LIGHTHOUSE

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Conférence hydrographique du Canada 2010

Hydrography: A science, technology and people dedicated to the maritime world
L'hydrographie : une science, des technologies et des gens au service du monde maritime

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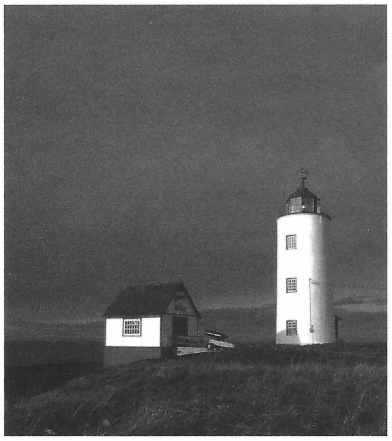


Île Verte Lighthouse

List of Lights: 1761.0
Chart: 1235
Position: 48 03 3.88N 69 25 2.27W
Nominal Range: 19NM

Photograph credit: Captain Jean Cloutier

Île Verte Lighthouse

The construction of Île Verte lighthouse began in 1806 to ensure the safety of the growing traffic in a particular treacherous section of the St. Lawrence Estuary at the mouth of the Saguenay Fjord. The tidal streams in this area, which can reach 7 knots at the ebb, are associated with strong tide rips and eddies. The lighthouse began operating in September 1809, making it the oldest lighthouse in the province of Quebec. It was designated as a national historic site in 1974 by Parks Canada. It also featured on a series of four stamps issued by Canada Post in 1984 illustrating significant historical lighthouses across Canada. The International Lighthouse Association published a book in 1998 listing the 100 most important lighthouses in the world and Île Verte was part of it. Today, a non-profit corporation manages the site and operates a B&B in the former lightkeeper's house and a museum in the foghorn house.

La construction du Phare de l'île Verte a débuté en 1806 afin d'assurer la sécurité du trafic maritime croissant dans une région particulièrement dangereuse sur l'estuaire du Saint-Laurent en face de l'embouchure du fjord du Saguenay. Les courants de marée dans le secteur, qui peuvent atteindre 7 nœuds au baissant, sont associés à de forts remous et des tourbillons. L'opération du phare a débuté en septembre 1809, constituant le plus vieux phare du Québec. Il a été désigné site historique national par Parcs Canada en 1974. En 1984, Postes Canada a publié une série de timbres des phares les plus significatifs historiquement ce qui incluait le phare de l'île Verte. Il est également apparu dans le livre publié par l'Association internationale des phares présentant les 100 phares les plus importants au monde. De nos jours, une corporation à but non-lucratif gère le site et opère un gîte dans l'ancienne maison du gardien de phare et un musée dans le hangar du cornet à brume.

directors/directeurs

Editor's Note / Note du rédacteur

This is the conference edition of *Lighthouse*, prepared as the companion to the Canadian Hydrographic Conference (CHC) 2010. It contains a preview of the conference, words of welcome, and a draft of the technical program. It also contains some very interesting articles, news and other features that are part of *Lighthouse*.

Producing a magazine, putting on a conference, or conducting hydrographic operations are similar in that they are all team efforts. It is not possible to mount much of an expedition all by oneself. Even if the survey is a fairly small one, those who support it are many. This is equally true when it comes to hosting a conference. There are steering committees, sub-committees, vendors, suppliers, venue staff, advertisers, and, most importantly, the presenters and delegates. Those who read this as they attend the conference in Québec City can bear witness to this. No matter how smooth and seamless the event is, one can be sure that there are always hurdles and challenges to overcome along the way.

Putting together a journal is equally a similar event. Especially in that it is the product of a team. The actual layout, the editing, the printing, and distribution are a series of coordinated steps; each relying on the efforts and skills of individuals. Their crafts serve to showcase the talents of those who make the edition what it is: the contributors.

The collection of papers is remarkable, both for their topics and for the quality of their writing. Contributions came in from around the country and around the world. Drs. Hall and Kristoffersen outline their hovercraft mission in support of Arctic geophysical research. David Dodd and Jon Griffin supply us with a paper that speaks of a topic that I am sure is of interest to many – using GPS derived heights and its implications for recovering vertical datums in a part of the world known for its large tidal range. Dr. Neale has kindly put together a piece from a flash presentation that he gave at FIG Hanoi on the need for and impediments to hydrographic capacity building in small states. Dick MacDougall provides an update on recent activities in the Canadian UNCLOS team's program, foreshadowing their talk at CHC 2010. Nick Stuifbergen has supplied an algorithm complete with code for the benefit of those who are active in the field of geo positioning. There is also branch news, corporate news and news from committees. The advertisers have new ads to portray their new products and many of them are here at the conference. There are also new profiles and more inside.

The remarkable part of this edition was how smoothly it seemed to come together. That is a credit to the team of teams who have contributed. To those at the conference, please use this magazine as an aid to this event. See how the sessions and vendors can help your team work better. To those at home, enjoy the magazine in and of itself. Know that we shall report on the proceedings in the next edition. To those of you, with something to say, with something to contribute, please accept this as your invitation to join the team. Let us help your plan come together.

Craig Zeller

Message from the National President
Mot du Président national

Greetings,

The CHC 2010 Conference Committee has been hard at work preparing a varied and interesting program and looks forward to welcoming all participants to Québec City in June for an enjoyable and stimulating conference. We look forward to celebrating World Hydrography Day as part of the conference on Monday, June 21st and to the opportunity to meet our national and international CHA members during the conference and at our AGM noon Tuesday, June 22nd. We invite all attendees to visit the CHA and THSOA Booths.

Congratulations to the new members of our National Executive Committee – we welcome Pacific VP Ken Halcro and National Treasurer Christine Delbridge. We look forward to working with them. Our heartfelt thanks to those who have served so well in the past – former Pacific VP Carol Novak and Treasurer Scott Youngblood.

Congratulations also to our hardworking committees. Special mention of the Hydrography Committee that has met regularly and through their efforts have produced an excellent public awareness pamphlet and the Website Renewal Committee that has worked very hard to have our website renovated and updated.

Congratulations also to the Association of Canada Land Surveyors who celebrated their 25th Anniversary during the recently held 6th National Surveyors Conference in St. John's, Newfoundland. In collaboration with the Association of Ontario Land Surveyors they have produced a 3 ½ minute video aimed at promoting the profession among young people and together with the Surveyor General of Canada Branch (SGB) have produced the NEW Property Rights Book "Surveys, Parcels and Tenure on Canada Lands" which will be available without charge, on-line, in both official languages, in time for the Fall CLS exams.

We extend good wishes to the Canada Council of Land Surveyors (CCLS) who will officially launch their transformation to become the member driven Professional Surveyors Canada (PSC) in September 2010.

In closing I encourage our members to become conversant with the provisions of the Labour Mobility Act – part of the Agreement on Internal Trade (AIT).

See you in Québec City!

Bonjour.

Le comité de la CHC 2010 a travaillé fort à préparer un programme varié et intéressant et se réjouit d'avance d'accueillir les participants en juin, à Québec, pour une conférence agréable et stimulante. La célébration de la Journée mondiale de l'hydrographie le lundi 21 juin qui fait partie intégrante de la conférence et notre AGA le mardi 22 juin sur l'heure du dîner donnent l'opportunité de rencontrer les membres canadiens et internationaux de l'ACH. Nous invitons tous les participants à visiter les kiosques de l'ACH et du THSOA.

Félicitations aux nouveaux membres du comité exécutif national, nous souhaitons la bienvenue au V.-P. Ken Halcro et à la trésorière nationale Christine Delbridge. Il nous sera très agréable de travailler avec eux. Nous remercions sincèrement Carol Novak, V.-P. section du Pacifique, et Scott Youngblood, trésorier, pour leur travail assidu pendant leurs termes.

Félicitations à nos comités pour leur entière implication. Une mention toute spéciale au comité de l'hydrographie qui s'est rencontré régulièrement et qui par leurs efforts a produit un excellent dépliant de sensibilisation pour le public et au comité pour le renouvellement du site internet qui a travaillé très fort à rénover et mettre à jour notre site.

Félicitations aussi à l'Association des arpenteurs des terres du Canada qui a célébré son 25e anniversaire dernièrement à la 6e conférence annuelle des arpenteurs tenue à St-John's, Terre-Neuve. Elle a produit en collaboration avec l'Association des arpenteurs de l'Ontario une vidéo de 3,5 minutes destiné à promouvoir la profession auprès des jeunes et ils se sont joint à l'Arpenteur général du Canada dans la production du nouveau livre sur les droits de la propriété « Surveys, Parcels and Tenure on Canada Lands » lequel sera disponible sans frais sur Internet, dans les deux langues officielles, pour l'examen des arpenteurs fédéraux cet automne.

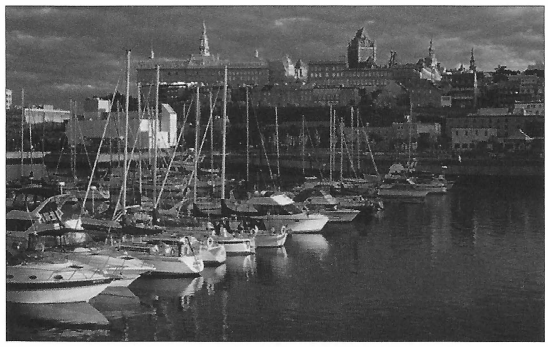
Nos bons vœux vont aussi au Conseil canadien des arpenteurs-géomètres qui inaugureront leur transition en devenant le membre dirigeant des Arpenteurs professionnels du Canada en septembre 2010.

Pour terminer, j'encourage nos membres à se familier avec les dispositions de la Loi sur la mobilité de la main-d'œuvre qui est parti intégrante de l'Accord sur le commerce intérieur.

Au plaisir de vous voir à Québec!

George McFarlane, National President / président national

La ville de Québec accueille la Conférence hydrographique du Canada 2010



L'Association canadienne d'hydrographie en collaboration avec le Service hydrographique du Canada de Pêches et Océans Canada est fière d'organiser la 36ième édition de la Conférence hydrographique du Canada qui se tiendra cette année du 21 au 23 juin 2010 au Centre des Congrès de Québec. Le cocktail de bienvenue ainsi qu'un atelier offert par ESRI ouvriront l'événement le dimanche 20 juin. L'événement offrira l'occasion à quelques 400 membres de la communauté hydrographique internationale de se rassembler sous le thème : « **L'hydrographie : une science, des technologies et des gens au service du monde maritime** ».

« Grâce à un programme complet composé de conférences, d'ateliers de formation, d'une session d'affichage, d'une exposition et de démonstrations à bord de bateaux hydrographiques, un tel rassemblement est une merveilleuse occasion de promouvoir le développement de l'hydrographie et de la cartographie marine au Canada. Cet événement permettra aussi de faire connaître les nombreux volets du travail d'un hydrographe.» explique George McFarlane, président national de l'Association canadienne d'hydrographie.

« En tant que chef de file en matière d'hydrographie, le Service hydrographique du Canada de Pêches et Océans Canada, est heureux de collaborer à cette conférence. Ceci permettra d'informer et de rapprocher les professionnels et les usagers de l'hydrographie ; cette science qui contribue à la sécurité et l'efficience des voies navigables canadiennes, à définir les limites territoriales sous-marines, à réduire les risques naturels du milieu marin et qui permet d'étendre les connaissances du vaste écosystème marin. Cette conférence permettra un échange d'idées pour relever les défis et identifier des opportunités pour faire avancer la science de l'hydrographie dans un monde en constante évolution. » souligne le Dr. Savithri Narayanan, Directrice générale et Hydrographe fédérale, Sciences océaniques et Service hydrographique du Canada.

L'ouverture officielle de cette année coïncidant avec la Journée mondiale de l'hydrographie, décrétée par l'ONU et sous l'égide de l'Organisation Hydrographique Internationale, la CHC 2010 soulignera cette journée mondiale en faisant valoir l'importance de l'hydrographie auprès du grand public. Pour ce faire, le grand public sera invité à visiter, au cours de l'après-midi du lundi 21 juin, l'exposition ainsi que des bateaux hydrographiques de la Garde côtière canadienne amarrés dans le Bassin Louise du port de Québec.

Sessions techniques

Les thèmes traités lors des sessions techniques et de la session d'affichage porteront sur :

- La délimitation de la frontière maritime (UNCLOS)
- Les affaires, carrières et formation
- L'hydrographie écosystémique
- L'acquisition des données
- Les systèmes de référence horizontaux et verticaux
- La navigation moderne (navigation électronique)
- La diffusion des données
- Le traitement des données
- La production cartographique

Les conférences présentées lors des sessions techniques seront accessibles à tous les participants grâce à un service d'interprétation simultanée.

Une session d'affichage sera également présentée dans la salle d'exposition pendant les 3 jours de la conférence. Les auteurs seront invités à présenter leur affiche pendant les pauses du dîner, selon un horaire établi, pour répondre aux questions ou pour discuter de leur présentation.

Ateliers de formation

Des ateliers de formation gratuits d'une journée et de demi-journée seront présentés le dimanche 20 juin ainsi que le mardi 22 juin. La compagnie ESRI ouvrira la série en offrant un atelier d'une journée complète le dimanche sur l'utilisation d'un système d'information géographique (SIG) qui repousse la portée de vos activités marines et hydrographiques.

Des ateliers de demi-journées seront offerts le mardi 22 juin en après-midi. La compagnie CARIS présentera un atelier sur la gestion de données bathymétriques avec la technologie SGBDR. Pendant ce temps, le groupe de discussion international sur l'assurance de qualité des données hydrographiques tiendra son 9ième atelier international de gestion de l'incertitude. La compagnie HYPACK Inc. offrira également un atelier sur ses nouveautés 2010. Finalement, la compagnie Chesapeake offrira un atelier sur le SonarWiz5, la prochaine génération de logiciels de cartographie du fond marin.

Exposition

Une exposition réunissant une cinquantaine d'exposants commerciaux et institutionnels internationaux aura également lieu durant les trois jours de la conférence. Ceci permettra aux congressistes et au grand public de découvrir les nouvelles technologies utilisées dans le domaine de l'hydrographie.

Voici la liste des exposants à jour au moment d'aller sous presse :

Aanderaa Data Instruments
Applanix
Atlas Maridan ApS
CARIS
C & C Technologies
Chesapeake Technology Inc.
CIDCO
CMC Electronics Esterline
Coden Hydrographic Survey boat
Edgetech
ESRI
Fugro
Garde côtière du Canada
Gemini Positining System
Hoskin Scientific Ltd
HYPACK Inc.
IIC Technologies
IVS 3D, Atlis, SevenCs
IXSEA Inc.
Knudsen Engineering Ltd
Kongsberg
Université Laval
Leica Geosystems Ltd
McQuest Marine Sciences Ltd
MosaicHydro Ltd
Odim Brooke Ocean
Quality Positioning Services Inc.
Reformar Inc / Seaforth Geosurvey Inc.
RESON
R2Sonic
ROMOR Ocean Solutions
Sciences océaniques et Service hydrographique du Canada
Shark Marine Technologies
Ship Motion Control
Technopole maritime du Québec et l'Observatoire global du Saint-Laurent
The Hydrographic Society of America
Triton Imaging Inc.

Programme social

Le comité organisateur a planifié des activités sociales qui agrémenteront la conférence. Le cocktail de bienvenue du dimanche soir se déroulera au mess des officiers de la Réserve Navale de Québec et sera assorti d'activités spéciales soulignant le 100e anniversaire de la Marine Canadienne dont une visite du Musée naval de Québec qui présente une nouvelle exposition : *Méandres : mémoires du Saint-Laurent en guerre*. Pour clore la Journée mondiale de l'hydrographie du 21 juin, les participants auront la chance d'embarquer à bord du Louis-Jolliet, bateau restaurant réputé pour un « souper-croisière » qui se déroulera sur le majestueux fleuve Saint-Laurent. La soirée des exposants, animée d'un spectacle haut en couleurs, se déroulera dans la salle d'exposition de la conférence et permettra à tous les participants d'échanger dans une ambiance détendue. Le comité organisateur invite également les participants de la CHC 2010 à poursuivre leur séjour dans la magnifique ville de Québec qui offre de nombreux attraits dont les festivités de la Fête Nationale du Québec, un spectacle du Cirque du Soleil ou encore le Moulin à images, immense projection extérieure gratuite sur l'histoire de Québec.

Partenaires

Le comité organisateur tient à exprimer ses plus sincères remerciements à tous ses précieux partenaires qui, par leur apport essentiel, ont contribué à la mise en oeuvre de la Conférence hydrographique du Canada 2010. Grâce à eux, l'événement est assuré d'un véritable succès.

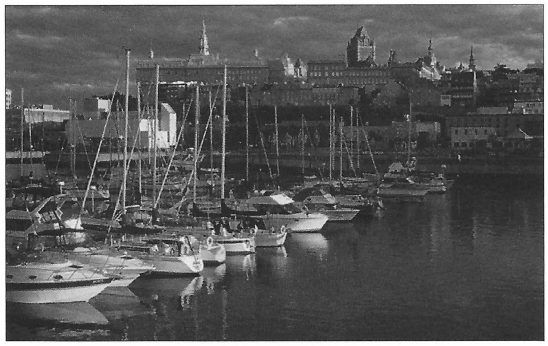
Merci à nos partenaires :
Amiral : Kongsberg Maritime
Commodore : ESRI
Capitaine : CARIS

Autres partenaires :
IIC Technologies
Fugro
Association des Arpenteurs des Terres du Canada
Ordre des arpenteurs-Géomètres du Québec
CIDCO
Corporation des pilotes du Bas-Saint-Laurent
The Hydrographic Society of America

Partenaires medias:
Lighthouse
International Ocean Systems
Sea Technology
Hydro International
The Journal of Ocean Technology
Professional Mariner
Maritime Magazine

Pour plus d'informations concernant la CHC 2010, consultez le site Web de l'événement : **www.chc2010.ca** ainsi que son profil Facebook (CHC2010) et sa page Twitter.

Québec City Welcomes the Canadian Hydrographic Conference 2010



The Canadian Hydrographic Association in collaboration with the Canadian Hydrographic Service of Fisheries and Oceans Canada is proud to be holding the 36th edition of the Canadian Hydrographic Conference which this year will be held at the Québec City Convention Centre from June 21 to 23. The event will open on Sunday, June 20 with an Icebreaker reception and a workshop offered by ESRI. The conference will bring together some 400 members of the international hydrographic community to explore the theme: **Hydrography: Science, technology and people dedicated to the maritime world**.

The National President of the Canadian Hydrographic Association, George McFarlane explains that "Through a comprehensive program consisting of lectures, workshops, poster sessions, exhibition and demonstrations on board hydrographic ships and launches, such a gathering is a wonderful opportunity to promote the development of hydrography and nautical charting in Canada. This event will also help communicate the many facets of the work of a surveyor and hydrographer."

"As a leader in hydrography, the Canadian Hydrographic Service of Fisheries and Oceans Canada is proud to collaborate with this Conference. This event is an opportunity to inform and engage the professionals and users of hydrography which contributes to safety and efficiency of navigation, enables delineation of maritime boundaries, contributes to mitigation of marine natural hazards and expands knowledge of the vast marine ecosystem. This Conference will be a dynamic exchange of ideas, challenges and opportunities for the science of hydrography in this rapidly evolving world." says Dr. Savithri Narayanan, Ocean Sciences and Canadian Hydrographic Service, Director General and Dominion Hydrographer.

Since this year's official opening will coincide with World Hydrography Day—established by the United Nations and under the umbrella of the International Hydrographic Organization—. The CHC 2010 will celebrate this world day by raising public awareness about the importance of hydrography. To this end, the public will be invited to visit the trade show and hydrographic vessels of the Canadian Coast Guard moored in the Port of Québec City's Bassin Louise during the afternoon on Monday, June 21.

Technical sessions

The themes covered during the technical sessions and poster session will deal with the following issues:

- Delineation of maritime boundaries (UNCLOS)
- Business, Careers and Training
- Ecosystemic Hydrography
- Date Acquisition
- Horizontal and Vertical Datum
- Modern navigation (e-navigation)
- Data Dissemination
- Data Processing
- Chart Production

All conference attendees will be able to enjoy the presentations during the technical sessions since a simultaneous translation service will be provided.

There will also be a poster session in the exhibit hall during the three days of the conference. The authors will be invited to present their posters during the lunch breaks, according to an established schedule, during which time they will be able to discuss the content and answer any questions.

Training workshops

On Sunday, June 20 and Tuesday June 22, there will be free one-day and half-day training workshops. ESRI will kick off the series by offering a full-day workshop on Sunday on using geographical information systems (GIS) to advance marine hydrographic objectives.

Half-day workshops will be offered on Tuesday, June 22. CARIS will present a workshop on managing bathymetric data with RDBMS technology. At the same time, the informal discussion group on data quality assurance in hydrography will be holding the 9th Annual International Uncertainty Management Workshop. Also, HYPACK Inc. will be offering a workshop entitled Best of HypackÒ 2010. Finally, Chesapeake Technology will be offering a workshop on the theme SonarWiz 5: Next generation sea-floor mapping software.

Trade show

A show featuring displays by some fifty commercial exhibitors and international institutions will also be held during the three days of the conference. This will give conference attendees and the public the opportunity to find out about the latest technologies used in the field of hydrography.

Here is the most recent list of exhibitors:

Aanderaa Data Instruments
Applanix
Atlas Maridan ApS
CARIS
C & C Technologies
Chesapeake Technology Inc.
CIDCO
CMC Electronics Esterline
Coden Hydrographic Survey boat
Edgetech
ESRI
Fugro
Canadian Coast Guard
Gemini Positining System
Hoskin Scientific Ltd
HYPACK Inc.
IIC Technologies
IVS 3D, Atlis, SevenCs
IXSEA Inc.
Knudsen Engineering Ltd
Kongsberg
Laval University
Leica Geosystems Ltd
McQuest Marine Sciences Ltd
MosaicHydro Ltd
Odim Brooke Ocean
Quality Positioning Services Inc.
Reformar Inc / Seaforth Geosurvey Inc.
RESON
R2Sonic
ROMOR Ocean Solutions
Oceans Science and Canadian Hydrographic Service
Shark Marine Technologies
Ship Motion Control
Technopole maritime du Québec and St Lawrence Global Observatory
The Hydrographic Society of America
Triton Imaging Inc.

Social program

The organising committee has planned a number of social activities to add to the enjoyment of conference attendees. Sunday evening's Icebreaker reception will take place at the Québec City Naval Reserve Mess; the evening will feature some special activities to celebrate the 100th anniversary of the Canadian Navy, including a visit of the Naval Museum of Québec which has a new exhibit: *Meanders: Memories of war on the St. Lawrence.* To close World Hydrography Day on June 21, participants will have the opportunity to board the *Louis-Jolliet*, the well-known restaurant ship, for a dinner cruise on the majestic St. Lawrence River. The exhibitors' evening, with its colourful and exciting entertainment, will be held in the conference exhibit hall where all participants will be able to meet in a relaxed and friendly atmosphere. The organising committee also invites CHC 2010 participants to extend their stay in magnificent Québec City, which offers numerous attractions like the festivities organised to celebrate the Fête Nationale du Québec, a Cirque du Soleil performance or the Image Mill, a vast—and free—outdoor screening of images showcasing the history of Québec City.

Partners

The organising committee would like to express its most sincere thanks to all its greatly appreciated partners whose contributions have played an essential role in the organisation of the Canadian Hydrographic Conference 2010. Thanks to them, the event is sure to be a fine success.

Thanks go to our Partners:
Admiral : Kongsberg Maritime
Commodore : ESRI
Captain : CARIS

Other Partners:
IIC Technologies
Fugro
Association of Canada Land Surveyors
Ordre des arpenteurs-géomètres du Québec
CIDCO
Corporation of Lower St. Lawrence Pilots
The Hydrographic Society of America

Medias Partners:
Lighthouse
International Ocean Systems
Sea Technology
Hydro International
The Journal of Ocean Technology
Professional Mariner
Maritime Magazine

For more information about CHC 2010, please visit the event Web site at www.chc2010.ca , it's Facebook profile (CHC2010) and it's Twitter page.

A Note on Building Hydrographic Surveying Capacity in Small Island Developing States (SIDS)

By: David Neale, Hydrographic Surveyor and Coastal Area Planner, Caribbean

[This paper represents a summary of a presentation delivered by Dr. Neale at the FIG Regional Conference held in Hanoi, Vietnam 19-22 October 2009.]

For many resource-constrained countries, particularly those that are Small Island Developing States (SIDS), the establishment and/or maintenance of hydrographic surveying capacity is an issue that is mired in ignorance, uncertainly and poor experiences. Despite the many efforts of the International Hydrographic Organisation (IHO) and the aid and support by developing countries, there are few successes. Increased awareness of the potential threats associated with Climate Change and increased use of marine space for human activity however push SIDS to again consider their hydrographic surveying needs and options.

The recent experience of capacity building in some areas of Caribbean development suggest that (i.) a managed communication strategy (ii.) the adoption of modern technology and (iii.) the pursuit of structured training are likely to offer some useful approaches to capacity building. Once initiated, these efforts can be supported by the capacity building initiatives of the IHO.

Introduction

The IHO Approach to Capacity Building

The issue of building hydrographic surveying capacity in coastal States are a central focus of the International Hydrographic Organisation (IHO). The IHO website[1] and the documents that can be assessed at that site, offer clear guidance to the organisations objectives. The IHO maintains a strong emphasis on capacity building through a well thought out approach that admits to the sense that 'one cap does not fit all.' The IHO approach is often suggested to SIDS. It is a three-stage strategy that provides interested States with the opportunity to self-determine its constraints and hydrographic survey requirements. States may then pursue capacity building that is consistent with these self-determined requirements and constraints, with IHO support or with that of other supporting agencies. A small State could, for example, decide that its requirements do not include the need for a hydrographic office that produces charts but rather an office that receives, archives and manages the dissemination of hydrographic data. That State could choose to affiliate itself to a larger hydrographic office in anearby jurisdiction. Hydrographic capacity building is therefore self-managed, self-determined, resource-minded and with plenty of room for change as local requirements evolve and or resources become available.

Challenges Faced By SIDS

Even with the flexible and enabling approach promoted by the IHO, there are many coastal States, in particular SIDS, whose response to almost any kind of reference to building hydrographic capacity is one of quiet indifference. Three main issues seem to inform that indifference: (i.) ignorance of the benefits of hydrography, (ii.) ignorance of a useful capacity building strategy and (iii.) the institutional memory of a bad experience.

Ignorance of The Benefits of Hydrography

Many States are generally unaware of the benefits, economic and otherwise, of establishing and maintaining some level of hydrographic surveying capacity. This is perhaps understandable for a number of reasons. In the Caribbean, for example, hydrography has not always been part of the university syllabus of the mainly land surveying graduate who currently leads survey departments and units under which hydrographic surveying tends to exist. The level of awareness associated with bathymetric survey techniques, technology and hydrographic data management is, at best, basic. By comparison, the increasing attention that is paid to land administration in the training of surveyors can overshadow attention to hydrography within the university curricula. While the importance and critical nature of land administration is not to be underestimated, some level of exposure of the

[1] www.iho-ohi.net

surveying student to hydrographic surveying is important. Unfortunately, hydrographic training and professional development opportunities are, in general, not easily available in SIDS and thus requiring the expenditure of scholarships and other forms of funding that would allow travel abroad.

Ignorance of a Useful Capacity Building Strategy

Despite the IHO attempts at communicating its capacity building strategy even through area conferences and area/regional meetings, the level of meaningful participation and understanding by SIDS seems weak. Indeed there is little follow-up or action towards capacity building after the single delegate returns from such meetings and workshops. In general, take up by SIDS is less that was expected.

Institutional Memory of a Bad Experience

The other issue often evident in SIDS is the difficulty of overcoming the institutional trauma of a bad experience of a recent attempt at hydrographic surveying capacity building. About twenty-five (25) years ago, both Jamaica and Trinidad and Tobago, two of the larger English-speaking Caribbean States were involved in substantial attempts at establishing hydrographic services as part of the survey agencies of these States. The approach included the foreign training of hydrographic surveyors, employment of consultants and the purchase of very expensive survey boats and hydrographic survey equipment. For a variety of reasons both ventures ended with very limited success and a clear institutional memory that seems well set against any further resource investment in hydrographic surveying capacity building.

Pursuing Alternative Approaches

More recent concerns that are driven by a growing awareness of climate change (in particular, sea level rise), urbanization (and its associated potential impacts), natural disasters and increased use of marine spaces for a variety of human activity are forcing SIDS to re-visit hydrographic capacity building. However, the debate remains largely in the arguments and discussions among small groups of champions: champions being persons who are prepared to strongly encourage or promote a stated cause or action. In the face of such circumstances the question faced by these champions who are interested in promoting the building of hydrographic survey capacity is -

'Are there alternatives or alternative approaches to the establishment of the traditional hydrographic office?'

Within the Caribbean region the suggestion is 'yes'. This response is based on the relative success of other capacity building programmes in other areas, within the region. Good examples include the on-going work in Barbados to build coastal zone management capability[2] and the establishment of the land management capability in Jamaica[3] and environmental management capability in the Republic of Trinidad and Tobago[4]. In each of these examples, the capacity building process drew on three (3) main approaches that are identified here as i.) talk, ii.) technology and iii.) training.

Talk

In terms of hydrographic capacity building, talk includes the need to communicate at all levels about the need for hydrographic surveying capacity building. In particular the need to communicate through a variety of media to politicians, industry leaders, marine professionals, coastal residents, coastal users and the larger community about hydrography and the benefits that can be derived from it. In Barbados the coastal zone management proponents sought representation on a wide variety State agency boards in the hope of influencing any decision associated with a potential application of hydrographic surveying. The technique is clearly supported by representation at local conferences and workshops through which the hydrographic surveying message may reach a wider perhaps more influential audience. Talk therefore requires a kind of professionalism, patience and tenacity that must be developed in hydrographic survey professionals.

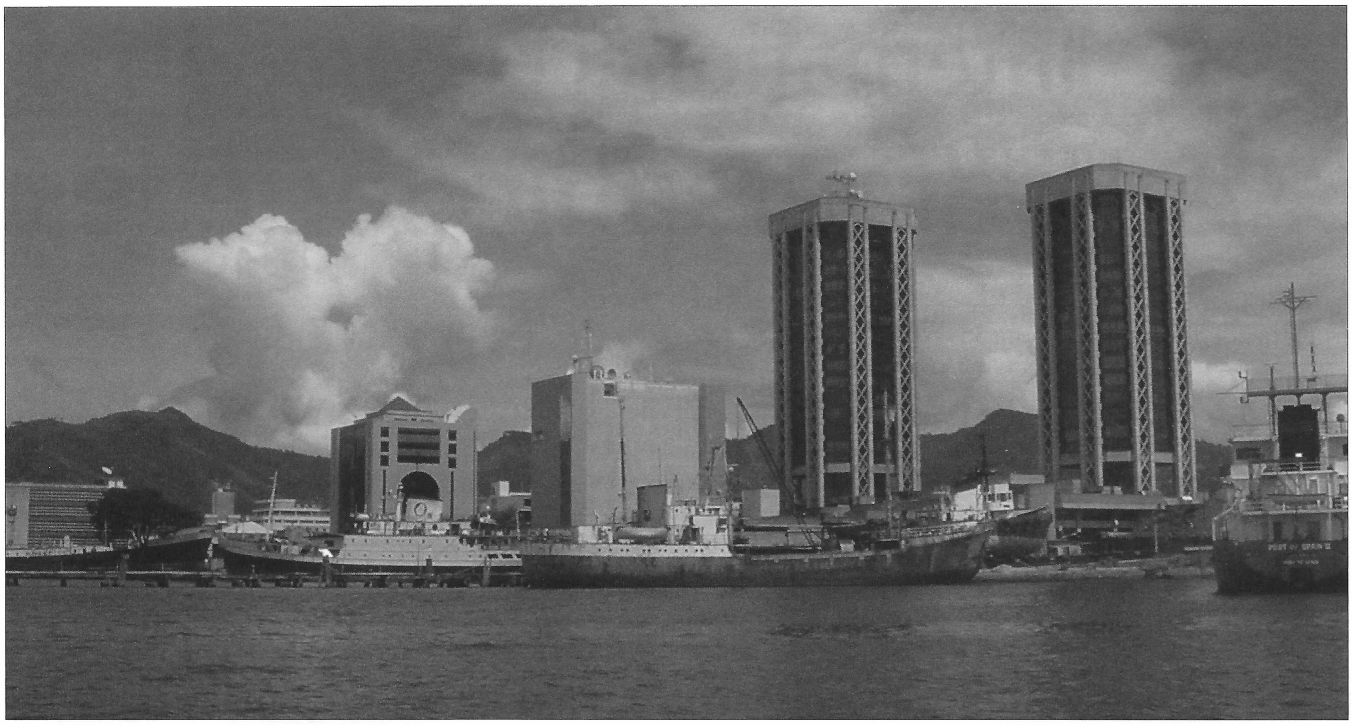
Technology

Over the last 20 years, there have been significant advances in technology that are offer significant benefits to SIDS including significant reduced costs and effort. These technological advances include increased access, accuracy and reliability of global satellite navigation systems, GIS for nautical charting and acoustic sonar systems. These technological advances have the potential to increase the out-sourcing base by encouraging local private enterprise in hydrographic surveying; leaving State agencies to focus data management, contracting, quality control and data distribution services. The National Land Agency in Jamaica for example, has systematically moved towards an e-land tool for the electronic distribution of its now digital products. No doubt such technological approaches must be informed by debates on a philosophy for cost recovery, data liability and data access issues.

Training

The technological fast-forwarding of any agency's capability puts tremendous pressure on professionals within that system to be sufficiently trained to manage and operate that system. In the case of hydrographers, that training is not just in traditional hydrographic surveying but also in a wide array of skills and skill sets that may not have been part of a traditional hydrographic surveying programmes. Change management, leadership, information technology, contract management, procurement and data management are examples of some of the 'new' skills that the modern hydrographic surveyor may have to include in his or

[2] www.coastal.gov.bb
[3] www.nla.gov.jm
[4] www.ema.co.tt



Cargo vessels at the city port of Port of Spain: an indication of increasing use of marine space and the associated urbanisation of coastal areas

her continuous professional development package. The training structure that is to be adopted is a critical and important step towards capacity building but one that should be measured and budgeted for as part of the wider capacity building programme.

Assistance in Hydrographic Surveying Capacity Building

The above approaches are not without some challenges. Firstly they assume the staying power of champions, even in the face of potentially big disappointments and attractive career changes. This is a challenge that is a common feature in SIDS and well understood by those involved in any development scenario in a SIDS. The Barbados Coastal Zone Management programme for example required a more than 30-year sustained effort in order to establish a formal Coastal Zone Management unit within Barbados national law.

Secondly these approaches require the availability of initial guidance and support. Here the IHO presents perhaps the best opportunity for small states to get such initial advice and guidance. That guidance and support is offered by the IHO's capacity building programme. No doubt, the national hydrographic and charting offices of larger states such as the United Kingdom, the United States, Canada, Australia and New Zealand remain willing to assist SIDS that are prepared to begin by assisting themselves.

Conclusions

Despite many inherent challenges, the need to build hydrographic surveying capacity in SIDS remains real and present. Increased awareness and concern for Climate Change and its potential impacts as well as increased use of marine spaces for human activity continue to drive such needs.

The Caribbean experience with capacity building suggest that those States interested in building capacity in hydrographic survey are likely to find success by developing and encouraging professionals who are prepared to openly pursue talk, technology and training as key approaches. Further any initial guidance and support may be drawn from the IHO capacity building programme across the world.

About the Author...

Dr. David Neale is a hydrographic surveyor and a coastal area planner who practises in the Caribbean. He holds academic qualifications in hydrographic surveying and urban and regional planning.

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A Five-Star Solution For The GPS Fix

By: Nick Stuifbergen, Canadian Hydrographic Service

This describes a novel method of computing GPS fixes by solving linear equations based on data from 5 or more NavStar satellites. The calculation yields a non-ambiguous unique direct solution, useful for a "cold start" initialization. Mathematical formulae with derivations, numerical examples and Fortran code are included. Key words: 1. InfraStructure Protection, 2. Position Fixing, 3. Radionavigation, 4. Urban Radiolocation, 5. Homeland Security, 6. GPS/NavStar, 7. New Closed-form Solution.

Disclaimer and Caution Note

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.

Caution Note

This software has not been thoroughly tested for applications in the Southern hemisphere, nor for applications in the vicinity of longitude 180 degrees, around the International dateline, and neither for projects that straddle the Equator or the Poles.

Acknowledgement

Acknowledged and appreciated is the time worked in the Navigation Group, at the Bedford Institute of Oceanography, headed by Mr. R.M. Eaton. This work experience led to an interest and awareness of positioning by hyperbolic navigation systems, mainly Decca, Loran-A and Loran-C, with an unexpected outcome of application to GPS.

Appreciation is also due to co-workers in the Canadian Hydrographic Service, including Geomatics Support, and to BIO library staff. This work was carried out in the Canadian Hydrographic Service, under the emeritus provisions of the Department of Fisheries and Oceans (Canada).

1.1 Introduction

This report is to present an idea for a new direct algorithm for the position fix by NavStar satellites of the Global Positioning System. (GPS)

It is based on solving linear equations derived from 5 or more measured pseudo-ranges. The advantage is a GPS fix, in a direct (non-iterative and unambiguous) solution, that does not need an approximate start value for the position, and so might be suitable for a "cold start" system initialization.

To demonstrate the algorithm, a simplified model of GPS has been set up for a simulation, exercised in Fortran Code. Simplification consists of:

1. Satellite positions given in rectangular geodetic XYZ coordinates, to bypass the conversion of orbital parameters into XYZ satellite coordinates.
2. Measured pseudo-ranges assumed to be fully corrected for ionospheric and tropospheric effects, so as to focus only on the geometric aspects of the problem.

Simulated data are given in units of kilometers to six decimal places, i.e. rounded to the nearest millimeter. Pseudo-ranges are generated for a test point, also given in XYZ co-ordinates, and then processed by this linear equation solution, to simulate a GPS position, computed in XYZ, that reproduces the original test point.

It is well known that measurements on four NavStar satellites are the minimum needed for a GPS fix. By using signals from 5 satellites, this simpler solution by linear equation emerges. More than 5 satellites yield an overdetermined solution for a minimum variance (best-fit) result.

Main Ideas

1. By recognizing the hyperbolic geometry resulting from taking range-differences of measured pseudo-ranges, the common synchronization constant is eliminated. Synch errors cancel.
2. By applying the plane cosine law to the space triangle, a linear equation emerges, in four unknowns.
3. By taking in an extra NavStar satellite (5 instead of 4), the four triangles provide four equations in four unknowns.
4. By solving linear equations for the four unknowns, a direct (non-iterative) fix solution by GPS is obtained.
5. The A2R and R2X subroutines enable an effective solution of systems of linear equations.

This GPS solution method does not need an initial lat-long point, as required for starting the usual iterative process. Thus this direct method might be suitable for a "cold start" initialization.

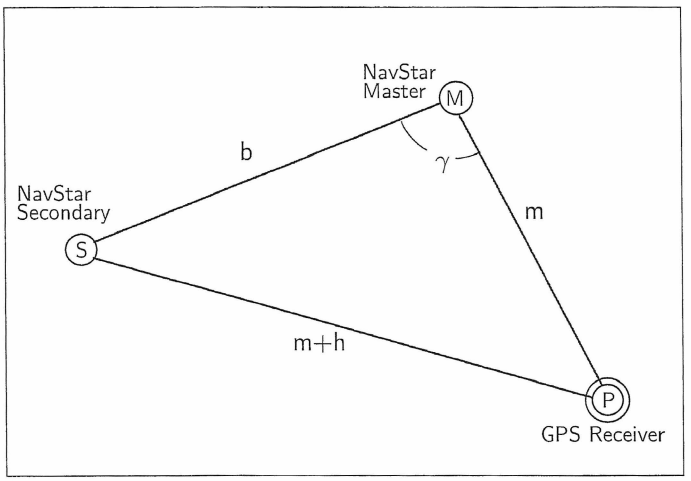
Purpose

The purpose of this write-up is to communicate an idea, somewhat incomplete and probably new, for computing positions by GPS, based on signals from NavStar satellites in space.

In this journal (*Lighthouse*) the report contents are not subjected to scrutiny by an editorial review. This is an advantage for rapid dissemination of ideas, to a very widespread and diverse readership, among whom there will be a some technical professionals directly involved with GPS development. In effect these individuals become the reviewers/referees.

Technical specialists employed in GPS development work are invited to make full use of this material.

2.1 Data Equation Formation



Notation
h (km) = pseudo-range difference: (Secondary) - (Master)
b (km) = length of baseline vector $\vec{b} = (b_x\, b_y\, b_z)$
m (km) = length of radial vector $\vec{m} = (m_x\, m_y\, m_z)$
$\vec{n}$= unit vector, aligned with $\vec{m}$, $= (n_x\, n_y\, n_z) \cdots = \vec{m}/|\vec{m}|$
a_{ij} = coefficients of linear equations
x_j = unknowns of solution vector

Plane Cosine Law applied to Space Triangle M-P-S:

$$(m+h)^2 = m^2 + b^2 - 2m\,b\cos\gamma$$
$$2mh + 2mb\cos\gamma = b^2 - h^2$$
$$h + b\cos\gamma = (b^2 - h^2)/2\,m$$
$$b\cos\gamma = -h + (b^2 - h^2)/2m$$
$$b\cos\gamma = b\left(\frac{\vec{b}\,.\,\vec{m}}{|\vec{b}||\vec{m}|}\right) = \vec{b}\,.\,\vec{n} = b_x\,n_x + b_y\,n_y + b_z\,n_z \qquad \cdots \text{ vector dot product for cosine}$$

$$\underbrace{-b_x}_{a_{11}}\underbrace{[n_x]}_{x_1} \quad \underbrace{-b_y}_{a_{12}}\underbrace{[n_y]}_{x_2} \quad \underbrace{-b_z}_{a_{13}}\underbrace{[n_z]}_{x_3} \quad + \underbrace{(b^2 - h^2)}_{a_{14}}\underbrace{[1/2m]}_{x_4} = \underbrace{h}_{w_1}$$

A linear data equation in 4 unknowns x_j: $\quad a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + a_{14}x_4 = w_1$

This data equation represents a hyperboloid surface in space, with axis of symmetry on the baseline b, i.e. a hyperbola of range difference h, rotated around the baseline axis.
With the direction unit vector $\vec{n} = (n_x\, n_y\, n_z)$ and the distance $m = \overline{MP}$ kilometres, the point in space is located on the surface of the hyperboloid with a range-difference of h km.

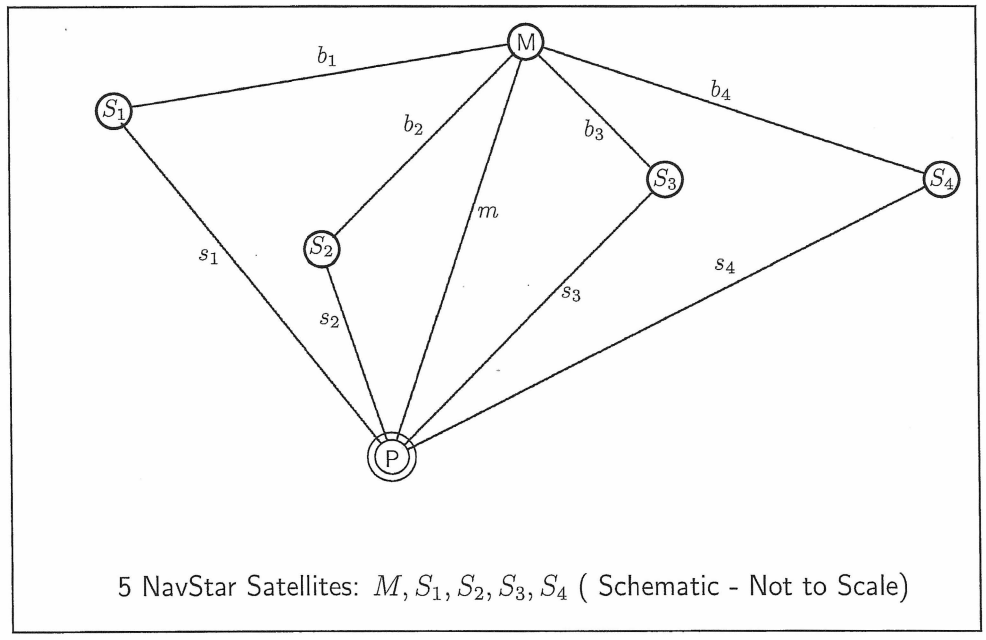
2.2 Equations for GPS Position Fix

The data equation is modified by a scaling factor c = 1000km, to improve numerical presentation by computer.

$$\underbrace{-\left(\frac{b_x}{c}\right)}_{a_{11}}\underbrace{[n_x]}_{x_1}\ \underbrace{-\left(\frac{b_y}{c}\right)}_{a_{12}}\underbrace{[n_y]}_{x_2}\ \underbrace{-\left(\frac{b_z}{c}\right)}_{a_{13}}\underbrace{[n_z]}_{x_3}\ \underbrace{+\left(\frac{b-h}{c}\right)\left(\frac{b+h}{c}\right)}_{a_{14}}\underbrace{[c/2m]}_{x_4}=\underbrace{h/c}_{w_1}$$

There are 4 unknowns in this equation, the distance m in kilometres, and the direction vector of $\overline{MP} = (n_x\, n_y\, n_z)$.

With four triangles M-P-S_i (i=1,4), there are four linear equations to solve, for the four unknowns that define a single solution point.
This point is at the intersection of the four hyperboloid surfaces.
Note that three surfaces in space normally intersect at a single point.
A fourth surface would not intersect exactly, due to data error in the measurements. Something like a three-dimensional equivalent of the "cocked hat" misfit triangle would occur (a tetrahedron misfit figure ??), with the fix somewhere inside.



5 NavStar Satellites: M, S_1, S_2, S_3, S_4 (Schematic - Not to Scale)

It is well known that a conventional GPS fix requires pseudo-ranges received from a minimum of four NavStat satellites. With 5 satellites as above, we have four triangles in space, by which a solution by 4 linear equations emerges, a solution which is direct and unique (non-ambiguous), perhaps suitable for a "cold start" initialization.

Packed array Aw transformed to upper triangular R

Aw is A-matrix augmented with column vector w
Using compact subroutine A2R , the 5 × 5 packed array Aw is transformed into an upper triangular form R, then unknowns x_j are solved by back-substitution.
A2R also works for overdetermined solutions, e.g. 4 unknowns in 5 or more equations.

$$\underset{\text{Aw}}{\begin{bmatrix} a_{11} & a_{12} & a_{13} & a_{14} & \vdots & w_1 \\ a_{21} & a_{22} & a_{23} & a_{24} & \vdots & w_2 \\ a_{31} & a_{32} & a_{33} & a_{34} & \vdots & w_3 \\ a_{41} & a_{42} & a_{43} & a_{44} & \vdots & w_4 \\ 0 & 0 & 0 & 0 & \vdots & 0 \end{bmatrix}} \Longrightarrow \boxed{\text{A2R}} \Longrightarrow \underset{\text{R}}{\begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & \vdots & r_{15} \\ 0 & r_{22} & r_{23} & r_{24} & \vdots & r_{25} \\ 0 & 0 & r_{33} & r_{34} & \vdots & r_{35} \\ 0 & 0 & 0 & r_{44} & \vdots & r_{45} \\ 0 & 0 & 0 & 0 & \vdots & r_{55} \end{bmatrix}}$$

The Fortran code shown for A2R is a combination in condensed code of the least-squares formulation, combined with the transformation into a triangulized ("echelon") form.
Then this is readily solved by back substitution in bottom-up sequence.

Back substitution to solve for x_j:

$$x_4 = r_{45}/r_{44} \qquad x_3 = (r_{35} - r_{34}\,x_4)/r_{33} \qquad x_2 = (r_{25} - r_{23}\,x_3 - r_{24}\,x_4)/r_{22}$$

$$x_1 = (r_{15} - r_{12}\,x_2 - r_{13}\,x_3 - r_{14}\,x_4)/r_{11}$$

$c\,r_{55}$ is the length of the residual error vector $= \sqrt{v^t v}$, an indication of inaccurate data, in an otherwise stable solution.

R2X is a Fortran subroutine that performs the back substitution. Rather than attempting to understand the large body of least-squares theory, plus the factorization method used to form the triangular echelon form R of the set of equations, it is simpler and more effective to familiarize with A2R and R2X by numerical experiments.

Tests are done by running A2R and R2X code on samples of equations with known answers. With known answers on 4 or more equations in 4 unknowns, simulation exercises can provide the familiarity and confidence to use A2R to solve any given set of linear equations effectively. More than 4 equations is 4 unknowns, an overdetermined case, will yield a best-fit solution. See also page 17 for Fortran code.

To compute XYZ coordinates of fix at P:

$$(n_x\,n_y\,n_z) = (x_1\,x_2\,x_3) \qquad m = \frac{c}{2\,x_4}$$

$$X_p = X_m + m\,n_x \qquad Y_p = Y_m + m\,n_y \qquad Z_p = Z_m + m\,n_z$$

Worked numerical examples are shown on pages 18 and 19.

2.4 Conclusion

Some novel ideas are presented for the GPS fix algorithm, a direct solution applicable to the entire space around the globe.

Perhaps it would be most useful in the initial signal acquisition phase of receiver operation. Technical professionals tasked with GPS development are invited to make full use of the material, and possibly carry the ideas forward into improved positioning of the Global Positioning System. ⊞

A.1 A2R Subroutine Fortran

```
*A2R
c...+....1....+....2....+....3....+....4....+....5....+....6....+....7....+....8
      SUBROUTINE A2R(NDA, A,M,N, NCZ, NDR,R )
C     ==============
C     -- triangulize A[M,N] into R[N,N] upper triangular
C     -- A[M,N] preserved
C     -- Note matrix A includes vector w in column n
C     -- NCZ = number of columns to be zeroed, NCZ .eq. N
C     -- NDA = Allocated row space for matrix A
C     -- NDR = Allocated row space for matrix R

         IMPLICIT NONE
      INTEGER NDA,M,N, NCZ, NDR, I,J,K
      REAL*8 A(NDA, N), R(NDR,N)
      REAL*8 SUM, RII

C     -- clear R[ ]
      DO 50 I=1,NDR
      DO 50 J=1,N
         R(I,J)=0
   50 CONTINUE

C     -- zero out NCZ columns of A into R
      DO 100 I=1,NCZ
      DO 100 J=I,N
         SUM=0
         DO 110 K=1,M
            SUM=SUM + A(K,I)*A(K,J)
  110    CONTINUE

         DO 120 K=1,I1
            SUM=SUM - R(K,I)*R(K,J)
  120    CONTINUE

         IF ( J .eq. I) THEN
            RII=SQRT( ABS(SUM) )
            R(I,I)=RII
         ELSE
            R(I,J)= SUM/RII
         ENDIF
  100 CONTINUE

      RETURN
      END
```

A.2 R2X Subroutine Fortran

```
*R2X
c...+....1....+....2....+....3....+....4....+....5
      SUBROUTINE R2X( NDR, R,N,X, Err)
C     ==============
C     -- solve for X by back substitution
C     -- NDR = dimension of allocated row space in matrix R

      IMPLICIT NONE
      INTEGER NDR,N,I,J
      REAL*8 R(NDR,N), X(N)
      REAL*8 Err, Sum

      Err= R(N,N)          ! misfit measure indicated
      DO 100 I= N-1,1, -1
             Sum= R(I,N)
             DO 110 J=I+1, N-1
  110           Sum = Sum - R(I,J)*X(J)
             X(I)= Sum/R(I,I)
  100 CONTINUE

      RETURN
      END
```

A.3 Fortran Notes

IMPLICIT NONE is non-standard Fortran, that requires all variables to be declared, so that misnamed variables are detected at complilation stage.

All Floating point variables are in double precision. (REAL*8)

Variable names chosen to resemble mathematical notation, where possible.

Matrix notation used for the compact expressions, for Fortran arrays that describe systems of linear equations, e.g. Aw and R.

B.1 Numerical Example on 5 Satellites

Xp	Yp	Zp	(km)
2033.000	-4078.000	4448.000	Receiver pt

Phi,Dlon,H = 44.501006274572 -63.502428363236 45.733874915168
Lat 44 30 03.6226 Lon -63 30 08.7421 Ht 45.734 m

Satellite Data generated

#	Xsat	Ysat	Zsat	PseudoRange (km)	
1	18057.0	-8420.0	1743.0	16820.777776	<-- Sat S1
2	16427.0	-7660.0	8452.0	15363.917990	
3	12817.0	-5976.0	14142.0	14624.318651	<-- Sat M
4	7660.0	-3572.0	18126.0	14798.879991	
5	1579.0	-736.0	19923.0	15838.267108	<-- Sat S4

5 Satellites

#	Bx	By	Bz	Baseline B	Hyperbola H (km)
1	5240.0	-2444.0	-12399.0	13680.860243	2196.459126
2	3610.0	-1684.0	-5690.0	6945.794123	39.599339
3	-5157.0	2404.0	3984.0	6945.942773	174.561341
4	-11238.0	5240.0	5781.0	13681.016227	1213.948458

4 Baselines

A-matrix coefficients: c = 1000

	1	2	3	4	w
1	-5.240000	2.444000	12.399000	182.341504	2.196459
2	-3.610000	1.684000	5.690000	47.697049	0.739599
3	5.157000	-2.404000	-3.984000	48.215649	0.174561
4	11.238000	-5.240000	-5.781000	185.696534	1.213948

Numerical Example on 5 Satellites (continued)

R-matrix coefficients

	1	2	3	4	5
1	13.906006	-6.484274	-12.298573	86.858150	0.026116
2	0.000000	0.001161	6.696152	186.177065	1.926807
3	0.000000	0.000000	6.269782	173.563781	1.778040
4	0.000000	0.000000	0.000000	0.872197	0.029820
5	0.000000	0.000000	0.000000	0.000000	0.000000 128

127.864942 = Error in mm. R(5,5)

	Nx	Ny	Nz	x(5)
x(j)=	-0.737401874	0.129783826	-0.662868489	0.341896270E01

Distance MP = m = 14624.318651 km

Xp	Yp	Zp (km)	Position of P
2033.000000	-4078.000000	4448.000000	P test point given initially
2033.000015	-4077.999969	4448.000000	Position of P by GPS algorithm

34.68 mm error in P

Computed GPS position reveals fine agreement with given position of P

GPS Fix by Iteration Method (Check)

R-matrix coefficients

	1	2	3	w
1	0.557055	-0.270179	-0.729465	0.346431E-06
2	0.00	0.019394	0.439514	-0.644826E-06
3	0.00	0.00	0.007072	-0.574651E-09
4	0.00	0.00	0.00	0.935746E-12

Xp	Yp	Zp (km)
2032.9999999983	-4078.0000000040	4448.0000000002

B.2 Numerical Example on 9 Satellites

```
   Xp             Yp             Zp          Given
2033.000000   -4078.000000    4448.000000    Receiver pt (km)

Phi,Dlon,Ht= 44.501006274572      -63.502428363236  45.733874915168
         Lat 44 30 03.6226   Lon -63 30 08.7421 Ht 45.7338 m

 Data generated for Test on 9 satellites
I     Xs        Ys        Zs     Pr pseudoranges (km)
-------------------------------------------
1  18057.0  -8420.0   1743.0  16820.777776  <- Sat S1
2  17508.0  -8164.0   5176.0  16021.891430
3  16427.0  -7660.0   8452.0  15363.917990
4  14848.0  -6923.0  11471.0  14887.604878
5  12817.0  -5976.0  14142.0  14624.318651  <--Sat M
6  10396.0  -4848.0  16383.0  14593.727899
7   7660.0  -3572.0  18126.0  14798.879991
8   4691.0  -2187.0  19318.0  15223.591725
9   1579.0   -736.0  19923.0  15838.267108  <--Sat S8

      Bx        By        Bz       BaseLine    H hyperboloid
-----------------------------------------------------------
1   5240.0  -2444.0 -12399.0  13680.860243   2196.459126
2   4691.0  -2188.0  -8966.0  10352.873079   1397.572779
3   3610.0  -1684.0  -5690.0   6945.794123    739.599339
4   2031.0   -947.0  -2671.0   3486.547146    263.286227
5  -2421.0   1128.0   2241.0   3486.503406    -30.590751
6  -5157.0   2404.0   3984.0   6945.942773    174.561341
7  -8126.0   3789.0   5176.0  10352.747123    599.273074
8 -11238.0   5240.0   5781.0  13681.016227   1213.948458

R-matrix coefficients - C= 1000 km
-----------------------------------------------
1    8.513600     -3.970583   -16.258860   -189.861561   -2.507072
2    0.0           0.001216     2.351428     65.356708    0.675992
3    0.0           0.0          2.962607     81.063835    0.807724
4    0.0           0.0          0.0           0.310484    0.010615
5    0.0           0.0          0.0           0.0         0.000000 164
                                                    163.6 =Error in mm.
Solved x(j)= -0.737401855   0.129783865   -0.662868487,  14624.318669 = m
      Xp           Yp           Zp
 2033.000000   -4078.000000   4448.000000  P xyz given test values
 2033.000283   -4077.999402   4448.000005  P xyz by the 5-star algoritm
                  661.2 = total position error (mm) in computed P.

This numerical result demonstrates, that the A2R & R2x method
also works for overdetermined solutions, here for 9 satellites.
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Readers Note

This is a draft technical report for an unpublished document collection.

CALENDAR OF EVENTS

- Canadian Geomatics Conference / ISPRS Commission 1 Symposium, Calgary, Alberta, June 14-18, 2010
- Canadian Hydrographic Conference, Québec City, Québec, June 21-23, 2010
- Advisory Board on the Law of the Sea Conference, IHB, Monaco, October 25-27, 2010
- International Hydro Conference and Exhibition, Rostock-Warnemunde, Germany, November 2-5, 2010
- United Stated Hydrographic Conference, Tampa, Florida, April 25-28, 2011
- F.I.G. Working Week, Marrakech, Moroccoo, May 18-22, 2011
- ACLS 7th National Surveyors Conference, Yellowknife, Northwest Territories, June 22-24, 2011

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

A Hovercraft For Marine Geophysical Work Off Canada's Northernmost Frontier

By: John K. Hall, Geological Survey of Israel (retired)
Yngve Kristoffersen, University of Bergen, Norway

We have constructed a polar hovercraft, convinced that a platform which can travel over sea ice of any thickness can successfully serve smaller research missions. This craft, the *R/H SABVABAA*, is a Griffon 2000TD hovercraft with nominal 2200kg payload. It is completely equipped to carry out marine geophysical surveys, such as bathymetry and both deep and shallow seismic profiling, in order to allow geological sampling by means of corer and dredge. The craft also has equipment for the measurement of ice thickness, and oceanographic casts to 500m. The concept has been successfully tested during the last two seasons with missions north of Svalbard (viz. http://www.polarhovercraft.no).

Background

Although Canada has done an excellent job of mapping the seabed off its Atlantic, Pacific and western Arctic coasts, its northern Arctic deep offshore remains one of the world's least studied areas. And based upon what little is known from the meandering tracks of scientific drift stations, it is one of the Arctic Ocean's most interesting places.

The Alpha-Mendeleyev Ridge begins some 100km north of Ellesmere Island, and in a somewhat dogleg fashion extends some 1900km over to the eastern Siberian shelf off Wrangel Island. It is by far the largest of the three ridges which cross the deep Arctic Basin. Although its height of 2-3km is only about a third the height of the Himalayas, it is almost twice as wide, and covers 10% more area. The half north of Canada is called the Alpha Ridge after drifting Ice Station Alpha that discovered it during the IGY in 1957-8, while the half off Russia is named after Dmitri Mendeleyev, formulator of the Periodic Table. The border between the two is a supposed abyssal gap discovered by Russia's North Pole 8, and named the Cooperation Gap during the Cold War.

What little we do know about the area north of Ellesmere is fascinating. Because of the thick multiyear ice surrounding northern Greenland and Ellesmere down to the Sverdrup Islands, the area up to 500km off Ellesmere is known only from the drift of Fletcher's Ice Island (T-3) from 1968-74, the 53 day operation of the Canadian CESAR camp and its two satellite camps in 1983 (Jackson et al., 1985), Hobsons' Choice in 1984-6, and subsequent short-lived ice camps such as in GreenICE in 2004-6. The object of our fascination was as follows:

1) Ice Station T-3 had two programs operated by the USGS and Lamont-Doherty Geological Observatory which routinely raised piston cores from the seabed. These almost random samplings account for three of the oldest cores from the Arctic, the fourth being Core 6 from CESAR. Three of them date to the Late Cretaceous up to 70 million years ago.

2) Seismic profiles obtained from a home-built Lamont seismic profiler operated intermittently from T-3 showed that over an area estimated at 200 by 600km, the upper 150-500m of the ~1km thick blanket of sediments observed over the Arctic Basin was severely disturbed. The cause of the disturbance could only have come from above, suggesting a catastrophic event such as an asteroid impact (Kristoffersen et al., 2009).

The Hovercraft Concept

In 2003 we met in Bergen to study the previously unanalyzed seismic data from the 1971-1974 T-3 drift (Hunkins and Tiemann, 1977). As the implications of a possible asteroid impact sank in we concluded that we must return to this most inaccessible area with a research platform that would allow relatively inexpensive mobility, inhabitability, and flexibility in studying this area in detail. The solution we arrived at was a hovercraft that could traverse both water and ice. This was a rehash of a 1995 proposal unsuccessfully pitched to the European Community. In the interim hovercraft, like the one we would build, had been shown to be extremely useful, operating in the Arctic (Prudhoe Bay and in Greenland), the northern Baltic (a dozen in local coast guards), and even in Antarctica (McMurdo Sound in the 1980s). The decade delay in implementation brought about instantaneous GPS navigation, worldwide Iridium satellite communication, as well as tremendous improvement in electronic equipment with crucial decreases in weight and power needs.

Figure 1: The research hovercraft R/H Sabvabaa crossing an open lead on the ice pack north of Svalbard over the Yermak Plateau. Inset: The project logo.

The R/H Sabvabaa

The hovercraft chosen was a 2000TD Mark II, built by Griffon Hovercraft Ltd. (now Griffon Hoverwork Ltd.) in Southampton, UK. It was given the name *R/H Sabvabaa*, after the Inupiaq word for "flows swiftly over it". The *Sabvabaa* (Figure 1) is 12m long with a 73cm obstacle clearance. The craft is powered by a water-cooled Deutz 440hp diesel engine, in common use throughout northern Europe. Internal fore-and-aft fuel tanks hold 450 liters, with a transfer pump maintaining active trim. Four extra fuel tanks on the side decks provide an additional 1500 liters of fuel. While diesel fuel is our main operational umbilical, the consumption is minimal compared with all other modes of transport. In sea trials, the craft attained a maximum speed of over 43kts, with full payload. The economical cruise "sweet spot" is between 16-28kts with 60l/hr fuel consumption, monitored by a GPS-linked NavMan-Diesel-3200 fuel management system. Thus with usage of 1.5–2 liters/km the craft has covered as much as 1340km without refueling. About 40% of the engine power is used for the lift fan, with ground loading of about 0.05 bar. Thus, 60% of the power is available to the ducted, two meter diameter variable-pitch propulsion propeller. The engine has a very large alternator as well as a hydraulic pump, supplying energy to two battery banks as well as hydraulic implements such as an air compressor, CTD and coring winches, 15cm ice drill, and 90cm chain-saw. The nominal 2000TD payload is 2200kg, above its 5000kg empty weight. Experience shows that payloads of 3200kg do not affect performance and additional increases over sea-ice for short hauls are quite likely.

The hovercraft was specially designed for Arctic conditions. It has double windows and 5cm of insulation. Its main cabin is configured with two bunks/settees, computer workspace, and kitchenette. A 1.5m deep after cabin provides two fold-down bunks, a head, and second gull-wing access door, and serves as an interlock to operations that can be carried out in an attached tent enclosure over a hydro-hole etc. Baseboard heat is supplied while underway, and two economical, diesel-fed Danish Refleks heaters provide warmth and cooking surfaces when drifting.

There is a full complement of mandated safety equipment (EPIRB beacon, life raft, etc.), as well as a portable electrical winch that is attachable fore and aft for pulling the craft off obstacles or onto thick ice. A forward-looking, infrared (FLIR) sensor allows night vision with a 25 frame per second display. A full Furuno navigation suite with radar and map display is installed, together with marine and aircraft VHF radios, as both base stations and mobile units, and three Iridium satellite telephones with Internet and data-transmission capabilities. A local area network (LAN) provides navigational information to up to eight laptop computers, operating off the science battery bank that is charged by a rooftop solar panel. An exterior, diesel-powered 6KVA generator also has its own hydraulic pump for static use when the main engine is not in use.

Scientific equipment

The craft is completely outfitted for science. Over the past four years specially built light-weight equipment has been developed and tested on the ice so that in some respects the craft has almost all the scientific capability of a research vessel of the 1960s.

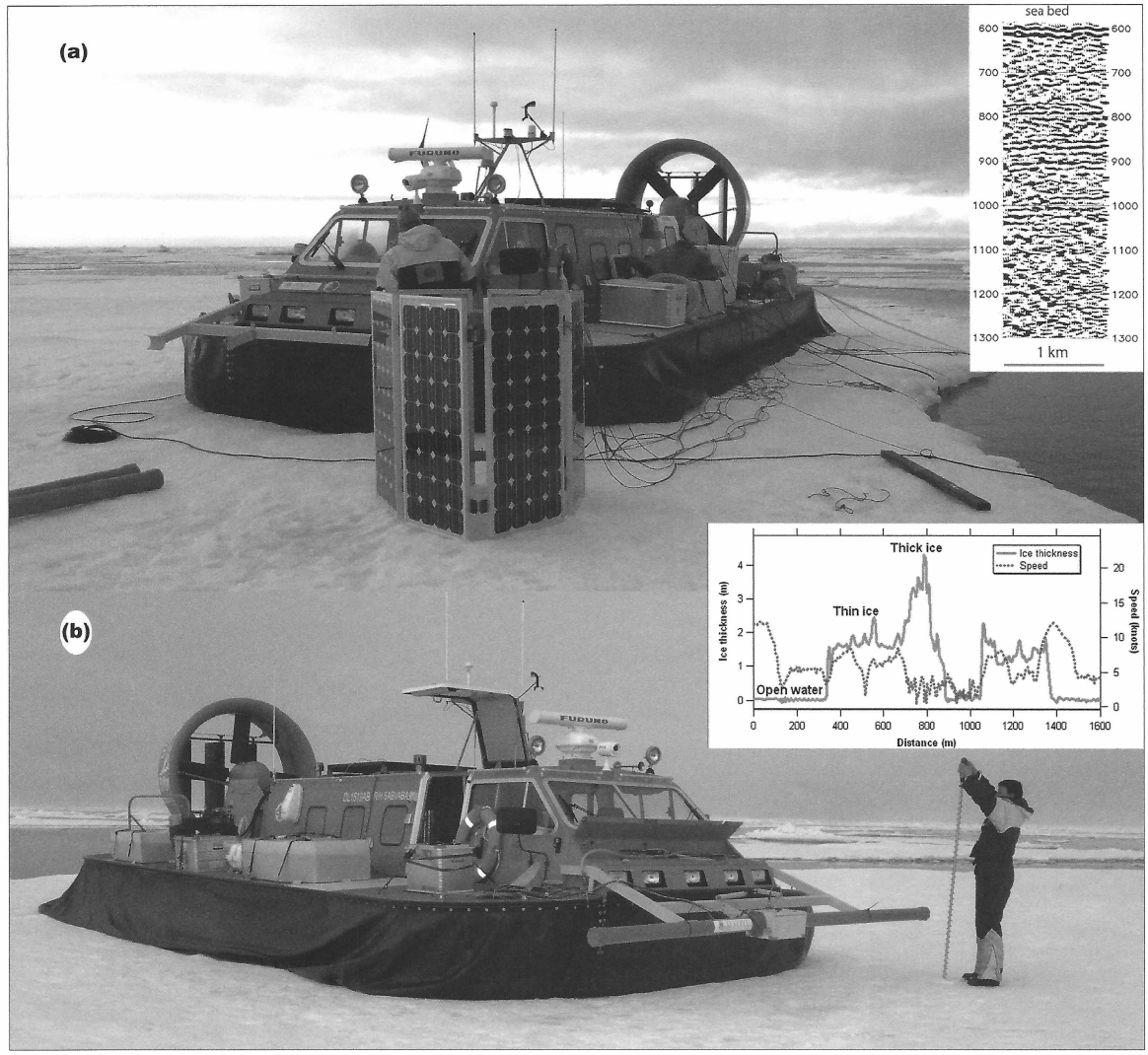

Figure 2: (a) The Sabvabaa on the ice pack. Tests of the autonomous seismic buoy components. Open water presents no problem, and the weight loading does not crack the ice. Inset: A 1km profile sent to Bergen via the Iridium link. Depth scale is milliseconds, so penetration is well over one kilometer. (b) The Geonics EM-31 ice-thickness system, which consists of an assembly of coils for the transmission and reception of low-frequency EM fields, and an acoustic altimeter. The mount was later raised a meter after a collision with a sastrugi. Inset: An ice thickness plot versus hovercraft speed over a 1600m profile.

Bathymetric, Seismic, and other Geophysical Equipment

For depth measurements, a Knudsen dual frequency echo-sounder has 5000m capability at 12kHz, and can simultaneously follow the depth migration of the Arctic deep scattering layer at 200kHz. Our Knudsen CHIRP sub-bottom profiler has four transducers, compared to the 16 elements used by the American icebreaker USCGC *Healy* (WAGB-20).

Seismic profiling is possible either underway as a self-propelled raft in leads or while drifting on the ice at rates of 5-20km/day. The sound source is a 13cm O.D. slim line Bolt Mod. 2800LLX 20 in^3 air-gun that can be towed in leads or lowered through holes drilled by our 15cm O.D hydraulic ice-drill. The receiver is either a single ITC-8073 special purpose preamplified hydrophone, or our SIG-16 6 channel 46m long hydrophone array. A 120m long, 24 channel snow-streamer is also available for receiving signals through the ice. The craft will generally carry a half dozen reusable sonobuoys and three LAN based sonobuoy receivers. While drifting, three sonobuoys placed in a triangle centered on the sound source at a radius of less than 1.5 times the water depth allow the recording of four separate seismic reflection profiles separated by up to half the water depth. This array could also act as a seismograph array for recording any microearthquakes. The ease with which such an system can be set up belies the fact that up until 2003, there were only about 20,000 line kms of mostly single-channel seismic available, of which Hall collected some 4000km from Ice Island T-3 with a home-built seismic profiler that used a 9kJ sparker as a source, getting up to 3.5s penetration. It is important to remember that in the Arctic, under relatively peaceful drift conditions, the deep Arctic Ocean is a very quiet place; with ambient noise 10dB below sea state zero.

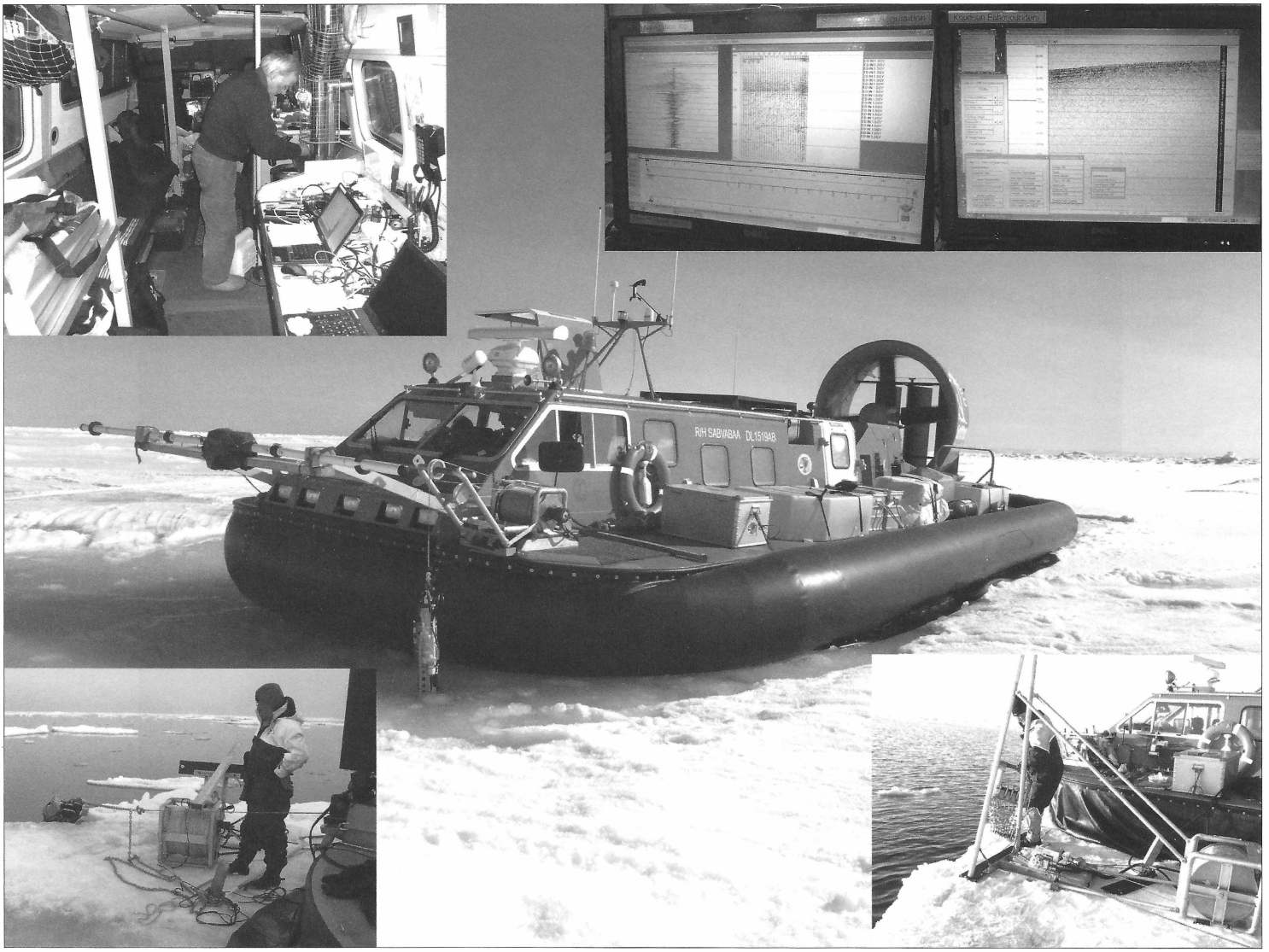

Figure 3: The Sabvabaa making a CTD cast through a seal's breathing hole. Insets clockwise from upper left: The cabin is a comfortable refuge for two or three. Computer screens with CHIRP subbottom profiles and 12kHz echosounder data. The dredge being set up, and a dredge haul of rocks being winched onto the ice.

The hovercraft is also an idea platform for emplacing as well as recovering or maintaining autonomous drifting buoys which can greatly enhance its data coverage. Two kinds, both unique, are now under development. Funded through the University of Bergen, two autonomous drifting seismic buoys are being built by Christian Michelsen Research (CMR) in Bergen. These systems consist of a sparker powered by a 65kg capacitor bank, hydrophone, power source, and internal processor controlling a GPS and Iridium telephone. After every 50m of drift, the system fires the sparker and then transmits the received signals to Bergen as a short burst data (SBD) packet. After experiments with solar panels and a wind generator, the buoys will likely be powered by an EFOY 2200 90 watt electrical source using Direct Methanol Fuel Cell technology. This compact environmentally friendly 8.8kg supply can charge batteries upon demand, providing up to 90 watts continuous power for a total of 2160wh per day.

The project has also rejuvenated the SSPARR (Seafloor Sounding in Polar and Remote Regions) project to develop autonomous drifting echo-sounder buoys that would gather bathymetric data at relatively low cost, especially in the Arctic. The original NSF funded echo-sounder designs are being replaced by the proven innards of the SyQwest EchoBox™ to allow sounding in depths to 5,000m, gain with data and position transmission via CMR developed Iridium link. Latest developments suggest that using the innards of the SyQwest Bathy-2010 PC™ would allow CHIRP subbottom profiling on demand.

For future bathymetric work in depths of less that 2000m there are also plans for adding a Kongsberg-Simrad EM710 multibeam sonar with 200 beams spread over a swath or up to 140° A simple 2° by 2° system weighing less than 200kg could be fitted to the bow for lowering from the edge of a floe. Circular sweeps created by slowly rotating the Mills Cross transducers would be made from time to

time, much like the 'pirouettes' made by the EM122 on the Swedish icebreaker *Oden*.

A very high frequency 900kHz Klein 3900 sidescan sonar has been acquired by the project for future observations under the ice floes, and for areas with sparse gravity measurements, a damped Lacoste and Romberg G-27 gravimeter is available.

Some of the *Sabvabaa's* equipment has been acquired through donations to institutions involved in polar research such as Columbia's Lamont-Doherty Earth Observatory and the UNH's Center for Coastal and Ocean Mapping. This ensures that data gathered will find its way into internationally recognized archives.

Oceanographic Measurements

Oceanographic measurements are also important for understanding what is happening now in the Arctic. For this reason, a new slip-ring winch with 500m of single conductor cable is operated from the forward port side deck. Rapid CTD measurements are possible by simply stopping in open water or on the edge of a floe, and lowering the sensor. A new Aanderaa Doppler Current Meter is also available to augment such lowerings. Ice thickness is a very important parameter: a Geonics EM-31 system with a front-mounted instrument that uses EM pulses and an acoustic altimeter, determines the ice thickness while underway. Every 2s, it measures the delay between the outgoing wave and the 180° phase-shifted reflection from the ice-seawater interface. It calculates the ice thickness by correcting for the 4m separation of the source and receiver and subtracting the altitude of the instrument determined by the laser. Calibration is obtained by random checks of ice thickness by drilling and also from crossings of open water. The fact that the hovercraft travels on relatively level ice provides average ice thicknesses, without the spikes from anomalous pressure ridges or fields of ice rubble. These thicknesses, especially of thick multiyear ice, are very important for calculating ice inventory. In one week in 2008 the thickness was measured over 200km of track.

Seafloor Sampling - Coring, Dredging, and Photography

The hovercraft is also equipped for direct sampling of interesting sites on the seafloor detected using the seismic gear. In inclement weather, a large tent can be affixed to the craft over the rear door, offering weather-free access directly to the ice from the after (air-lock) cabin. When installed over a suitable opening cut or drilled through the ice, the tent provides a workspace for a specially built, lightweight winch. This winch can handle up to 3500m of Kevlar aramid fiber line, which is run around a hydraulically powered capstan. This line, with breaking strength greater than 2 tons, is spooled under light tension on three tandem drums. The overall winch system, which weighs just 170kg, can be used for lowering a bottom camera or our 2 meter long lightweight hydrostatically boosted corer. The sediment corer is a patented design where the core barrel is fired into the seabed, driven by a hydrostatic boost.

A lightweight dredge made of stainless steel has also been successfully tested three times in up to 600m of water on the continental margin north of Svalbard. A second dredge is being equipped with a video-camera to record

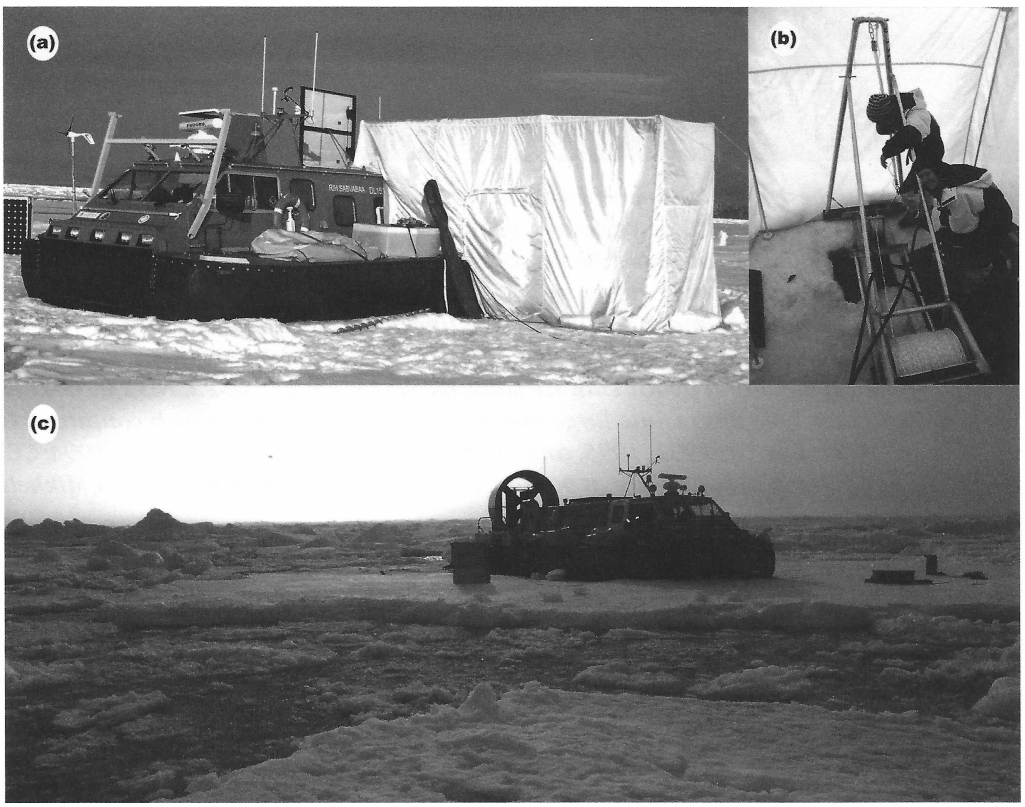

Figure 4: (a) The Sabvabaa in drift mode on a large ice floe over the southern Yermak Plateau. The tent provides cover over an open hydro hole for bottom sampling and oceanographic stations etc. The wind generator and solar collector (far left) are part of the test setup for the autonomous seismic buoys. (b) Lightweight, hydraulically powered winch, and two of the IPY Classroom on the Ice high school students. (c) The craft on a small floe during Trip 4 of 2008. The Sabvabaa can operate in relatively rough ice, as shown, and can operate as a drift station from floes little bigger than the hovercraft itself.

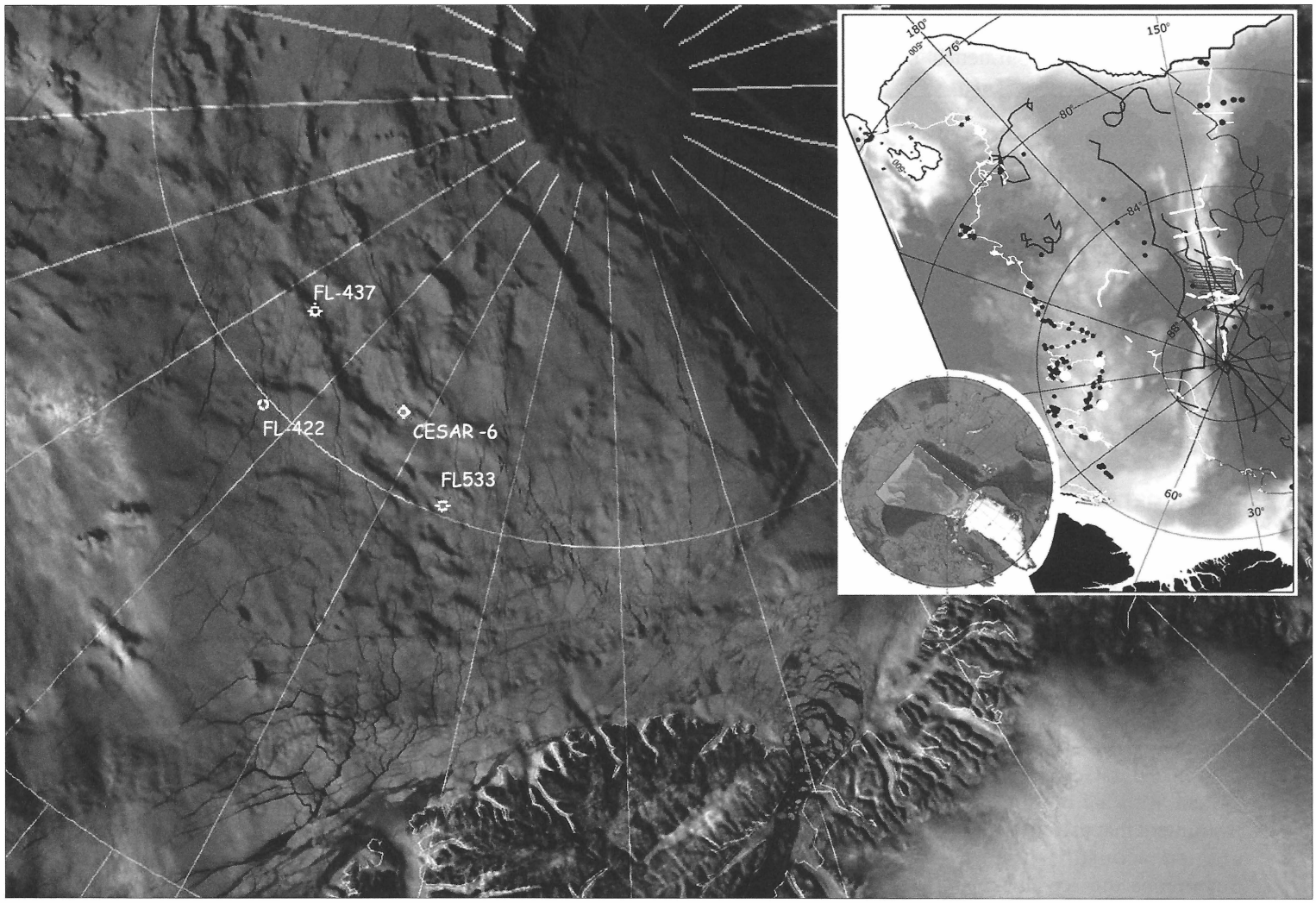

Figure 5: The highest priority operational area. Here is the Wokingham UK Weather Station HRPT image for the area north of Ellesmere on March 9, 2010. It is texturized using the latest IBCAO bathymetry. Note the hundreds of constantly shifting short and long leads (50 to 800km). The oldest Arctic cores are shown in white. Inset: Seismic reflection profiles and sediment cores collected from the Alpha and Lomonosov ridges and their vicinity: icebreaker surveys (heavy white lines); drifting ice stations (Russian = thin black lines; Canadian and U.S. = thin white lines); SCICEX high-resolution chirp sonar surveys (thin gray lines just south of 88°). The seismic data were acquired by "Polarstern" in 1991 and 1998, "Oden" in 1996, Arlis-II in 1964-65, CESAR in 1983, LOREX in 1979, T-3 in 1966-74 and by Russian ice stations NP-13, NP-21, NP-22, NP-23, NP-24, NP-26, and NP-28. Sediment core locations are shown by black dots with white large dots representing the cores, which contained Cretaceous sediments. Sediment cores were recovered by "Polarstern" in 1991, 1995, and 1998; "Oden" in 1996; "Polar Sea" in 1994; CESAR in 1983; and T-3 in 1966-74. Northern Greenland and Ellesmere Island are at bottom. (modified after Kristoffersen and Mikkelsen, 2004.)

the hits. The winch can also be used for lowering other instruments to depths below 500m that cannot be reached with the CTD winch.

Construction, Sea Trials, Basing, and Initial Results

The *Sabvabaa* was ordered in October 2006 and completed in September 2007 at a cost, including much of the scientific gear, of less than US$1,500,000. Sea trials and acceptance tests were carried out successfully in October 2007. On 2 June 2008, the hovercraft arrived by ship in Longyearbyen, Svalbard (78°-10'N, 10°-30'E), where it is based at the University Centre in Svalbard (UNIS). Over two summers the craft has made 10 trips to the sea-ice over the Yermak Plateau north of Svalbard, accumulating nearly 12,000km of travel. The primary objective has been to adapt standard geophysical, geological, and oceanographic instrumentation and test the performance of the craft as a scientific research platform in heavy sea ice. Five of these week-long forays included pairs of young Norwegian students, aged 12 to 18, interested in polar science. This was a Norwegian contribution to the IPY 2007-2008, called IPY Classroom on the Ice. The other five trips tested out the hovercraft performance, the corer and dredge, the seismic buoy, the CHIRP, echo-sounder and seismic equipment, measured ice thickness, and did CTD and current meter profiling.

The craft performs at least as well as expected in pack ice. Pack-ice fields may look messy, but usable passages can always be found with little delay. A rule of thumb for all ice-surface travelers is that the actual distance made

between two points will be 1.5–2 times the great circle route. *Sabvabaa* moves with the same ease whether the ice is thick or thin, and the craft has proved to be useful for a variety of scientific tasks. It appears more efficient than any other platform for long-term scientific work on the ice.

Future Plans

We hope to put the hovercraft some 500km north of Ellesmere in the spring of 2011. In early summer 2010 we will cross over to northwestern Greenland and carry out hydrographic surveys through the ice in Independence Fjord, including the approaches to Station Nord. This will be followed by the first seismic reflection work in the 200km long fjord. Later in the summer additional field tests of the seismic and SSPARR buoys will be carried out over the Yermak Plateau north of Svalbard with additional dredging in the area to 82°-83°N. The hovercraft is a small vessel and requires relatively good weather for unsheltered open ocean passages. Part of the transit to Greenland may be together with or aboard a chartered supply ship.

The hovercraft activities to date have been largely self-supporting. Once we have a proven track record we hope that our interests and capabilities will receive symbiotic support from the circum Arctic government research programs and research institutions presently laying out extensive resources for aircraft and icebreakers. With our minimum crew of 2-3, and ability with air-support to remain on the ice for periods of many months at a time, the hovercraft platform is very efficient and has a realistic potential to obtain significant geoscience information from the Arctic Ocean. This is illustrated in Figure 5, where in the multiyear ice on this Wokingham Weather NOAA HRPT image of 9 March 2010, open leads up to 800km in length appear. In these leads the hovercraft can deploy its seismic gear and make excellent CHIRP and deep seismic profiles, together with sonobuoy aided wide angle seismic velocity measurements. The future availability of the seismic and echo-sounding buoys under development should also strongly leverage our contribution.

Farther into the future, there would be a need for a platform like the *Sabvabaa* to perform site surveys for the planned European icebreaking drill-ship *Aurora Borealis*, which would act as a mother ship. More information is available at our Web site, http://www.polarhovercraft.no, where you can find daily updates on the *Sabvabaa's* activities.

Acknowledgments

The *Sabvabaa* belongs to the Delaware-based Blodgett-Hall Polar Presence LLC. It is a research project dedicated to the memory of Hall's parents and grandparents, who made it possible. The project is completely academic and supported by contributions from AF-UNIS (American Friends of UNIS), an IRS 501(c)(3) tax-exempt, nonprofit research-supporting organization. Data gathered by the project will be open to the public, within the usual temporary constraints attached to academic theses and reports. Corresponding authors: jkh1@012.net.il and Yngve.Kristoffersen@geo.uib.no.

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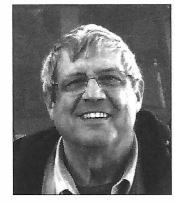
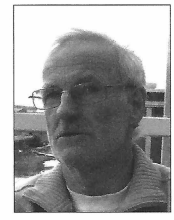
About the Authors...



John K. Hall obtained his Ph.D. in Marine Geophysics from Lamont-Doherty in 1970, based upon the 1962-70 drift of scientific ice station Fletcher 's Ice Island (T-3). He is a long-time member of GEBCO and was recently elected a member of the Norwegian Academy of Sciences for Polar Research.



Yngve Kristoffersen obtained his Ph.D. in Marine Geophysics from Lamont-Doherty in 1977. His extensive experience on drift stations and icebreakers since the 1970s led to his formulating the need for this hovercraft.

A Comment on "Marine Boundaries - Towards a Simple Data Representation"

In issue 75, Nick Stuifbergen points out the need for plotting various limit and boundary lines correctly on charts and that there could be a problem by joining the end points of a line by a straight line in the particular map projection being used at the moment. Let me assure you that while I was in the Canadian Hydrographic Service and responsible for the depiction of limits and boundaries on nautical charts and on other maps (essentially 1994-2005), that I foresaw this very problem and built up data files for plotting territorial sea, fishing zones, EEZ, NAFO fishing zones, and the like, by a series of points less than 500 metres apart. Rhumb lines and geodesics were replaced with their own intermediate points. I even went to the trouble of defining points at a constant distance from a geodesic, because the resulting line is not a geodesic itself. The worst case scenario would be a small radius arc being depicted on a large scale chart. Arcs of 12 mile radius being depicted on a chart of 1:60,000 would have an error of 0.02 mm at chart scale because the chord was used instead of a circular arc. To my knowledge the same files, or those files updated, are still being used.

David H. Gray, M.A.Sc., P.Eng., CLS
Definitive Hydrographic & Geodetic Consulting

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."

FIG 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).

May 2010

The 24th FIG Congress was held in Sydney, Australia 12-16 April, 2010 and drew a record 2100 delegates to the Sydney Convention Centre. The conference theme was "Facing the Challenges – Building the Capacity". Commission 4 endeavoured to deliver on the theme while hosting a total of 9 technical sessions, some joint with other commissions; some included some peer reviewed papers:

- Positioning Techniques for Hydrography
- Vertical Reference Frame
- Hydrographic Surveying in Practice with High Resolution Data
- Hydrographic Capacity Building
- Economic Benefits of Hydrography
- Nautical Charting and Marine Cartography
- Administration of Marine Spaces.
- Measuring and Monitoring the Coastal Zone
- Coastal Zone Issues

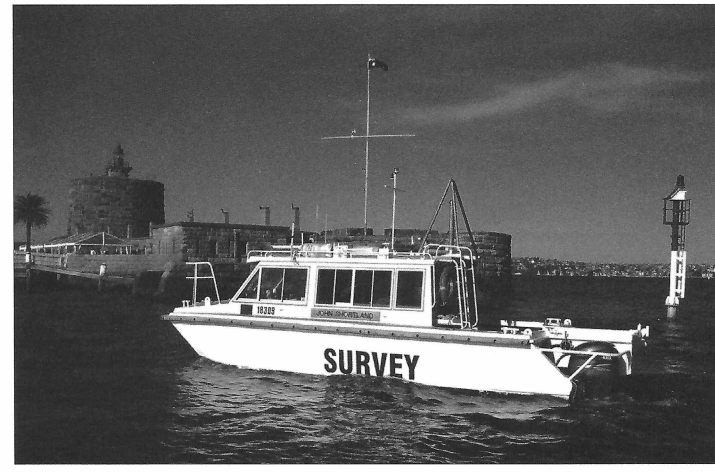
The latter two were offered as flash sessions, a new approach to FIG conferences whereby poster sessions are given as short presentations with a limited number of slides. All of the sessions were well attended and in some cases were subject to standing room only. Notable speakers included Cdr. Roderick Nairn the RAN Hydrographer of Australia and chair of Australaisian Hydrographic Surveyors Certification Panel (AHSCP), who presented a paper on their hydrographer certification program. Dean Battilana from the Royal Australian Navy's Hydrographic School presented a paper by CHS's David Dodd entitled Hydrographic Surveying Using the Ellipsoid as the Vertical Reference Surface. The paper which is co-authored by Mike Gourley of CARIS and Jerry Mills of NOAA will be the subject matter of a new (2011-2014) joint commission 4/5 working group to be lead by Jerry Mills.

For the benefit of hydrographic-types and others interested in getting out on the water for a day, a technical tour was organized by Sydney Ports and co-hosted by Sydney Ports, Newcastle Port Corporation and the Royal Australian Navy. The tour (which was oversubscribed) provided delegates with on-the-water demonstrations of three different multibeam sonar systems, aboard three different survey vessels plus a tour of Fort Denison (completed in 1855) one of the best known landmarks of Sydney Harbour and site of one of Australia's oldest permanent tide gauge stations (est. 1870). On display was an original Harrison tide recorder (John Harrison invented the first ship's chronometer for determining longitude).

The annual general meeting plus an executive meeting of commission officers were held, the latter included discussions on the development of the 2011-2014 workplan and as well two publications scheduled for release this fall on the Economic Benefits of Hydrography and Port Hydrography. During the FIG Congress, Malaysia was selected as the host for the 2014 Congress, Mr. Teo Chee Hai was elected as the incoming president, Prof. Dr. Rudolph Staiger and Ms. Chrissy Potsiou were elected as vice-presidents.

The surveying profession is alive and well in Australia. Australians recognize the role of the surveyor in discovery and opening up the country to settlement as noted by the Governor General of New South Wales during the opening ceremonies. For hydrographers, the profession enjoys prominent stature through the advancements the Australians and New Zealanders have made over the past 15 years with the AHSCP in building a credible certification regime for hydrographers with full support from government, industry and academia.

Andrew Leyzack, Chair of FIG Commission 4



Newcastle Port's survey launch John Shortland approaching Fort Denison, Sydney Harbour

Important Announcement about Canada-wide DGPS Service

April 15, 2010 **Canada-wide DGPS Service (CDGPS) to be decommissioned by March 31, 2011**. CDGPS, the free GNSS augmentation initiated as a public service by the Canadian Council on Geomatics (CCOG), has been broadcasting continuously since October, 2003, with a North American footprint that extends from Mexico to 15° north of the Arctic Circle.

The CDGPS L-band broadcast has been carried by SkyTerra Communications Inc.'s MSAT communications satellites, which are expected to be replaced this year by the next-generation SkyTerra satellites. Significant new investment in infrastructural changes would be required to migrate to a new communication satellite. Given that several alternatives to CDGPS are now available, including commercial correction services, the requirement for a government-provided free service has been reduced, prompting the decision to cease operation of CDGPS beyond March 31, 2011.

According to SkyTerra's 10-K filing on February 25, 2010, their projected launch window is from August through October 2010. Following an in-orbit test and verification period, the MSAT traffic will be transitioned to the new SkyTerra satellites. It is possible that CDGPS' L-band services on MSAT may remain operational well into next year. However, CDGPS customers will receive 60 days notice if MSAT services transition to the new satellite network before March 31, 2011.

CDGPS has been broadcasting Natural Resources Canada's (NRCan's) real-time GPS correction stream known as GPS*C, generated from NRCan`s Real-Time Canadian Active Control System. It is important to note that NRCan remains committed to the generation and improvement of its GPS*C correction beyond March 31, 2011.

NRCan has solicited and is negotiating non-exclusive arrangements with commercial operators to broadcast/multicast GPS*C, possibly filling the void left by the decommissioning of CDGPS. For more information about NRCan and its progress in commercializing GPS*C, contact NRCan at information@geod.nrcan.gc.ca

Application of GPS Heights to Bay of Fundy Multibeam Data

By: David Dodd, Canadian Hydrographic Service, Central & Arctic
Jonathan Griffin, Canadian Hydrographic Service, Atlantic

1 Introduction

Many groups involved in hydrographic surveying and ocean mapping are using High-accuracy GPS for three dimensional positioning. The vertical component is of particular interest to hydrographers. The benefit of this form of vertical positioning is that objects in question (sea surface, water column, sea floor etc) are referenced directly to a mathematically derived reference ellipsoid.

Hydrographic surveying has traditionally been conducted solely for the purpose of creating nautical charts for safety of navigation. It now encompasses a multitude of methods and applications in the marine environment, and has a vital role in coastal zone management. The coastal zone encompasses a wide swath along the shoreline that includes both the land and sea, and properly merging information from the two is essential for the analysis of coastal processes and sound management decisions. In the past, vertical land data (topography) and ocean data (bathymetry) were collected for different purposes, using different methods and related to different vertical reference surfaces. The need to merge the two data types has driven the need to resolve these differences.

One surface that is used for modern data collection on both land and sea is a reference ellipsoid. Traditionally, reference ellipsoids were used to define horizontal datums; however, with the emergence of high-accuracy GPS, reference ellipsoids are now being used to define vertical datums as well. Data collected both on land and at sea can be related to the same satellite based vertical reference surface, making the merging of the two a trivial process. Although these reference ellipsoids are convenient, they are not physical surfaces, such as those defined by gravity (geodetic datum) or mean sea level (tidal datum). Therefore, for analysis and map/chart production, GPS derived vertical information must be translated. Translations from the ellipsoid to geodetic or tidal datums are usually performed through transformation models. The ellipsoid can be used as the reference for all of the translation models.

Between 1996 and 2009 several different vessels conducted mutibeam surveys in the Bay of Fundy. Removal of the tidal effect and the establishment of a vertical reference were the most challenging aspects of the data reduction process. Due to the tidal range (8 to 16 metres) these effects must be removed in order for the results to be used effectively. Simply establishing gauges and measuring tides is extremely challenging, which makes this environment ideal for the use of GPS heights. Surveys conducted in 2007, 2008 and 2009 observed GPS heights during multibeam data collection. Surveys conducted prior to 2007 relied on a combination of tide gauge observations and predicted tides. The mandate for this project was to reduce the 2007 to 2009 surveys to a common Mean Sea Level (MSL) datum, and to try to incorporate surveys conducted prior to 2007.

GPS heights from multibeam surveys conducted by the *Creed*, *Matthew*, *Plover* and *Pipit* in 2007, 2008 and 2009 were used to remove tidal effects and establish the vertical datum. GPS height observations were evaluated with respect to the Saint John tide gauge. GPS Tides were edited to remove sections where high-accuracy GPS solutions were not available. Depths were determined relative to the International Terrestrial Reference Frame (ITRF), as established by the GPS observations. Lines where GPS heights were not available were removed from the process. Depths from each survey were used to create regular gridded surfaces at a 5x5 metre resolution. All surfaces were compared to ensure consistency in overlap areas and combined into a single surface.

Multibeam surveys without GPS heights were conducted by the *Creed* and *Heron*. For surveyed areas where GPS heights were not available, WebTide predicted tides were used. This included lines from the surveys that used GPS heights, but where GPS heights were not available. WebTide derived surfaces were translated to ITRF97 (1997 epoch) through a geoid-to-ellipsoid model using the Canadian Spatial Reference System (CSRS) NTv2. The WebTide vertical reference was Mean Sea Level (MSL), the NTv2 reference was Geoid03, and the difference between the two was Sea Surface Topography (SST). These Webtide derived surfaces were compared to GPS Tide derived surfaces where overlap occurred. Biases between the two surfaces ranged between +0.03 and -0.36m.

Chapter 2 summarizes the project and data and Chapter 3 outlines the basic procedures used. Chapter 4 looks at vessel configuration with particular emphasis on the *Creed*. Chapter 5 looks at a comparison of GPS tides derived surfaces and Webtide derived surfaces. Chapter 6 presents the results the final chapter presents conclusions and recommendations.

2 Project and Data

The primary focus of this project is the establishment of a common datum for a series of multibeam surveys conducted in the Bay of Fundy between 1996 and 2009. Much of the multibeam data were received in the form of CARIS HDCS files from the Canadian Hydrographic Service (CHS), Atlantic region. GPS position observations were also received from CHS Atlantic. Tide gauge observations for Saint John (Gauge 65) were obtained from the CHS Atlantic(Tides Currents and Water Levels) at the Bedford Institute of Oceanography (BIO). Raw multibeam observation data were obtained for the UNB Ocean Mapping Group (OMG). Predicted tide observations (MSL) were obtained from the OMG using the BIO "WebTide" program using the Scotia Shelf model.

Tide gauge and GPS height comparisons were conducted using specifically developed MatLab routines. The multibeam data were reprocessed using CARIS HIPS version 7.0, where 5x5 metre surfaces, relative to the ITRF ellipsoid, were created. Surface comparisons, translations and combinations were performed in CARIS Bathymetric Editor version 2.3. The translation values between the CSRS geoid (03) and ITRF (97) were determined using the CSRS program GPS-H version 2.1.

Vessels involved included *Creed*, *Matthew*, *Plover* and *Pipit*. Data were also obtained from UNB OMG from *Heron* surveys.

3 Methodology

The following described the step-by-step procedure used to process and evaluate the various data sets:

1. Gather Data
   - Multibeam in CARIS HDCS or raw Simrad format
   - GPS hts (OMNIStar)
   - Tide Gauge (Saint John – 065)
   - Vessel Configuration
   - Vessel diagrams showing location of transducer, antenna, RP and MRU
   - Separation model from GPS-H
   - Obtain WebTide predicted tides for all navigation lines

2. Evaluate offsets
   - Find time when vessel near to Saint John Tide Gauge
   - Develop vertical offset diagram showing (Figure 1)
     - ITRF ellipsoid
     - Chart Datum
     - waterline
     - Tide Gauge
     - Vessel Antenna, Transducer
   - Update Vessel Configuration File (VCF) inserting Navigation offsets between antenna and Reference Point (RP) for depth reference [Water Level (WL) at Transducer]

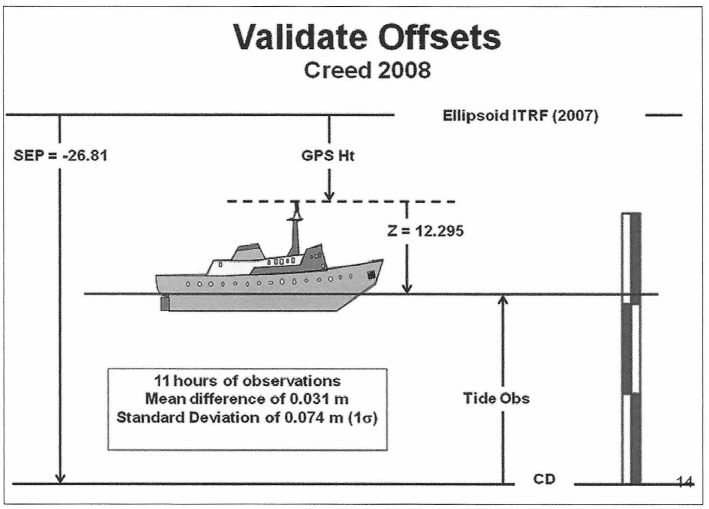


Figure 1: Creed 2008 Vertical Offset Diagram

3. Compare GPS WL to SJ Tide Gauge using Matlab routine (Figure 2)

4. Create HIPS compatible text file
   - Concatenate all OMNIStar files for each survey using DOS "copy" command
   - Run through Matlab routine to extract Date, Time, Lat, Long, height (ITRF), standard deviation lat long ht

5. Import into HIPS, include GPS height uncertainty as SSS ht (SSS ht used as a place holder only)

6. Compute GPS tide (no vertical shift) and remerge.

7. Use the HIPS Attitude editor to verify time synchronization

8. Create a new surface and evaluate standard deviation surface for GPS tide errors (Figure 3)

9. Evaluate areas of concern in the HIPS Attitude editor, viewing GPS heights, heave, GPS Tide and SSS ht (proxy for vertical standard deviation)

10. Create final surface

11. For data without GPS tides:
    - Create navigation files from survey lines for use in WebTide. WebTide generates a MSL water level value given a position and time.
    - Create standard HIPS tide files from WebTide MSL results

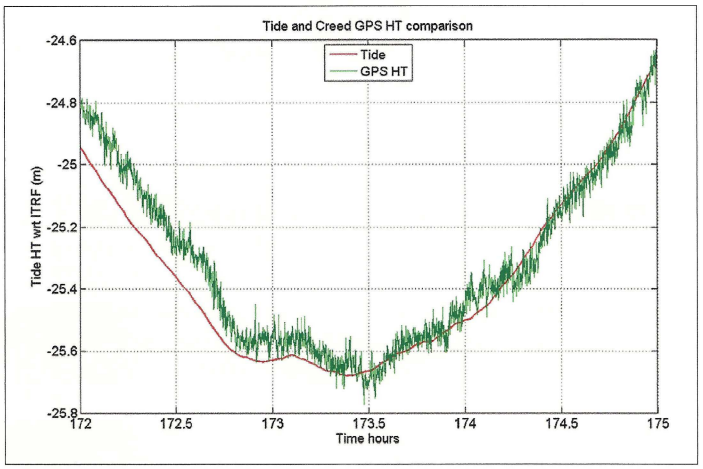


Figure 2: Creed and Saint John Gauge Comparison. Mean = 0.031m, standard deviation = 0.074m (1σ)

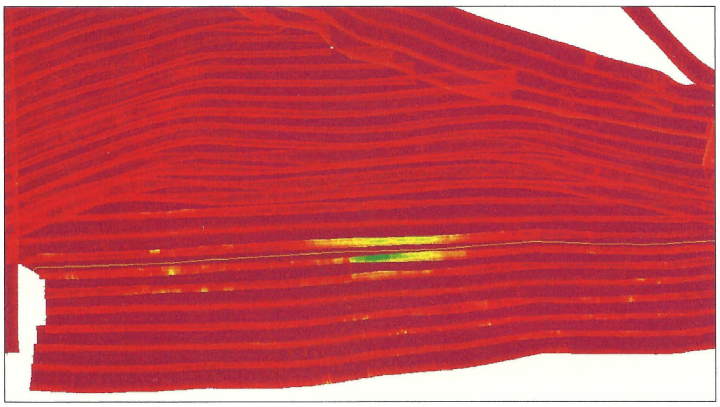


Figure 3: Sample standard deviation surface with GPS tide error

- Remerge HIPS HDCS files using standard tides
- Create new base surfaces

12. Using the CARIS Bathymetry Editor, compare 2007 through 2009 GPS tide surfaces (ITRF).
    - Find overlap between any of the surfaces and compute the surface difference.
    - Export an ASCII file of the difference surface
    - Using Matlab, compute the mean and standard deviation

13. Using the CARIS Bathymetry Editor, combine the 2007 through 2009 GPS tide surfaces (ITRF). Newer surveys to take precedence in overlap areas.

14. Using the CARIS Bathymetry Editor, transform the WebTide derived MSL surfaces (*Creed* 1996. 1999 and 2006) to the ellipsoid using CSRS NTv2 geoid to ellipsoid (ITRF97) model

15. Using the CARIS Bathymetry Editor, compare the shifted WebTide derived surfaces (*Creed* 1996. 1999 and 2006) to the combined 2007 through 2009 GPS tide generated surface. Evaluate the difference surface in Matlab.

16. Using the CARIS Bathymetry Editor, combine the shifted WebTide derived surfaces (*Creed* 1996. 1999 and 2006) with the 2007 through 2009 GPS tide generated surface.

17. Using CARIS Bathymetry Editor, translate the combined surface from ITRF97 to the geoid through CSRS NTv2.

4 Vessel Configuration

When processing and applying GPS heights in CARIS HIPS it is very important to ensure that the VCF has the appropriate settings. If the high-accuracy GPS positions are to be imported with the GPS heights, then it is important to ensure that the VCF is configured for the appropriate position reference point. If the original navigation observations are to be used, then it is important to configure the VCF so that the appropriate horizontal reference is used, keeping in mind that the GPS height may have to be corrected for pitch and roll. In many cases all sensor offsets are applied during data collection; therefore, most of the offsets used in post processing will be set to zero. However, in many cases the GPS heights are derived from post-processing techniques and are referenced to the antenna. This would require that the appropriate offsets be put into the VCF in order to correctly translate the height from the antenna to the vessel RP (or transducer).

For most of the survey platforms used in the Bay of Fundy project, the GPS antenna was either very close to the transducer, in the horizontal plane, or the GPS height was translated to the vessel reference point during data collection, as was the case with the Matthew. With small horizontal lever arms (less than 1m), the effect of pitch and roll on the height translation was minimal. However, this was not the case for the *Creed*, where the fore/aft offset between the GPS antenna and transducer was over 7 metres. Another complication with the *Creed* data was that the heave observations included pitch and roll induced heave. These effects were removed from the heave (Apply MRU Remote Heave in the CARIS HIPS GPS Tide Computation), to get the actual heave at the RP. Pitch and roll were used to translate the GPS height from the antenna to the RP and then to the Transducer.

5 WebTide Evaluation

Data that did not have GPS heights were tidally corrected using Webtide and the Scotia Shelf model. These MSL referenced surfaces were then translated to the ITRF 97 ellipsoid using a NTv2 (GPS-H) derived translation surface. In order to validate these processes two Webtide evaluations were performed. The first looked at a very small section in the North-east of the Bay and the second looked at the entire area covered by GPS heights (2007, 2008 and 2009, *Creed*, *Matthew*, *Plover* and *Pipit*).

5.1 North-East Evaluation

A small section of the 2009 survey was used to compare GPS tide and shifted WebTide surfaces. A standard deviation surface from the GPS Tide generated results is shown in Figure 4, and from the WebTide results is shown in Figure 5. Note the high standard in the line to line overlap areas of the WebTide surface. The difference between GPS Tide and shifted WebTide is shown in Figure 6. The striping shown in this figure clearly indicates the discrepancy between lines resulting from the WebTide model.

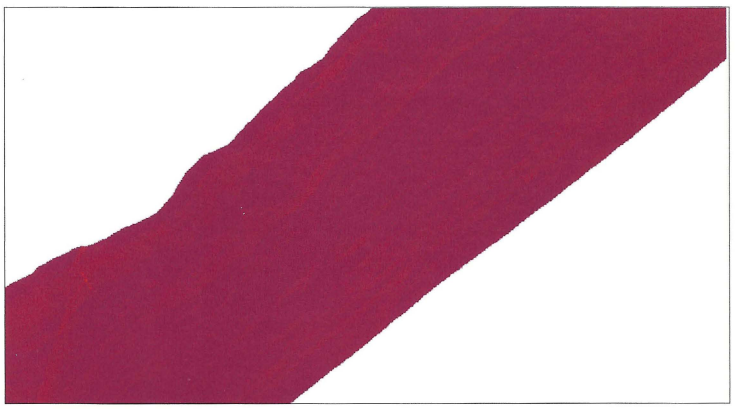


Figure 4: 2009 GPS Tide standard deviation surface

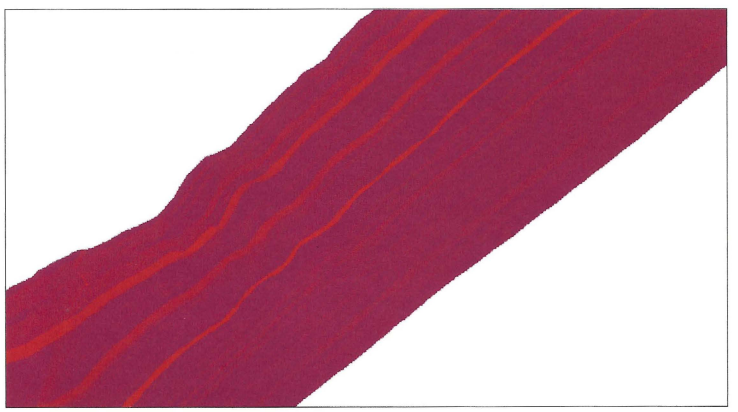


Figure 5: 2009 WebTide standard deviation surface.

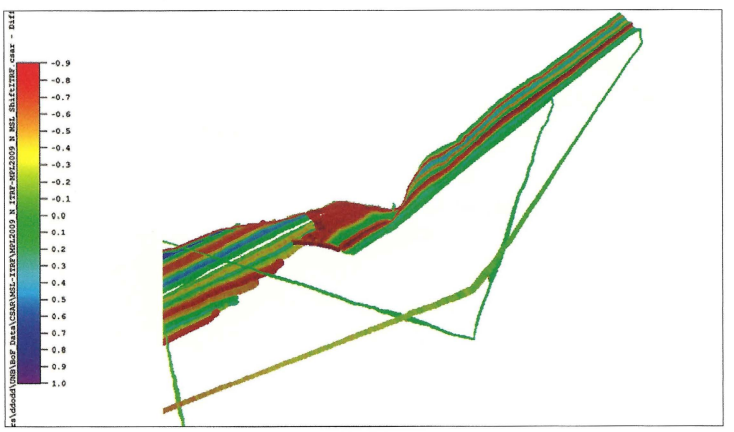


Figure 6: Difference between GPS Tide and shifted WebTide surfaces. Legend is ±1m

Figure 7 shows a plot of the difference between GPS Tide and WebTide for the region shown in Figure 6. The mean was -0.125m and the standard deviation was 0.40m (1σ). The mean difference was due to the MSL to geoid separation (Sea Surface Topography [SST]), which was not accounted for in the separation model. The standard deviation was due primarily to the WebTide model phase and amplitude uncertainty. This indicated that using the WebTide generated surfaces (with the Scotia Shelf model) introduced a significant variation in the bottom, but overall, that variation averaged out. This indicated that the MSL model was consistent with the geoid surface generated from CSRS NTv2.

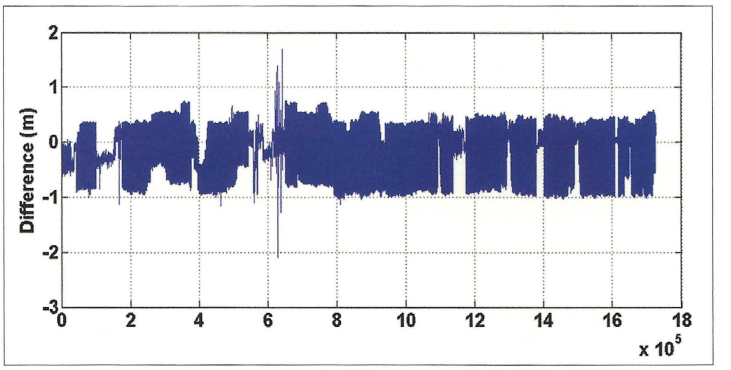


Figure 7: Plot of difference between GPS Tide and WebTide for section of 2009 survey. Mean = -0.125, Standard deviation = 0.400

5.2 Map Sheet Evaluations

All of the data with GPS heights (*Creed*, *Matthew*, *Plover* and *Pipit* from 2007, 2008 and 2009) were also processed using WebTide correctors. The resulting two surfaces were differenced (GPS Tide – WebTide) and then evaluated. Means and standard deviations (1σ) were determined for each of 17 map sheet (Table 1 and Figure 8). For all but map sheet 14, the mean difference was negative, indicating that the Webtide derived surface was lower that the GPS tides derived surface.

The map sheets shown in Figure 8 coincide with the map sheets produced by the Geological Survey of Canada (GSC) for their Bay of Fundy project. These extends were used for this evaluation because they were also used to deliver the final depth surfaces to the GSC.

The translation from the Webtide derived MSL surface to ITRF was performed using the NTv2 model, which translated from the Geoid03 to ITRF97, not taking into consideration sea surface topography (SST - separation between MSL and the geoid). The resulting differences (shown in Figure 8) indicate a large negative SST region along the southern edge of the Bay. It indicates a region of lower SST around Grand Manan and into Passamaquody Bay.Given the relatively high standard deviations (16cm to 53cm), it would not be prudent to read too much into these results without further investigation. The standard

deviations show the consequence of using a prediction model to remove the effect of tide in the Bay of Fundy.

Map Sheet	Mean	Standard Deviation
1	-0.164	0.156
2	-0.243	0.224
3	-0.301	0.224
4	-0.024	0.526
5	-0.360	0.209
6	-0.260	0.235
7	-0.035	0.278
8	-0.287	0.206
9	-0.241	0.239
10	-0.069	0.235
11	-0.166	0.260
12	-0.083	0.305
13	-0.311	0.328
14	0.033	0.261
15	-0.080	0.281
16	-0.201	0.465
17	-0.139	0.382

Table 1: Webtide and GPS Tide difference means (m) and standard deviations (m)

6 Results

For the most part, the tide gauge evaluation results were good. Unfortunately, not all vessels for all years had GPS height data from Saint John. Inter-comparison between the *Creed*, *Matthew*, *Plover* and *Pipit* surveys of 2007 through 2009 were used as the ultimate vertical offset check. Mean offsets varied from a low of 0.02 metres to a high of 0.25 metres, indicating a very close comparison between surveys. The standard deviations (all at 1σ), from the 2008 and 2009 surveys varied from 0.1m to 0.2m. The standard deviations from the 2007 surveys varied from 0.5m to 1.0m. This high standard deviation can be attributed to problems with the high-accuracy GPS solutions.

More diligent editing of the GPS heights was required to reduce the standard deviations from the 2007 surveys and improve the confidence in the resulting surfaces. However, the only way to edit bad GPS heights was to remove the affected depths from the dataset, which created holes (data holidays) in the resulting surface. A solution to this was to use the shifted WebTide generated surfaces for the data holidays. Differencing good GPS tide surfaces from the shifted Webtide surfaces for the same area and time provided the necessary shifts. Although the majority of the artefacts due to bad GPS heights were removed, some remained in the final surface.

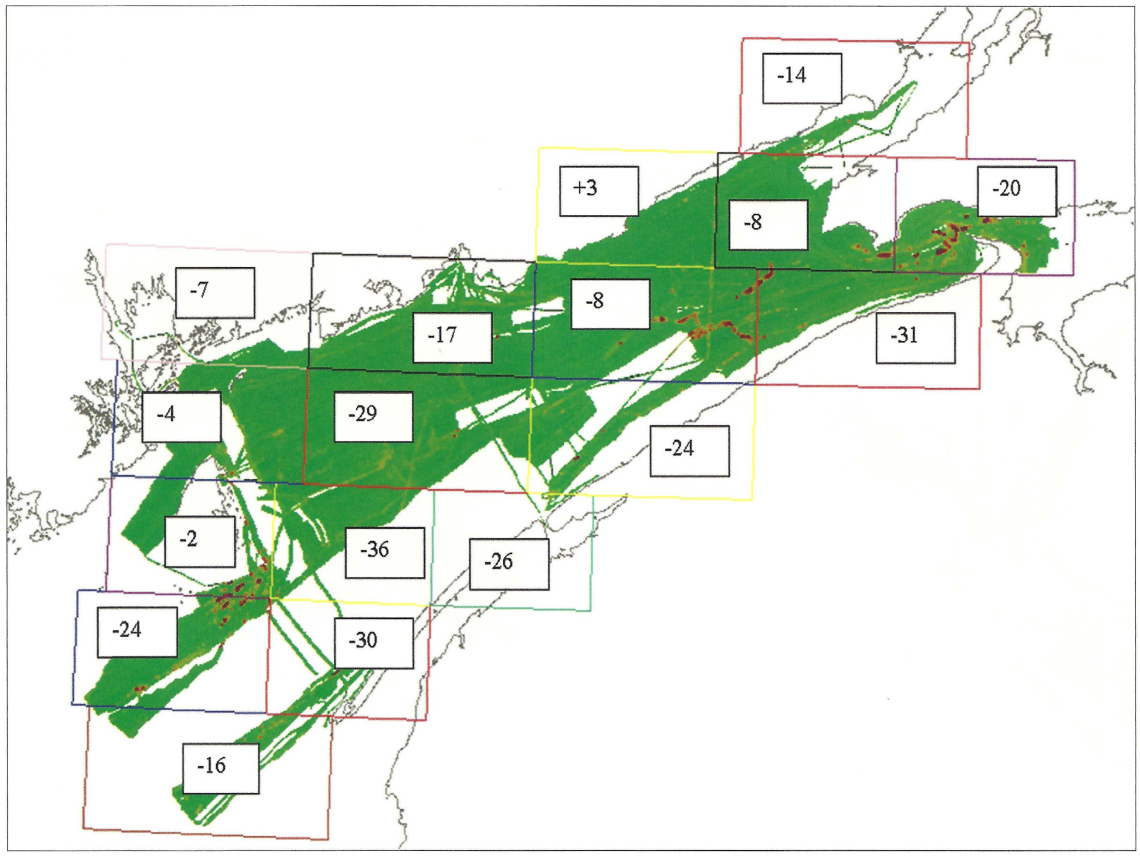


Figure 8: Map Sheet and difference means (in cm)

The depth data received in CARIS HDCS format from CHS Atlantic was already cleaned. Data imported into CARIS from raw telegram files had to be cleaned before final surface generation. This was the case for the 1996 and 2006 *Creed* surveys, as well as all of the *Heron* surveys. Data were cleaned by removing obvious outliers; and, in the case of the 1996 data set, some sound velocity refraction editing was necessary.

6.1 Creed 1996

The *Creed* 1996 survey was edited for outliers and sound velocity errors. A MSL surface was generated using WebTide for tidal corrections. The resulting surface was translated to the ITRF ellipsoid and then differenced from the 2007 through 2009 combined ITRF surface (Figure 9). The mean difference was -0.15m with a standard deviation of 0.57m.

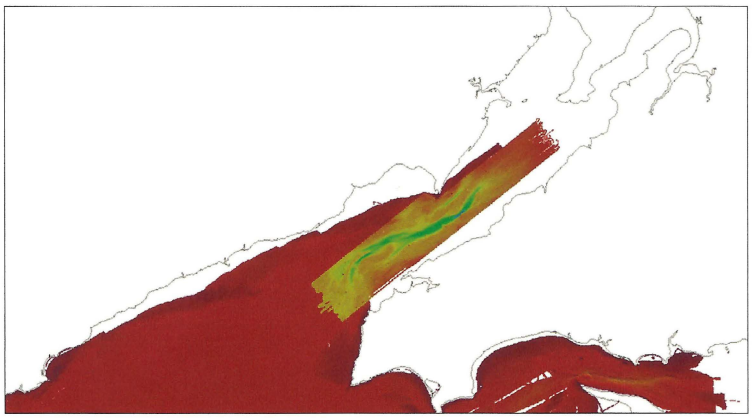


Figure 9: Creed 1996 survey on top of the 2007 through 2009 combined surface

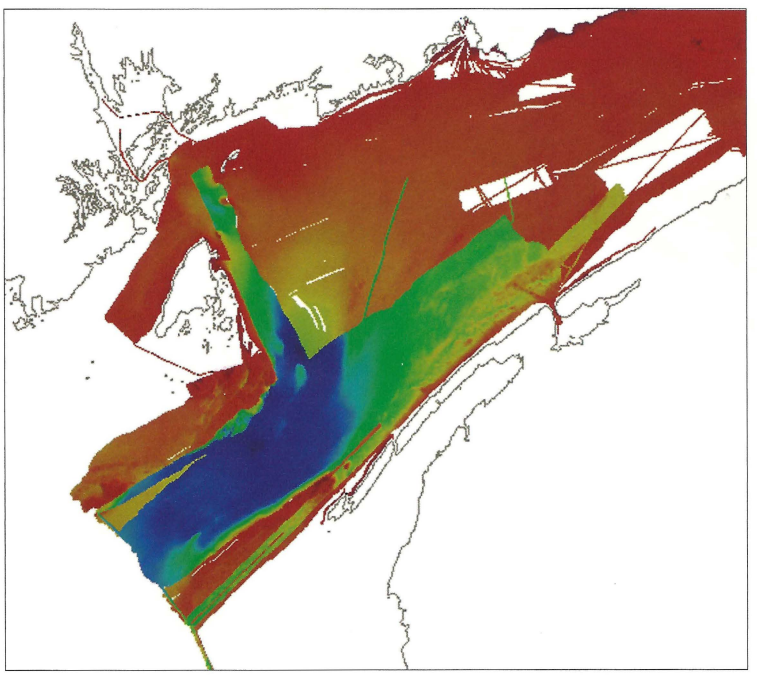


Figure 10: Creed 2006 Survey on top of the 2007 through 2009 combined surface

6.2 Creed 2006

The *Creed* 2006 survey was edited for outliers. A MSL surface was generated using WebTide for tidal corrections. The resulting surface was translated to the ITRF ellipsoid and then differenced from the 2007 through 2009 combined ITRF surface (Figure 10). The mean difference was -0.45m with a standard deviation of 0.60m.

6.3 Creed 1999

The *Creed* 1999 data set was handled slightly differently than the *Creed* 2006 and *Creed* 1996. CARIS HDCS files were provided for this data set that included tide files. These chart datum referenced tide files were used rather than generating new predicted tides. A chart datum surface was created from the data set, which was then translated to an ITRF reference, which included the MSL/Chart datum offset. This surface was then differenced from the combined 2007 through 2009 ITRF surface. The difference surface was divided into 7 areas for individual evaluation (Figure 11). The resulting statistics are shown in Table 2. Only three areas were used for integration into the larger data set; North, Centre and East. Each area was shifted by the bias, assumed to be the chart datum/geoid separation. The resulting surfaces were merged into the existing ITRF Surface.

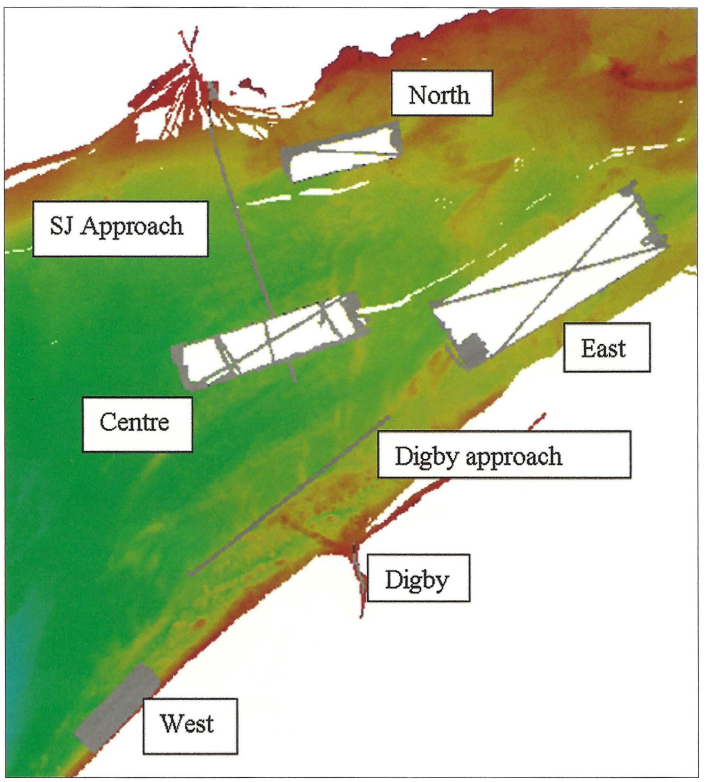


Figure 11: Creed 1999 Difference Evaluation Areas

Area	Mean	Std Dev
Centre	4.222	1.041
Digby	6.220	1.108
Digby Approach	7.074	0.470
East	5.124	1.655
North	5.284	1.083
SJ Approach	5.172	0.731
West	4.965	1.142

Table 2: Combined ITRF - Creed 1999 statistics

6.4 Heron 2006, 2007 and 2008

Several data sets collected by the UNB OMG using the *Heron* in 2006, 2007 and 2008 were incorporated into the final surface. These data sets were imported and cleaned in HIPS, where WebTide derived tidal correctors were used to remove the tidal effect. The resulting surfaces were translated to ITRF and merged with the other data sets. Some areas of Passamaquody Bay were still missing. These data were supplied by the UNB OMG in the form of 5m XYZ grid text files. These files were translated to ITRF and then incorporated into the overall dataset.

6.5 Final Surface

Figure 12 shows the final combined surface. This is a 6 GB 5x5m surface in CARIS CSAR format (All_CMPPLH_96thru09_ITRF_Inter_UNB.CSAR). This surface can be viewed using the freeware program CARIS Easy View. The surface is comprised of data from the *Creed, Matthew*, *Plover*, *Pipit*, and *Heron* collected from 1996 through 2009.

7 Conclusions and Recommendations

On average, the predicted tide surfaces agreed well with the GPS tide generated surfaces, even though large discrepancies occurred. The mean differences could be attributed to Sea Surface Topography; however, this must be investigated further before any definitive conclusions can be drawn. The standard deviation of the differences

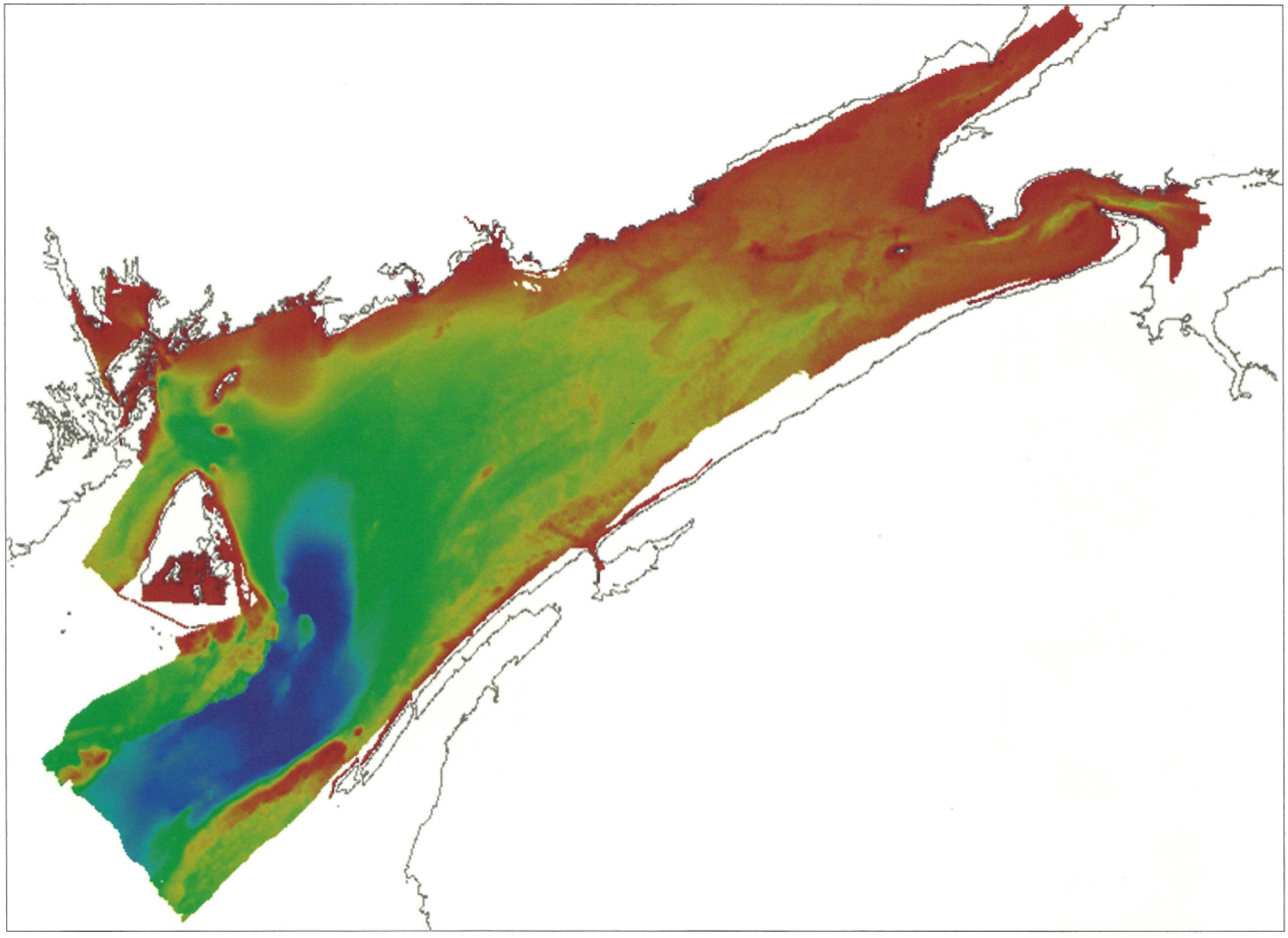


Figure 12: Final Bay of Fundy surface (ITRF)

indicated the effect of using a hydrodynamic model that does not capture the true nature of the Bay of Fundy tides. A closer evaluation of these differences could be used to help improve the models, and a re-evaluation conducted to validate those improvements.

Further cleaning of GPS data is required in order to remove all GPS height related artefacts. In areas where GPS heights have been removed, locally shifted predicted MSL tides (WebTide) were used, but not all anomalies were detected and removed.

Using GPS heights to remove all vertical vessel movement from the data is a very effective method for producing consistent bathymetry. The challenge is in developing the models for translating that GPS derived surface to a chart datum.

For future surveys it is recommended that raw GPS data be recorded constantly on all survey platforms. As an integral part of the calibration process, prior to the beginning of a project, vessels should spend some time by a tide gauge where the separation between the ellipsoid and chart datum are well established. These calibration data sets should be considered a vital component of the overall data and be stored with the production survey files.

The surfaces produced for this project were at 5m resolution. This was chosen to avoid gaps in the data in deeper water. A much more desirable solution would be to have a multi-resolution surface, where it could be reduced to 1m or less near shore and expand to 5m or greater in the deeper waters, depending on depth observation spacing and feature form. Research is being conducted in the development of these surfaces.

Acknowledgements

The following people and/or groups were instrumental in the completion of this project

- CARIS provided the use of HIPS and Bathymetry Editor software
- Ian Church of the University of New Brunswick's OMG for creating the predicted tide files
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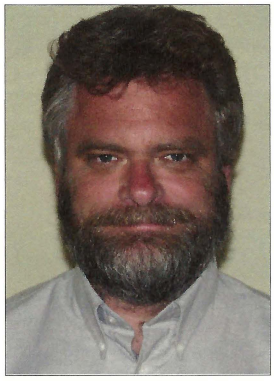
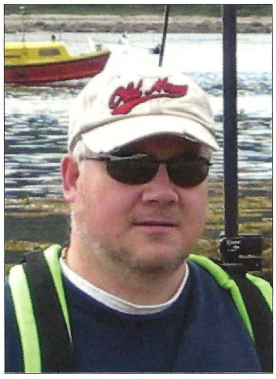
- Phillip MacAulay of Canadian Hydrographic Service (CHS) Atlantic for providing Saint John tide gauge data
- Russell Parrott of GSC Atlantic for providing funding

About the Authors...



David Dodd received a B.Sc. and M.Sc. in Surveying Engineering from the University of New Brunswick (UNB) in Fredericton, NB, Canada. He completed a PhD in Marine Science at the University of Southern Mississippi (USM). He spent eight years conducting research and directing the Hydrographic Science Master's program at USM before moving to UNB as a Senior Research Associate with the department of Geodesy and Geomatics Engineering. He recently joined the Tides and Water Levels group of the Canadian Hydrographic Service, Central and Arctic region.



Jonathan Griffin is currently a Hydrographer-in-Charge with the Canadian Hydrographic Service (Atlantic Region). He has worked with the Bay of Fundy project since 2007. Jon joined the CHS in 1991 bring ing with him training in Remote Sensing and GIS and experience as a Deck Officer with the Canadian Coast Guard. A recent Masters graduate of UNB (2005) Jon is currently running a field revisory program for local hydrographic and charting programs in Atlantic Canada

UNCLOS Update: Spring 2010

By: J. Richard (Dick) MacDougall, Law of the Sea Project, Canadian Hydrographic Service

Background:

The Canadian work on preparing a submission of the outer limits of the Canadian continental shelf to the Commission on the Limits of the Continental Shelf (CLCS) under Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS) has been underway since early 2005 working towards a submission deadline of December 2013.

Previous papers and *Lighthouse* updates covered off establishing an UNCLOS office at the Bedford Institute of Oceanography and data collection projects which can be summarized as follows:

Atlantic

Summer 2006	contract multibeam bathymetric survey around the Grand Banks.
Summer 2007	contract reflection seismic and bathymetric survey off the Scotian Shelf.

Arctic

Winter 2006	LORITA (Lomonosov Ridge Test of Appurtenance) refraction seismic survey on the Arctic Ocean – a joint Canada-Denmark project from CFS Alert.
Summer 2006	bathymetric survey and test seismic survey in the Canada Basin from the icebreaker CCGS *Louis S. St-Laurent*.
Winter 2007	Through-ice bathymetric survey from CFS Alert.
Summer 2007	Seismic and bathymetric survey of the Canada Basin from the CCGS *Louis S. St-Laurent*.
Summer 2007	Canadian-Danish seismic and bathymetric survey on *Oden* collected data on Lomonosov Ridge.
Winter 2008	ARTA (Alpha Ridge Test of Appurtenance) refraction seismic survey from Eureka and a through-ice bathymetric survey from an ice-camp at the mouth of Nansen Sound.
Summer 2008	Seismic and bathymetric survey of the Canada Basin from the CCGS *Louis S. St-Laurent* and the USCGC *Healy*.
Winter 2009	Canadian-Danish through-ice sounding program using helicopters from an ice camp located on the Ward Hunt ice shelf.
Winter 2009	Canadian-Danish Aero-Gravity and Aero-Magnetic program between Ellesmere Island and the north Pole, flown from Eureka, CFS Alert and Station Nord.

Update

Atlantic

There were two data collection programs on the Atlantic margin in summer 2009, both in the Labrador Sea area. A contract reflection seismic and multibeam bathymetry program carried out by Fugro GeoSurveys and a Canadian-Danish refraction seismic survey on CCGS *Hudson* using Ocean Bottom Seismometers (OBS) (Figure 1). These surveys were strategically designed to add to the existing seismic data in the Labrador Sea.

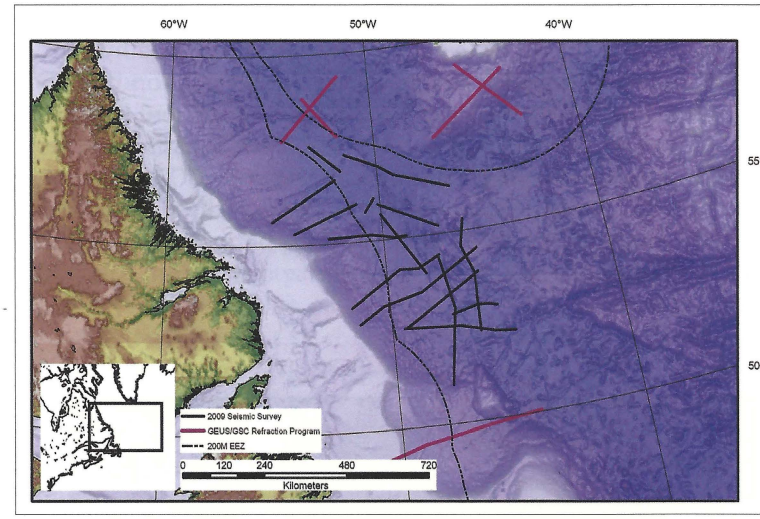


Figure 1: Contract Survey - Bathymetric and Seismic survey line (black) and CCGS Hudson - Refraction survey lines (red).

Arctic

Arctic surveys continued in summer 2009 with the CCGS *Louis S. St-Laurent* conducting bathymetric and seismic surveys in the Canada Basin. In 2009 the CCGS *Louis S. St-Laurent* was again joined by a second icebreaker, the US Coast Guard Cutter *Healy* (Figure 2). These vessels complement each other since CCGS *Louis S. St-Laurent*

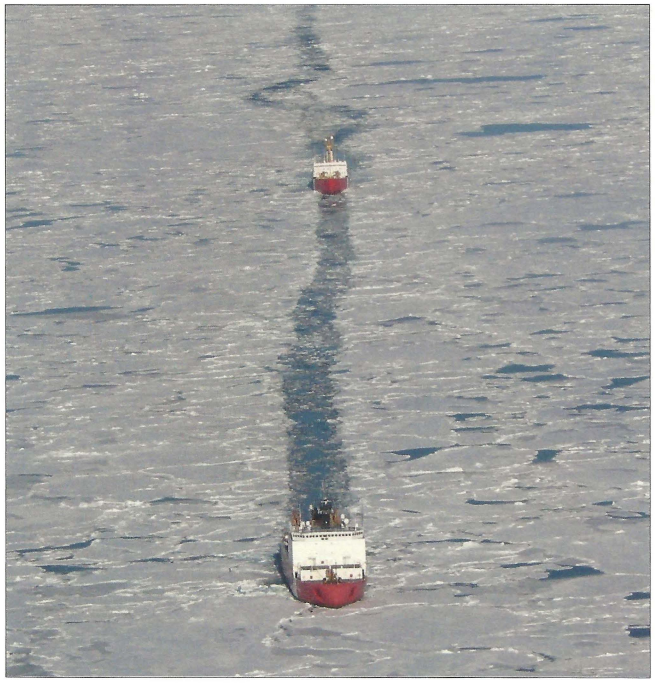


Figure 2: 2009 survey - CCGS Louis S. St-Laurent following USCGC Healy

is equipped with a seismic system and the USCGC *Healy* with both a multibeam echo sounder and a sub-bottom profiler. This two-ship operation saw the USCGC *Healy* breaking ice for the CCGS *Louis S. St-Laurent* where seismic data collection was a priority and vice-versa when bathymetry was a priority. Again, ice conditions allowed the survey to proceed further north than planned – all the way to 84° 12'N. Both vessels collected bathymetry on all legs while seismic was collected only on profiles where seismic was a priority (Figure 3). Where feasible, spot depths were collected between the sounding profiles using a transducer suspended from the CCGS *Louis S. St-Laurent*'s helicopter (Figure 4). Since the ship profiles are nominally 50NM apart, these spot depths help fill in the gaps in this area of very sparse data.

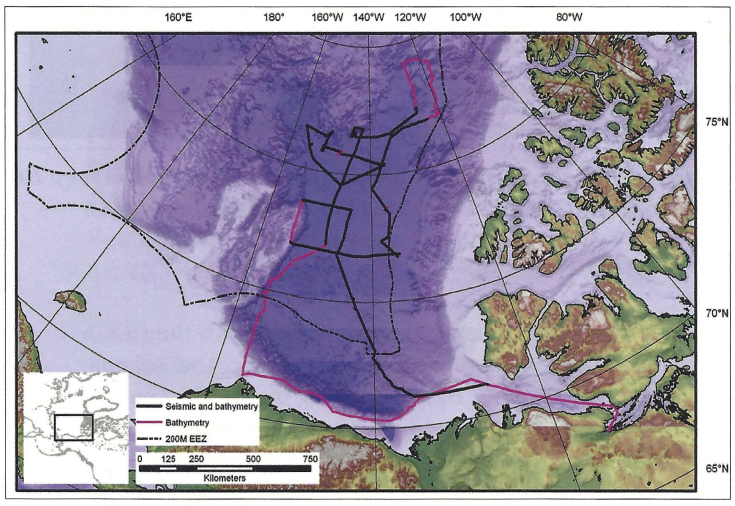


Figure 3: CCGS Louis S. St-Laurent and USCGC Healy 2009 survey lines

Figure 4: Spot sounding from CCGS Louis S. St-Lautent helicopter

Canada and Denmark also cooperated on a joint program on Lomonosov Ridge in summer 2009 using the Swedish icebreaker *Oden*. A Canadian hydrographer was part of the team. The objectives were to collect bathymetry and seismic data on both sides of Lomonosov Ridge working from the area of the north pole back towards the North American margin (Figure 5). All objectives were met on the cruise as well as a visit to the pole itself (Figure 6).

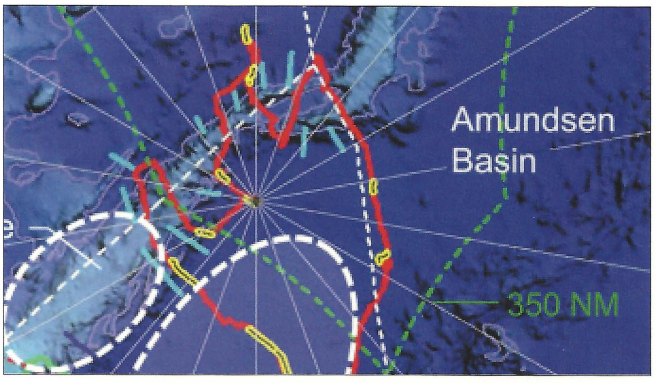


Figure 5: 2009 coverage by Oden - red is ship track; yellow is seismic data; bathymetry on both red and yellow; light blue is bathymetry collected by helicopter from Oden *(source : www.a76.dk)*

In September 2009 the government of Canada took delivery of two Autonomous Underwater Vehicles (AUV) manufactured by International Submarine Engineering (ISE) in Vancouver. These vehicles are Explorer class and were funded by the UNCLOS program and by Defence Research and Development Canada. The purpose of these vehicles is to collect bathymetry under the ice and they are designed to be recharged and data downloaded without a requirement for the AUV to surface. These vehicles are rated to 5000 metres depth, have an endurance of 72 hours and a mission range of approximately 400km. They are equipped with both a Knudsen single beam echo sounder and a Kongsberg EM2000 multibeam echo sounder. Acceptance trials were performed in Vancouver in September and a full length mission trial conducted at the Department of National Defence facility at Nanoose Bay on Vancouver island.

Figure 6: Canadian hydrographer Mike Lamplugh and Oden at the North Pole

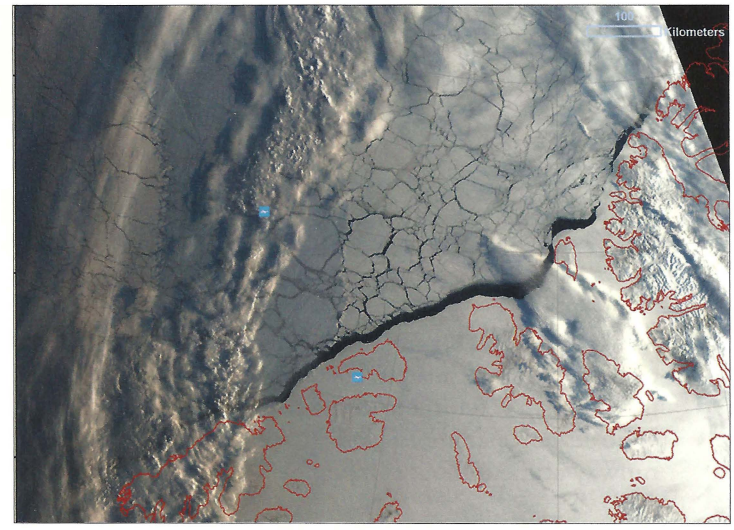


Figure 8: Blue squares are camp locations - black areas are open water

In November 2009, the UNCLOS teams from Canada, Denmark and Russia met in Halifax for an Arctic data workshop. A representative from the USA also attended and each country presented updates on their data collection and analysis. The possibility of future joint projects was discussed. A tangible outcome was an agreement that Canada, Denmark and Russia would jointly analyse their data and write a joint scientific paper on Lomonosov Ridge.

Winter 2010 (February 22 – late May)

Bathymetric Survey

An on-ice bathymetric and gravity survey was conducted from an ice- camp near Borden Island in winter 2010 using 4 helicopters (Figure 7). This camp was also the launching base for the AUV program and reached a day time population high of 45 people at one time. A second camp staffed by 10-11 people was located 300km offshore to provide a charging station of the AUV as well as weather information, a refuelling base and a secondary base for helicopters for short periods. The objective of the project was to complete the bathymetric surveys between the winter 2008 ARTA survey and the 2009 surveys data collect by the CCGS *Louis S. St-Laurent* and the USCGC *Healy*.

The timing of the program slipped due to inclement weather in the Borden island area. The construction of the camp and runway were contracted and while construction commenced earlier than in the previous year, the wind and visibility did not cooperate and occupation of the camp was significantly delayed.

The Canadian Weather Service was funded to provide weather products in the survey area as well as to track changes to the ice and the drift of ice, including Figure 8. A significant lead opened all along the margin the Canadian Archipelago as well as many smaller leads and the offshore pans of ice were in constant motion. The large lead near Borden Island caused ice fog. This impacted the ferrying of material and fuel to the camp, the arrival of the helicopters at the camp and on many days the helicopters could not get around the fog bank to reach the intended work area.

Once the initial three week time delay was factored in, the time-line for the remainder of AUV program evolved essentially as planned. The overall deployment plan was not delayed by the fact that the original remote camp drifted out of the range of the AUV and had to be torn down, moved closer to Borden Island and reassembled because this activity occurred while the AUV was being prepared for its mission (Figure 9). Because the mission could not be extended into May due to contract commitments and expected weather deterioration that would impact the remote camp, the start up delays meant that the AUV ran only one mission. However, this was a significant achievement because the AUV completed two transits of 330km each (Borden camp to remote camp return) and a 300km mission to Sever Spur from the remote camp – all under the ice without along-track surface

Figure 7: Ice camp near Borden Island; (L to R) AUV tent, main camp tents, workshop tents (Photograph courtesy of Tim Janzen, CHS)

Figure 9: Photo of the AUV tent lit from the inside at sun rise

navigation aids (Figure 10). In all, the AUV successfully collecting approximately 1000km of bathymetry. By the time the AUV returned to base at Borden Island, there were leads opening up less than a kilometre from the runway at the remote camp.

Once the AUV was underwater it was relatively immune to surface weather conditions which significantly impacted the helicopter sounding operation. Less data than planned was collected using the helicopters (Figure 11).

There was significant interest in the winter 2010 program. Visitors included Lawrence Cannon, the Minister of Foreign Affairs and International Trade, Canada and a bevy of journalists including Paul Watson of the Toronto Star and a German TV crew.

General

In May 2009 the UNCLOS Management Board met with the teams that presented the New Zealand and Australian submissions to the CLCS to learn from their experience both with regards to the science used in their submissions and the feedback they received from the CLCS. In May 2010 similar meetings were held with Norway.

Evolution of Team

Louis Simard, Director, Continental Shelf Division and the original DFAIT member of the Management Board has returned to the Board. Hydrographers Joe Manning and Paola Travaglini have joined the program and Tim Janzen has assumed the role of Hydrographer in Charge of the Arctic winter surveys. Jon Biggar continues as Hydrographer in Charge of the CCGS *Louis S. St-Laurent* survey. Walli Rainey has joined the program as GIS support.

Future Plans

Conduct a joint seismic and bathymetric survey in the Beaufort Sea / Canada Basin using the USCGC *Healy* and the CCGS *Louis S. St-Laurent* in summer 2010.

Continue Arctic data comparisons and discussions with Denmark, Russia and the USA.

Review AUV operation and plan 2011 program.

Acknowledgements

Thanks to Jon Biggar, Kevin Desroches, Garry Heard, Tim Janzen, Joe Manning for input of photos and figures.

Figure 10: AUV returned home to launch hole

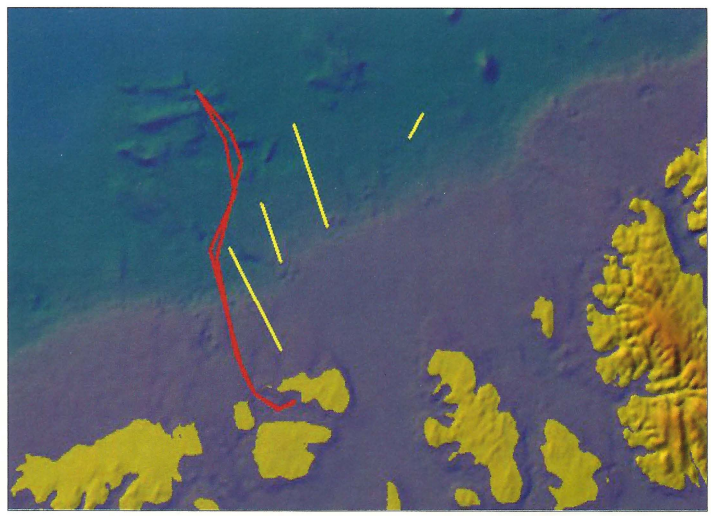


Figure 11: Winter 2010 - AUV survey track in red; helicopter sounding profiles in yellow

Dimanche 20 juin 2010

Heure	Activités	Lieu
8h00 - 16h30	Pré-inscription	Centre des Congrès (CCQ) Foyer 2
8h00 - 23h00	Montage des kiosques	Centre des Congrès (CCQ) 200C
9h00 - 16h00	Atelier de formation offert par **ESRI** : Un SIG qui repousse la portée de vos activités marines et hydrographiques (en anglais)	Centre des Congrès (CCQ) 204A
17h30 - 20h00	Cocktail de bienvenue (service de navette)	MESS de la Réserve Navale de Québec
18h00 - 19h30	Visite du Musée naval de Québec (100e anniversaire de la marine royale canadienne)	

Lundi 21 juin 2010 (Journée mondiale de l'hydrographie)

Heure	Activités	Lieu
7h00 - 8h30	Montage des kiosques	200C
7h30 - 17h00	Inscription	Foyer 2
8h30 - 10h00	Ouverture officielle de la conférence	200A
9h00 - 16h00	Programme des conjoints (activité payante)	Tour de ville
10h00 - 17h00	Ouverture de l'exposition	200C
10h00 - 10h30	Pause-café	200C
10h30 - 12h00	**Session 1** : La délimitation de la fontière maritime (UNCLOS)	200A
12h00 - 13h30	Dîner (commandité par CARIS, partenaire Capitaine)	200C
13h00 - 13h30	Session d'affichage avec auteurs	200C
13h30 - 15h00	Visite de bateaux hydrographiques Ouvert au grand public (gratuit)	CCQ (à l'extérieur) et Port de Québec
13h30 - 14h50	**Session 2** : Affaires, carrières et formation	200A
14h50 - 15h20	Pause café	200C
15h00 - 17h00	Exposition portes ouvertes au grand public (gratuit)	200C
15h20 - 16h40	**Session 3** : L'hydrographie écosystémique	200A
17h00	Fermeture de l'exposition	200C
17h00-17h45	Départs des navettes pour le quai Chouinard	Hall Principal du CCQ
18h	Embarquement sur le Louis-Jolliet	Quai Chouinard
19h	Souper-croisière sur le Louis-Jolliet (commandité par Kongsberg, partenaire Amiral)	
22h	Retour au quai	

Mardi, 22 juin 2010

Heure	Activités	Lieu
7h30 - 17h00	Inscription	CCQ Foyer 2
8h30 - 16h30	Ouverture de l'exposition	200C
8h30 - 10h10	**Session 4** : Acquisition des données	200A
9h30 -14h30	Programme des conjoints (activité payante)	Wendake
10h10 - 10h40	Pause-café	200C
10h40 - 12h00	**Session 5** : Systèmes de référence horizontaux et verticaux	200A
12h00 - 13h30	Dîner (commandité par CARIS, partenaire Capitaine)	200C
12h00 - 13h30	Assemblée générale annuelle de l'ACH	202
13h00 - 13h30	Session d'affichage avec auteur	200C
13h30 - 17h00	**Ateliers** de formation de demi-journées (en anglais) :	CCQ
	9e atelier internationale de gestion de l'incertitude	204A
	CARIS: Gérer des données bathymétriques avec la technologie SGBDR	204B
	Hypack Inc: Les nouveautés 2010 de Hypack®	205A
	Chesapeake Technology: SonarWiz5 : la prochaine génération de logiciels de cartographie du fond marin	205B
	Démonstrations à bord de bateaux hydrographiques	Port de Québec
13h30 - 14h50	**Session 6A** : Navigation moderne (navigation électronique)	200A
14h50 - 15h20	Pause-café	200C
15h20 - 16h40	**Session 6B** : Navigation moderne (navigation électronique)	200A
16h30	Fermeture de l'exposition	200C
17h30 - 20h00	Soirée des exposants (commandité par ESRI, partenaire Commodore)	200C

Mercredi, 23 juin 2010

Heure	Activités	Lieu
7h30 - 15h00	Inscription	Foyer 2
8h30 - 16h30	Ouverture de l'exposition	200C
8h30 - 10h10	**Session 7** : Diffusion des données	200A
9h00 - 12h00	Visite du centre de simulation et d'expertise maritime	Port de Québec
10h10 - 10h40	Pause-café	200C
10h00 - libre	Programme des conjoints (activité payante)	Quartier Petit-Champlain
10h40 - 12h00	**Session 8A** : Traitement des données	200A
12h00 - 13h30	Dîner (commandité par CARIS, partenaire Capitaine)	200C
13h00 - 13h30	Session d'affichage avec auteur	200C
13h30 - 14h50	**Session 8B** : Traitement des données	200A
14h50 - 15h20	Pause-café	200C
15h20 - 16h40	**Session 9** :Production cartographique	200A
16h30	Fermeture de l'exposition	200C
16h40 - 17h10	Cérémonie de clôture	200A

Sunday, June 20, 2010

Time	Activities	Where
8:00am - 4:30pm	Pre-registration	Québec City Convention Center (CCQ) Foyer 2
8:00am-11:00pm	Booth preparation	Québec City Convention Center Room 200C
9:00am - 4:00pm	Training Workshop offered by **ESRI** : Using GIS to Advance Your Marine and Hydrographic Objectives	Québec City Convention Center Room 204A
5:30pm - 8:00pm	Icebreaker Cocktail (shuttle service)	Québec City Navy reserve MESS
6:00pm - 7:30pm	Tour of the Naval Museum of Québec (100th anniversary of the Royal Canadian Navy)	

Monday, June 21, 2010 (World Hydrography Day)

Time	Activities	Where
7:00 - 8:30am	Booth preparation	200C
7:30am - 5:00pm	Registration	Foyer 2
8:30 - 10:00am	Official conference opening	200A
9:00am - 4:00pm	Spouses' program (activity with a fee)	City Tour
10:00am-5:00pm	Exhibition	200C
10:00 -10:30am	Coffee break	200C
10:30-12:00pm	**Session 1**: Delimitation of seaward borders (UNCLOS)	200A
12:00-1:30pm	Meal (sponsored by CARIS, Captain Partner)	200C
1:00 -1:30pm	Poster session with authors	200C
1:30 - 3:00pm	Visit of hydrographic vessels open to the public (free)	CCQ (outside) and Port of Québec
1:30 - 2:50pm	**Session 2** : Business, Careers and Training	200A
2:50 - 3:20pm	Coffee break	200C
3:00 - 5:00pm	Exhibit open to the public (free)	200C
3:20pm-4:40pm	**Session 3** : Ecosystemic Hydrography	200A
5:00pm	Exhibition closure	200C
5:00pm-5:45pm	Shuttle departures for Chouinard Pier	CCQ Main hall
6:00pm	Participants board the Louis-Jolliet	Chouinard Pier
7:00pm	Dinner Cruise aboard the Louis-Jolliet (sponsored by Kongsberg, Admiral Partner)	
10:00pm	Return to the wharf	

Tuesday, June 22, 2010

Time	Activities	Where
7:30am-5:00pm	Registration	CCQ Foyer 2
8:30am - 4:30pm	Exhibition	200C
8:30 - 10:10am	**Session 4** : Data Acquisition	200A
9:30am-2:30pm	Spouses' program (activity with a fee)	Wendake
10:10 - 10:40am	Coffee break	200C
10:40 - 12:00pm	**Session 5** : Horizontal and Vertical Datum	200A
12:00 - 1:30pm	Meal (sponsored by CARIS, Captain Partner)	200C
12:00 -1:30pm	CHA annual general meeting	202
1:00 - 1:30pm	Poster session with authors	200C
1:30pm- 5:00pm	Half-Day Training **Workshops** :	CCQ
	9th Annual International Uncertainty Management Workshop	204A
	CARIS: "Managing Bathymetric Data with RDBMS technology"	204B
	HYPACK, Inc: Best of HYPACK® 2010	205A
	Chesapeake Technology: SonarWiz5: Next generation sea-floor mapping software	205B
	Demonstrations aboard hydrographic vessels	Port de Québec
1:30 - 2:50pm	**Session 6A**: Modern Navigation (e-navigation)	200A
2:50 - 3:20pm	Coffee break	200C
3:20 - 4:40pm	**Session 6B**: Modern Navigation (e-navigation)	200A
4:30pm	Exhibition closure	200C
5:30pm-8:00pm	Exhibitors@evening (Sponsored dy ESRI, Commodore Partner)	200C

Wednesday, June 23, 2010

Time	Activities	Where
7:30am-3:00pm	Registration	Foyer 2
8:30am-4:30pm	Exhibition	200C
8:30 - 10:10am	**Session 7:** Data Dissemination	200A
9:00am-12:00pm	Visit of Marine Simulation and Resource Centre	Port de Québec
10:10 - 10:40am	Coffee break	200C
10:00am - ...	Spouses' program (activity with a fee)	Quartier Petit-Champlain
10:40 - 12:00pm	**Session 8A**: Data Processing	200A
12:00 - 1:30pm	Meal (sponsored by CARIS, Captain Partner)	200C
1:00 - 1:30pm	Poster session with authors	200C
1:30pm-2:50pm	**Session 8B**: Data Processing	200A
2:50 - 3:20pm	Coffee break	200C
3:20 - 4:40pm	**Session 9**: Chart Production	200A
4:30pm	Exhibition closure	200C
4:40 - 5:10pm	Closing ceremony	200A

U.S. HYDRO 2011

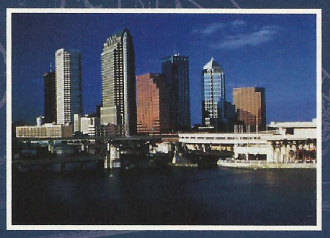
April 25-28, 2011 • Marriott Waterside Hotel • Tampa, Florida USA

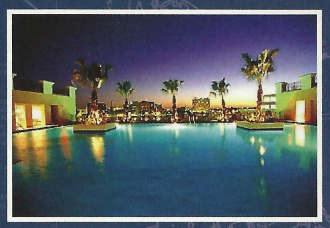
The Hydrographic Society of America (THSOA) will organize and host the 2011 U.S. Hydrographic Conference.

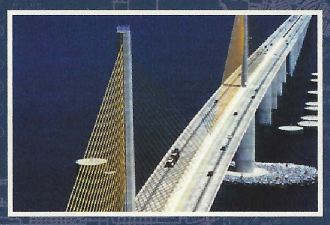
U.S. Hydro 2011 will offer participants:

- Hydrographic Workshops
- Technical Program
- Commercial Exhibits
- On Water Demonstrations
- Social Events

With plenty of water, sand and sunshine, Tampa is a Florida west coast community with an inherent Southern charm. The conference will be held at the Tampa Marriott Waterside Hotel, a luxury waterfront hotel and marina situated along the Channel Riverwalk overlooking Tampa Bay in the heart of Downtown.







For more information, please visit the THSOA website

www.thsoa.org

chc2010

21-23 juin | June 21-23
Québec, QC, CANADA
www.chc2010.ca

TECHNICAL PROGRAM – PROGRAMME TECHNIQUE

SUNDAY, 20 JUNE 2010 — DIMANCHE, 20 JUIN 2010

09:00 – 16:00 **WORKSHOP – ATELIER**
Using GIS to Advance Your Marine and Hydrographic Objectives (ESRI)
Québec City Convention Center - Room 204A
Centre des congrès de Québec - Salle 204A

17:30 – 20:00 **ICEBREAKER COCKTAIL – COCKTAIL DE BIENVENUE**
Québec City Navy Reserve Mess – Mess de la Réserve navale de Québec

Tour of the Naval Museum of Québec [100th anniversary of the Royal Canadian Navy]
Visite du Musée naval de Québec [100ième anniversaire de la Marine royale du Canada]

MONDAY, 21 JUNE 2010 — LUNDI, 21 JUIN 2010
WORLD HYDROGRAPHY DAY — JOURNÉE MONDIALE DE L'HYDROGRAPHIE

08:30 – 10:00 **OPENING CEREMONIES – CÉRÉMONIES D'OUVERTURE**
Québec City Convention Center – Room 200A
Centre des congrès de Québec – Salle 200A

10:00 – 10:30 **Opening of Exhibits and Coffee Break** sponsored by the Association of Canada Lands Surveyors
Ouverture de la salle d'exposition et Pause Café commanditée par l'Association des arpenteurs des terres du Canada
Room/Salle 200C

SESSION 1 **DELINEATION OF MARITIME BOUNDARIES [UNCLOS] – DÉLIMITATION DES FRONTIÈRES MARITIMES [CNUDM]**
Room/Salle 200A

10:30 – 12:00 Chair/Président: Julian Goodyear (CHS-SHC)

Joint United States-Canada Arctic Extended Continental Shelf Bathymetry Program
[Programme conjoint Canada/États-Unis de bathymétrie du plateau continental étendu de l'Arctique]
Julian Goodyear (CHS-SHC), Andrew Armstrong (NOAA), Larry Mayer (UNH) and/et Jon Biggar (CHS-SHC)

The Foundational Role Hydrography Plays in U.S. Arctic Strategic Planning
[Le rôle fondateur de l'hydrographie dans la planification stratégique des États-Unis dans l'Arctique]
Ashley Chappel (NOAA)

Expérience arctique [Arctic Experience]
Christian Comtois (CHS-SHC)

PLENARY – PLÉNIÈRE

12:00 – 13:30	**LUNCH BREAK** sponsored by CARIS, Captain Partner **DÎNER** commandité par CARIS, Partenaire Capitaine *Room/Salle 200C*
13:00 – 13:30	**POSTER SESSION 1 – SESSION D'AFFICHAGE 1** *Room/Salle 200C*
SESSION 2	**BUSINESS, CAREERS AND TRAINING – AFFAIRES, CARRIÈRES ET FORMATION** *Room/Salle 200A*
13:30 – 14:50	Chair/Président: Paul Bellemare (CHS-SHC – retired/retraité)
	La gamme de produits et de services du Service hydrographique du Canada **[Canadian Hydrographic Service - Products and Services]** *Daniel Pelletier and/et Christopher Hemmingway (CHS-SHC)*
	Simplifying the Hydrographic production line - A proof of concept **[Simplifier la chaîne de production hydrographique – Démonstration de faisabilité]** *Terje Haga Pedersen (Kongsberg Maritime) and/et Mark Masry (CARIS)*
	Hydrography at IHO cat. A level: in deep scientific education, at sea training, and interaction with industry **[L'hydrographie de catégorie A de l'OHI: Éducation scientifique en profondeur, formation en mer et interaction avec l'industrie]** *Nathalie Debese, Roderick Mitié and/et Nicolas Seube (ENSIETA)*
	Academic Formation and Research in Hydrography at Laval University's Department of Geomatics Sciences **[La formation et la recherche en hydrographie au Département des Sciences géomatiques de l'Université Laval]** *Rock Santerre (Université Laval)*
14:50 – 15:20	**Coffee Break** sponsored by Ordre des arpenteurs-géomètres du Québec **Pause Café** commanditée par l'Ordre des arpenteurs-géomètres du Québec *Room/Salle 200C*
SESSION 3	**ECOSYSTEMIC HYDROGRAPHY – L'HYDROGRAPHIE ÉCOSYSTÉMIQUE** *Room/Salle 200A*
15:20 – 16:40	Chair/Président: Kian Fadaie (CHS-SHC)
	Filling in the white strip: An evaluation of the use of phase-measuring bathymetric sidescan sonar for nearshore bathymetric and habitat mapping **[Remplir la bande blanche: Évaluation de l'utilisation du sonar bathymétrique à vision latérale et mesure de phase pour la bathymétrie littorale et la cartographie des habitats]** *Rob Hare (CHS-SHC), Doug Lockhart (Teledyne RD Instruments), Kalman Czotter and/et Jacques Gagné (CHS-SHC)*
	Mapping capelin demersal spawning habitat off northeast Newfoundland **[Cartographie de l'habitat de fraie du capelan au nord-est de Terre-Neuve]** *André Roy (CHS-SHC)*
	Using multibeam angular range analysis coupled with "underway" in-situ ground-truthing technology for benthic habitat mapping **[Utilisation de l'analyse de la portée angulaire multifaisceaux couplée à la technologie de référence-terrain in situ pour la cartographie des habitats benthiques]** *Derrick Peyton (ODIM Brooke Ocean), Craig Brown (DFO-MPO), Gerard Costello (CHS-SHC) and/et Patrick Potter (NRCan-RNCan)*
	The Benthic Ecology of Beaufort's Dyke **[L'écologie benthique de la région de Beaufort's Dyke]** *Alex Callaway (University of Ulster), Craig Brown (DFO-MPO), Rory Quinn (University of Ulster), Matthew Service (Agri-Food and Biosciences Institute) and/et Dave Long (British Geological Survey)*
17:00 – 17:45	**Shuttle departures for Chouinard Pier – Départ des navettes pour le Quai Chouinard** *Main Hall/Hall principal*
18:00	**Participants board the Louis-Jolliet – Embarquement sur le Louis-Jolliet**
19:00 – 22:00	**DINNER CRUISE ABOARD THE LOUIS-JOLLIET** sponsored by Kongsberg, Admiral Partner **SOUPER-CROISIÈRE SUR LE LOUIS-JOLLIET** commandité par Kongsberg, Partenaire Amiral

TUESDAY, 22 JUNE 2010 — MARDI, 22 JUIN 2010

SESSION 4 — **DATA ACQUISITION – ACQUISITION DE DONNÉES**
Room/Salle 200A
08:30 – 10:10 Chair/Président: *(to be determined)*

Testing the Capability of a Terrestrial-based Lidar Instrument to Inventory on-shore Assets from a Moving Boat
[Évaluation de la capacité d'un Lidar "terrestre" pour répertorier les infrastructures côtières depuis un navire en mouvement]
Eric Martin and/et Tyler Kou (Optech Incorporated)

Contrasting a ship-based acoustic patch test with an automated calibration routine for a circular-scanning airborne lidar system
[Comparaison d'un "patch test" acoustique à bord d'un navire et d'une procédure d'étalonnage automatisée pour un système lidar aéroporté à balayage circulaire]
Michael Gonsalves (NOAA/NOS/NGS/Remote Sensing Division)

Value and Use of Simple Statistical Techniques in Multibeam Sonar Performance Analysis
[Valeur et utilisation de techniques statistiques simples pour les analyses de performance des sonars multifaisceaux]
Susan Sebastian and/et Clay Whittaker (U.S. Naval Oceanographic Office)

Accuracy modelling of bathymetry measurement by amplitude processing for multibeam echosounders
[Modélisation des précisions des mesures bathymétriques par traitement d'amplitude pour les échosondeurs multifaisceaux]
Yoann Ladroit, Xavier Lurton and/et Jean-Marie Augustin (IFREMER NSE/AS), René Garello (Télécom Bretagne ITI)

HUGIN 1000 and HISAS 1030: Efficient high-quality seabed mapping under ice
[HUGIN 1000 et HISAS 1030: Cartographie efficiente de grande qualité sous la glace]
Per Espen Hagen, Bjørn Jalving, Øystein Engelhardtsen, Einar Gustafson and/et Nick Burchill (Kongsberg Maritime)

10:10 – 10:40 **Coffee Break – Pause Café**
Room/Salle 200C

SESSION 5 — **HORIZONTAL AND VERTICAL DATUM – DATUM HORIZONTAL ET VERTICAL**
Room/Salle 200A
10:40 – 12:00 Chair/Président: Rock Santerre (Université Laval)

Intégration de données topographiques et bathymétrique dans un modèle unique
[Integrating Topographical and Bathymetric Data in a Single Model]
Frédéric Lavoie (CHS-SHC)

Evaluations of VDATUM in California
[Évaluations des plans de référence altimétriques en Californie]
Jerry Wilson and/et Dean Moyles (Fugro Pelagos), Mike Zieserl (JOA Survey, LLC)

Ellipsoidal Referenced Surveys and the Changing Realization of the Hydrographic Vertical Datum
[Levés basés sur un ellipsoïde de référence et la modification des datums verticaux hydrographiques]
Jack Riley and/et Corey Allen (NOAA)

Implementation and Validation of Separation Models for the use of GNSS Heights in Hydrographic Surveys
[Implémentation et validation de modèles de séparation pour l'utilisation des hauteurs GNSS pour les levés hydrographiques]
Ian Davies (Net Survey)

12:00 – 13:30 **LUNCH BREAK** sponsored by CARIS, Captain Partner
DÎNER commandité par CARIS, Partenaire Capitaine
Room/Salle 200C

12:00 – 13:30 **Canadian Hydrographic Association Annual General Meeting –**
Assemblée générale annuelle de l'Association canadienne d'hydrographie
Room/Salle 202

13:00 – 13:30 **POSTER SESSION 2 – SESSION D'AFFICHAGE 2**
Room/Salle 200C

13:30 – 17:00 **WORKSHOPS – ATELIERS**

9TH Annual International Uncertainty Management Workshop (CHS)
Room/Salle 204A

Managing Bathymetric Data with RDBMS Technology (CARIS)
Room/Salle 204B

Best of HYPACK® 2010 (HYPACK, Inc.)
Room/Salle 205A

SonarWiz5: Next Generation Sea-Floor Mapping Software (Chesapeake Technology)
Room/Salle 205B

13:30 – 17:00 **DEMONSTRATIONS ABOARD HYDROGRAPHIC VESSELS – DÉMONSTRATIONS À BORD DE BATEAUX HYDROGRAPHIQUES**
Port de Québec

SESSION 6A **MODERN NAVIGATION (e-Navigation) – NAVIGATION MODERNE**
Room/Salle 200A

13:30 – 15:10 Chair/Président: Capt. Robert Ward (IHB – BHI)

Hydrographic Products/Services as a Fundamental Component of the e-Navigation Concept of Operation
[Produits et services hydrographiques - des éléments fondamentaux de la navigation électronique]
Lee Alexander (Center for Coastal and Ocean Mapping, UNH) and/et Robert Ward (IHB-BHI)

Developing Custom Maritime Products and Tools for the Mariner
[Développer des produits et des outils sur mesure pour les navigateurs]
Kurt Nelson and/et Matthew Austin (NOAA Office of Coast Survey)

Weather Monitoring Buoys: Operational Wave Monitoring and Sea State Forecasting
[Bouées météorologiques: surveillance opérationnelle des vagues et des prévisions de l'état de la mer]
Andrew Rae (Canadian Marine Pilots' Association - Association des Pilotes Maritimes du Canada)

Using XML to Modernize the United States Coast Pilot®
[Moderniser les instructions nautiques américaines avec XML]
Scott Sherman (NOAA Office of Coast Survey)

PLENARY – PLÉNIÈRE

Recent Developments of US Army Corps of Engineers Inland Electronic Navigational Charts Program
[Développements récents du Programme de cartes électroniques de navigation des eaux intérieures du "US Army Corps of Engineers"]
Robert Mann and/et Denise LaDue (US Army Corps of Engineers)

L'ajout de la navigation électronique dans la boîte à outils du pilote
[Adding e-navigation to the pilot's toolbox]
Bernard Boissonneault (Corporation des Pilotes du Saint-Laurent Central)

Best standardized nautical information for safe navigation in ports - the Port ENC
[La meilleure information nautique normalisée pour une navigation sécuritaire dans les ports - CEN portuaire]
Dieter Seefeldt (Hamburg Port Authority)

PLENARY – PLÉNIÈRE

15:10 – 15:40 **Coffee Break – Pause café**
Room/Salle 200C

SESSION 6B **MODERN NAVIGATION (e-Navigation) – NAVIGATION MODERNE**
Room/Salle 200A

15:40 – 16:40 Chair/Président: Capt. Robert Ward (IHB – BHI)

Surestimation des capacités des appareils électroniques pour la navigation
[Overestimating the capabilities of electronic devices for navigation]
Alain Victor (Marine Simulation and Resource Centre - Centre de simulation et d'expertise maritime)

Nouvelle génération de système de carte électronique (carte 4-D)
[The next generation of electronic chart systems (4-D chart)]
Alain Richard (Institut Maritime du Québec)

Introducing bathymetric ENCs
[Introduction aux CEN bathymétriques]
Friedhelm Moggert-Kaegeler (SevenCs GmbH)

Canadian Contour Line Bathymetry Additional Military Layers Production: The Challenge with Supplementing the S-57 ENC
[Production de couches militaires additionnelles aux contours bathymétriques canadiens: le défi lié à l'amélioration de la CEN S-57]
Kevin Jones (Hydrographic Services Office – Esquimalt)

PLENARY – PLÉNIÈRE

17:30 – 20:00 **EXHIBITORS' EVENING** sponsored by ESRI, Commodore Partner
SOIRÉE DES EXPOSANTS commanditée par ESRI, Partenaire Commodore
Room/Salle 200C

WEDNESDAY, 23 JUNE 2010 — MERCREDI, 23 JUIN 2010

SESSION 7 **DATA DISSEMINATION – DIFFUSION DES DONNÉES**
Room/Salle 200A

08:30 – 10:10 Chair: *(to be determined)*

NOAA's H-Cell Sounding and Feature Management
[Gestion des sondages et objets à l'aide des "H-Cell" de la NOAA]
Edward Owens (NOAA Office of Coast Survey)

Seamless Online Distribution of Amundsen Multibeam Data
[Distribution en ligne des données multifaisceaux de l'Amundsen]
James Muggah, Ian Church, Jonathan Beaudoin and/et John Hugues Clarke (Ocean Mapping Group, UNB)

L'Observatoire global du Saint-Laurent - Un réseau innovateur et des solutions technologiques
[St. Lawrence Global Observatory: An innovative network and technological solutions]
Joanne Hamel (SLGO-OGSL)

Bathymetric Attributed Grids (BAGs): Discovery of Marine Datasets and Geospatial Metadata Visualization
[Format BAG: Découverte d'ensembles de données marines et visualisation des métadonnées géospatiales]
Andrew Armstrong and Kurt Schwehr (NOAA-UNH Joint Hydrographic Center), Richard Brennan (NOAA Atlantic Hydrographic Branch), David Fischman (NOAA National Geophysical Data Center), Jon Sellars (NOAA National Geodetic Survey) and/et Shep Smith (NOAA Ship Thomas Jefferson)

High Density Bathymetry on the Web
[La bathymétrie à haute densité sur le Web]
Kevin Wilson (CARIS)

10:10 – 10:40 **Coffee Break – Pause café**
Room/Salle 200C

09:00 – 12:00 **Visit of Marine Simulation and Resource Centre – Visite du Centre de simulation et d'expertise maritime**
Port de Québec

SESSION 8A **DATA PROCESSING – TRAITEMENT DES DONNÉES**
Room/Salle 200A
10:40 – 12:00 Chair: *(to be determined)*

Multibeam Echosounder Errors Characterization on Dumped Rocks Areas
[Caractérisation des erreurs des échosondeurs multifaisceaux dans des zones de dépôts rocheux]
Nathalie Debese, Nicolas Seube and/et Michel Legris (ENSIETA), Laurent Heydel (IGN) and/et Thibault Neumann (BOSKALIS)

Modeling the Effect of Oceanic Internal Waves on the Accuracy of Multibeam Echosounders
[Modélisation de l'effet des ondes internes océaniques sur la précision des échosondeurs multifaisceaux]
Travis Hamilton (Ocean Mapping Group, UNB) and/et Jonathan Beaudoin (Centre for Coastal and Ocean Mapping, UNH)

New Approaches for Evaluating Lidar-Derived Shoreline
[Nouvelles approches d'évaluation du trait de côte mesuré par Lidar]
Shachak Pe'eri, Brian Calder and/et Yuri Rzhanov (Centre for Coastal and Ocean Mapping, UNH), Chris Parrish and/et Stephen White (NOAA National Geodetic Survey, Remote Sensing Division)

Advanced Compilation Techniques for Regional Bathymetric Charting, Demonstrating the Integration of Disparate Datasets
[Techniques avancées de compilation pour la production de cartes bathymétriques régionales - Démonstration de l'intégration d'ensembles de données disparates]
Andy Hoggarth (CARIS), Wendy Woodford (DFO-MPO) and/et Ron MacNab (Geological Survey of Canada-Commission géologique du Canada – retired/retraité)

12:00 – 13:30 **LUNCH BREAK** sponsored by CARIS, Captain Partner
DÎNER commandité par CARIS, Partenaire Capitaine
Room/Salle 200C

13:00 – 13:30 **POSTER SESSION 3 – SESSION D'AFFICHAGE 3**
Room/Salle 200C

SESSION 8B **DATA PROCESSING – TRAITEMENT DES DONNÉES**
Room/Salle 200A
13:30 – 14:50 Chair: *(to be determined)*

4D Multimodal Visualization and Analysis of Seafloor Vents and Plumes
[Visualisation multimodale 4D et analyse des évents et des panaches du fond marin]
Maurice Doucet and Mark Paton (IVS 3D, Inc.), Jens Greinert (Royal Netherlands Institute for Sea Research) and/et Jim Gardner (Centre for Coastal and Ocean Mapping, UNH)

Reconstruction tridimensionnelle de scènes sous-marines à partir d'images acoustiques
[3D reconstruction of underwater scenes using acoustic imagery]
Naouraz Brahim and/et Sylvie Daniel (Université Laval), Didier Guériot (Télécom Bretagne)

Intrinsic acoustic quality of bathymetry measurement by multibeam echosounders
[Qualité acoustique intrinsèque des mesures bathymétriques par les échosondeurs multifaisceaux]
Xavier Lurton, Jean-Marie Augustin and/et Yoann Ladroit (IFREMER)

Application of JPEG 2000 Wavelet Compression to Multibeam Echosounder Mid-water Acoustic Reflectivity Measurements
[Application de la compression JPEG 2000 aux mesures de réflectivité acoustique de la colonne d'eau des échosondeurs multifaisceaux]
Jonathan Beaudoin (Ocean Mapping Group, UNB)

14:50 – 15:20 **Coffee Break – Pause café**
Room/Salle 200C

SESSION 9 **CHART PRODUCTION – PRODUCTION CARTOGRAPHIQUE**
Room/Salle 200A

15:20 – 16:40 Chair: Jacinthe Cormier (CHS-SHC)

Le chargement des bases de données du Service hydrographique du Canada, les défis et les contraintes associées
[Loading Canadian Hydrographic Service Databases: Challenges and Related Constraints]
Roger Côté, André Godin, Michelle Grenier and/et Denis Lefaivre (CHS-SHC)

One Database, One Object, Many scales. Approaches to Eliminating Data Redundancy in a Centralized Production System
[Une base de données, un objet, plusieurs échelles: des approches pour éliminer la redondance des données dans un système de production centralisé]
Timothy Kearns, Tom Depuyt, Rafael Ponce and/et Beata Van Esch (ESRI)

Le WikiSIG : un outil de cartographie participative appliqué à l'espace maritime
[WikiSIG: A participative mapping tool applied to the maritime context]
Mathieu Rondeau (CIDCO) and Stéphane Roche (Département des Sciences géomatiques, Université Laval)

Live chart compilation and quality control using CARIS Base Editor
[Compilation cartographique et contrôle de qualité en temps réel avec CARIS BASE EDITOR]
Louis Maltais (CHS-SHC)

16:40 – 17:10 **CLOSING CEREMONIES**
Room/Salle 200A

AVIS
ASSEMBLÉE GÉNÉRALE ANNUELLE

Association canadienne d'hydrographie
Le mardi 22 juin 2010 de 12h à 13h30 HE – Lunch inclus
Conférence hydrographique du Canada 2010
Centre des congrès de Québec - Salle 202

Les vice-présidents des sections devront aviser leurs membres respectifs du lieu et de la date.

Ordre du jour:

1. Appel à l'ordre
2. Lecture et adoption l'ordre du jour
3. Adoption du procès-verbal de l'assemblée générale annuelle 2009 ayant été distribué
    a. Corrections et adoption du procès-verbal
4. Suivi sur les actions des procès-verbaux
5. Mise à jour des activités de l'exécutif national
6. Réception des rapports pour l'année 2009 ayant été soumis par les directeurs de section
7. Adoption des états financiers de l'Association et du rapport financier du vérificateur pour l'année se terminant le 31 décembre 2009
8. Nomination des vérificateurs pour l'année se terminant le 31 décembre 2010
9. Adoption du budget national proposé pour 2010
10. Rapport sur la revue Lighthouse incluant ses états financiers – C. Zeller
11. Rapport sur le programme de la bourse d'étude – C. Delbridge
12. Rapport sur le site internet renouvelé – A. Smith
13. Rapport des sections : Québec. Mise à jour de l'adhésion de toutes les section
14. Affaires nouvelles ayant été dûment apportées devant l'assemblée
    a. CHC2012
15. Date et lieu de la prochaine assemblée
16. Levé de l'assemblée

Les membres en règle peuvent voter en personne à l'assemblée ou à tout ajournement ou ajournements subséquents, ou ils peuvent nommer une autre personne (qui doit être un membre en règle de l'Association) comme leur mandataire à assister et à voter à leur place. Un formulaire de procuration en bonne et due forme est fourni pour la commodité des membres. Cependant, toute autre forme appropriée de procuration peut être utilisée. Une fois la procuration complétée, celle-ci doit être acheminée au Secrétaire National au plus tard le 17 juin 2010 ou déposée par un directeur de la Corporation avant le début de l'AGA 2010.

PAR ORDRE DU CONSEIL D'ADMINISTRATION
Daté du 24 avril 2010

George McFarlane
Président national
Association canadienne d'hydrographie

NOTICE OF ANNUAL GENERAL MEETING

2010 National Annual General Meeting
Canadian Hydrographic Association
Tuesday June 22, 2010
12:00 to 13:30 ET, Room 202 – buffet lunch included
CHC 2010
Québec City Convention Centre

Branch Vice – Presidents will notify their branch members of the location and time.

The agenda for the meeting is:

1. Call to Order.
2. Approve the Agenda.
3. Motion to accept the minutes of the 2009 Annual General Meeting, having been circulated.
    a. Corrections and approval of the minutes.
4. Matters arising from the minutes.
5. Update on National Executive Activities
6. To receive the Branch reports from the Directors for the year 2009, having been circulated.
7. To accept the financial statement of the Corporation and the auditor's financial report for the year ending 31 December 2009.
8. To appoint auditors (TBD) for the year ending 31 December 2010.
9. To accept the proposed National Budget for the year 2010.
10. Lighthouse Report including financial statement – C. Zeller
11. Student Award Program Report. – C. Delbridge
12. Website Renewal Report – A. Smith
13. Status of Branches: Quebec. Membership updates all branches.
14. To transact any other business that is properly brought before the meeting.
    a. CHC2012
15. Set the time and place for the next meeting
16. Motion to adjourn.

Members in good standing may vote in person at the Meeting or at any adjournment or adjournments thereof or they may appoint another person (who must be a member in good standing of the Corporation) as their proxy to attend and vote in their stead. The form of the proxy is provided for the convenience of the member in good standing. However, any other proper form of proxy may be used. This completed proxy or other proper form of proxy must be delivered to the National Secretary, before June 18, 2010, or by depositing it with a Director of the Corporation prior to the commencement of the 2010 AGM.

BY ORDER OF THE BOARD OF DIRECTORS
Dated this 24th day of April, 2010.

George McFarlane
National President
Canadian Hydrographic Association

L'Association des Arpenteurs des Terres du Canada fête son 25ème anniversaire à la Conférence nationale des arpenteurs-géomètres

L'Association des arpenteurs des terres du Canada (AATC) célèbrera au mois de mai son 25è anniversaire. Les arpenteurs des terres du Canada (ATC) sont les personnes autorisées à effectuer l'arpentage cadastral ou de propriétés sur les terres du Canada. Les terres du Canada sont, de manière générale, les territoires du Nord (Yukon, Territoires du Nord-Ouest, Nunavut), la plupart des réserves indiennes du Canada, les zones extracôtières du Canada ainsi que les parcs nationaux.

L'AATC est unique pour plusieurs raisons :

- Elle est la seule association professionnelle auto-réglementée de juridiction fédérale.
- Ses membres sont répartis partout au Canada.
- Elle a juridiction sur un territoire immense.
- La plupart de ses membres ont également un ou deux brevets ou permis de pratique d'arpenteur-géomètre reconnus au niveau provincial.
- L'Association est officiellement bilingue (français et anglais).
- La profession d'ATC est vraiment multidisciplinaire.

Même si 25 ans peut sembler assez jeune comparativement aux associations d'arpenteurs-géomètres provinciales du Canada, l'historique de l'AATC remonte passablement loin en arrière. En 1882 « The Association of Dominion Land Surveyors » (c'est ainsi qu'on appelait les arpenteurs fédéraux), a été formée. Cette organisation est devenue par la suite l'Association canadienne des sciences géodésiques (maintenant géomatiques). L'influence de la « Dominion Land Surveyors » s'en trouva réduite au sein de cet organisme agrandi.

En 1979, le gouvernement fédéral a amendé la Loi sur l'arpentage des terres du Canada afin de permettre à des gens autres que des arpenteurs-géomètres d'effectuer des levés légaux sur les terres du Canada. En même temps il changeait le nom de « Dominion Land Surveyors » pour celui « d'arpenteur des terres du Canada ».

Suite à cette démarche, on vît un accroissement considérable du nombre d'arpenteurs des terres du Canada et, au début des années 80, ceux-ci reconnurent le besoin de se regrouper en une organisation qui les représenterait adéquatement. Le 30 mai 1985, l'assemblée inaugurale de l'Association des arpenteurs des terres du Canada eût lieu. Ainsi donc, même si l'AATC fête cette année son 25è anniversaire, elle peut s'enorgueillir de sa riche histoire qui la ramène à ces premiers arpenteurs qui exerçaient le métier il y a plus de cent ans.

Tranchant le gâteau de fête à la dernière conférence nationale des arpenteurs-géomètres à St. John's, Terre-Neuve et Labrador, de gauche à droite: Gary Hughes, président de l'Association of Newfoundland Land Surveyors, Jim Banks, ex-président de l'Association of Prince Edward Island Land Surveyors, Glen Crews, président de l'Association of Nova Scotia Land Surveyors, Ron Robichaud, président de l'Association des arpenteurs-géomètres du Nouveau-Brunswick, Wally Kowalenko, président de l'Association of Ontario Land Surveyors, Norm Cote, vice-président du Conseil Canadien des arpenteurs-géomètres, John Kulchycki, président l'Association of Manitoba Land Surveyors, Dave Gurnsey, président sortant de la Saskatchewan Land Surveyors Association, Brian Ross, président de l'Alberta Land Surveyors Association, Chuck Salmon, secrétaire-trésorier de l'Association of British Columbia Land Surveyors et George Schlagintweit, président de l'Association des Arpenteurs des Terres du Canada.

Association of Canada Lands Surveyors Celebrate their 25th Anniversary at the National Surveyor's Conference

In May, the Association of Canada Lands Surveyors (ACLS) celebrated its 25th anniversary. Canada Lands Surveyors (CLS's) are persons authorized to carry out legal or property surveys on Canada Lands. Canada Lands are in general, the northern territories, (Yukon, Northwest Territories, Nunavut), most of Canada's Indian Reserves, the Offshore areas of Canada and the National Parks.

The ACLS is a unique organization in many ways:

- It is the only federally enacted self-governing professional surveying association
- Members are spread out all over Canada
- It has jurisdiction over a vast territory
- Most ACLS members also have one or two provincial surveying commissions
- It's officially bilingual (English and French)
- The CLS profession is truly multidisciplinary in that a CLS can carry out legal surveys using other than traditional land surveying methods.

Although 25 years is not a very long time when measured against the age of Canada's Provincial Surveying Associations, the ACLS's history goes back much further. Back in 1882 the Association of Dominion Land Surveyors, (as federal surveyors were called then), was formed and that organization eventually became the Canadian Institute of Surveying (now Geomatics). The influence of Dominion Land Surveyors was much diminished within the greatly enlarged organization.

In 1979 the Federal Government modified the Canada Lands Surveys Act to allow legal surveys on Canada Lands to be done by other than land surveyors. At the same time, it changed the name Dominion Land Surveyors to Canada Lands Surveyors, i.e. "surveyors of Canada Lands".

This resulted in a great expansion in the number of Canada Lands Surveyors and in the early 1980's they began to recognize that they needed an organization to properly represent them. On May 30, 1985 the new Association of Canada Lands Surveyors held its inaugural meeting. So, although the ACLS is celebrating its 25th anniversary, it can look back with pride to its connections with those early surveyors of over a century ago.

Cutting the birthday cake at the last National Surveyors Conference in St. John's, Newfoundland and Labrador, from left to right: Gary Hughes, President of the Association of Newfoundland Land Surveyors, Jim Banks, Past President of the Association of Prince Edward Island Land Surveyors, Glen Crews, President of the Association of Nova Scotia Land Surveyors, Ron Robichaud, President of the Association of New Brunswick Land Surveyors, Wally Kowalenko, President of the Association of Ontario Land Surveyors, Norm Cote, Vice President of the Canadian Council of Land Surveyors, John Kulchycki, President of the Association of Manitoba Land Surveyors, Dave Gurnsey, Past President of the Saskatchewan Land Surveyors Association, Brian Ross, President of the Alberta Land Surveyors Association, Chuck Salmon, Secretary Treasurer of the Association of British Columbia Land Surveyors and George Schlagintweit, President of the Association of Canada Lands Surveyors.

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Your Company Here
Consider becoming a CHA Corporate Member.
Your organizations contact information would be posted here for all to see as a CHA Corporate Member.
See the Corporate Members section for additional benefits.
Contact *Lighthouse* at the address listed in this journal or at www.hydrography.ca

We invite your organization to become a corporate member in our association. Consider the following benefits:

- ***Receive three copies of each issue of Lighthouse (published twice annually).***
- ***An invitation to participate in CHA seminars.***
- ***Listing and recognition in every edition of Lighthouse.***
- ***An annual 250 word description of your organization in Lighthouse.***
- ***10% off advertising rates in Lighthouse.***
- ***10% off exhibitor fees at CHA sponsored events.***
- ***Listing and link to your home page on each CHA Branch Web site.***
- ***News from corporate members in every edition of Lighthouse.***

The CHA, through *Lighthouse,* is active in promoting the strength and diversity of organizations and companies that support the hydrographic and related communities. Get onboard with us as a corporate member and we will help you reach potential customers throughout our worldwide distribution.

To join, please contact one of the Directors as listed on page 2. International applicants please remit to Central Branch. To obtain an application visit us at *www.hydrography.ca*

Annual dues for CHA Corporate Membership is $150.00 (CDN).

ASI Group Ltd

ASI Group provides a complete range of hydrographic, geophysical and visual inspection techniques to conduct underwater investigations. Lake bottom surface features and targets are located, measured and mapped with precision accuracy in real-time using a combination of geophysical mapping and charting tools. In-house cartographers and graphic specialists interpret geophysical data to produce quality technical reports in hardcopy and GIS compatible formats.

ASI's survey vessels are trailerable and equipped with a wide variety of survey equipment packages. In addition to surface vessels, ASI owns and operates a fleet of purpose-built remotely operated vehicles (ROVs) to deploy sonar and video imaging in open water, tunnels and pipelines.

ASI provides greater efficiency and accuracy in mapping rivers, estuaries, channels, lakes or harbour bottom surfaces for:

- Geological investigations
- Habitat mapping and archaeological surveys
- Underwater search, survey and recovery
- Dredging surveys and volumetric determination
- Sonar profiling/imaging surveys
- Remotely operated vehicle inspections
- Integrated navigation and positioning services
- Cable and pipeline inspections.

For further information please contact:

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Tel: (905) 641-0941 Fax: (905) 641-1825 Website: *www.asi-group.com*

Corporate Members
Membres corporatifs

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

For further information please contact:

Association of Canada Lands Surveyors
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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 electro-magnetic ice thickness measurements every 2 sec, CTD casts to 500m, and Acoustic Doppler Current Profiling. Future plans envisage an intermediate depth multibeam sonar for making pirouette sweeps of the seafloor to 1500m depth while drifting. While the Sabvabaa's hover height of 73cm precludes crossing pressure ridges and rough rubble ice, it can navigate around such obstacles, and is comfortable in most ice conditions irrespective of ice thickness. The hovercraft was especially designed for geoscientific investigations in areas of thick multiyear ice presently inaccessible to icebreakers.

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C & C Technologies

C & C Technologies (C & C), an international hydrographic surveying company, headquartered in Lafayette, Louisiana, has approximately 400 employees and seven offices worldwide.

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

C & C Technologies has performed hydrographic survey work for various Government groups including NOAA, the US Geological Survey, and the Corps of Engineers. In 1994, C & C was contracted by the U.S. Naval Research Labs to perform research and development work on semi-submersible autonomous underwater vehicles (AUV's) for hydrographic surveying purposes. In January 2000, C & C and Kongsberg Simrad began working on C & C's new commercial AUV rated for water depths up to 4500 meters. The AUV's sensor payload included multibeam swath high resolution bathymetry and imagery, chirp side-scan sonar and sub-bottom profiler, differential GPS integrated with acoustic / inertial navigation and acoustic communications. Since delivery in January 2001, C & C's AUV has completed over 100,000 kilometres of survey lines for a variety of worldwide clients.

Additional services offered by C & C include: C-Nav™, the highest accuracy worldwide Gc-GPS differential correction service available, in-house state-of-the-art soil analysis lab, and 3 D hazard assessment reporting for MMS deep water site clearances.

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

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visit C & C's Website at *www.cctechnol.com*

Fugro Jacques GeoSurveys Inc.

Fugro Jacques GeoSurveys Inc. (FJGI) is a Canadian established company majority owned by Fugro NV. FJGI has offices in St. John's, NL and in Dartmouth, NS and has a large, Canadian based, inventory of hydrographic, geophysical, geotechnical and positioning equipment. With approximately 75 employees, FJGI has established an impressive track record in Canada and on the international stage.

FJGI 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.

FJGI's Hydrographic Group operates a wide range of multibeam equipment including Reson 8101, 8111 and 8125 systems. These systems are routinely mobilized by FJGI 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, FJGI 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 Jaques GeoSurveys Inc. please contact:

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Corporate Members
Membres corporatifs

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.

Whether you are collecting hydrographic survey data or environmental data or just positioning your vessel in an engineering project, HYPACK® provides the tools needed to complete your job. With users spanning the range from small vessel surveys with just a GPS and single beam echosounder to large survey ships with networked sensors and systems, HYPACK® gives you the power needed to complete your task in a system your surveyors can master.

For more information regarding HYPACK, Inc. please contact:

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Interactive Visualization Systems (IVS 3D)

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

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

IVS 3D has a dynamic and creative team of professionals that are committed to advancing visualization technology; and dedicated to unveiling opportunities to develop and improve visualization and interpretation software in ways that will provide our clients with first-rate software tools to ensure success of their business or research endeavours.

IVS 3D is headquartered in Fredericton, New Brunswick, Canada with an office in Portsmouth, New Hampshire. Both offices provide full support, worldwide in association with a number of alliance partners.

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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.

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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.

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Corporate Members
Membres corporatifs

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:

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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:

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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.:

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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:

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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:

Dave Neufeldt
Tel: (250) 656-0931 / (800) 814-4212 FAX: (250) 656-4604 E-mail: dave.neufeldt@terraremote.com
Website: *www.terraremote.com*

KONGSBERG

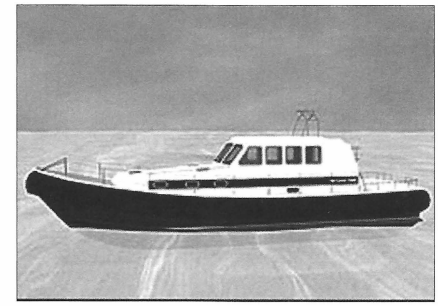
Orders for Next Generation KONSBERG Multibeam Echosounder

12. Mar 2010

Kongsberg Maritime announces order for its 4th generation multibeam echosounder EM2040 from Dutch survey company Geoplus BV.

The order for the EM 2040, the world's only true wide band high resolution multibeam, was taken by Kongsberg Maritime's Dutch subsidiary Kongsberg Maritime BV.

Attracting forward thinking early adopters, the new multibeam is designed to meet all requirements for shallow water mapping and survey inspection, and is to be installed aboard Geoplus BV's survey vessel "BNR 1640" in September 2010. The vessel is currently under construction to Lloyds Class, enabling it to operate in Antarctic and tropical areas.



Geoplus has purchased the latest, the EM 2040- 0,5x1 degree dual head array, which will be installed on the new Survey vessel BNR 1640 in September 2010

To date, Geoplus BV has purchased five Kongsberg Maritime multibeam systems and its newest, the EM 2040, will be configured with 0.5° x1° dual head array. Geoplus BV will use EM 2040 for surveys such as bathymetry and pipe line inspection in shallow waters, and also in deep water due to EM2040's wide frequency range.

Geoplus BV is located in Scheemda in The Netherlands and operates world wide, carrying out inshore and offshore surveys for dredging, construction and offshore companies. The Company is currently working on expanding its survey fleet with five new vessels within two years to meet the future demands of the survey market.

IXSEA

Philippe Debaillon Vesque: New iXSea President

Philippe Debaillon Vesque will be joining the iXCore group on 1 June as C.O.O. (Chief Operating Officer) taking responsibility for the Group's marine division. He will be based in Marly-le-Roi and will also become iXSea's CEO. With an engineering degree from Télécom-Paris, Philippe Debaillon Vesque spent most of his career in the Thalès group. He worked many years in Spain and then in Australia. He became MD of Thalès-SAFARE for several years, one of the rare SMEs of the group. Recently, he headed a business unit called "Surface Ships Sonars and Torpedos" across France, the UK and Australia.

Hervé Arditty, the President of iXCore, said, "I am very happy to welcome Philippe to our Group. His management experience is very much complementary to ours and will enable us to structure and deploy our strategy in the most effective way, and to answer our clients' needs in the best way."

About IXSEA
Founded in 2000, iXSea designs and manufactures navigation and positioning systems based on its state-of-the-art Fibre Optic Gyroscope technology, along with a complete range of seafloor mapping solutions for the scientific, offshore and defence industries.
iXSea has more than 400 clients over five continents and a turnover in excess of 35 million in 2009.

For more information, please contact:
Anne Colliou
Press Manager
iXSea
Email: anne.colliou@ixsea.com

55 avenue Auguste Renoir
78160 Marly-le-Roi, France
Tel: 01 30 08 98 88

CHC 2010

IXSEA offers innovative products and solutions for the marine and hydrographic community as well as the survey industry.

At CHC 2010, we present:

- FOG Gyrocompass (AHRS), Inertial Navigation Systems:
  - OCTANS: gyrocompass and motion sensor
  - HYDRINS: Inertial Navigation System for multibeam surveys
  - PHINS: Inertial Navigation System
- Seafloor mapping products and solutions
  - SHADOWS Mapping Sonar: the new sonar solution for seafloor mapping: EEZ, hydrography, environmental, law of the sea, etc...
  - DELPH Software Suite: sonar, seismic and magnetometer data acquisition and interpretation software
- Acoustic Positioning
  - OCEANO: a complete range of acoustic releases
  - GAPS: pre-calibrated USBL

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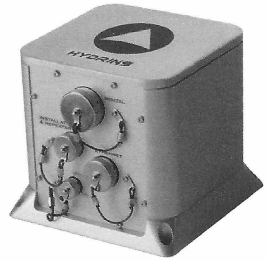


HYDRINS: Inertial Navigation System for multibeam surveys

Williams, "Ken"

Williams, Roland Kenneth – 80, Halifax, passed away peacefully with his family by his side on December 1, 2009. Born in Ostrea Lake on December 3, 1928, he was the eldest son of the late Roland David and Myrtle (Bayers) Williams. Ken had a 32 year career in the Canadian Hydrographic Service, most years spent at the Bedford Institute of Oceanography. He finished his career in Quebec (Regional Director) and Ottawa (Sr. Advisor to Director General – Marine Science and Surveys). He met and married Mineola Gridley in Yarmouth. They shared a wonderful 53 years together. Volunteer and community work was important to Ken and he was a past member of Dartmouth Kinsmen, founding president of Kinsmen K-40 club. After retirement, he was president of Berwick Lions Club which developed the Lions Park in Berwick, contributed to Canadian National Institute for the Blind, Victorian Order of Nurses and Breakfast School Program. Ken will be dearly missed by his family and friends. He is survived by his loving wife, Min; daughter, Kendra (Randy) Marshall, Ottawa; son, David (Susan), Dartmouth; daughter, Pam (Halifax). Grampy (Granster) always had a smile and twinkle in his eye for his grandchildren, Robert and Jennifer Williams, Randall and Laura Marshall, and step granddaughter Rebecca. He is also survived by brothers, Leonard and Mike; sisters, Vivian, Shelia, Dale and Rose. He was predeceased by brothers, Cameron, Maynard, Wayne; sister, Gladys. He will live on in the hearts of those who knew and loved him.

PACIFIC REGION

CHS Pacific Region, Data Acquisition and Technical Services (DATS) Division

April 20, 2010; Rob Hare, Manager

The 2010 field season planning is in full swing.

The *Otter Bay* and *Vector* EM710 will be conducting surveys in support of the Kitimat Gateway initiative and Gwaii Haanas National Marine Conservation Area (NMCA) in the Queen Charlotte Islands. Surveys of opportunity with other Science programs proved successful last year and will continue aboard Vector in 2010. Tofino Basin mapping will commence in the fall and likely continue for the next several years. Ernest Sargent and Kalman Czotter will supervise many of the multibeam and Revisory Survey projects in the coming year. Peter Milner is retiring in June 2010 after 35 years with CHS.

The fast response craft *Shoal Seeker*, outfitted with a Teledyne Benthos C3D and Coda Octopus F185 motion sensor continues to have some time synchronization and post-processing issues. Kalman Czotter and his R&D team will be trying to address these deficiencies in the coming months, hopefully resulting in a robust near shore mapping solution for the 2010 season and beyond.

In addition to validating field returns, the Data Validation, Integration and Access unit, supervised by Bodo de Lange Boom, continues to work toward complete BC coast coverage of digital bathymetry as well as integrated bathymetry-topography grids and other non-navigation data products to support client requests.

Tidal group, with Denny Sinnott at the helm, has been upgrading the PWLN and Emergency Response (tsunami) gauges. In 2010, the need for field gauges will continue to be a priority, as will ongoing GPS observations to support the development of vertical datum separation models.

The computer and technical services unit, lead by George Schlagintweit, will continue to support CHS in both office and field environments. Keith Lee retires in April after 32 years with CHS, 38 if you include the years he spent on contract. Ken Halcro, meanwhile, has taken an acting assignment for the coming year as Supervisor of our HDC.

We welcome new MDH Brent Bowman, Jessica Burke, Michel Breton and Duncan Havens to DATS for next year. They will all be attending the data acquisition course in the fall. Rosie Sheppard, Brad Strong and Greg Dixon have moved into HPD production with NP&S.

CHS Pacific Navigational Products and Services Division

April 2010; Dave Prince, Manager

As we enter the new Fiscal Year we welcome 2 new staff to CHS Pacific, Tanja Gundling and Paul Scott. Both are former Coop Students from the University of Victoria and both have completed their BSc in Geography. They enter the organization as Multidisciplinary Hydrographers just as a number of senior staff are leaving the organization over the next few years. Brian Port will be returning to school this fall and will be taking a one year leave of absence. His leadership with HPD implementation will be missed.

The largest challenge we face right now is the movement towards the HPD production system. While we are trying to maintain the flow of data through the production process, we find we are spending a great deal of time training staff and developing new procedures along the way. We see a payoff in the coming years, but this time of transition will be a challenge for staff.

Moving to an HPD environment has presented us with a new way of having to look at how we plan the work we do. At one time we had a plan to produce charts to replace older charts. Then we moved to a Risk Based approach to managing the portfolio, and now we have to look at source as driving those production planning decisions. Since in an HPD environment we need to work on all overlapping charts where new source falls, this may influence the products we issue at the end of the source loading. When we look at the sources as they arrive, we are now taking a more dynamic approach as to how this affects our Risk Classification model. This makes the planning process very dynamic but we at the same time must keep the longer range vision in mind.

We have made good progress towards the completion of the Gateway charts in the Approaches to Kitimat. With half of them now completed and released, we have about 12 more to go over the next couple of years. Many are already in production, and a few we are still gathering source information with new surveys every year.

Once we have finished the Gateway charts, we will be looking at the modernization of the small scale charts in that area, then looking towards the west coast of the Queen Charlotte Islands, the last frontier on the Pacific Coast that still has some unsurveyed and sparsely charted areas. This will require extensive client consultation to ensure the scheme and individual formats will be adequate for future navigation needs.

CHS Pacific Non-Navigation Products and other areas of interest

Terry Curran

Pacific region continues to develop products for non-navigation, amongst other product developments. We have recently realized a better title for the effort might be products intended for free public distribution, primarily for the GIS user.

Over the past few years Pete Wills and others have created three charted coastlines – high water, low water, and a high water coastline with a height relative to low water. The difference between the two coastlines is often important – it defines an intertidal polygon. Contracts to LGL Consulting for independent verification revealed that the high water and low water coastlines needed improvement for use in geographic information systems. A semi-automated repair technique has been developed and will be described in a poster at CHC 2010. Another area of interest is processing the multibeam backscatter, both as a sidescan image and as classified sea floor. The coming year will see a project to compare GeoCoder processing and Quester Tangent MultiView processing.

The Lighthouse pin is bestowed upon first time authors as a gesture of appreciation by the CHA

We are currently in possession of a limited supply of the coveted Lighthouse pins. These pins are approximately 1 inch in height. National President George McFarlane has authorized us to distribute these to first time authors to Lighthouse, as a gesture of our appreciation. The pins are of sentimental value. However, the die is at an unknown location and once the supply is exhausted it will not be replenished. The surest way for one to receive a pin, is to contribute to Lighthouse today.

NATIONAL

The Launch of the Canadian Hydrographic Association Website

The CHA has a new website at a familiar address: www.hydrography.ca

This has been a project undertaken by the executive of the CHA on behalf of the membership. A committee was struck last November, and so began the process of finding a suitable web designer at a suitable price. The previous site served the association well for several years, but it was felt that the site needed a more modern look and feel. PHP was used, and this is a general purpose scripting language which used to stand for 'Personal Home Page' but later became Hypertext PreProcessing language [source:http://en.wikipedia.org/wiki/PHP, accessed 17-May-2010]. In conjunction with the Content Management System (CMS), PHP works very well for CHA - it means that individual branches across the country can maintain and update their own content.

Through consultation with the branches, and with several iterations and refinements, the CHA has attained that which it has striven for: a modernized, functional and attractive web-design. We hope that the membership will use and enjoy it, and that the site will serve the CHA well into the future.

PACIFIC BRANCH

Olympic fever captured the attention of most CHA members in February as the Vancouver 2010 Winter Olympics and Paralympics took place in our own backyard. As most members chose to watch the events from the comfort of their living room, one of our members Craig Lessels had the opportunity to volunteer for some of the events. Herein are his observations from the 2010 Olympics;

CHA Olympic Experience

I recently completed a 2 week volunteer experience for the winter Olympics in Vancouver. When people ask me abut my experience I reply with the following statement, "The hours were long, the outfits were bad and the food was awful but I would do it again in a second." That pretty much sums up my Olympic experience.

I was a volunteer at Cypress Mountain, host venue for the Freestyle skiing events (Skier cross, Moguls, and aerials) as well as the snowboarding events (Half pipe, Boarder cross, and Parallel Giant Slalom). I was fortunate enough to be assigned to work on the venues themselves. I was assigned to the side slip crew. These are the people who help maintain the course for the athletes. I was on the slip crew for skier cross, boarder cross and parallel giant slalom. I was working on the course and interacting with the athletes. I had better than a front row seat for the events as I was on the course. The people who had tickets were seated in a grand stand at the bottom where we were able to watch from the sides of the course for the entire length of the race. This was an amazing experience to be involved in such a big event. The energy was amazing.

I was also able to spend some time in the city and absorb the energy of the Olympics. The downtown core was the busiest I have ever seen. There were thousands of people out everyday and every night. The atmosphere was just incredible. I was fortunate enough to have tickets to the opening ceremonies, and the women's gold medal hockey game. These 2 events were well worth the price I paid for them. The atmosphere inside the hockey arena for the women's gold medal game had the feeling of a Stanley cup final.

I was also downtown after the men won the gold medal hockey game. I have never heard or seen so many people wearing Canada's colours. I have never heard so many spontaneous renditions of Oh Canada being sung. There were high fives and hugs everywhere. The maple leaf was displayed proudly. That night I sat with some friends, who also had been volunteers at Cypress, and we watched the closing ceremonies in a pub across the street from the stadium. The line that summed it up for me and the group I was sitting with was when John Furlong, the CEO of VANOC, said in his closing speech, "Blue Jackets 1, Cypress Mountain weather nothing!".

Other News

In other news, Michael Ward completed his CPS training, passing with an almost perfect score. Jim Galloway (ret.) has joined the 'Snowbirds' spending most of his time in sunny Mexico. Congratulations to the CHA runners in the Times Colonist 10K marathon on Sunday April 25th; Rob Hare, Al Schofield, Craig Lessels and Michael Ward.

We wish Brian Port and his family, Christine, Calla and Angus a good trip as Brian is set to begin a one year leave of absence for educational reasons. They have sold their house in Sidney and are relocating to Castlegar, BC.

SECTION DU QUÉBEC

La Section du Québec continue sa collaboration avec la revue « Québec Yachting » en écrivant une chronique à chacune des parutions du magazine. Les sujets traités portent sur le domaine de l'hydrographie en général et sur tout ce qui peut s'y rattacher. La chronique prend la forme de tout ce que vous aimez savoir sans jamais oser le demander. La Section a profité de la parution de l'édition du printemps de la revue Québec Yachting pour promouvoir la Conférence hydrographique du Canada et son site internet afin d'inciter le public en général de venir voir ce qui s'en vient dans le monde de la navigation et l'inviter à venir visiter les plateformes hydrographiques du Service hydrographique du Canada.

La 19e édition du Carnet de Bord a paru en février 2010 avec un tirage de 3000 copies. La réalisation de la prochaine édition dépendra du renouvellement de l'entente avec le Regroupement des plaisanciers du Québec. La Section du Québec espère renouveler cette entente pour une autre période de trois ans d'ici la fin de l'été.

Le Section du Québec prend une part active dans l'organisation de la Conférence hydrographique du Canada. Elle est en charge de la trésorerie et de la comptabilité en général, elle a aussi engagé madame Fannie Bernier en tant que coordonatrice de l'événement. Fannie travaille en étroite collaboration avec le président de la conférence, monsieur Robert Dorais, et le comité organisateur mandaté par le Service hydrographique du Canada, région du Québec. Elle assure aussi le suivi avec le Centre des congrès de Québec, les différents fournisseurs de service pour la Conférence, la mise à jour du site internet et bien d'autres tâches essentielles à la réussite de l'événement.

La Section du Québec est toujours à la recherche de nouveaux membres et membres corporatifs pour réaliser pleinement le mandat de l'Association et la Conférence hydrographique du Canada est, en ce sens, un aide important au renouvellement de l'adhésion. La Section est aussi ouverte à toute suggestion d'activités, vous n'avez qu'à téléphoner à ses bureaux de Rimouski au 418-723-1831 ou écrire à l'adresse courriel bernard.labrecque@globetrotter.net pour nous les faire connaître.

Les membres de la Section du Québec espèrent voir les membres de l'ACH, les participants à la Conférence et le public en général en grand nombre en juin à Québec afin d'échanger sur les défis et les préoccupations du monde maritime, et ce, dans un milieu convivial et de détente. La Vieille Capitale n'a que le nom car la ville de Québec fourmille d'activités des plus intéressantes les unes que les autres et elles n'attendent que vous!

Bonne Conférence hydrographique du Canada 2010 à tout le monde et que *l'hydrographie soit une science, des technologies et des gens au service du monde maritime*!

ATLANTIC BRANCH

The Atlantic Branch has commenced another action-packed year. Following the 2009 AGM, a membership renewal commenced in early 2010 and is ongoing. CHA Atlantic hosted an interesting lecture on February 22, given by Jamie Townsend of ODIM-Brooke Ocean. The subject was the installation and testing of Moving Vessel Profilers (MVP) and Free-Fall Cone Penetrometers (FFCPT) with the Australian and Norwegian navies.

Several Atlantic CHA members have made plans to attend the Canadian Hydrographic Conference, being held June 21-23, 2010 in Québec City, PQ.

Preparations are also underway for the World Hydrography Day celebration in the Atlantic Region, to be held on June 18 (technically, WHD is June 21 but the celebration will be held the Friday immedately prior). Distinguished speaker, Steve Blasco will be delivering a lecture on June 18, 2010. With his 30 years as a Marine Geologist, it promises to be an interesting session.

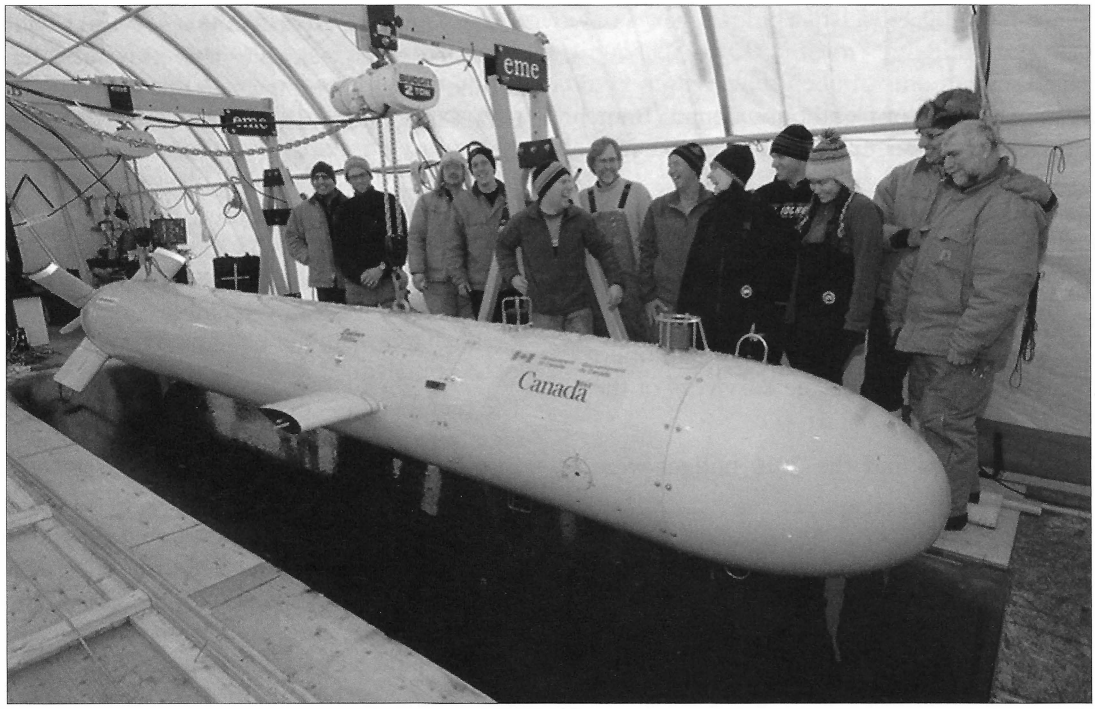
Stay tuned for more lectures and events leading up to an exciting AGM in December of this year.

CENTRAL BRANCH

Central Branch member and Past President of CHA Andrew Leyzack attended the XXIV FIG International Congress 2010 held in Sydney, Australia April 11-16. Andrew concluded his term as Chair Commission IV, being succeeded by Dr. Michael Sutherland, also a member of Central Branch. CHA President George McFarlane attended the Association of Canada Lands Surveyors (ACLS) Sixth National Surveyors Conference and 25th Anniversary ACLS AGM May 6-8 in St. John's Newfoundland. George is a member of the ACLS but was also there to promote the CHA. The CHA was a Bronze sponsor of the conference.

Since February, Tim Janzen of the Canadian Hydrographic Service has been running an ice camp near Borden Island in the high Arctic. The ice camp is one of the largest ever established in the Arctic and is the base for Canada's UNCLOS (United Nations Convention on the Law of the Sea) Project. Aside from helicopters used to obtain spot soundings, the camp has also successfully used an Autonomous Underwater Vehicle (AUV) for data collection. The ice camp has been covered in the Canadian media and Tim was the subject of an article in the Toronto Star.
http://www.thestar.com/news/canada/arctic/article/800014
[Photos courtesy of DFO and NRCan Ice Camp staff]

Helicopters await periods of good visibility to fly.



The AUV team celebrate retrieval after the first run.

UNCLOS Ice Camp at Borden Island

Member News

Long-time member Paola Travaglini has departed for Ottawa to take on the task of Technical Advisor in Geomatics, currently working on the UNCLOS portfolio. We wish her all the luck in the world and we'll miss her!

Terese Herron has been appointed Engineering Project Supervisor, Tides, Currents and Water Levels.

Andrew Leyzack and Roger Cameron participated on the CCGS *Wilfrid Laurier* survey in the western Arctic.

Jon Biggar and Fred Oliff participated in the UNCLOS survey aboard the CCGS *Louis S. St. Laurent* and made it as far north as 83°13'N.

Scott Youngblut led the Beaufort Sea survey aboard the CCGS *Nahidik*.

Brad Tinney will retire on June 18th.

Seminars

Since the previous edition of Lighthouse Central Branch has held four General meetings and one Executive meeting.

- January: Executive meeting
- February: A video "Icebound: The last voyage of the Karluk" which documented the lost Canadian Arctic Expedition, lead by Vilhjalmur Stefansson. Robert Bartlett (the Ice Master) rescued the survivors of the shipwreck
- March: Branch business and the 2010 budget were reviewed
- April: The meeting was held at the Hamilton Beach Rescue Unit a Canadian Coast Guard Auxiliary unit located on the shores of Lake Ontario. Charlie Witherington and Leon Buta –Chief of the HBRU gave a presentation on the role of the unit and tour of the facility.
- May: Sam Weller did a presentation of his month long trip to China where he taught at an English language camp.

Special Thanks to Heimo Duller and Sam Weller for hosting meetings, your hospitality is greatly appreciated. Meetings were also held at The Burlington Central Library and at the Canada Centre for Inland Waters

Correspondence

Membership renewals continue to come in along with new memberships.

Announcements for upcoming meetings were sent out to members. Regrets were noted and included in the meeting minutes. Frequent correspondence occurred within the CHA Executive regarding CHA business.

Canadian Institute of Geomatics (CIG) and CHA exchanged correspondence. Central Branch and CHA National corresponded on a number of items.

Admiralty Launch Surveyor

Admiralty Launch *Surveyor* will be on display at CHC2010, the Canadian Hydrographic Conference in Quebec City, June 21-23.

Membership

Branch

The Central Branch membership stands at 61. The branch is pleased to welcome new members Eileen Gann President of Chesapeake Technology Inc. and Helen Fuchs-Trapp of the Canadian Hydrographic Service. Central Branch is also pleased to welcome new corporate members Shark Marine Technologies Inc. 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 8 International members and ensures they have an opportunity to voice opinions and take part in CHA activities.

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

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. The website is currently undergoing a makeover. Please direct your browser to http://www.hydrography.ca .

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*

Rates / Tarifs

POSITIONING / EMPLACEMENTS

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.

DIGITAL REQUIREMENTS
EXIGENCES NUMÉRIQUES

Advertising material must be supplied by the closing dates as digital Tiff 600dpi files. Proofs should be furnished with all ads.

Single-page inserts will be charged at a full-page body rate. Material must be supplied by the client. Page size must conform to the single page insert trim size (below).

L'annonce publicitaire doit être fournie aux dates de tombée. Les épreuves devraient être fournies avec tous les suppléments.

Les insertions d'une page seront chargées au tarif d'une pleine page. Le matériel devra être fourni par le client.

PUBLICATION SIZE
DIMENSIONS DE LA PUBLICITÉ

Publication Trim Size/ Dimension de la revue:	**8.5" x 11.0"**
Live Copy Area/ Encart libre:	**7.0" x 10.0"**
Bleed Size/ Publicité à fond perdu:	**8.75" x 11.5"**
Single Page Insert Trim Size/ Insertion d'une page	**8.25" x 10.75"**
Standard Ad Sizes/ Grandeurs standards des suppléments:	
Full Page/ Pleine page:	**7.0" x 10.0"**
1/2 Page/ Demie-page:	**6.875" x 4.75"**
or/ ou:	**3.375" x 9.75"**

PRINTING / IMPRESSION

Offset screened at 133 lines per inch.
Internégatif tramé à 133 lignes au pouce.

CLOSING DATES / DATES DE TOMBÉE

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%.

	B & W/ N & B	Colour/Couleur Four/Quatre
Outside Back Cover *Couverture arrière*	NA/SO	$1,025
Inside Cover *Couverture intérieure*	NA/SO	$825
Body, Full Page *Pleine page*	$475	$675
Half Page *Demie-page*	$300	$475
Single-page Insert *Insertion d'une page*	$475	$675
Professional Card *Carte d'affaire*	$125	NA/SO

RATE PROTECTION
TARIFS ASSURÉS

Advertisers will be protected at their contract rates for the term of their contracts up to one year. Cancellations are not accepted after closing date.

Les tarifs sont assurés aux termes des contrats publicitaires jusqu'à concurrence d'un an. Les annulations ne sont pas acceptées après la date de tombée.

All advertising material should be directed to:
Tout le matériel publicitaire doit être acheminé à:

LIGHTHOUSE
LIGHTHOUSE, Canadian Hydrographic Association
CHS Atlantic, Craig Zeller
Bedford Institute of Oceanography P.O. Box 1006
Dartmouth, NS Canada B2Y 4A6
Telephone/Téléphone: (902) 426-3918
Fax/Télécopieur: (902) 426-1893
E-mail editorlighthouse@hydrography.ca

SUGGESTIONS TO AUTHORS

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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