news from them.

Admiralty Launch Surveyor

Admiralty Launch *Surveyor* was on display at the Canada Centre for Inland Waters on June 16 to promote World Hydrography Day. Surveyor was also was display at CHC2010 held in Quebec City, June 21-23. Surveyor also participated in a War of 1812 re-enactment at Fanshawe Pioneer Village in London, Ontario, October 2-3.

Summer BBQ

The Annual BBQ was held on Saturday July 10 at the Duller residence in Burlington. Attendance was up from last year likely due to the excellent weather. A good time was had by all. Thanks to Heimo and Leigh Duller for hosting this years BBQ.

CHC2010

The 2010 Canadian Hydrographic Conference was held in Quebec City from June 21-23.

Central Branch members Dale Nicholson, George McFarlane, Terese Herron, Michel Gougen and Roger Cameron attended.

Website

The CHA maintains a website that covers National and Branch information. The site is updated throughout the year for Branch activities as information becomes available. Christine Delbridge is now maintaining the Central Branch page of the CHA website.

Please direct your browser to http://www.hydrography.ca .

Central Branch VP Roger Cameron, National President George McFarlane and National Secretary Terese Herron in the CHA booth at CHC 2010

Friends of Hydrography

A Canadian Volunteer Group

We invite you to the Friends of Hydrography Web Site 'http://www.canfoh.org'

The Friends of Hydrography are a small group of both retired and current Canadian Hydrographic Service (CHS) employees who believe there is a need to record and preserve the historical highlights of Canadian hydrography.

Please browse the many pages of the site to get a sense of the history of Canadian hydrography and the Canadian Hydrographic Service (CHS). If you ever worked with the CHS, or had friends who did, search the site for their names. If you don't find the name please contact us. Also, if you have photographs of ships or launches, used at any time by the CHS we would be grateful if you would share them with us.

The site is the primary distribution vehicle for Friends of Hydrography and is a work in progress. The site has grown nicely since its inception in 1998 and new information is added on an opportunity basis.

Please feel free to contact us at (CANFOH@cogeco.ca) We would be delighted to hear from you. Your questions, comments, corrections and/or contributions to the site are welcomed.

Supported by and in collaboration with the Canadian Hydrographic Association and the Canadian Hydrographic Service

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The acceptance and positioning of advertising material is under the sole jurisdiction of the publisher.

L'approbation et l'emplacement de l'annonce sont à la discrétion de l'éditeur.

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LIGHTHOUSE is published twice yearly, in Spring and Fall. The closing dates are March 15th and September 15th respectively.

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.

RATES / TARIFS

All rates are quoted in Canadian Funds. Corporate Members receive a 10% discount.

Tous les tarifs sont en devises canadiennes. Les membres corporatifs ont droit à un rabais de 10%.

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LIGHTHOUSE publishes material covering all aspects of hydrography.

Authors submitting manuscripts should bear the following points in mind:

1. Submit a hardcopy complete with graphics including tables, figures, graphs and photos.
2. Submit digital files, one with text only and a separate file for each graphic (tables, figures, photos, graphs) in its original form or in .tif format (600 DPI). Photos may be submitted separately to be scanned. These may be submitted via E-mail or on CD ROM to the Editor.
3. Papers should be in either English or French and will be published without translation.

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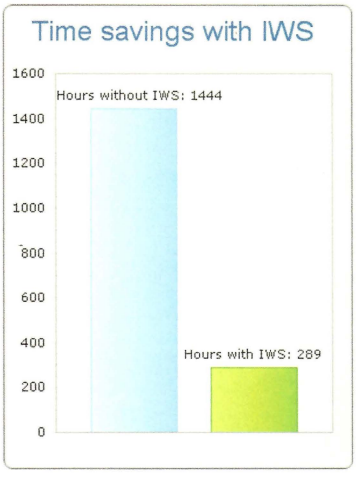

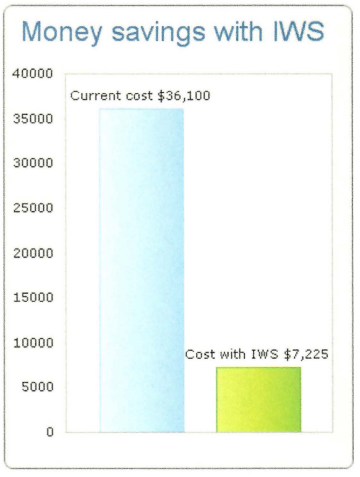

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