

LIGHTHOUSE

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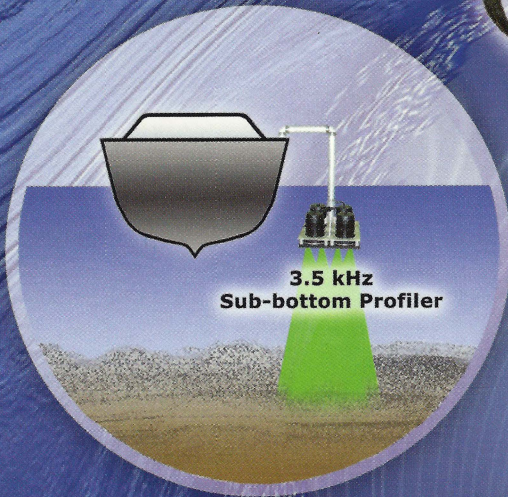
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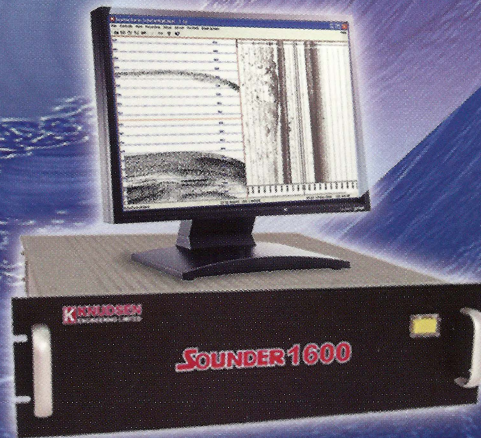
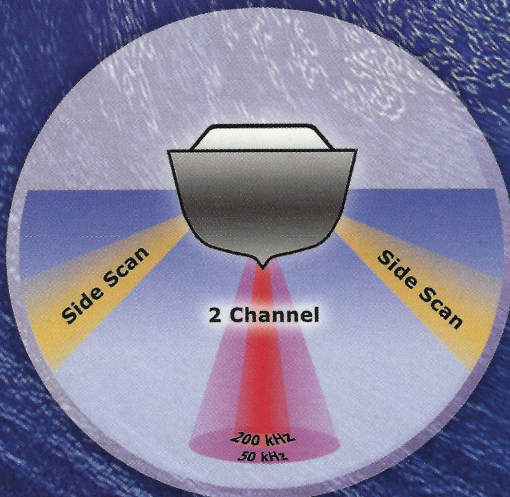
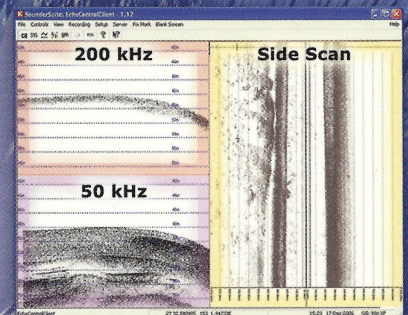
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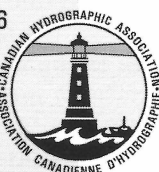
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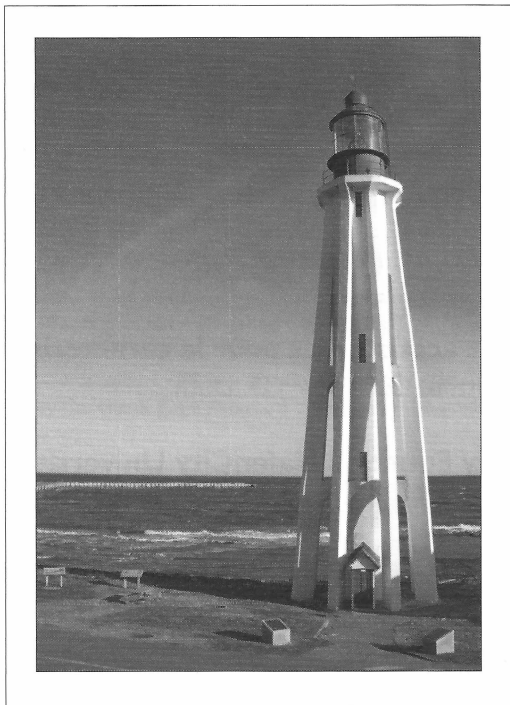
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Pointe-au-Père Lighthouse
Le phare de Pointe-au-Père

Point-au-Père Lighthouse / Le phare de Pointe-au-Père

Pointe-au-Père Lighthouse played a primordial role in the history of navigation on the St. Lawrence River. The existing lighthouse, built in 1909, is the third to be built on the site and the second highest lighthouse in Canada. The tower of this lighthouse is an octagonal shape, built of re-enforced concrete and strengthened by eight pillars, a rare style for Canadian lighthouses. Today, the lighthouse is decommissioned but it is part of a National Historic Site managed in partnership with the Site historique maritime de la Pointe-au-Père. Guided tours of the lighthouse and related installations are offered by the museum which also presents the history of the passenger ship *Empress of Ireland* which sank on the 29th of May 1914. This disaster which had 1,012 victims is the biggest maritime disaster in Canada.

Le phare de Pointe-au-Père a joué un rôle primordial dans l'histoire de la navigation sur le fleuve Saint-Laurent. Construit en 1909, le phare existant est le troisième à avoir été construit sur le site et il est le deuxième plus haut phare au Canada. De forme octogonale, la tour érigée en béton armé, est renforcée de huit contreforts, lui conférant un style plutôt rare dans l'histoire des phares canadiens. Aujourd'hui le phare n'est plus en opération mais constitue un lieu historique national géré en partenariat avec le Site historique de la Pointe-au-Père. En plus d'offrir des visites du phare et de ses installations, le musée présente l'histoire du paquebot *Empress of Ireland* qui a sombré le 29 mai 1914. Cette catastrophe qui a fait 1012 victimes est la plus grande tragédie maritime au Canada.

Photograph/Text credit: Serge Guay, Site historique de la Pointe-au-Père, Rimouski, Québec.

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Editor's Note / Note du rédacteur

It is winter in Canada. The nights are long. The year is still young. The turning of the calendar is a chance to pause and reflect on last year's successes and to look forward with resolve to the year ahead. The Right Honourable Pierre Trudeau, the late former Prime Minister of Canada, once took advantage of this season; he made up his mind to retire after his famous "walk in the snow". It was likely a brisk walk - Ottawa can be cold.

Lighthouse is the product of an army of volunteers from across this land and beyond. The pieces come together amidst the other duties and diversions. Somewhere between the resolving to get the edition to press and before the post production reflection, the question has been asked, "Why do we bother and who would miss it if we did not produce an edition?". It all comes back to the commitment that we share: to promoting hydrography, to showcasing the industry, to supporting the development of current and future hydrographers. It also serves as a journal of what has gone on before – the history of the people, places, and technologies that have brought hydrography to where it is now. Lighthouse tries to do all of that with a unique Canadian perspective. It is local, from the inside out, from coast to coast to coast.

This issue has some of all of those topics, seasoned with a international flavour. On the educational side, there is a paper from Volker Böder and Delf Egge on a Hydrographic Education program at the HafenCity University in Hamburg (first presented at FIG regional conference in Costa Rica). Dick MacDougall has provided an update on UNCLOS related activities, including some international collaboration. Closer to home, Schmitt et al from the Quebec region have a paper on a cross-discipline effort to use backscatter and bathymetric data to help classify seabed habitats. The pull of the North remains as strong as ever as Mike Lamplugh presents some stunning photos from the *CCGS Matthew* surveys of Labrador. Nick Stuijbergen combines his historical knowledge, voracious appetite for scientific readings, and his logical mind to solve an old mystery. As well, this issue has great new advertisements, news from industry and from across the country

Internally, this has been referred to this as the pre-conference edition. This is in reference to CHC2008, a joint production with the Association of Canadian Land Surveyors, to be held in Victoria. Brian Port has more to say inside. The promising theme of what is sure to be a great conference is "Bringing Land and Sea Together". This conference will be the feature of edition 72 and we encourage you to be a part of it.

It is a new year and the work continues: preparations, publications and compilations in the South and surveys up North; it is an endeavour far more intricate than a walk in the snow. Still, a completed edition is akin to a walk in the snow; it is invigorating. Edition by edition, we see that it is a fascinating industry in a vast and incredible land, replete with remarkable individuals. This is bound to make for great stories. Please keep them coming in.

Craig Zeller



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Message from the National President

Mot du Président national



Colleagues – Greetings,

I sit down to write this message having just completed attendance at the first FIG Regional Conference in Latin America, The 6th Regional Conference, in San Jose, Costa Rica, CA. The Conference was well attended and perhaps not surprisingly, a recurring theme was that of Social Justice and the Surveyors' responsibilities to the communities in which they practice. As your President, I have found managing the affairs of CHA quite a challenge, a welcome one I must say! During this time I could not help but reflect on all that has transpired in the last nine months, since my election to the National Presidency. Your National Executive has managed to resolve our Governance, so now we can in confidence operate under our Articles of Incorporation and the By-laws contained therein. Your President has represented our association at several Council Meetings of the CIG as Technical Councillor for Hydrography and at the ACLS's 3rd National Surveyors Conference in Quebec City. We continue our support of Friends of Hydrography and made another generous National Award to a deserving student in the field of Hydrography/Geomatics. We are in the process of a much needed update to the Terms of Reference of the CIG's Hydrography Committee and of clarifying our Transfer of Surplus Funds

Policy between our Branches and National. We have seen the production of yet another excellent edition of our Journal – *Lighthouse*. We have also managed to negotiate a modest reduction in the premium of our Liability Insurance.

On September 25th, 2007 we held our Annual General Meeting by Teleconference. Our plan is to publish the Minutes in the Conference Edition of *Lighthouse* and we look forward to your attendance at our next Annual General Meeting in Victoria, B.C., during CHC 2008.

On the down side, it is with deep regret that we have seen our previously vibrant association reduced to four active Branches. There are those who consistently say our Association "is on its last legs" or that the "CHA is dead". I beg to differ! I believe we can and we must all work together in revitalizing our association, by providing increased services to our membership, vigorous participation at Branch Level and active engagement on National Committees. We must also partner with the CHS to improve opportunities for Training and Education. The need for competent Hydrographers has never been greater! At the recent FIG Conference a number of 1000 was frequently referred to.

We look forward to meeting many of you at CHC 2008 next May in Victoria, B.C., and to join with you in celebration of World Hydrography Day on June 21, 2008.

George McFarlane

Collègues – Meilleurs voeux,

Message from the National President

Mot du Président national



Je prends un moment pour écrire ce message suite à ma participation à la première conférence régionale de la FIG en Amérique latine et à la 6^e conférence régionale tenue à San Jose au Costa Rica, AC. Il y avait une bonne participation à la conférence et peut-être sans surprise, un thème qui revenait fréquemment était celui de la justice sociale et des responsabilités des arpenteurs envers les communautés où ils pratiquent. En tant que votre président, j'ai trouvé que la gestion des affaires de l'ACH fut tout un défi, je dois dire qu'il est le bienvenu! Durant cette période, depuis mon élection à la présidence nationale, je ne peux m'empêcher de réfléchir sur tout ce qui s'est passé dans les derniers neuf mois. Votre exécutif national a œuvré à résoudre notre gouvernance et nous pouvons maintenant travailler en toute confiance selon les articles de notre incorporation et les règlements généraux s'y reportant. Votre président a représenté notre association en tant que conseiller technique en hydrographie à plusieurs conseils de l'ACSG et à la 3^e Conférence des arpenteurs nationaux de l'AATC à Québec. Nous continuons notre support aux Amis de l'hydrographie et avons remis une autre généreuse bourse nationale à un étudiant méritant dans le domaine de l'hydrographie/géomatique. Nous travaillons sur une mise à jour des plus nécessaires des termes de référence du Comité de

l'hydrographie de l'ACSG et sur la clarification de notre politique de transfert de fonds entre nos sections et le national. Nous avons été témoins de la parution d'une autre excellente édition de notre revue Lighthouse. Nous avons aussi réussi à négocier une modeste réduction de notre prime d'assurance responsabilité.

Le 25 septembre 2007, nous avons tenu notre réunion générale annuelle par appel conférence. Nous avons l'intention de publier le procès-verbal dans la prochaine édition conférence du Lighthouse et nous espérons votre présence à notre prochaine réunion générale annuelle à Victoria, C.-B., lors de la CHC 2008.

C'est avec tristesse et un profond regret que nous avons vu notre prestigieuse association d'autrefois réduite à quatre sections actives. Il y a ceux qui disent constamment que notre association « est sur sa fin » ou que « l'ACH est morte ». Permettez-moi de ne pas partager cet avis! Je crois que nous pouvons et nous devons tous travailler ensemble à revitaliser notre association en fournissant des services accrus à nos membres, par une participation énergique au niveau des sections et un engagement positif sur les comités nationaux. Nous devons aussi nous associer avec le SHC pour améliorer les opportunités de formation et d'éducation. Le besoin d'hydrographes compétents n'a jamais été aussi grand! À la dernière conférence de la FIG, le chiffre de 1000 revenait fréquemment.

Nous espérons rencontrer plusieurs d'entre vous à la CHC 2008 en mai prochain à Victoria, C.-B. et nous joindre à vous pour la célébration du Jour mondiale de l'hydrographie le 21 juin 2008.

George McFarlane

International Federation of Hydrographic Societies

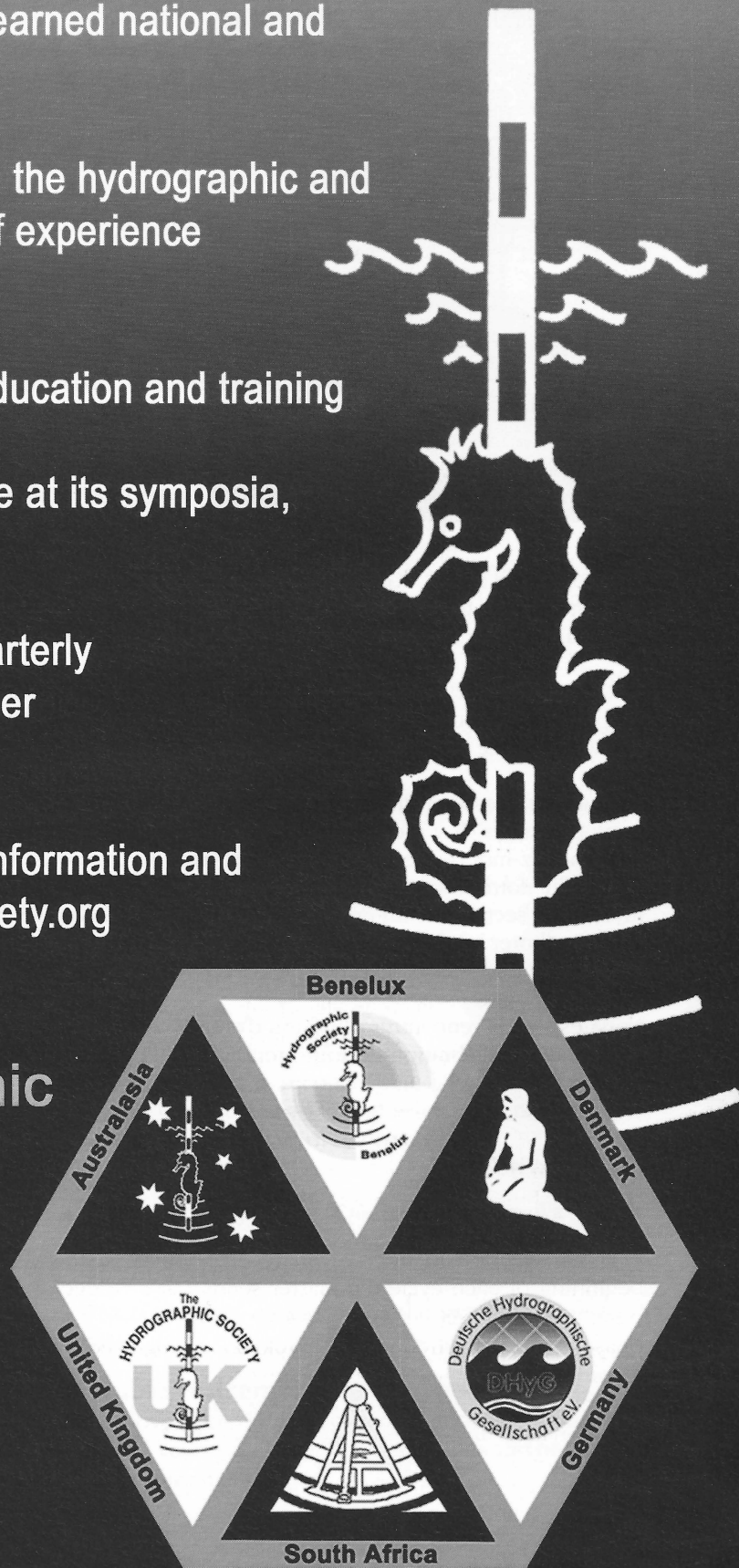
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A HiFix® Mystery Resolved

By: Nick Stuijbergen, Canadian Hydrographic Service (Atlantic Region), Dartmouth, NS

The HiFix® radio-location system failed mysteriously in 1966, on a hydrographic survey of Robeson Channel, despite having equipment in perfect working order. A recent discovery by Paul Mileski, an engineer with the US Naval Undersea Warfare Center (NUWC), provides us with a plausible explanation of the problem.

In multi-year sea ice a ducting channel is formed, a wave guide that allows radio signals to be propagated inside the thick ice layer. The duct acts as a leaky waveguide, so that some of the signal radiates upward to mix with the air-path signal. Due to the two different propagation velocities, there are places where the two signals are 180 degrees out-of-phase, causing cancellation, dead-zones in which the signals combine to drop signal strength down to zero. The HiFix receiver loses phase-lock, and loses track of the lane count. There was no remedy for this problem with HiFix. The permanent ice sheet in the Arctic could however be usable as an efficient waveguide, for the design of an alternate means of communication between ice camps, in a region where sky-wave HF radio blackouts frequently arise, due to anomalous disturbances in the ionosphere.

HiFix System Description

Inspired by the success of the Decca Navigator System, HiFix was designed as a hyperbolic positioning system of improved accuracy to serve a growing requirement to support offshore exploration for oil and natural gas. The HiFix hyperbolic radio-location system operates at a single frequency (1710 kHz), with narrow-band transmissions time-shared between a Master and two Slave transmitters. The antenna is a 35-foot vertical aluminum tubular mast mounted on a base insulator, surrounded by radial wires to form a ground plane. Radiated power is less than 100 Watts. Each pair, Master to Slave I and Master to Slave II, forms a baseline that generates a fan of hyperbolic position lines. (LOP's – "Lines of Position") See Figure 1 for an illustration of hyperbolic geometry.

The mobile receiver measures the phase difference between Master and Slave signals received, to locate the mobile receiver on a particular hyperbolic LOP. A pair of measured LOP's intersect at a point, the position of the mobile receiver. The time-shared transmission sequence: Master, then Slave I and Slave II, operates in a repeating cycle of 1-second duration. Each transmission burst lasts 200 milliseconds. A 100m-sec gap ("guard period") between bursts allows enough time for the relays to switch over, and for the receiver to phase-lock onto the next transmission in the time-shared sequence. At the beginning of each cycle the Master sends out a "trigger burst" of 100m-secs, at a frequency 60Hz below the phase-comparison frequency (1710kHz). Recognized by all units in the chain, the trigger burst serves to maintain the time-frame of the synchronized time-sharing sequence, common to all units in the chain. The phase of the received signal burst provides an update to a continuous phase remembered inside the receiver. Each pair of replicated

phase, Master to Slave, is fed to a phase comparison device, a goniometer. ("gonio") The goniometer, consisting of a pair of crossed coils, very precisely crafted for accuracy, acts as a phase comparator to yield the value of the measured phase difference, displayed as a lane fraction, in decimal units.

There is no measurement of whole lanes; these are obtained by accumulation. As the mobile receiver moves through the progression of lane fraction measurements, a count is carried along on whole lane cycles traversed. At the start of a day's work on survey, the initial lane count is set at the value known for a particular location, a buoy, a wharf side reading, or at the landing pad of the helicopter. Any break in signal tracking ("lost phase-lock"), due to interference, lightning or precipitation static, required a return to a known point to reset the lane count.

In its day, HiFix served us well to provide accurate positioning for hydrographic surveys. This was mainly due to the precision of the phase-comparison measurement technique, and a careful consideration of hyperbolic geometry, when choosing the layout of transmitter station sites to suitably cover the area of the survey. Subsequent to the design of HiFix, later Decca designs included HiFix /6 and HyperFix.

Narrative

In 1966 a hydrographic survey was begun in Robeson Channel, to chart the depths in the narrow passage between Ellesmere Island and northern Greenland. The project was said to be "very important". Much later the reason for this became known. The passage was a "choke-point" for submarine transits, of significant defence interest in the Cold War era.

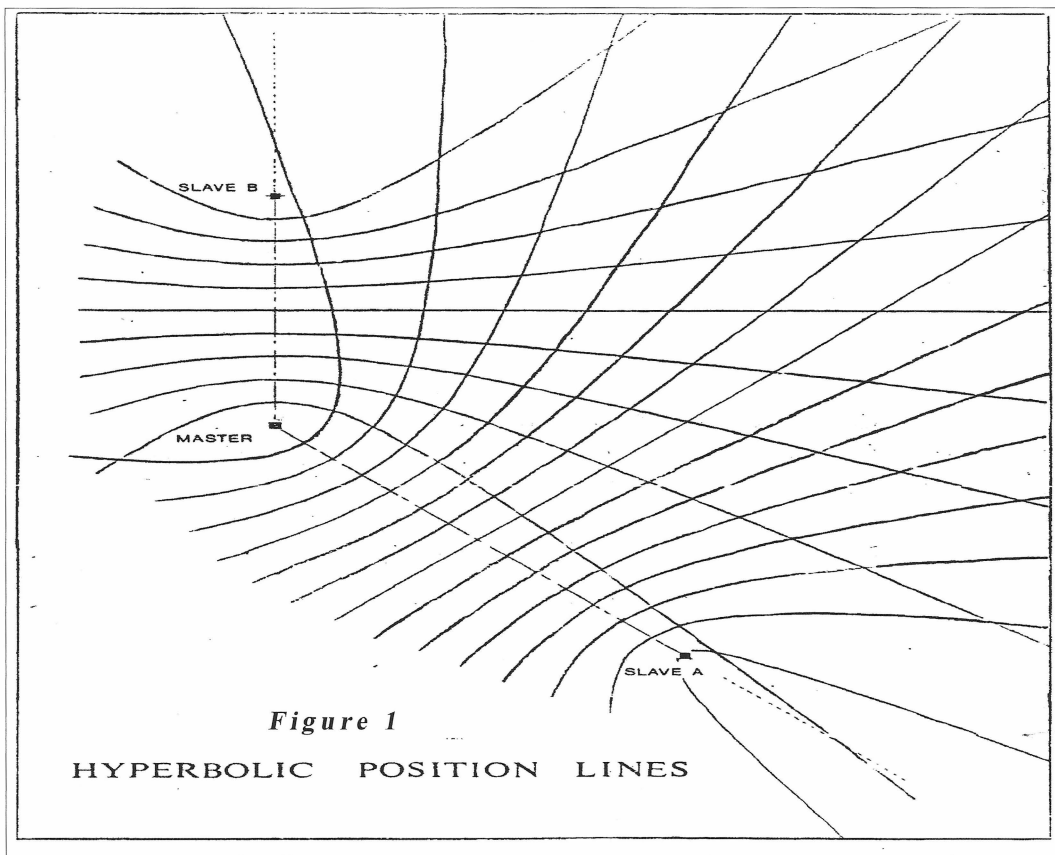


Figure 1: Illustration of hyperbolic position lines.

A hydrographic base site was built near the weather station and military base at Alert NWT (Latitude 84° N, Longitude 73° W). The plan was to measure spot depths by echo-sounding through the ice. Position fixes were to be acquired with the HiFix electronic positioning system, which had been employed with great success on previous surveys in the Arctic.

The usual start-up procedures for the HiFix chain consisted of setting up the equipment at each station, installing the power source (propane-fired thermo-electric generators), raising the antenna masts, surveying the station co-ordinates, and drawing up the hyperbolic lattice plotting sheets, etc. Then came the task of running baseline crossings and lane counts along the two baselines, for an overall check on the HiFix chain setup.

Here, the first sign of trouble appeared. Somewhere along the baseline run, the receiver in the helicopter suddenly lost track, with red lights flashing and the display counters spinning. Repeated runs, at varying altitudes and with different receivers, made no difference. The newly refurbished equipment was again checked and found to be in perfect working order.

A message was sent to Polar Shelf headquarters, and a team of radio scientists from the National Research Council, Ottawa, arrived to examine the problem. Using

some special equipment, reflections were measured from the ionosphere, the surmised source of the difficulty. The results were not conclusive.

Then a "null-hunting traverse" on the ice field was undertaken, with a fly camp set up near where the helicopter ran into a trouble spot. Using a HiFix receiver, with antenna and 12 Volt batteries, rigged on a stretcher, a line was sampled at regular intervals, recording signal strength and phase at a 50-foot spacing. On the third day of a hard hike, carrying the stretcher across the slippery rubble of broken and re-frozen sea ice, the effort was rewarded with readings that gave a detailed picture of the dropout zone.

Measurements showed signal strength fading, then disappearing altogether, and rising again towards normal further along the line. The measured phase was seen to rise above the expected linear trend. Beyond the dead zone of the null, the phase was seen to recover at a low value, and then to come back up further along the line, towards the steady linear trend of a normal progression. Graphs of the data suggested an effect of two signals travelling at different velocities, causing a distortion of the measurement, and dropout of the signal, where the phase of the two radio waves appeared to differ by 180 degrees. Somehow, from somewhere, there was thought to be some kind of a second signal, that interfered with the proper functioning of HiFix.

After a bit of speculation as to the source of the strange second signal, it was decided that HiFix® would not be usable for accurate positioning of the depth soundings on this project. The project proceeded with positioning by theodolite intersections, with surveyors stationed at survey markers on the high ground of the western shore, and with the helicopter pilot flashing a signal mirror to provide the aiming point for the intersection.

The HiFix chain was kept going, for approximate guidance to govern the spacing of spot soundings. Whenever the lane count was lost, an approximate reset was based on an educated guess of the distance from the previous point.

The survey was completed successfully, leaving the question of the mysterious malfunction of HiFix unanswered, gradually forgotten. The recent discovery, by Paul Mileski, of the waveguide effect in sea ice, at long last provides an explanation.

Explanation

In multi-year sea ice ("old ice") the repeated annual cycle of thaw and re-freeze causes the salt content to leach downward. Early Arctic explorers knew that the ice in the top layer could be melted for drinking water. The gradient of increasing salinity downward creates a gradient of increasing conductivity, a variable refractive index that induces an upward curvature of the signal path in the ice layer. The effect is to form a duct, a channel that confines the radio waves, so that the ice layer acts as a wave-guide (see Figure 2). Some fraction of the energy is radiated upwards to interact with the air-path signal. It is a "leaky wave-guide" phenomenon.

From Adversity to Advantage

The HiFix malfunction at the time was a vexing problem without a solution, that bedevilled our survey operation. The powerful observation provided by Paul Mileski, a discovery now forty years later, not only clears up the HiFix problem, but also leads us to the idea of making good use of the efficient propagation enabled by the 2D wave-guide, in the duct formed by the salinity gradient inside the layer of permanent multi-year sea ice.

With relatively low-power units, communication links at fairly long ranges could be achieved, between researchers stationed on the ice. Some experimentation on site would be needed to find suitable

frequencies, to devise suitable antennas for coupling the signal to the ice layer, find the optimal range performance, etc. Thus, there is possible a design for a backup radio link, to overcome the problem of radio blackouts of HF sky-wave communications in the Arctic, caused by disturbances in the ionosphere.

Conclusion

The propagation of radio waves, ducted inside the waveguide formed in the layer of multi-year polar sea ice, might offer an interesting new idea for communication links between researchers stationed on the permanent ice sheet, in the high Arctic region.

Researchers use ice as a waveguide

A US researcher has used Arctic ice – over a hundred miles of it – as a waveguide.

On a recent trip to the Arctic Paul Mileski, an electronics engineer and scientific diver with the US Naval Undersea Warfare Center, found time to take a detailed look at using ice as a giant two-dimensional waveguide and got some surprisingly good results.

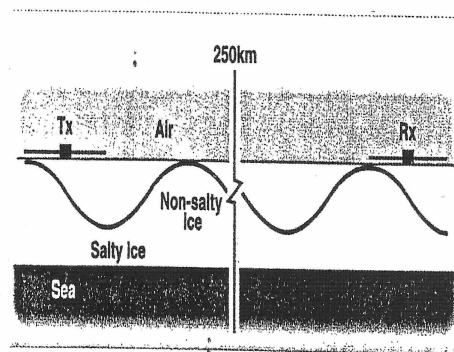


Figure 2: Illustration of ice wave-guide.

"Surprising because sea ice has quite a high salt content," he said. "We got a range of over 150 miles [240km] on 10 to 100mW and the receiver [antenna] was a clip-lead from a multimeter."

Mileski has worked out what is going on. "The way it behaves in a classic sense is as a conductive surface on top of which is a dielectric slab. The relatively low loss dielectric supports TEM (transverse electric-magnetic) waves bounded by the sea water."

Coupling radio waves into the ice has been done in two ways. Mileski has found that an insulating wire with an exposed conductive end can be lowered through a narrow hole in the ice. "We were getting very successful results with a length of wire terminated in sea water with a meshing network [to match it] on

top," he said.

This technique requires a long drill, so he favours the second method; roll out a long insulated dipole across the ice. Mileski finally settled on two 150m wires to couple the 600m wavelength (500kHz) radio signal into the ice. This dipole does not act like a classic antenna, with a null in line with its length, but rather as a coupling structure that has a peak in line and a null at right angles.

Voice and 75bit/s data were sent and the signal successfully leaps gaps in the ice 30m wide. One problem is noise generated by charged snow particles hitting the wire. Covering the wire with snow cuts down the noise.

What use is the whole thing? "It would be terrific for emergency communications," said Mileski.

[Editor's note: This article was first published in "Electronics World" magazine, in the August 2001 issue. For more information please go to: www.stjohnpatrick.com.]

Acknowledgement

We appreciate the permission, granted by Ms. Svetlana Josifovska, magazine editor, to reproduce the article describing the discovery of the waveguide in sea ice, by Paul Mileski.

This article was first published in "Electronics World" magazine, in the August 2001 issue. For more information please go to: www.stjohnpatrick.com 

Sources

Anonymous Website: www.g4ftc.co.uk/index.htm

-- A radio amateur's perspective, with photo's and history of the Decca Navigator System, the predecessor of HiFix.

Cordwell, Alan (2006) Website:

www.alancordwell.pwp.blueyonder.co.uk/nav/index.html

-- Technical information about HiFix and its successors, HiFix /6 and HyperFix.

Eaton, R.M., (1966) The Use of HiFix Hyperbolic.

Unpublished internal CHS report.

Bedford Institute of Oceanography, Dartmouth, NS. Jan 1966.

-- A detailed description of procedures in the application of HiFix to hydrographic surveys.

Mileski, Paul M. (2001) Researchers use Ice as a Waveguide.

Electronics World, August 2001 issue

-- Article describes the discovery of the waveguide in polar ice.

Proc, Jerry. Website: <http://jproc.ca/hyperbolic/index.htm>

-- An overview of hyperbolic radiolocation systems.

Sample, Ian. (2001). ColdPlay.

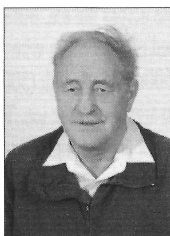
New Scientist, May 19 2001 issue, page 23.

-- Another description of Mileski's findings.

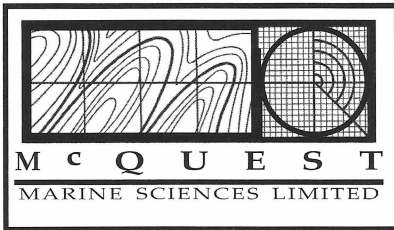
An excerpt is available at:

www.newscientist.com/article/mg17022913.300-coldplay.html

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Simple classification de données bathymétriques et acoustiques pour la caractérisation et la gestion d'habitats d'espèces marines

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Multibeam sonars provide both bathymetric and seabed backscattering measurements. Exploring this set of information provide a means of describing the morphology and estimating physical properties related to the composition of the seabed. Both the morphology and these physical properties of the seabed are considered to be related to the distribution of marine species and, hence, could be used to characterize seabed habitats. A project has been undertaken by the Interdisciplinary Center for the Development of Ocean Mapping (also known as CIDCO) and the Department of Fisheries and Oceans (Quebec Region), which aim is to evaluate the potential of marine geomatics tools to help classify the seabed from multibeam data. Multibeam data (EM1002) have been collected by the Canadian Hydrographic Service (Quebec region) over three sites off the Gaspésie peninsula. The high resolution bathymetry has been classified with the concept of "Bathymetric Position Index" that measures the difference between a specific node and an average over a neighbouring region. Preliminary works have been started to use the backscatter to provide a complementary way to classify the seabed. Data interpreted from video transects have also been compared to the multibeam information.

The voluntary simplicity of the bathymetric classification scheme presented in this paper aims at allowing a large community of non-multibeam specialists to be able to interpret bathymetric data objectively and in a timely manner.

Les sonars multifaisceaux fournissent une mesure de la bathymétrie et de l'intensité du retour du signal acoustique provenant du fond marin. Une analyse de ces deux mesures permet d'offrir une description spatiale de la distribution du relief et d'estimer la nature du fond marin. Ces propriétés physiques sont considérées comme étant liées à la distribution d'espèces marines et servent à caractériser des habitats. Le présent projet, mené par le Centre Interdisciplinaire de Développement en Cartographie des Océans (CIDCO) et le Ministère des Pêches et des Océans (MPO), a pour objectif d'évaluer le potentiel des outils de géomatique pour la classification des types de fonds marins à partir de données de sonars multifaisceaux. Des données multifaisceaux (sonar EM1002) ont été acquises par le Service hydrographique du Canada, sur trois sites au large de la Gaspésie. La classification de la bathymétrie a été effectuée à l'aide du concept d'index bathymétrique qui mesure, pour chaque nœud du modèle numérique de la bathymétrie, une différence bathymétrique entre celui-ci et son voisinage. Des travaux préliminaires ont été entamés pour utiliser également la mesure de l'intensité du retour du signal acoustique pour classer ces fonds. Cette classification du relief et de la nature des fonds a ensuite été comparée à des informations issues de l'interprétation de vidéos sous-marines acquises à l'aide d'un traîneau benthique sur ces mêmes fonds. La simplicité volontaire des outils de classification proposés a pour but de rendre accessible à un large public de scientifiques et de gestionnaires du milieu marin l'information issue de données bathymétriques et acoustiques.

I. INTRODUCTION

Un habitat marin est défini par des paramètres aussi différents que la géologie, la profondeur, la sédimentologie, les conditions environnementales, l'association de communautés biotiques et d'autres attributs. L'utilisation de paramètres aussi variés par une communauté scientifique pluridisciplinaire a inévitablement mené à l'élaboration d'une vaste gamme de méthodologies et de définitions liées à la caractérisation de l'habitat marin (Greene, 1999). Il est encore difficile aujourd'hui de trouver un consensus sur le type de données à utiliser et sur les méthodes à appliquer pour définir un habitat benthique (CIDCO, 2006). Cependant, on observe depuis quelques années une tendance à définir un habitat marin principalement par sa morphologie et la nature du substrat sur lequel se développent et prospèrent les organismes vivants. Ces deux variables principales sont acquises par des techniques de télédétection issues de la géophysique

marine, représentées essentiellement par les techniques de sonar multifaisceaux.

Plus en détail, un environnement marin est composé de structures et d'objets dont les composantes spatiales sont caractérisées par des échelles différentes (du talus continental à la taille de grains de sédiment, par exemple). Greene et al. (1999) fournit une méthodologie combinant la caractérisation de la géométrie des éléments structurant un habitat et les limitations des méthodes géophysiques actuelles. Il propose de considérer quatre catégories d'habitat suivant la taille des structures qui le compose. On distingue, par ordre de taille :

- Le mega-habitat. Il est caractérisé par des structures physiographiques dont les dimensions varient de quelques kilomètres à quelques dizaines de kilomètres (talus, plaine, canyon,...). Plusieurs assemblages de poissons démersaux peuvent vivre dans un mega-habitat.

- Le meso-habitat. Il est composé d'unités morphologiques

dont les dimensions varient de quelques dizaines de mètres à quelques kilomètres. On y trouvera par exemple des bancs de sable, des récifs coralliens, etc. Un assemblage unique de poissons démersaux correspondra généralement à un meso-habitat.

-Le macro-habitat. Il se caractérise par des structures de quelques mètres à quelques dizaines de mètres, telles qu'une dune de sable, une moraine, etc. Une espèce ou un assemblage (généralement peu varié) de poissons démersaux est associé à un macro-habitat.

-Le micro-habitat. Il se définit par des éléments de quelques centimètres à quelques mètres (sable, argile, gravier, fracture de roche, roches erratiques, ...). Ce type de caractéristiques est largement associé à la nature du matériel composant le fond marin. Des organismes biologiques individuels sont associés à chaque micro-habitat.

La classification automatique de données bathymétriques et d'imagerie à haute résolution offre de nombreux avantages tels que l'objectivité, la rapidité d'exécution, la répétabilité et son caractère quantitatif. De nombreuses techniques de caractérisation de la morphologie et de l'imagerie issue de méthodes de sondage multifaisceaux ont fait l'objet de recherche (Pratson et Edwards, 1996). Cependant, on constate que l'utilisation de ces techniques s'est essentiellement limitée aux scientifiques et ne s'est pas démocratisée. On suppose que cette limitation est le fait de la complexité des algorithmes utilisés. On se propose, ici, de présenter une méthode et un algorithme de classification des données bathymétriques basés sur des principes simples.

2. ACQUISITION ET TRAITEMENT DE DONNÉES BATHYMÉTRIQUES HAUTE RÉOLUTION ET D'IMAGERIE ACOUSTIQUE

Les récents progrès de l'électronique et de l'informatique ont permis l'avènement des systèmes SONAR (SOund NAVigation and Ranging) du type multifaisceaux. La géométrie classique de ces SONAR est illustrée à la Figure 1. Une antenne émet ("transmit beam") un signal acoustique transversalement à l'axe du sonar (i.e. perpendiculairement au sens de marche du bateau ou "across-track"). Une série de transducteurs (céramiques détectant des changements de pression) réceptionnent l'énergie acoustique réfléchi par le fond marin ("receive beam") dans l'axe longitudinal du sonar (i.e. parallèlement au sens de la marche de la plateforme de sondage ou "along-track"). L'intersection de la géométrie d'émission et de réception se formalise par une série de "faisceaux" individuels (Figure 1). La mesure du temps requis pour que l'onde acoustique provenant de chaque faisceau effectue le trajet aller retour (SONAR-fond marin) permet de fournir les mesures de profondeur correspondantes. En plus de mesurer le temps de propagation, les systèmes multifaisceaux modernes mesurent l'énergie acoustique réfléchi par le fond marin. Cette mesure est plus

généralement connue sous le nom de signal rétrodiffusé ou backscatter. Ce signal permet d'offrir une information relative quant à la nature du fond marin. Cependant, il existe encore de nombreuses limitations à l'utilisation de cette information avant que l'on puisse caractériser de manière non-équivoque la nature du fond marin. En particulier on notera que le signal rétrodiffusé dépend de nombreux facteurs tels l'intensité du signal émis, la pente, l'angle d'incidence sur le fond marin, la distance oblique parcourue, l'atténuation du signal dans la colonne d'eau.

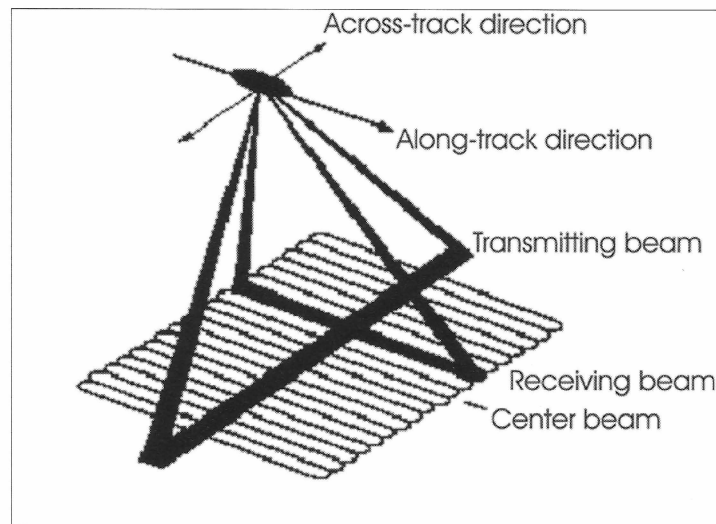


Figure 1: Géométrie des sonars multifaisceaux (tiré de Schmitt, T., 2005)

De telles données bathymétriques haute résolution sont couramment acquises par le Service hydrographique du Canada (SHC), à bord, entre autre, du CCGS Frederick G. Creed. Le Frederick G. Creed est équipé d'un sonar multifaisceaux Simrad EM-1002. Ce système dispose de 60 faisceaux couvrant un arc de 150°. La couverture transversale par passage correspond à 4 à 5 fois la profondeur d'eau locale. Les informations de navigation sont collectées simultanément à l'aide d'un DGPS, offrant une précision de l'ordre de 3m. Les mouvements de pilonement (heave), tangage (pitch), roulis (roll) ainsi que l'orientation (heading) de la plateforme sont mesurés, eux aussi simultanément, à l'aide d'un système de navigation inertiel (POS-MV320). Des mesures de la célérité acoustique dans la colonne d'eau sont prises épisodiquement et sont utilisées pour déterminer précisément le trajet de l'onde acoustique dans la colonne d'eau et réduire les artéfacts associés à la réfraction.

De manière générale, le traitement des données bathymétriques est effectué en visualisant les données des sondes bathymétriques et en supprimant les valeurs aberrantes. Les informations de positionnement et de mouvements de la plateforme de sondage sont inspectées afin de s'assurer de l'absence de valeurs erronées. De plus, les mesures bathymétriques sont ajustées en tenant compte des mesures de la marée en utilisant les données

des marégraphes du SHC et des mesures de vitesse de propagation de la vitesse du son dans l'eau. Finalement, la création d'un modèle numérique de terrain à partir des points de sondes constitue la dernière étape du traitement et permet d'uniformiser la géométrie de grille régulière dont le maillage est choisi en fonction de la profondeur d'eau. Dans le cas de la Figure 2 et dans le cadre des travaux présents, la taille des cellules des grilles est de 4m.

Parallèlement, le traitement des mesures de réflectivité est effectué afin de minimiser les effets de l'acquisition et de rendre cette mesure la plus représentative possible de la nature du fond marin. Plus précisément, il s'agit de corriger les données de réflectivité par rapport à la géométrie d'acquisition et de réception de l'onde acoustique (patron

d'émission des ondes acoustiques, par exemple) ainsi que pour ses caractéristiques radiométriques (atténuation de l'onde acoustique compensée par des changements de puissance d'émission et de gain durant les levés). La Figure 3 présente les résultats du traitement de données de réflectivité.

Le levé utilisé pour le propos de cet article se situe à proximité du Cap Gaspé. On notera la présence d'un réseau de marques linéaires dont la nature reste incertaine. Du fait de la présence de ces marques, mais aussi d'autres attributs bathymétriques, cette zone est particulièrement appropriée à l'élaboration et au test de la méthode de classification de la bathymétrie qui est décrite ci-dessous.

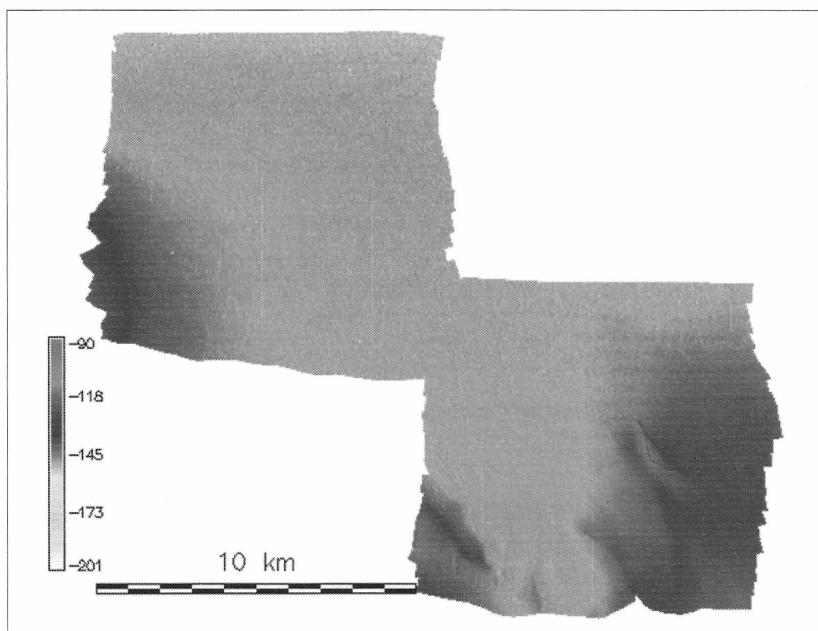


Figure 2: Bathymétrie de la région d'étude après traitement des données et création du modèle numérique de terrain au sein d'une grille régulière de 4m. Les profondeurs sont en mètres.

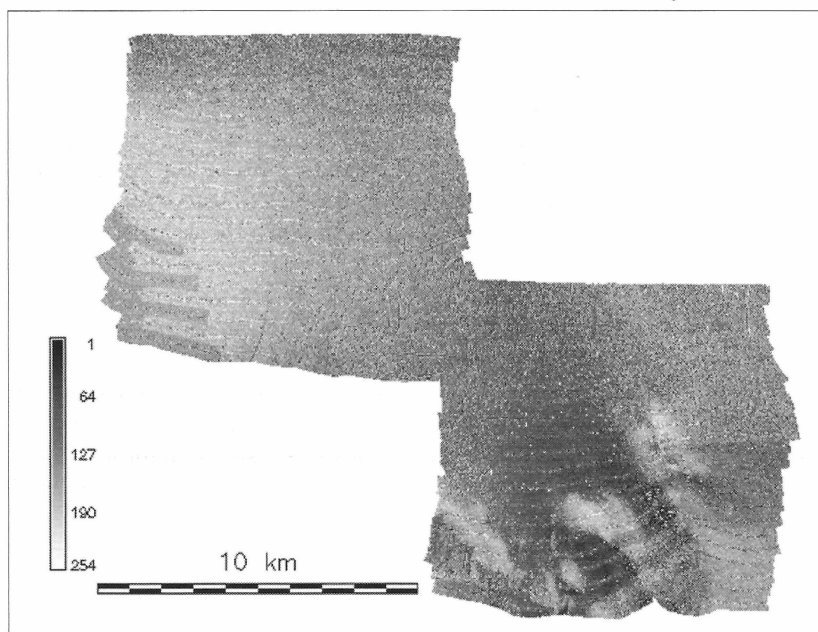


Figure 3: Mosaïque de réflectivité acquise pour la même région que la Figure 2. L'intensité de réflectivité est codée sur une échelle de teinte de gris entre 0 et 255. (0 : Faible réflectivité; 255 : Forte réflectivité).

3. MÉTHODE DE CLASSIFICATION DE LA BATHYMÉTRIE

L'outil de classification développé au cours de ce projet a pour objectif de quantifier la relation qu'un point a avec son entourage (Figure 4). Il est largement inspiré de précédents travaux de Lunblad (2004). Cet entourage est défini par le concept de moyenne focale. Cette dernière se résume au calcul de la valeur moyenne de la profondeur (au sens bathymétrique) à l'intérieur d'une surface ayant la forme d'une couronne définie par son rayon interne et son rayon externe. La valeur de la moyenne focale ainsi calculée est comparée à la valeur de la profondeur bathymétrique au point d'intérêt (centre de la couronne). Dans un formalisme mathématique, le concept se traduit par l'équation suivante :

$$IB = z(x, y) - MF((x, y), r_int, r_ext)$$

où IB est la valeur de l'index bathymétrique au point d'intérêt (x,y), $z(x,y)$ est la valeur de la profondeur bathymétrique au point d'intérêt (x,y), et $MF((x,y), r_int, r_ext)$ est la moyenne focale calculée au point x,y à l'intérieur de la couronne définie par un rayon interne (r_int) et un rayon externe (r_ext) (cf. zone grise des schémas de la Figure 4).

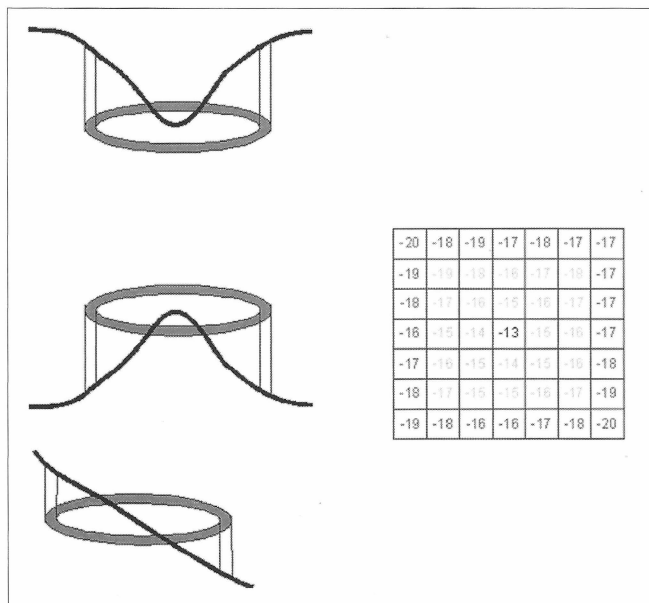


Figure 4: Méthode de calcul de l'index bathymétrique. En gris foncé : zone circulaire sur laquelle est calculée la moyenne focale comparée au point central d'intérêt. À gauche, différentes géométries possibles. À droite, représentation correspondant à la notion de moyenne focale de la grille du modèle bathymétrique

Les figures 4 et 5 montrent différents types de géométrie de la morphologie qui peuvent se présenter. D'une manière générale un index bathymétrique tendant vers une valeur nulle correspondra à un fond plat ou à pente constante. Une valeur négative de l'index bathymétrique suggèrera

la présence d'une dépression dont l'intensité sera qualifiée par sa valeur absolue. De manière similaire, une valeur positive soulignera l'existence d'une crête.

Le choix du rayon interne, mais surtout du rayon externe permettra à l'utilisateur d'analyser les tendances locales (de l'ordre de quelques mètres) ou régionales (de l'ordre de quelques dizaines à centaines de mètres). Ainsi, la figure 5 montre le type de valeurs de l'index bathymétrique pour une échelle grossière (Figure 5, haut) et pour une échelle fine (Figure 5, milieu) pour la même morphologie. Cette analyse motive le calcul de l'index pour deux types d'échelles (une grossière, l'autre fine) qui seront déterminées par l'utilisateur suivant sa connaissance a priori du modelé bathymétrique.

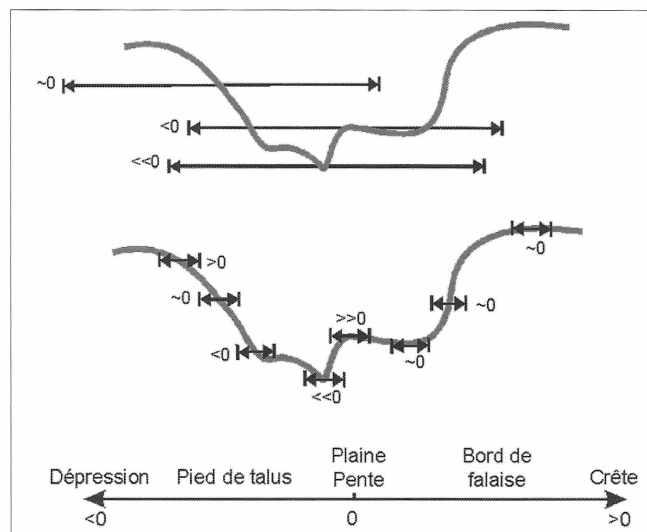


Figure 5: Interprétation de la morphologie à l'aide de l'index bathymétrique : en haut, échelle grossière; au milieu, échelle fine; en bas, type de morphologie en fonction de la mesure de l'index bathymétrique

À l'aide de ces deux indices calculés à des échelles différentes et le calcul de la pente, le processus de classification peut se résumer à un arbre de décision matérialisé par la Figure 6. Dans un premier temps, l'analyse est réalisée à une échelle grossière (i.e. petite échelle cartographique) définissant trois classes. Dans un second temps, une analyse similaire est réalisée à une échelle plus fine (i.e. grande échelle cartographique). De fait des sous-classes sont définies au sein de celles précédemment identifiées. Dans le cas de valeurs d'index bathymétrique proches de zéro, l'utilisation de la pente permet de différencier un fond plat d'une pente régulière. Le choix des critères de décisions reste l'entière responsabilité de l'utilisateur, lui permettant ainsi de focaliser à son souhait sur les objets morphologiques de son intérêt.

La méthode décrite ici et l'algorithme correspondant ont été implantés au sein de GRASS (Geographic Resource Analysis Support System) version 6.2 (<http://grass.itc>).

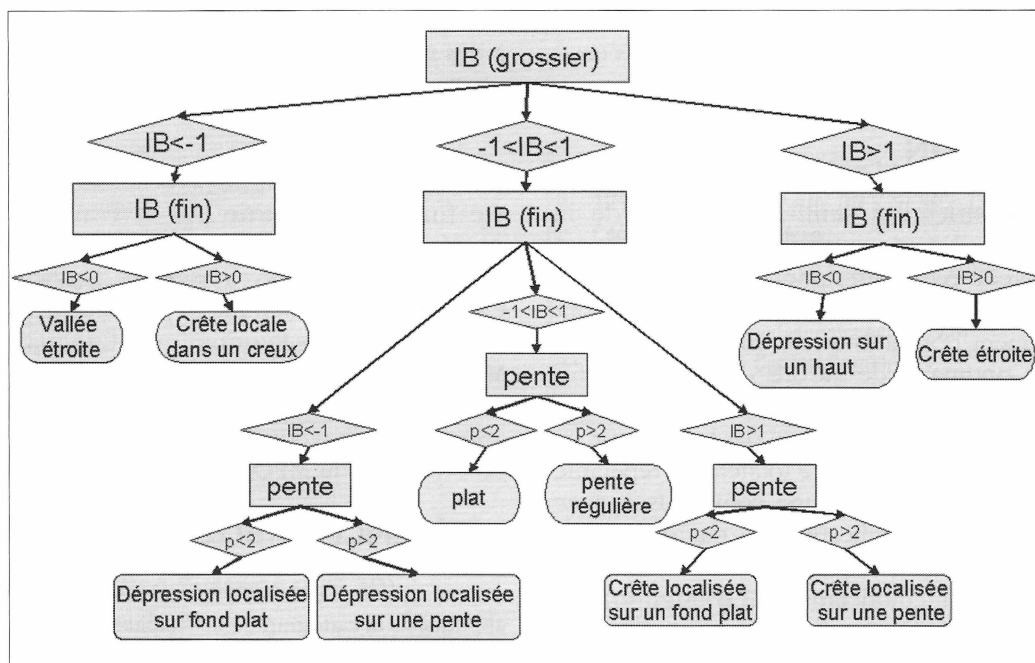


Figure 6: Arbres de décision menant à la classification de la morphologie, grâce aux calculs d'indices bathymétriques pour une échelle grossière et pour une échelle fine, et au calcul de la pente

it/). Cette application, initiée par le United States Army Corps of Engineers, offre un Système d'Information Géographique complet d'accès libre.

4. RÉSULTATS

Le modèle d'élévation et la classification morphologique correspondantes d'une sous-zone de la figure 2 sont illustrés dans la figure 7 et la figure 8, respectivement. Dans

la Figure 7, une illumination artificielle a été appliquée provenant du sud-ouest et révèle la morphologie irrégulière du fond marin et ce du fait de la présence de marques. La figure 8 correspond à la classification déterminée par le calcul des indices bathymétriques par la procédure mentionnée plus haut et en utilisant respectivement pour l'échelle grossière un rayon externe de 100m, un rayon interne de 60m et pour l'échelle fine un rayon externe de 20 m et un rayon interne de 12m. Les caractéristiques de l'arbre de décision sont celles représentées à la Figure 6.

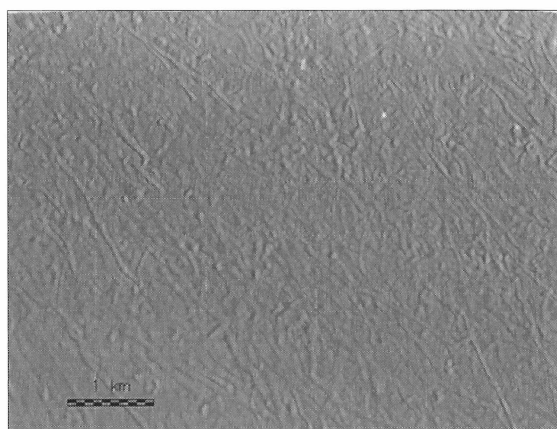


Figure 7: Modèle d'élévation soumis à une illumination artificielle provenant du sud ouest. On notera l'irrégularité du fond et plus particulièrement la présence de marques

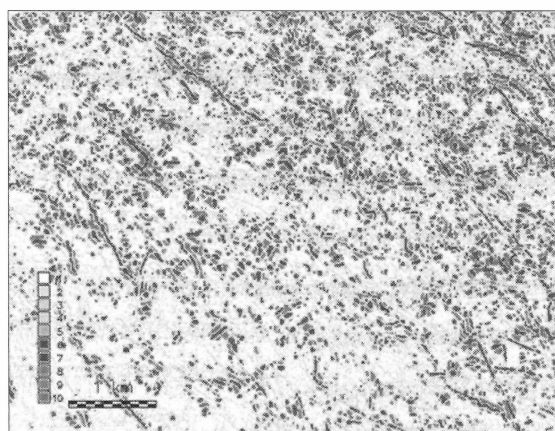


Figure 8: Classification morphologique de la zone correspondant à la figure 7. (1: terrain plat, 2: pente régulière, 3: dépression localisée sur un fond plat, 4: dépression localisée sur un fond en pente, 5: crête localisée sur un fond plat, 6: crête localisée sur un fond en pente, 7: vallée étroite, 8: crête localisée dans un vaste creux, 9: dépression localisée sur une vaste crête, 10: crête étroite)

On constatera que la méthode est relativement efficace pour déterminer la présence des creux et des crêtes (voir légende des classes à la figure 8).

5. DISCUSSION

Un outil de classification semi-automatisée de la morphologie du fond marin a été présenté. La présente technique se veut particulièrement simple dans sa méthodologie et son implantation. Des travaux sont menés actuellement pour affiner cet outil en identifiant les paramètres optimaux de l'arbre décisionnel, afin que le choix des dimensions de zones de calcul des moyennes focales ne soit plus imposé par l'utilisateur, ce qui permettrait à la méthode d'être totalement répétable sur différents sites. D'autre part une comparaison avec d'autres techniques de classification n'a pas encore été entreprise, bien qu'elle puisse permettre de relativiser le succès de la présente méthode.

Comme c'est le cas pour la méthode de classification de la bathymétrie, il est important de développer une méthode relativement simple pour la classification des données à partir des données de réflectivité. Dans ce cadre des essais ont été entrepris par le SHC et le CIDCO (CIDCO, 2007). La méthode des bris naturels ou méthode de Jenks a pour but de déterminer des classes en utilisant le contenu de l'histogramme de teintes de gris caractérisant chaque mosaïque. Le résultat semble cependant mitigé du fait de la variabilité intrinsèque des données de réflectivité.


Une comparaison préliminaire entre les résultats de la classification morphologique et la classification des bandes vidéo prouve qu'il existe un conflit de résolution entre les deux techniques. En d'autres termes, les deux techniques ne sont pas nécessairement comparables, mais plutôt complémentaires. La perception de la morphologie fine du fond marin telle que révélée par sondage multifaisceaux est de l'ordre du mètre allant vers la dizaine de mètres alors que les relevés par caméra remorquée permettent de visualiser les objets du fond marin dont la taille se situe entre le décimètre et le mètre, bien que la précision du positionnement soit de l'ordre de la dizaine de mètres.

6. CONCLUSION

L'outil d'analyse proposé ici se veut simple et accessible en plus d'être complémentaire aux méthodes d'interprétation couramment employées par les géologues et les autres utilisateurs de données bathymétriques à haute-résolution. Il permet de tirer le meilleur parti du volume et de la résolution des données issues des sonars multifaisceaux dans un cadre d'analyse quantitative et répétable au sein d'une méthode automatisée. Dans le cadre de projets régionaux au cours desquels de très larges volumes de données sont collectés, tel que celui mené présentement dans le Saint-Laurent par le SHC et Ressources Naturelles

Canada, cet outil pourrait être mis à profit avant de recourir à des méthodes plus complexes.

REMERCIEMENTS

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RÉFÉRENCES BIBLIOGRAPHIQUES

CIDCO (2006). Synthèse critique des outils de télédétection appliqués à la cartographie des habitats benthiques en domaine côtier. Rapport pour le compte du Ministère des Pêches et des Océans et des Ressources Naturelles.

CIDCO (2007). Classification d'habitats marins à partir de données de bathymétrie et de réflectivité haute résolution – comparaison avec des sections de vidéo sous-marines. Rapport pour le compte du Ministère des Pêches et des Océans.

Greene, H.G., et al. (1999) A classification scheme for deep seafloor habitats. *Oceanologica Acta*, 22,6, 663-678

Jenks, G.F. (1977). Optimal data classification for choropleth maps, Occasional paper No. 2. Lawrence, Kansas : University of Kansas, Department of Geography.

Pratson, L.F. et Edwards, M.H. (1996). Introduction to advances in seafloor mapping using sidescan and multibeam bathymetry data. *Marine Geophysical Researches*, 18, 601-605

Lundblad, E. (2004). The Development and Application of Benthic Classifications for Coral Reef Ecosystems Below 30 m Depth using Multibeam Bathymetry: Tutuila, American Samoa. Masters Thesis, Oregon State University, Corvallis.

Schmitt, T. (2005). Morphology and dynamics of headland connected sandbanks from high resolution bathymetric surveys: Helwick and Nash Sands, Bristol Channel, UK. PhD Thesis, School of Earth, Ocean and Planetary Sciences, Cardiff University.

NOTES BIOGRAPHIQUES

Les travaux du Docteur Schmitt sont reliés à la cartographie du fond marin dans le milieu côtier. Fort d'une expérience dans le domaine de la géophysique marine et l'océanographie acquise lors de son doctorat à l'Université de Cardiff (Pays de Galles, G.B) et de sa maîtrise à l'Université Laval, il est depuis 2005 Directeur Scientifique du Centre Interdisciplinaire de Développement en

Cartographie des Océans, basé à Rimouski. Le rôle du CIDCO est d'initier, de participer à la recherche et au développement dans le domaine de la géomatique marine et de fournir des services associés tout en favorisant le développement économique et la gestion saine de l'environnement marin.

Les recherches de Dutil et Larocque portent notamment sur la productivité des communautés de poissons démersaux dans l'estuaire et le golfe Saint-Laurent. Leur intérêt dans ce projet est venu de la nécessité de décrire les habitats essentiels de trois espèces de loups et des communautés de poissons auxquelles ces espèces sont associées.

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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:

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1. Le candidat ou la candidate doit être un étudiant ou une étudiante inscrit à plein temps à un programme reconnu en sciences géodésiques (ce programme doit inclure les levés hydrographiques ou un contenu des systèmes d'informations géographiques, de cartographie ou des levés terrestres) par une université ou un collège situé au Canada. Un programme en environnement seulement ne sera pas éligible. L'administrateur de cette bourse déterminera l'admissibilité du programme pour la bourse d'études.
2. La bourse s'adresse aux étudiants et étudiantes inscrits dans un programme menant à un diplôme collégial ou de premier cycle universitaire conforme aux disciplines de base. Le candidat doit soumettre une copie de son dernier relevé de notes post-secondaire avec sa demande. Les notes doivent être au-dessus de la moyenne de sa classe et être obligatoirement supérieures à 70 %.
3. La bourse sera remise au candidat ou à la candidate qui, de bonne foi, peut démontrer ses besoins financiers et qui respecte les exigences académiques mentionnées ci-haut.
4. Le candidat ou à la candidate devra écrire un court texte clair et concis, démontrant ses besoins financiers sur le formulaire de la demande ou, si nécessaire, sur une lettre jointe. Une grande importance est accordée à cet aspect de la demande.
5. La demande doit être soumise à l'Association canadienne d'hydrographie au plus tard le 30 juin de chaque année à l'adresse mentionnée à l'article 11 ci-bas.
6. La valeur de la bourse est de 2000 \$. Il n'y a qu'une seule bourse remise par année civile. Il n'y aura que le gagnant qui sera avisé.
7. Le récipiendaire recevra un certificat spécial de l'Association canadienne d'hydrographie, dûment encadré. Il ou elle recevra aussi un médaillon à l'effigie de l'Association canadienne d'hydrographie et verra son nom ajouté sur la plaque des gagnants. Une photo de la plaque, dûment gravée sera postée au gagnant avec un chèque de 2000 \$ au cours de la deuxième semaine de juillet.
8. Le candidat ou la candidate doit soumettre une lettre de référence d'un représentant de l'université ou du collège où il a suivi son cours l'année précédente. Cette lettre de référence doit inclure l'adresse et le numéro de téléphone de ce représentant.
9. Un étudiant ne peut recevoir la bourse qu'une seule fois.
10. Une lettre d'appréciation du récipiendaire sera publiée dans l'édition suivante de notre revue professionnelle « Lighthouse ».
11. La demande devra être faite en se servant du formulaire prescrit ou préférentiellement téléchargée à partir du site internet officiel de l'ACH « www.hydrography.ca » et envoyée à :

Barry M. Lusk, Manager / Administrateur

Canadian Hydrographic Association Award Program / Bourse de l'Association canadienne d'hydrographie

4719 Ambleswood Drive, Victoria, BC V8Y 2S2

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Hydrographic Education (Category A) at the Newly Founded HafenCity University, Hamburg (HCU)

By: Volker Böder and Delf Egge, Department of Geomatics, HafenCity University, Hamburg, Germany

For twenty years the seaport Hamburg has offered a study program for hydrography students. For several years the course has been certified by the International Hydrographic Organization (IHO) and the FIG as a Category A course. The English spoken course is addressed to both foreign and German students. The student fees are low compared to other courses worldwide.

In the beginning of 2006 the “Hamburg University of Applied Sciences” changed to “HarbourCity University Hamburg” (HCU). Additionally this course is accredited by the German ASIIN group. In February 2006, the first master students graduated from the university.

In order to get in contact with interested students, the HCU initiates a two week *International Hydrography Summer Camp* for students from various universities in Europe. The first experiences are discussed. The project is open to all students worldwide and will be offered in English.

The Hydrography Working and Research Group uses the survey launch *LEVEL-A* for education. She has newly been constructed mainly for educational and research purposes. The equipment on board consists of a modular system including precise GPS positioning and attitude determination, precise INS attitude determination, multibeam echo sounder and a parametric sediment echo sounder. The students learn the processing of the data with different tools like CARIS and QPS software, and ESRI in projects and investigations for coastal zone management.

However, professional education should approach practical applications. A newly founded company takes advantage on one hand of the availability of the equipment and on the other hand helps the university with financing the use of the survey vessels and to giving students an insight in practical surveys. In times when universities reduce the possibilities for an education in hydrographic surveying the HCU offers a new approach. The working group inside the Department of Geomatics plans to take part in projects of capacity building and offers an international English spoken master course.

The article presents the new concept of professional education in Hydrography and a short overview of the equipment and processing software used at the HCU.

[Editor's Note: This paper was previously presented at the 6th Regional FIG Conference in San José Costa Rica, November and has been reprinted with permission of the International Federation of Surveyors.]

I. INTRODUCTION

For twenty years the seaport Hamburg has offered a study program for hydrography students. For several years the course has been certified by the International Hydrographic Organization (IHO) and the FIG as a Category A course. The English spoken course is addressed to both foreign and German students. The student fees are low compared to other courses worldwide. The study program and the equipment (ship, sensors, software) of

the Hydrography Working and Research Group will be listed in this article.

In order to get in contact with interested students the HCU initiates a two week *International Hydrography Summer Camp* for students from various universities in Europe. The first experiences will be discussed. The project is open to all students worldwide and will be offered in English.

Our philosophy is, that professional education should approach practical applications. A newly founded company takes advantage on one hand of the availability of the equipment and on the other hand helps the university with financing the use of the survey vessels and to giving students an insight in practical surveys. The article presents the new concept of professional education in Hydrography and a short overview of the equipment and processing software used at the HCU.

2. HISTORICAL OVERVIEW

Professional education in Hydrography has a more than 20 year old tradition in Hamburg, Germany. Until 1985 hydrographers in Germany usually had to finish two studies, one in nautical sciences and one in surveying. The first consecutive studies "Hydrography" started in 1985 with 3 additional semesters at the Hamburg University of Applied Sciences (HUAS) and a half-year practical training. From this point of time Hamburg has offered the only professional education for students in Germany. After 5 years (6 semesters in Surveying, 3 semesters in Hydrography, 1 semester practical training) the students finished with the diploma in "Vermessungswesen und Hydrographie" (Surveying Engineering and Hydrography).

For security reasons each professional training location for Hydrography has to fulfil special requirements, namely the Standards of Competence for Hydrographic Surveying of the International Federation of Surveyors (FIG) and the International Hydrographic Organization (IHO). The Standards of Competence distinguish two different levels for the quality of education, Category A and Category B. The higher Category A courses are defined as follows:

A programme which provides a comprehensive and broad-based knowledge in all aspects of the theory and practice of hydrography and allied disciplines for individuals who will practise analytical reasoning, decision making and development of solutions to non-routine problems.

Category B courses are directed to less qualified staff. The certificate has to be renewed every 10 years. In 1990 the International Advisory Board (IAB) of the FIG/IHO certified the consecutive studies "Hydrography" in Hamburg at the highest level: Category A (Academic).

In 2000 a new curriculum was established at the HUAS, offering studies in Geomatics with 8 semesters and a master program of 4 semesters in "Hydrography". It was possible to combine modules from the diploma studies with the master program, so that the diploma in Geomatics and the Master of Science in Hydrography could be reached in a total of 5 years. The Master of Science Program "Hydrography" was re-certified by the IAB of the FIG/IHO at Category-A in 2001.

In January 2006 the Department of Geomatics moved from the Hamburg University of Applied Sciences (HUAS)

to the HafenCity University (HCU) Hamburg, founded by the Federal State of Hamburg. The HCU starts with the advantage of already well-established departments (architecture, civil engineering, geomatics, urban planning) coming from the Technical University, the University of Arts and the University of Applied Sciences, all of them located in Hamburg. With its Master of Science Programme in Hydrography, the Department of Geomatics is still the only academic institution in Germany offering a two-year postgraduate program which is certified according to the "Standards of Competence of Hydrographic Surveyors" by the IAB of FIG/IHO at category A.

3. HYDROGRAPHIC EDUCATION AT HCU

From the 1st through to the 4th semester in the diploma or Bachelor course Geomatics at the HCU there are courses that are compulsory. For example, all Geomatics' students (Diploma or Bachelor) in Hamburg have to enrol in Hydrography I. The course (2h) aims to give a basic understanding of and a first insight into hydrography.

For admission to study Hydrography in the Master of Science course at the Department of Geomatics, the following requirements have to be fulfilled:

- language requirements: foreign applicants whose first language is not English must provide proof of their language ability. The following certificates are accepted: TOEFL (550/220), IELTS (band 6), Cambridge Certificate (CAE, CPE).
- academic / other requirements: Bachelor's degree in a related field. A good score on the Bachelor's exam is required. Applicants whose university qualification is from a country outside of the European Union have to take the Graduate Record Examination (GRE) general test.

The Master of Science course Hydrography is offered in English, so that foreign students can enter into the course. By taking the course in English, the German students are well prepared to work abroad. Since Hydrography is an international study program, one has to prove his/her English language proficiency.

The master course covers modules such as Hydrography (Basics, I, II, III), Higher Geodesy, GIS-Hydrography, Data Processing, Navigation, Marine Geology/Geophysics, Fundamental Oceanography, Marine Environment, Software Technology, Practise, Project, and ends with the Master Thesis. In total 120 credit points are possible. Normally students in the master course should absolve 24 hours a week. Details are shown in Figure 1.

According to the IHO Special Publication S-47 (March 2006) approximately one hundred courses in Hydrography, Nautical Charting, and Marine Sciences – lasting from one week to five years – are offered worldwide.

Sem.	A	CP	B	CP	C	CP	D	CP	Σ CP
M 4	Project Field of Marine Engineering Geomatics Project Management 	9	Elaboration of Master Thesis 3 Months 		Final Examination 			21	30
M 3	Marine Geology/Geophysics Geology/Geomorphology Basics Subbottom Profiling Seismics Magnetics 	8	Fundamental Oceanography Physical Oceanography Tides 	7	Marine Environment Oceanography Marine Weather Legal Aspects 	7	Software Technology Object-Oriented Programming Project: Digital Cartography 	8	30
M 2	GIS-Hydrography Desktop Mapping GIS-Projects: e.g. Coastal Zone Management 	7	Hydrography III Sonar Systems with Area Coverage Hybrid Hydrographic Measurements Digital Terrain Model (DTM) 	9	Navigation Nautical Science Traffic Control Systems Electronic Chart Display Integrated Navigation 	7	Practice Supplementary Field Training (3 Weeks) Quality Management 	7	30
M 1	Data Processing Interface Technology Data Acquisition Basics on CARIS 	6	Higher Geodesy Mathematical Geodesy Physical Geodesy Gravimetry 	7	Basics Hydrography Remote Sensing Applied Mathematics II Hydrography I 	8	Hydrography II Basics Underwater Acoustics Acoustic/Parametric Systems Determination of Position and Water Depths 	9	30
Sem.	A	CP	B	CP	C	CP	D	CP	120

CP: Credit Points

Figure 1: Course of Study Hydrography at the HCU

Only 41 from approximately 100 courses in Hydrography, Nautical Charting and Marine Sciences are recognized as Category A or Category B courses according to the “Standards of Competence for Hydrographic Surveyors” of the FIG/IHO/ICA International Advisory Board IAB. There are 21 Category A courses and 20 Category B courses, including the ones with a pending submission (list of July 2007). Only 10 Category A courses are English spoken.

Due to stagnating public budgets more and more courses – particularly Category A – seem to disappear for years. On the other hand, mainly caused by increasingly used high-sophisticated techniques and software packages, there is a rising need for courses providing a comprehensive and broad-based knowledge in all aspects of the theory and practice of hydrography and associated disciplines.

Additionally, the students in Hamburg can make use of the possibilities to absolve a practical training in the near-by institutions, dealing with hydrography or bathymetry. Near-by institutions are for example, the Federal Maritime and Hydrographic Agency of Germany (BSH), the Alfred Wegener Institute (AWI, Bremerhaven), the Hamburg Port Authority (HPA) and various companies.

4. EQUIPMENT AND LOGISTICS

There are two survey crafts in the HCU ship-pool. The launch *LEVEL-A* (length 8m, optimized to operate in extremely shallow water) is mainly used for education and research purposes (see Figure 2). The in-situ-facilities like survey craft, office and storage containers are located on the Ship and Buoy Yard in Wedel, belonging to the Water and Shipping Authority (WSA) Hamburg.

The outstanding equipment installed onboard of *LEVEL-A* offers best conditions for practical exercises: RESON Multibeam SeaBat 8101, INNOMAR Parametric Sub-Bottom Profiler SES-2000 fan incl. Side-Scan, IxSEA motion sensor Octans III, GNSS-Javad-Gyro-4 (GPS, GLONASS), Marine Magnetism Mini Explorer, RESON Sound Velocity Probe SVP 15 and other instruments. Software packages as PDS 2000, Qinsy, WinProfile, ISE for SES-2000, Geo++ @ GNET-RTK and CARIS HIPS/SIPS/GIS are available for survey planning and data analysis.

Despite the high accuracy of all used sensors (position, heading, heave, roll, pitch and sound velocity), the main problem is to integrate these complementary sensors with the sonar systems with reference to timing and their



Figure 2: HCU survey craft LEVEL-A for training, research and special purposes (Photo: Prof. P.Andree)

relative locations to obtain reliable Digital Terrain Models (DTM). To solve this problem, a new Integrated Multi-Sensor System IMSS will be used to measure heading, heave, roll, and pitch under all topographical conditions (e.g. passing huge container ships, running/surveying under bridges and in waterways between rows of houses as found in Hamburg Harbour).

The data delivered by the IMSS components (GNSS-Javad-Gyro-4, Motion Sensor OctansIII, IMU Inertial Measurement Unit) are integrated by the software GNNET-RTK developed by Geo++ GmbH, Garbsen.

5. THE NORTHERN INSTITUTE OF ADVANCED HYDROGRAPHICS GMBH (NIAH)

Mainly caused by the limited and stagnating budget for the practical education in hydrography it became more and more difficult to ensure a high level in hydrographic education at the HUAS with state-of-the-art hardware and software and well trained staff during the past few years. To overcome this situation, the HUAS/HCU invested a lot of money in ship capacity and state-of-the-art survey equipment. With this investment the HCU has entered into a commitment for a significant higher quality of practical education and the implementation of related research projects.

To guarantee a sustainable operation, continuous maintenance and regular upgrades of the equipment and for a greater independence of the public budget, NIAH was founded as a public/private partnership (70% HCU, 30% private companies) in January 2006 with Prof. P.

Andree as scientific director. Besides HCU, the private companies Innomar (producer of hydrographic hardware and software) and Felshardt (hydrographic services) are shareholders.

NIAH is responsible for assuring a high quality offering of practical exercises for students in hydrography at any time. Besides the maintenance of the acquired systems it is one of the aims to integrate excellently trained staff into the company. The staff will be trained regularly in close cooperation with the suppliers of the systems and the software installed onboard the NIAH-launches.

Advantages of NIAH

Moving the operation of the vessels including the equipment from the university to a private company results in lots of benefits:

- highly educated and permanently trained staff,
- state of the art survey equipment,
- specialized exercises and intensive practical training for the students,
- flexible operation and application-oriented research.

To be effective and to keep or extend this high technical standard, NIAH will offer this platform not only for student education in hydrography but also for the use in national and international scientific projects in hydrography and for geophysical, environmental, archaeological or biological investigations.

With the NIAH joint venture the HCU has unique possibilities for the practical education of its students. This will be most important for the many survey companies



Impression from the 1st International Hydrography Summer Camp 2007

looking for hydrographic surveyors who are familiar with state-of-the-art technology and equipment. These companies are also interested in keeping their staff well educated to ensure that their survey projects are realized with the highest possible accuracy and efficiency.

6. THE HYDROGRAPHY SUMMER CAMP 2007

In Germany, there exists a problem in interesting young people in the study programs dealing with engineering. Complementary to a decreasing number of students we find an increasing need for hydrographic surveyors. In order to address this development the first International Hydrography Summer Camp 2007 was carried out at the Lake Hemmelsdorf. Fifteen students from Spain, Austria and Germany took part in the two week course.

The course was addressed to all students dealing with geodesy/geomatics and related disciplines, preferential students from the 2nd study year and above. The course was held in English and German.

Lake Hemmelsdorf is located 15km northwest from Luebeck and 5km south from Timmendorfer Strand, a tourist beach at the Baltic Sea. The lake offers interesting aspects:

- the sea bottom hides the deepest point on the mainland of Germany;
- possibly archaeological sites (Slavonic settlement); and a
- nature reserve.

The measurements took place onboard the survey craft *LEVEL-A*. Costs for food and accommodation had to be paid by each participant. The course itself was free of charge.

In terms of the project the students worked with a two frequency echo sounder, multibeam echo sounder, side scan sonar, subbottom profiler, and a magnetic sensor. The positioning was carried out with RTK. After a short introduction the measurements were processed independently from the students in the camp with the software products Qcloud, WinProfile, and ISE. In order to get the direct contact to the manufacturer one part of the Camp was supported by Innomar (subbottom profiling, side scan sonar). Archaeologists from the State Archaeological Department of Schleswig-Holstein took a brief look at the results of the project and gave some insight into their work. Actually one student applied the results of the project towards his bachelor thesis. All together the participants obtained a short insight into hydrographic surveying and processing.

7. CONCLUSIONS

By the foundation of NIAH the education of hydrographic surveyors at the HCU will become more flexible and reinforced by the associated companies in terms of teaching, practical training and research. NIAH is going to take over new jobs in education and research like international institution-building, professional training and enhancement of positioning systems. The first students benefiting from the new public-private partnership are the HCU's master students in hydrography. Other companies and institutions are invited to take part in the new Hamburg way of securing and supporting the necessary professional education in hydrography.

The perfectly equipped survey craft allow the HCU/NIAH to operate with an extremely short lead time nationally as well as internationally. The knowledge transfer to survey companies and to countries developing new hydrographic services will be supported by workshops with all kinds of users. These efforts will create a huge benefit for the students at the HCU.

The new future-orientated model of an excellent public university with privately operated equipment will attract attention from international students of hydrography. The location in one of the biggest harbours of the world as well as the intention of the president of the HCU to push hydrography ahead will contribute to this goal.

The professional education in Hamburg starts into a new epoch with new ideas. The Department of Geomatics today offers its well known English language spoken Master of Sciences Program Hydrography at the newly founded HafenCity University, Hamburg (HCU). The study program is supported by a public/private partnership with companies that deal with hydrographic surveying and development of hydrographic instruments.

HCU invites students from all over the world to use the possibilities. Students who do not otherwise have the possibility to get involved with hydrography projects may take part at the yearly English spoken International Hydrography Summer Camps (IHSC).



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About The Authors...

Volker Böder graduated in geodesy from the University Hannover in 1994. His doctoral thesis of 2002 is about the precise positioning and attitude determination in marine applications. He received his Assessor Degree from the Government of the Federal State of Lower Saxonia in 2005. Since 2005 he is the professor for practical geodesy and hydrography at the HafenCity University, Hamburg.

Delf Egge graduated in geodesy at the University of Hannover in 1973 and passed the upper level state examination in 1975. In 1984 he received his doctorate degree at the University of Hannover in the field of satellite geodesy. Starting 1985, he spent two years as Assistant Professor of Civil Engineering at the University of Washington in Seattle. Since 1987 he holds the position of Professor of Hydrography and Geodesy at the Department of Geomatics at the HafenCity University, Hamburg. He is Vice Chairman of the Department and a member of the International Advisory Board on the FIG/IHO/ICA Standards of Competence.

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A Canadian Volunteer Group

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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

The CCGS Matthew Surveys of Northern Labrador

By: Mike Lamplugh, Canadian Hydrographic Service

This article is a quick overview of the three year adventure that the *CCGS Matthew* undertook on the northern Labrador coast to chart access for marine vessels. The accompanying pictures of the scenery and wildlife are inspirational and will likely encourage a few adventurous folks to make the effort to visit – I hope so anyway. At CHC 2008 in Victoria, (if schedules permit) I hope to present a more complete slide show of the hydrographic adventures and the scenery. As Canadians we should be proud and protective of these vast beautiful areas that are a largely unknown part of this beautiful country.

Last August, as we left Nain (the most northerly community in Labrador) through Strathcona Run and headed north up the coast, we were very pleased with the weather outlook. The year before, we had to run for shelter at the start of our survey time and lost a day and a half due to winds over 90 knots with the accompanying 1-2 degree temperatures. This year we had planned for the crew and staff changes to complement each other so as to maximize our survey time, if the weather would cooperate. It was looking like we were off to a good start. The next day was our first look of this year of the southern extent of the snow and ice capped Torngat Mountains as we entered Saglek Fiord. It was a brilliant sunny day that allowed the grandeur of the horizon to be fully appreciated - it was good to be back!

This year was to be the final year of a three year program to survey the very rugged and shoal infested coastline between Cape Mugford and Cape Chidley. This was the last piece needed to complete the inshore route along the entire Labrador Coast. If we were successful this year, a vessel could now transit the entire length of the Labrador coast within surveyed waters and always have a "harbour of refuge" close by if required. The northern half of inshore Labrador is one of the most dangerous stretches of coastline on the east coast of Canada. It has been a dream of the Canadian Hydrographic Service for many decades to have this route surveyed to modern standards. In fact, my first trip to Labrador in 1979 was in support of this vision – I would now be privileged to be able to participate in its completion.

In fact, this proved to be the first day of an unprecedented 22 day stretch of fair weather which allowed the objective to be achieved. In addition to completion of the more than 360km route, the *CCGS Matthew* survey flotilla was able to chart McLellan Strait & Grenfell Sound. This approximately 20km narrow passage between the Atlantic Ocean and Ungava Bay has rarely been transited let alone surveyed.

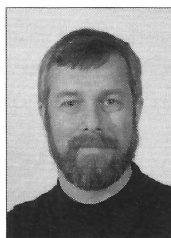
On December 1st, 2006 the Torngat Mountain National Park came into being. After more than 30 years of negotiations the Labrador Inuit Association's (LLA) land claim was settled along with other issues, including the Nunavik (Quebec) Inuit's claims. The establishment

of Canada's 42nd National Park (to be co-managed by Parks Canada), is a wonderful example of a collaborative negotiation that could be a model for future discussions. Our survey work will now allow visitors to this area to safely navigate through much of the marine portion of the Park. Before now, local knowledge was mandatory as the shoreline was off datum and soundings were scarce and miss-positioned. In my 30 years of hydrographic survey work I can not recall a more treacherous area to survey. There are numerous very dangerous shoals and reefs north of Cape White Handkerchief, all the way to Cape Chidley.

Over the three years of this project, I was privileged to be Hydrographer-in-Charge for both the 2006 and 2007 phases. The work in 2005 by Bruce MacGowan et al was largely exploratory and provided an excellent basis for us to find and survey the navigable route over the next two years. At this point, I must admit that I am a bit disappointed that the route is now finished as that means we do not have to go back in 2008!



The *CCGS Matthew* is primarily a hydrographic vessel which carries two hydrographic launches. The 2007 field season was a significant one for the *Matthew* survey platform, as this was the first time the second launch (*Pipit*) was also equipped with the same multibeam capability (Kongsberg EM3002) as the *Plover*. The additional multibeam greatly increased the efficiency of inshore survey operations. The *CCGS Matthew* itself utilizes the high resolution Kongsberg EM710 multibeam system. Without this additional survey capacity we would not have been able to complete the route survey in 2007.

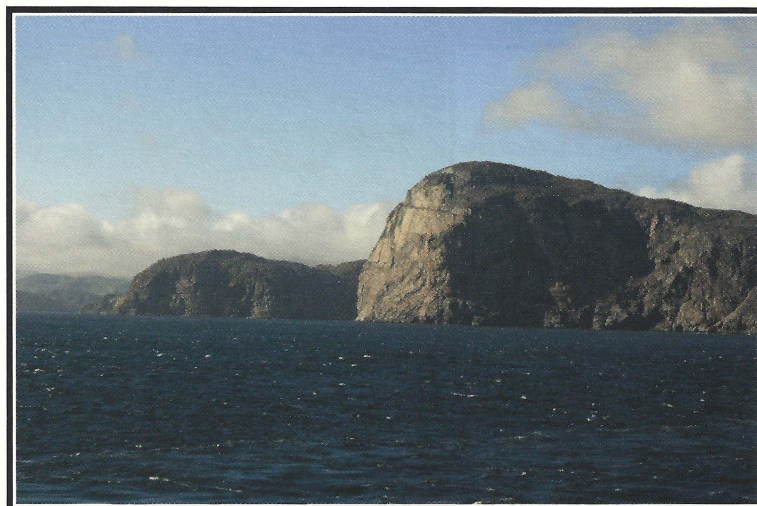


Michael Lamplugh has been a field hydrographer in CHS-Atlantic for the last thirty years. He sailed on the *CSS Maxwell* and the *CSS Baffin* in his early years and even claims to have participated in a couple of sextant surveys. He first participated in a multi-transducer sounding platform in 1987 when he worked aboard the *FCG Smith* & in 1997 he started working on the swath vessel *FG Creed*. He was H-I-C aboard the *Creed* for five years before moving to the *CCGS Matthew*. He was very involved in the joint project agreement started in 2003 that upgraded the sounding capability of the *Matthew* from an EM100 to EM1002 and most recently to the high-resolution EM710.

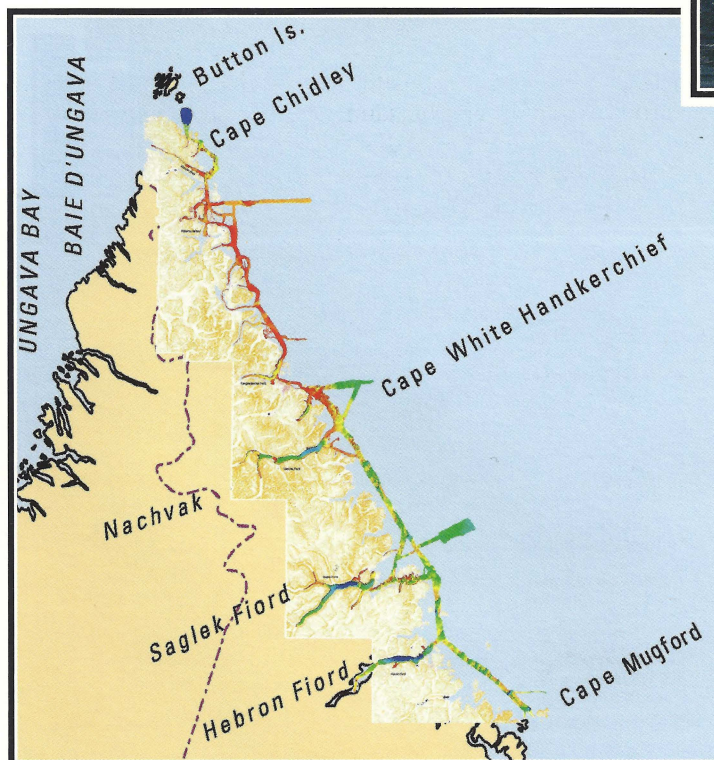
CCGS Matthew sounding (slowly) near shore in Hebron Fiord. Launch Plover is visible in the starboard chocks. Note that the roof of the large restored Moravian Mission building is visible just astern of the ship.



Launch Plover & Pipit (left to right) off Trout Trap Fiord at the start of a day's sounding. They are getting velocity casts and waiting for the GPS and motion sensors to lock on and settle in before starting work. This was the day after the storm day -note the new snow ashore.



Cape Chidley is the most northern point in the Torngat Mountains National Park and of Labrador, per se. All of the land and islands north of this point belong to Nunavut. The geography here is comprised of high vertical cliffs with deep water nearshore. The winds here are very much funneled by the land.



Imagery shows the extent of the Matthew's three year survey program. The blue areas indicate water depths over 200 meters and at the other end of the spectrum the red areas are less than 20 meters. The original goal was a two mile wide corridor but extensive shoal areas and limited choices as to where navigable depths could be found, quickly modified this plan.



While running a sounding line in a southerly direction one sunny day off Seven Islands Beach, we had a close call. The sun's glare on the water prevented us from seeing this family until they were virtually under the bow. This gave us a good picture opportunity but did not endear us to the mother!

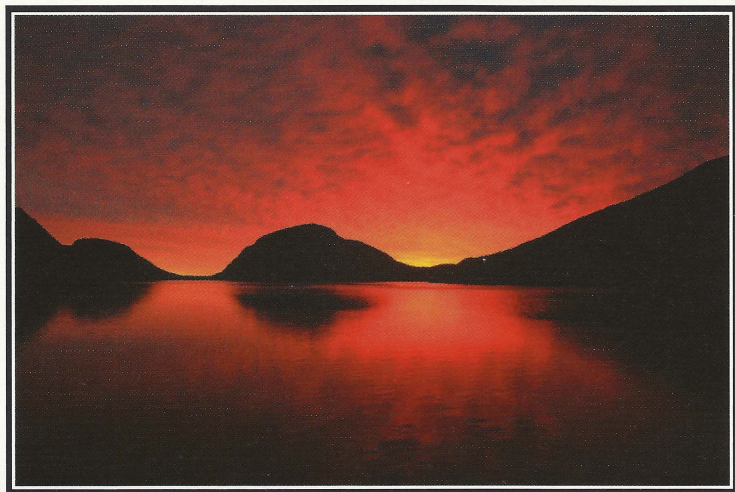
September 9th brought us the only real storm/ weather day of the 2007 survey. The Matthew sought shelter in Trout Trap Fiord (excellent anchorage) for the day. That night the system had moved on toward Greenland and we were treated to a spectacular sunset over the mountains covered in the first snow of the season.



After many years of seeing Killer Whales (Orcas) in Newfoundland and Labrador waters, I finally had the opportunity to get some pictures of them. This pod was comprised of three females and two calves. They are usually heading north in July/ August so we just see them as they transit through the work area.



A walk ashore one day in Trout Trap Fiord allowed staff to realize the impressive diversity of plant life that flourishes in these latitudes. The land was extremely moist (soft) which made walking difficult. There were also many streams such as this being fed by the ice & snow fields in the mountains.



This spectacular sunrise occurred while we were anchored in Ryans Bay on September 8th and signaled the end of our incredible stretch of fair weather. The next day we were storm- stayed for the first time this year. Perhaps there is some truth to the old saying: Red sky at night; sailors delight... red sky in morning; sailors take warning.



In the heart of the Torngat Mountains National Park is Nachvak Fiord. This view is looking up the valley at the head of the Fiord just after the Matthew had turned around after running a sounding line the entire length of this spectacular fiord. Of course, we had to sound on the way out too.

Canadian Hydrographic Conference and National Surveyors Conference
Conférence hydrographique du Canada et Conférence nationale des arpenteurs-géomètres

Bringing
Land and Sea
Together

Réunir
terre et mer

2008

Photograph by Brian Schofield

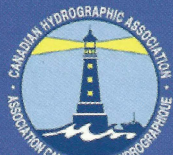


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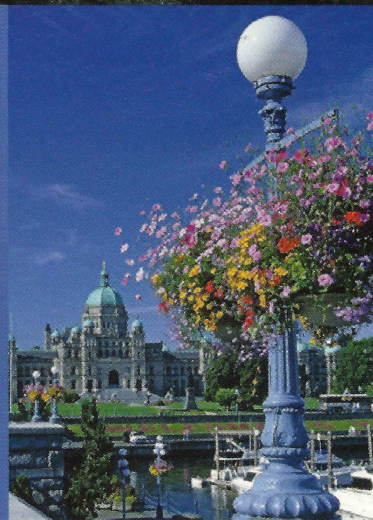


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An Update Regarding the Delineation of Canada's Continental Shelf

By: Richard MacDougall, Director, Law of the Sea Project, Canadian Hydrographic Service

[Editor's Note: Lighthouse Edition 69 contains a paper on Canada's Challenges in delineating the Continental Shelf under the United Nations Convention on the Law of the Sea (MacDougall et al., 2006). Here is an update on some key activities pursuant to that initiative.]

The United Nations Convention on the Law of the Sea (UNCLOS) confirms the sovereign rights of coastal states in their continental shelf. It also provides the criteria for establishing the outer limits of the continental shelf. A coastal State intending to establish the outer limits of its continental shelf is obligated to submit particulars to the Commission on the Limits of the Continental Shelf (CLCS) along with supporting scientific and technical data within 10 years of the entry into force of UNCLOS for that State.

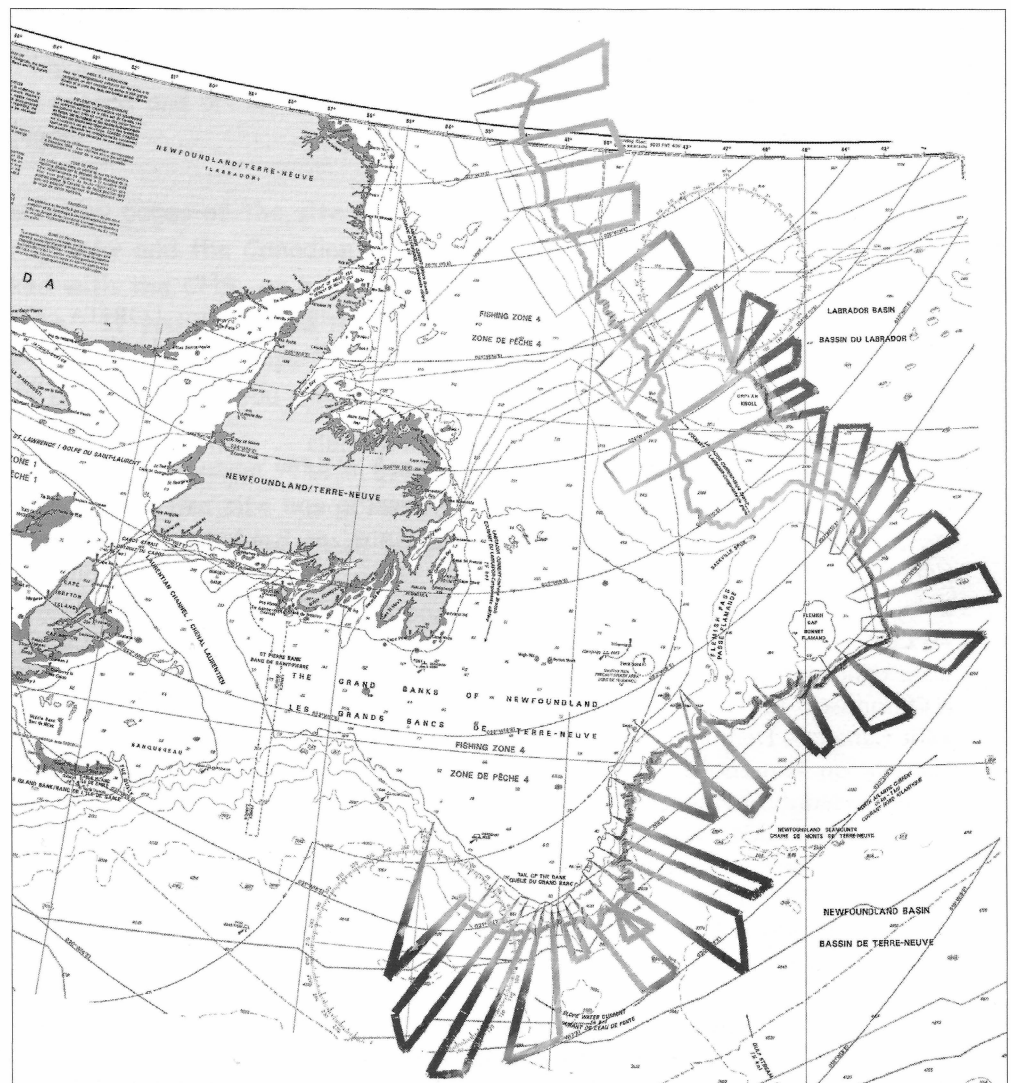
Canada ratified UNCLOS in November 2003 and therefore must present its submission to the CLCS in 2013. In making the submission, Canada is seeking international recognition of the area over which Canada has sovereign rights for the purpose of exploring and exploiting the natural resources, including oil and gas, of the seabed and subsoil.

The data required to support this submission includes determining the foot of the slope of the continental shelf, mapping the 2500 metre depth contour and measuring sediment thickness to determine the point where the sediment thickness is 1% of the distance to the foot of the slope. Bathymetric and Seismic surveys can also assist in determining if submerged elevations are a natural prolongation of the continental shelf. The following details some of the surveying that has been completed.

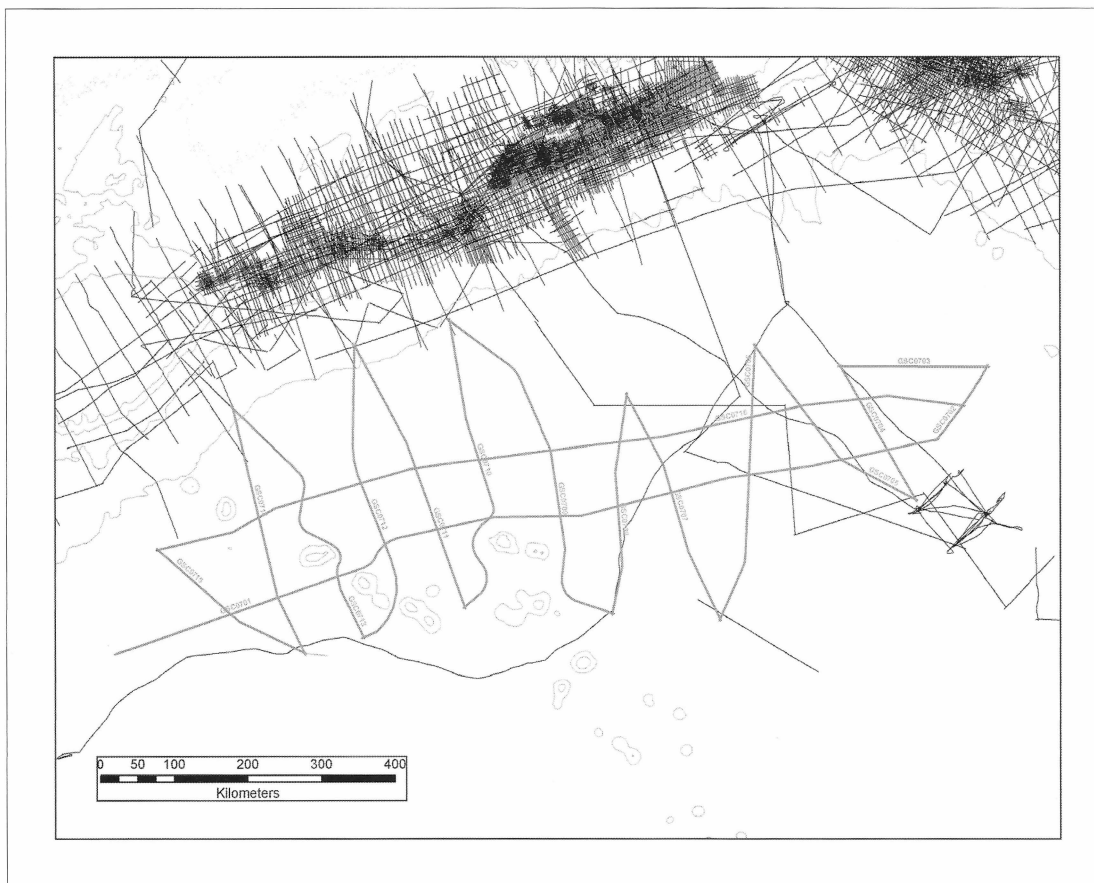
Atlantic

2006 saw a \$2M contract bathymetric survey conducted off the Grand Banks of Newfoundland. Multibeam echo

sounder profiles were run perpendicular to the continental shelf every 30 Nautical Miles (NM) to supplement existing data in determining foot of slope. The 2500 metre contour was also mapped from southern Labrador to the Laurentian Channel. The bathymetry formula (foot of slope + 60 NM) and the 2500 metre depth contour plus 100 NM constraint formula will maximize Canada's continental shelf off the Grand Banks.



East Coast - 2006 Bathymetric Survey



East Coast - 2007 Seismic - Scotian Shelf

A \$6M contract seismic survey off the Scotian Shelf in June-August 2007 collected 6900 kilometres of multi-channel seismic data to determine sediment thickness. This survey was designed to tie into and use all available existing seismic data. In this area, the sediment formula (distance to the point where sediment thickness is 1% of the distance to the foot of the slope) and the 350NM from the Territorial Sea baseline constraint formula maximizes Canada's extended continental shelf.

Arctic

Data collection began in March 2006 with the LORITA (LOmonosov RIdge Test of Appurtenance) project, a joint Canada - Denmark expedition to conduct seismic surveys on Lomonosov Ridge. The objective was to collect scientific evidence that would help determine if Lomonosov Ridge was a natural prolongation of the continental shelf. Despite losing 65-70% of the season to bad weather the primary objective of collecting the seismic data was achieved. Little bathymetry was collected due to the weather.

A new seismic system was successfully tested in the western Arctic on board the *CCGS Louis S. St-Laurent* during the summer of 2006.

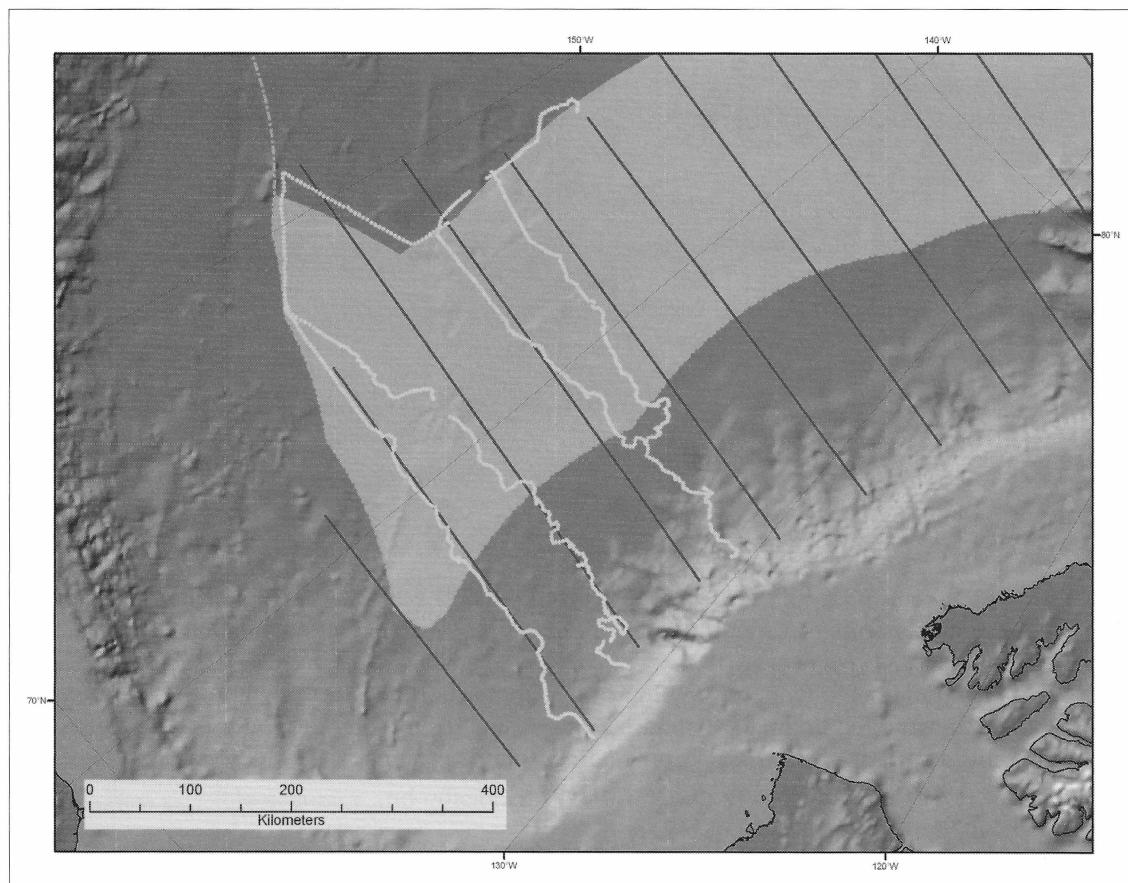
A March- April 2007 bathymetric survey was again based at CFS Alert to collect bathymetric data not collected

during LORITA. Time lost due to the weather that impacted helicopter flying exceeded 95% and little of the primary objective was achieved.

Canada also participated in a Swedish - Danish International Polar Year (IPY) project in August-September 2007 that included a survey north of Greenland which planned to collect additional seismic and bathymetric data on the Lomonosov Ridge. The scientific work was conducted from the Swedish icebreaker, *ODEN*, escorted by the Russian nuclear icebreaker, *50 Let POBEDY*. Ice conditions were severe, 10/10 multiyear ice 3 to 5 metres thick with pressure ridges to 6 metres. After losing several seismic streamers, the vessels moved to plan B; an area off Greenland and did not come into the Canadian waters.

A seismic and bathymetric survey in the western Arctic on board the *CCGS Louis S St-Laurent* took advantage of light ice conditions and collected 3000km of seismic, 7800 kilometres of bathymetry and 180 spot depths (by helicopter, between ship profiles) during a 6 week survey (September-October 2007). In this area the sediment formula will maximize the area of the continental shelf.

Collaborative programs with Denmark continued and discussions were held with the USA and Russian concerning our respective programs in the Arctic and possible collaboration. A tentative plan to use the *USGC*



Western Arctic (Planned in Black, Achieved in Gray)

Healy in tandem with the CCGS Louis St-Laurent for seismic surveys is being discussed with the US Geological Survey.

Summary

As of December 2007, 65% of the Atlantic and 15% of the Arctic area has been completed and the project is on target. A formative evaluation of the project is being conducted in early winter 2008 to determine if there needs to be course corrections to mitigate risk and ensure that

Canada will complete the mapping and have a credible submission ready for the December 2013 deadline.

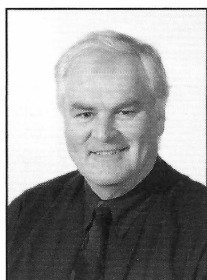
For further information and updates, please consult the Canadian UNCLOS site:

http://geo.international.gc.ca/cip-pic/geo/continental_shelf-en.aspx

http://geo.international.gc.ca/cip-pic/geo/continental_shelf-fr.aspx



About The Author...



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

The Canadian Hydrographic Association Award

By: Barry Lusk, Manager, CHA Award Program

The Canadian Hydrographic Association award was created in 1992 under the leadership of Barry M. Lusk, the National President of the Canadian Hydrographic Association, during the years 1987 to 1990.

The perpetual funds necessary to finance the award were earned by the CHA through the management of a Canadian International Development Agency (CIDA) project that was then under the direction of Thomas McCulloch, ex Director General of DFO's Marine Sciences Branch at the CCIW. Mr. McCulloch's CIDA projects focused on creating hydrographic expertise in developing countries during a period of about 15 years. The CHA's professional sponsorship of these endeavours provided real time support of worthwhile hydrographic related activities.

The first CHA "Award for Deserving Students" was made in 1993 and has continued providing the very generous \$2000 per year assistance since that time.

In 2000, no award was made as all the applicants were judged to be non compliant. This means that none of the applications received were from students that met the rules criteria in respect to an appropriate faculty.

This year's winner (2007) was Katie Seely who, at the time of her application, was a student at the Northern Alberta Institute of Technology and was enrolled in their Geomatics Engineering Technology programme. These programmes are considered relative to this award as "hydrography only" programmes in Canadian schools are non-existent or at least minimal.

I, as manager of this award, congratulate Ms. Seely on the quality and timeliness of her application, her outstanding marks while in school and her desire to become a provincial and Canada Lands Surveyor.



CHA Award Plaque



CHA Award Individual Recipient Medal



CHA Award 2007 recipient medal and certificate

Dear Editor of Lighthouse,

As the recipient of the Canadian Hydrographic Association Award, I would like to say thanks. I know there must of been good competition and it honors me to be the winner.

I would like to share a bit of information about myself and the people your award helps. I grew up on a farm in central Alberta. I have always enjoyed the outdoors and when I was looking for a career, geomatics was a perfect fit. I attended the Northern Alberta Institute of technology for two years and earned a diploma with honors. I grew very interested in the Alberta Land Surveys Association where I plan on becoming a member some day.

After graduation I bought myself a farm and joined a small survey firm. I believe I will go far in surveying and reach the goals I have set. Your award brings me one step closer.

Thank you for your generosity,

Katie Seely

Katie Seely

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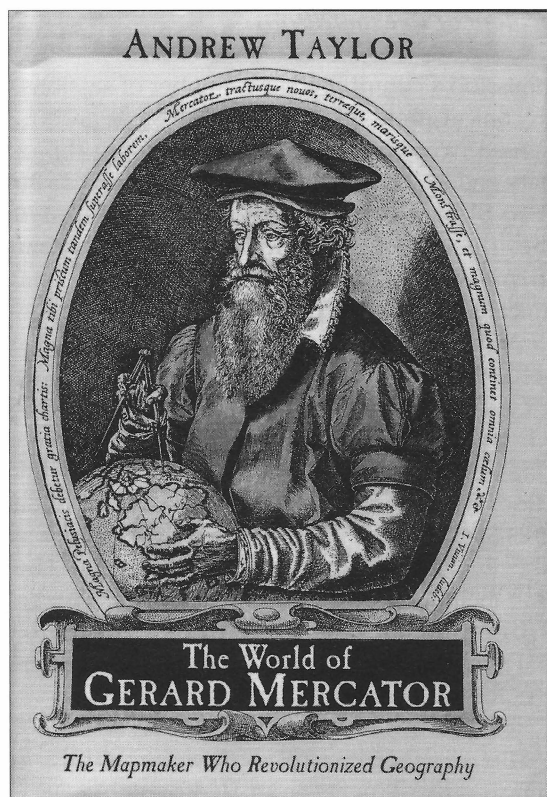
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Did you miss it...?

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 where there are vulnerable or protected marine areas."

The poster for World Hydrography Day (Journée mondiale de l'hydrographie) on June 21st (21 juin) is titled "Contributing to Worldwide Safety to Navigation" (Contribution à la sécurité de la navigation mondiale). It features a collage of images including a lighthouse, a ship, a boat, and a person. Logos for the Canadian Hydrographic Service (Service hydrographique du Canada), the International Hydrographic Organization (Organisation Hydrographique Internationale), and the Canadian Hydrographic Association (Association canadienne d'hydrographie) are displayed. The poster also includes the website www.hydrography.ca and the website www.ihoo.org. The word "Canada" is prominently displayed at the bottom right.



The World of Gerard Mercator

Written by Andrew Taylor

Review contributed to *Lighthouse* by Mike Ruxton

Published by Walker and Company, New York, New York 2006
ISBN: 0802713777

Andrew Taylor's biography "The World of Gerard Mercator - The Mapmaker Who Revolutionized Geography" isn't a heavy read; you will have to look elsewhere for scholarly detail. If, however, you are curious about the man and the world he lived in, Taylor introduces you to Mercator, his family, his friends, his patrons, his profession, his contemporaries, and his inquisitors.

Gerard Mercator (Gheert Cremer) was born into a world of trade, by land and sea, at the dawn of the Protestant Reformation. Family ties to the Church afforded him an education, and he continued his studies through university and the rest of his life. He truly was a child of the Reformation, but an internment by the Inquisition and a pragmatic nature led him to keep his opinions mostly to himself.

Mercator made his living as an engraver, a mapmaker, an instrument maker, and a teacher. Mercator learned his craft at Leuven, under the tutelage of Gemma Frisius and Gaspard van der Heyden. He proved very capable, and soon set up his own shop. His engravings were most often maps or globes, and globes in particular seemed popular with his clientele.

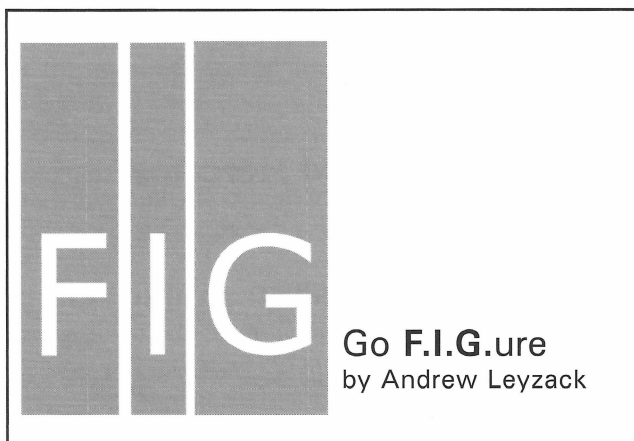
Mercator as mapmaker and scholar pieced together various sources to accurately represent countries, the continents, and the world. His first work was a map of the Holy Land,

a work the pious could consult as they studied the Bible. Other work included a scholarly rendition of Ptolemy's map of the world.

Mercator as mapmaker included Mercator as surveyor. He made his own instruments, and used them, for instance, in making a map of the duchy of Lorraine for Duke Charles. Mercator was aided in his work at this point by his three sons, Arnold, Bartholomew, and Rumold. Only Rumold survived his father, ensuring the completion after Gerard's death of Mercator's Atlas of the World.

In his lifetime, Mercator had a reputation as a world class cartographer, perhaps the world's foremost. We know him today most notably for his projection, which he used on his world map of 1569, a "Nova et Aucta Orbis Terrae Descriptio ad Usum Navigatum Emendate" ("new and augmented description of Earth corrected for the use of navigation"). His map projection was a construction rather than being encapsulated in a mathematical formula; forty years later, an English mathematician would formalize the construction. Eventually the British, and then the world, would recognize its value to mariners.

Taylor has provided a very readable life of Gerard Mercator, and although we don't feel the burdens of scholarly minutiae, we end up learning a great deal about Mercator and his world. LH

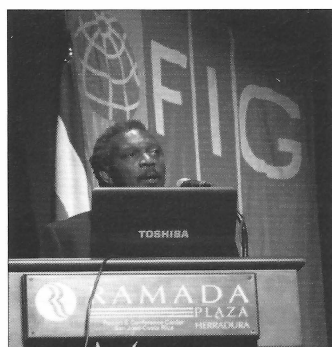


This regular feature provides information and current news from the International Federation of Surveyors (FIG) with emphasis on FIG Commission 4 (Hydrography).

Commission 4, Newsletter – January 2008

Chair's report on the 6th FIG Regional Conference Coastal Areas and Land Administration - Building the Capacity

The 6th FIG Regional Conference was held this past November in San José, Costa Rica. This regional conference was focused on providing answers to specific challenges faced within Central America, particularly within the coastal zone. Commission 4, was called upon to deliver technical sessions dealing with Coastal Zone Management (CZM), the Administration of Marine Spaces and Capacity Building. On the latter issue, the IHO was keen to participate and to make contact with local stakeholders in regards to promoting the benefits of developing hydrographic capacity within the region because to date, Costa Rica has not established a national hydrographic office. The objective of this conference was also to educate and provide guidance to regional land professionals towards practicing sustainable land development and management by focusing specific research and good practice presentations during the technical program.



Dr. Michael Sutherland speaking on Coastal Zone Management 6th Regional FIG Conference.

Overview of Presentations:

Commission 4 contributed to a number of sessions within the technical program. Dr. Michael Sutherland (Canada) presented two papers: the first was during the opening plenary entitled, **Coastal Zone Management as Strategy for Pro-poor Land Management and Administration** at the, the second entitled **International Issues in Administering Marine Spaces**, he also chaired a technical session on CZM and was joined by commission officers Mr. Gordon Johnston (UK), Andrew Leyzack (Canada) and representatives from commissions 3, 7 and 8 for a workshop on Pro-Poor CZM. The workshop which was chaired by Mr. Rob Mahoney (UK) served as a starting point for work on an FIG publication on the topic. Mr. Gordon Johnston chaired a session on Administering Marine Spaces and Andrew Leyzack chaired a session on the Economic Benefits of Hydrography. The latter session included an invited paper entitled, **The Value of Hydrographic Information and its Influence** from Capt. Hugo Gorziglia (Chile), director IHB. Other invited papers for the commission 4 sessions were:

- Marine Geospatial Software: Generating Economic Benefits from Hydrographic Data and its Management by Mr. Serge Lévesque and Mr. Alexis Cardenas (Canada);
- Surveys for Shoreline Monitoring Programme by Mr. Teo Chee Hai (Malaysia); and
- Economic Benefits of Hydrography In Terms of Hydrographic Education by Dr. Volker Boeder (Germany).

Past FIG president, Mr. Rob Foster (USA) presented an interesting paper entitled, **Where's the Shoreline?** Sources of Historical and Contemporary High Water Position Developed in the context of Massachusetts coastal regulations. The paper illustrated the extent of public access to lands within the greater Boston area created as a result of centuries of land reclamation.

Summary:

The conference provided a focused forum for FIG to link land and hydrographic surveying expertise to address the topics raised by the region. The following summary draws together key points raised during the various Commission 4 presentations. Given the dynamic nature of the land-sea interface, we ought to change our thinking that the role of the land surveyor ends at the water line. 'Tanah Air', the Malaysian expression for 'Homeland' translates to the words land and sea. Its meaning is inclusive of both land and sea and gives recognition to the submerged lands

below the shore. A comprehensive understanding of land both above and below the sea and changes effected by the dynamics within this area is based upon an integrated approach to land and hydrographic surveying. This would include a program of continual monitoring of changes to the shoreline.

Article 76 of the UN Convention of the Law of the Sea (UNCLOS) illustrates the land-sea interface and describes those submerged lands to which a coastal state may be entitled. To benefit from UNCLOS it is therefore important that a developing coastal state accurately survey its coastal zone area, implement and maintain a land use management and property rights system which extends into its offshore area. Key to defining and managing the extent of ownership and rights within a coastal area is an accurate definition of shoreline; both high and low water with the latter serving as a baseline to project seaward boundaries of a territorial sea and beyond.

So, to arrive at a complete picture, it would be necessary that the surveyor take a multidisciplinary (land and hydrographic) approach to first accurately delineate shoreline as (high water and low water) lines of elevation using tidal data as the basis for establishing these. The surveyor should then gather the necessary data to provide information on the effects of change both man-made and natural on the rights of those who inhabit the coastal zone. Hydrographic surveying is needed to fulfill a coastal state's obligation to chart its waters under Article 5 of SOLAS (Safety of Life at Sea). Good hydrography provides a basis for the effective use and maintenance of port infrastructure from which economic benefits may be realized. Hydrographic data is needed to secure ownership and rights to a coastal state's adjacent offshore area. Hydrographic surveying is essential to acquire data and transforming it into information necessary for making informed decisions for the delineation and effective management of the coastal zone and those submerged lands offshore. Hydrographic education is required for a coastal state to build capacity to practice hydrography.

Papers from the 6th Regional FIG Conference can be found on the FIG website ⁽¹⁾.

CHC-NSC2008:

The links between land and hydrographic surveying are the theme of an upcoming FIG-sponsored conference to be held in Victoria, Canada, 5-8 May, 2008. The Canadian Hydrographic Association and the Association of Canada Lands Surveyors are co-hosting a Canadian Hydrographic Conference and National Surveyor's Conference entitled "*Bringing Land and Sea Together*". The next **Commission 4** meeting will be held during this conference where offshore issues including the role of the surveyor in the Administration of Marine Spaces will be discussed. For more information please visit the conference website ⁽²⁾.

FIG Working Week 2008

Our next working week will be held in Stockholm, Sweden, 14-19 June, 2008. The theme "*Integrating Generations*" will focus on present and future surveying issues including recruitment, qualifications and capacity building. For more information please visit the Working Week website ⁽³⁾.

Andrew Leyzack C.L.S

Commission 4 Chair

Email: andrew.leyzack@dfo-mpo.gc.ca

(1) www.fig.net/news/news_2007/costarica.htm

(2) www.chc2008.ca

(3) www.fig.net/fig2008

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(affiliation - CHA Atlantic Branch)

Kongsberg Maritime

261 Brownlow Avenue, Dartmouth, NS, B3B 2B6, Canada
Contact: John Gillis
Tel: (902) 468-2268 FAX: (902) 468-2217
E-mail: john.gillis@kongsberg.com
Website: www.km.kongsberg.com
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IXSEA Inc.

500 West Cummings Park, Suite 1000, Woburn, MA, 01801, USA
Contact: Stephane Loeul, Managing Director
Tel: (781) 937-8800 FAX: (781) 937-8806
E-mail: stephane.loeul@ixsea.com
Website: www.ixsea.com
(affiliation - CHA Central Branch)

L-3 Communications Klein Associates Inc.

11 Klein Drive, Salem, NH, 03079, USA
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Tel: (603) 893-6131 FAX: (603) 893-8807
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Jeppesen Norway AS

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E-mail: info@hydroservice.no
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Mackay Mackay & Peters Limited

3380 South Service Road
Burlington, ON, L7N 3J5, Canada
Contact: Ross Clarke
Tel: (905) 639-1375 FAX: (905) 333-9544
E-mail: rclarke1@clarkesurveyors.com
Website: www.mmplimited.com
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CORPORATE MEMBERS / MEMBRES CORPORATIFS

McQuest Marine Sciences Ltd

489 Enfield Road
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Tel: (905) 639-0931 FAX: (905) 639-0934
E-mail: email@mcquestmarine.com
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(affiliation - CHA Central Branch)

Sani-International Technology Advisors Inc.

3075 14th Avenue, Suite 224
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NetSurvey Ltd.

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Terra Remote Sensing Inc.

1962 Mills Road, Sidney, BC, V8L 3S1, Canada
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Website: www.terrareMOTE.com
(affiliation - CHA Pacific Branch)

RESON Inc.

100 Lopez Road, Goleta, CA, 93117, USA
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(affiliation - CHA Central Branch)

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:

ASI Group Ltd
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
Tel: (613) 723-9200 FAX: (613) 723-5558 E-mail: admin@acsls-aatc.ca
Website: www.acls-aatc.ca

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:

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

ESRI Canada Limited

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

As a member of the international ESRI family, ESRI Canada is one of 91 international distributors and consulting firms (totalling over 2,300 employees) that provide ESRI software and services around the world. Headquartered in Toronto, Ontario, ESRI Canada has regional offices

and training centres in major urban areas, coast to coast, providing a complete range of GIS services to Canadian clients. With over 200 employees and 20 years of experience, ESRI Canada has built a highly coordinated and innovative team of engineers, information technology specialists, GIS specialists, and resource professionals.

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

For further information please contact:

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

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.

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

Interactive Visualization Systems (IVS 3D)
Tel: (603) 431-1773 FAX: (603) 766-0485 E-mail: info@ivs3d.com
Website: www.ivs3d.com

Corporate Members

Membres corporatifs

Jeppesen Norway AS

Through Jeppesen's aviation heritage, the company has over 70 years of valuable experience working with complex data, enhancing, assembling and packaging that data to meet the needs of its customers. Jeppesen has long believed in the value and importance of strategic partnerships with industry groups and source providers, and we carry those beliefs forward with us into the marine industry.

Based upon Jeppesen Marine's relationships with hydrographic offices around the world, we share a common goal of providing superior data solutions to mariners, whether they are on the high seas, coastal or inland waterways. Jeppesen Marine also shares a common bond in improving waterway safety, increasing customer efficiency, and ensuring environmental protection.

Coupled with the acquisition of C-Map and HydroService AS, Jeppesen Marine utilizes a range of data types including vector and raster navigation charts and other digital

products. By applying advanced technologies, Jeppesen Marine increases the usefulness, availability and timeliness of hydrographic data, tightly packaging that information into systems and tools that anticipate and meet customer needs.

Customers count on Jeppesen Marine to provide them with the most innovative, reliable navigational tools and data solutions for their commercial or maritime needs. Services include: Cartography services, dKart office tools and services, CM-93 data services and OEM toolkits, CM-ENC toolkit, and 24/7 customer support.

Jeppesen Marine values the unique contributions of hydrographic offices and other data providers and looks forward to continuing to build strategic alliances in the spirit of working together to advance the interests and welfare of mariners around the world.

For further information please contact:

Egil O. Åarstad
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Website: www.hydroservice.no

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 Columbia. The Headquarters are located in Kongsberg, Norway. Kongsberg Maritime exports its products to all of the world's major markets.

For more information regarding Kongsberg Maritime please contact:

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

NetSurvey Limited

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

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

We offer an in-house data processing service that can range from simple swath bathymetry cleaning to full 3D

Visualization and fly-through using Fledermaus software. NetSurvey also offers bespoke training courses with a practical emphasis.

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

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

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

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

Mr. Duncan Mallace
Tel: +44 1295 750 600 FAX: +44 1295 750 700 E-mail: duncan@netsurvey.co.uk
Website: www.netsurvey.co.uk

RESON Inc.

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

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

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

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

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

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

For further information please contact:

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

Corporate Members

Membres corporatifs

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 (IKONOS and OrbView imagery) Lizardtech (MrSID GeoExpress and DocumentExpress) and Nuvision (softcopy photogrammetry hardware) and is also the Authorised Training Centre in Canada for the complete suite of ERDAS IMAGINE software products running on SUN Solaris (UNIX) and Microsoft Windows platforms. SANI-ITA is a sister company to Spatial Geo-Link Limited, the exclusive distributor in Canada for Leica Geosystems softcopy photogrammetry and geographic imaging products.

SANI-ITA is ISO 9001:2000 registered. ISO 9001:2000 (the most comprehensive of the ISO 9000 series of standards for quality assurance developed by the International Organisation for Standardisation) encompasses all aspects of quality management inclusive of understanding customer requirements, design control and development and consulting services.

Services offered by SANI-ITA include:

- Project Consulting and Project Management
- Airborne and spaceborne data acquisitions
- Control surveys
- Hydrographic surveys
- Aerial triangulation and orthorectification of airborne data (metric, digital or video cameras) and satellite sensors (SPOT, IRS-1C, IKONOS, ASTER, QuickBird, EROS1A, OrbView SPOT5, THEOS1, FORMOSAT2 and Landsat)
- Digital Elevation/Terrain collection – automatic or static mode
- Orthomagery production
- Digital topographic mapping and map and chart revision
- GIS data structuring
- Map conversion and data translation services
- Image compression services (lossy and lossless)
- Third party audits of mapping and image data
- Visualisation services including dynamic fly-throughs and stereoscopic viewing

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

www.sani-ita.com

or contact us at

Tel: (905) 943-7774 FAX: (905) 943-7775

News From Corporate Members

Nouvelles de Membres corporatifs

Association of Canada Lands Surveyors / Association des Arpenteurs des Terres du Canada

In June of 2007, the ACLS hosted the third National Surveyors' conference in conjunction with its Annual General Meeting in Québec City. The Fourth National Surveyors' Conference will be held in the Victoria Conference Centre on May 5 to May 8. It will be held in conjunction with the CHC 2008. The Theme is: "Bringing Land and Sea Together". For details visit: www.chc2008.ca

La troisième conférence nationale d'arpenteurs-géomètres a eu lieu à Québec en juin dernier. La quatrième Conférence nationale d'arpenteurs-géomètres se déroulera au Centre des congrès de Victoria du 5 au 8 mai 2008 conjointement avec CHC 2008 qui est une conférence majeure d'hydrographes qui alterne entre les États-Unis et le Canada à tous les ans. Le thème cette année est : *Réunir terre et mer*. Pour les détails visitez : www.chc2008.ca

For further information please contact:

Association of Canada Lands Surveyors
Tel: (613) 723-9200 FAX: (613) 723-5558 E-mail: admin@acsl-aatc.ca
Website: www.acsl-aatc.ca

IXSEA

IXSEA has announced an order to equip Dynamic Positioning Services (DPS) with four OCEANO HD55 Pull and Lift Heavy Duty Acoustic Releases and two telecommand units as well as acoustic modules and cable for subsea construction.

With a head office in Aberdeen, Scotland, DPS is a specialized offshore service company offering equipment rental, product sales, engineering solutions and personnel supply.

"DPS is delighted to be the first global survey and ROV equipment rental company to add IXSEA's OCEANO Heavy Duty Releases to their rental inventory," said Scott Johnstone, DPS Sales Director. "DPS aims to be the leading supplier of rental equipment to the subsea construction market; the introduction of these acoustic releases to our rental inventory is yet another example of DPS providing leading edge equipment to the demanding subsea sector."

"DPS chose IXSEA's Heavy Duty Acoustic Releases because of their power, performance and reliability at any depth or environmental conditions," said IXSEA Ltd. Sales Director, Nick Goodwin. "OCEANO Heavy Duty Acoustic Releases allow heavy load handling without hardwire connection, hydraulic hose or ROV. Easy to operate and rugged, they are the perfect tool for offshore construction operations."

About IXSEA

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

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

To sail. To sound. To analyze.

Further information:

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Tel: +33 (0)6 13 49 05 66

News From Corporate Members

Nouvelles de Membres corporatifs

Jeppesen Norway AS

Please note that on September 8, 2007 Hydroservice AS has merged into its parent company, C-Map Norway AS. In addition, C-Map Norway AS has changed its name to Jeppesen Norway AS.

Jeppesen is a Boeing company and a market leader in the aviation industry. After the merge with C-Map, Jessesen

has now entered into the marine market. Jessesen Norway AS will be the main office for the worldwide commercial marine activities, doing business as Jeppesen Marine Norway.

For further information please contact:

Jeppesen Norway AS
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E-mail: info@c-map.no
Website: www.c-map.no

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

Markham, Ontario, October 5, 2007 - SANI-INTERNATIONAL TECHNOLOGY ADVISORS INC. (SANI-ITA), is pleased to announce that new training courses are being offered on ERDAS IMAGINE and Leica Photogrammetry Suite (LPS) at its Training Centre in Markham. On-site training can also be provided. Training courses being offered on an on-going basis include Fundamentals of ERDAS IMAGINE, Advancing with ERDAS IMAGINE, Desktop Mapping with LPS and DEM generation and editing with LPS. Other training courses are available for ArcGIS extensions - Stereo

Analyst and Image Analysis that are marketed exclusively in Canada by its sister company Spatial Geo-Link Limited. Training programs enable participants to display and analyse imagery from various sensors including metric cameras (digital or video) and satellite - SPOT, IRS-1C, IKONOS, ASTER, OrbView, SPOT5, and Landsat, as examples. The Corporation is an authorized distributor of GeoEye's IKONOS and Orbimage one-metre panchromatic and 4-metre multispectral satellite imagery and soon to be launched GeoEye-1 forty centimetre panchromatic imagery.

For further information please contact:

SANI-INTERNATIONAL TECHNOLOGY ADVISORS INC. (SANI-ITA)
Tel: (905) 943-7774 FAX: (905) 943-7775
Website: www.sani-ita.com

ANNOUNCEMENTS / ANNONCES

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

Canadian Hydrographic Conference and National Surveyors Conference 2008 Conférence hydrographique du Canada et Conférence nationale des arpenteurs-géomètres 2008

Bringing Land and Sea Together – Réunir terre et mer

**Victoria Conference Centre / Fairmont Empress Hotel
Victoria, BC, Canada May 5 – 8, 2008**

I am pleased to invite you to the Canadian Hydrographic Conference and National Surveyors Conference 2008. For the first time ever, the Canadian Hydrographic Association (CHA) and the Association of Canada Lands Surveyors (ACLS) are co-hosting a joint conference. This is a natural fit for both associations as our professions increasingly exist in the realm of the greater geomatics community. The overlap between disciplines creates an opportunity to promote the transfer of ideas, knowledge and best practices. As well, 'Canada Lands' as defined in legislation includes Canada's offshore territorial waters; therefore, hydrographic surveyors are often members of the ACLS.

The Canadian Hydrographic Conference is a continuation of conferences which alternate annually between the U.S. and Canada. This event follows the U.S. Hydro conference in Norfolk, Virginia in May 2007 and the Canadian Hydrographic Conference in Halifax, Nova Scotia in June 2006. This will be the fourth annual National Surveyors Conference, following the Third National Surveyors Conference in Québec City, Québec in June 2007.

To accommodate the wide spectrum of topics that arise from having a joint conference, we are scheduling a unique, three day technical program. Day One will have concurrent sessions for the 'wet' and 'dry' sides, Day Two will consist of plenary sessions relevant to both disciplines and Day Three will once again consist of concurrent sessions. Of course, delegates will be able to attend any of the concurrent technical sessions that they wish, and our theme, "Bringing Land and Sea Together," encourages this 'cross-pollination' between the two host groups.

At the time of writing, we are grateful to have Kongsberg as our platinum sponsor and ESRI as our gold sponsor, and we look forward to adding additional sponsor names in the future. The Canadian Hydrographic Service is providing considerable in-kind support as a government partner. Exhibitor booths are being filled on a first-come, first-serve basis, and we currently have a dozen booths spoken for. The conference website is continuously being updated, and on-line registration is now available for delegates wishing to register.

For additional information regarding the technical program, workshops, on-the-water demos, exhibitors, social program, sponsorship opportunities, conference hotel and to register on-line, please visit www.chc2008.ca.

Brian Port
Conference Chair

Important Dates:		Conference contact information:	
Nov 30, 2007	Deadline for abstracts	Telephone:	(250) 363-6741
Jan 11, 2008	Decision notification	Fax:	(250) 363-6841
March 28, 2008	Deadline for papers	Email:	info@chc2008.ca
April 25, 2008	Deadline for presentations		

CENTRAL REGION

June

Celebrated World Hydrography Day, unveiled new chart of Hamilton Harbour to dignitaries.

Charts Released

- New Edition Chart 2067 – Hamilton Harbour
- New Edition Chart 1438 – Grindstone Island to Carleton Island
- ENC Chart 2224 – Rose Island to /à Parry Sound
- ENC Chart 2225 – Approaches to / Approches à Parry Sound
- New Edition Chart 2181 – Harbours in Lake Erie

Surveys

- Fathom Five Marine Park two week survey was completed for Parks Canada
- Revisory survey gathered data at Windsor (multibeam) and Woods Bay in Georgian Bay

July

Charts Released

- ENC 7620 Demarcation Bay to /à Liverpool Bay
- ENC 7790 Melville Sound
- ENC 7791 Bathurst Inlet - Northern Portion / Partie nord
- ENC 7792 Bathurst Inlet - Central Portion / Partie Centrale
- ENC 5457 Deception Bay
- ENC 2181 Wheatley Harbour, Erieau Harbour

Surveys

- A survey of the approaches to Puvirnituk and Akulivik was completed in the Eastern Arctic.
- Revisory survey completed sounding operations at Woods Bay, Blackstone Harbour, Moon River, North River Bay and Arnolds Bay. A survey was completed for Blind River and Lake Duborne.
- Investigations at Bellot Strait/Kugluktuk were done from *CCGS Louis S. St-Laurent*.
- CHS supplied hydrographic and technical support of DFO's science program aboard *CCGS Nabidik* in the Western Arctic.

August

Charts Released

- ENC 2042 Welland Canal St.Catharines to /à Port Colborne
- ENC 2110 Long Point Bay

- ENC 2201 Georgian Bay / Baie Georgienne

Marketing

- CHS sponsored a United Way Fund Raiser – 'Stepping the Mast' by hosting Derek Hatfield and his sailboat the *Spirit of Canada*
- CHS staffed a booth at the Port Credit In-Water Boat Show

Conferences

- A paper was presented by John Mercuri, a poster was prepared by Paola Travaglini and an information exhibit was provided at the International Polar Year GeoNorth 2007 Conference

Surveys

- A survey of the northern communities of Kangiqsujaq and Salluit were completed in the Eastern Arctic
- Revisory survey completed sounding operations at Pembroke, Kingston and Cornwall
- UNCLOS survey staff joined the Swedish icebreaker *Oden* and *CCGS Louis S. St-Laurent*
- Western Arctic survey aboard *CCGS Nabidik* conducted multibeam surveys at various locations in the Beaufort Sea

September

Charts Released

- New Edition 1437 – Summer Group to Grindstone Island
- ENC 7778 – Coronation Gulf Eastern Portion / Partie est
- ENC 7750 – Approaches to / Approches à Cambridge Bay

Marketing

- CHS wins Level 1 Award – 'Recognition of Commitment to Quality' for the Levels of Service (LOS) Project at Public Sector Quality Fair 2007
- CHS sponsored a second United Way Fund Raiser 50/50 Draw raising \$433 and selecting a name to go on the side of the *Spirit of Canada*

Surveys

- Revisory survey of the Queenston-Chippawa Canal (Area1 and Area2) was completed in partnership with Ontario Power Generation
- UNCLOS survey concluded on the Swedish icebreaker *Oden*.

Notable retirements:

Mike Lloyd after 35+ years of service and Michel Desjardins after 35+ years of service. Congratulations and best of luck in your retirement!

PACIFIC REGION

CHS Pacific Region, Data Acquisition and Technical Support Division

(formerly Hydrographic Surveys Division)
October 26, 2007

The 2007 field season is drawing to a close. The *Otter Bay* c/w EM3002 and MVP-30 will complete its last project (San Juan Islands) today. It was a very successful season for the vessel and hydrographers aboard, traversing the coast of BC from Sooke to Prince Rupert, the west coast of Vancouver Island, the Inside Passage, repeat surveys of Sandheads and Squamish for NRCAN, 5 harbour surveys (only 4 were planned) to support the Kitimat Gateway charting initiative, nearshore areas in Howe Sound for DND to support security planning for the 2010 Olympic Games and hazard investigations too numerous to document here. The sub-bottom profiler (2x2 array) functioned well, after some software upgrades from Knudsen.

The fast response craft *Shoal Seeker* (22 foot Lifetimer) was fully outfitted for hazard investigations anywhere on the coast at a moment's notice. It was used to investigate and document changes due to siltation in Stewart Harbour (three large rivers flow into the inlet) and changes to the shoreline in Rupert Inlet (Quatsino) due to slumpage of tailings from the now abandoned mine site.

Revisory and Sailing Directions surveys were carried out in support of Fraser River charts and the New Chart of Kyuquot as well as other small investigations.

The *Vector* worked for just shy of 10 weeks in Queen Charlotte Basin from July through September in support of priority areas for NRCAN, EC (Canadian Wildlife Service), DFO (Oceanography and Marine Environment and Aquaculture Divisions and habitat mapping) and the Kitimat Gateway charting project for CHS. Exceptionally good weather in Hecate Strait allowed coverage to progress north to the 54th parallel. There are just over 2 more weeks of work planned in southern waters in March 2008.

Meanwhile, our tidal group has been very busy making much needed upgrades to several of the Permanent Water Level Network (PWLN) and Emergency Response (tsunami) gauges. The Tides and Currents Supervisor position (Pacific) has been staffed. Denny Sinnott was the successful candidate. Denny will be mentoring with Fred

Stephenson in the coming months in order to take on some of Fred's national and international responsibilities. Fred plans to retire in 2008.

On August 1st, CHS Pacific region reorganized to two divisions. The various components of Geomatics Engineering Division have been integrated within Nautical Publications and Hydrographic Surveys. The new divisions, called Data Acquisition and Technical Support (DA&TS) and Nautical Publications and Services, are working hard to incorporate their newly acquired functions and personnel into cohesive units. QMS procedures will be updated in parallel with opportunities for improvement gained under this new structure.

The new components of DA&TS include Sonar Systems Group (at one time part of Client Liaison and Support) and Computer Support (including software, desktop, server and network support). Hydrographic Systems Support (also previously part of CL&S) became part of Hydrographic Surveys during the previous reorganization (from 4 to 3 divisions).

Hydrographic Systems support, of course, has a hand in mobilization and demobilization of all surveys, and provides on-board technical support and data processing during *Vector* survey operations. They have also been actively involved in the technical support of the tidal network rebuild.

Computer Support has been busy supporting the office network and CARIS desktop for CHS, developing and maintaining software applications, production of tide and current table predictions, and shipboard networks and software support aboard vessels. Dave Gartley has taken a 1 year assignment with DND as a CS-02.

Sonar Systems Group has been working on seabed classification of multibeam data for two small-scale charts covering Strait of Georgia. The *Otter Bay* spent two weeks in the field collecting bottom samples for ground truth of the acoustics seabed classification results.

The manager is now working to staff EL and CS positions to help support surveys and publications requirements. A supervisor position will be staffed to lead the support group in the coming months.

ATLANTIC BRANCH

The CHA's Atlantic Branch has had an interesting few months. With an initial slow start to the membership drive, the numbers approached those of the previous 2 years of operation. Earlier in the year, a number of CHA members attended the United States Hydrographic Conference in Norfolk, Virginia. The Atlantic branch successfully sponsored a BBQ in celebration of World Hydrography day at Oaklawn House, in Dartmouth, Nova Scotia (see photo). The branch was also a co-sponsor of the recent IHO Tidal Committee meeting in Halifax. Part

of this sponsorship included a dinner for the delegates. The branch is currently involved in discussions about, and planning for a group of display cases. These will be used to house and display a number of Hydrographic 'artifacts' and memorabilia at the Bedford Institute of Oceanography. More recently, the October Open House at the Bedford Institute of Oceanography featured an informational display about the Canadian Hydrographic Association. There will be a branch general meeting coming up in December or early in the new year, so members stay tuned!



PACIFIC BRANCH

The branch has had a quiet summer. We had a good number of our membership and executive away in the field over the summer working on various surveys. The one major development was the departure of Past Vice President Dave Gartley. He has accepted a one year assignment with DND. He subsequently resigned from

the position of past Vice President. We here at the branch thank Dave for his years of service and wish him well with his new assignment.

The branch has been busy working with the CHC-NSC 2008 organizing committee in preparation for the conference to be held in May 2008 in Victoria. Many of our members and executive are busy working on the

organizing committee planning this event. The pace of the organizing committee has increased in the last few months as we get closer to the conference. The web site www.chc2008.ca is up and running and being constantly updated with new information. They have had companies come on board for sponsorship and exhibitor registration is well underway. The delegate registration is now available, online, to those who wish to participate in this first ever event where we bring land and sea together. It promises to be an exciting and ground breaking event.

The branch executive is planning for the remainder of the fall and the New Year with the focus being on the annual Christmas party/lunch and the Annual General Meeting.

CENTRAL BRANCH

The Central Branch held their annual BBQ later than usual this year due to a lot of people being away in the field. It took place in July under somewhat threatening skies in the backyard of the Power residence. Mother Nature stopped threatening and delivered a healthy dollop of rain which oversaturated the ground but not the enthusiasm of the children who still went for a swim in the heated pool. The rest of us gathered under the pergola to enjoy the burgers and hot dogs rescued from the barbecue before they got too soaked!

We hosted two general meetings in the fall, the first being a presentation at the Burlington Central Library by Tim Janzen of CHS Central & Arctic Region who spoke about the UNCLOS co-operative survey aboard the Swedish icebreaker *ODEN*. A particular treat was the attendance of Tim's wife and children. The second meeting was hosted by the Central Branch at the Bayfield Institute in Burlington. Mr. Lindsay Reich spoke about the City of Hamilton's database and the particular need for metadata. He briefly touched on their SCADA (Supervisory Control and Data Acquisition) project, a highly centralised monitoring network controlling the operations of the City's water plant, three wastewater plants and 130 outstations from a single location.

The Mimico Cruising Club was the locale for our 18th Annual General Meeting and Dinner and it proved to be one of the best ever, if comments received during and after are any gauge. Mr. Ian Kerr-Wilson, curator of the Dundurn Historical Site and Hamilton Steam Museum spoke to an enthralled audience about the War of 1812 ships *Hamilton* and *Scourge* wrecks sunk in Lake Ontario

during a freak summer squall. Of particular interest was the way in which the site is being monitored to keep divers from "salvaging" artifacts from the wreck. Personal thanks to the committee including Roger Cameron for securing the speaker and other related duties and Jim Weedon who once again did a wonderful job producing the programme!

QUÉBEC BRANCH

La campagne pour la recherche de publicitaires de la 17^e édition du Carnet de bord 2008 est amorcée. Un publicitaire majeur pourrait se joindre à cette nouvelle édition. Il est encore trop tôt pour révéler son nom parce que nous sommes à l'étape de la négociation et qu'aucune entente écrite n'est encore conclue. La Section du Québec travaille fort pour rentabiliser cette publication.

Nous avons toujours sur le projet des 400 ans de fondation de la ville de Québec en partenariat avec le Service hydrographique du Canada, région du Québec, et la baleinière hydrographique SURVEYOR de la Section Centrale en sera l'élément majeur.

La Section poursuit son travail pour établir des ponts pour le renouvellement des membres et des membres corporatifs. C'est un travail de longue haleine et qui exigera aussi un effort de tous les membres de la Section et non pas seulement le conseil d'administration.

Tout récemment, nous avons participé à une réunion exploratoire pour un projet de revitalisation du quai de Pointe-au-Père. Cette réunion était conduite par le Site historique maritime de la Pointe-au-Père. Nous verrons si nous pouvons mettre en valeur l'ancien site marégraphique qui sert d'assise aux références verticales canadiennes et étatsuniennes. D'ailleurs, le ministère des Ressources naturelles du Canada utilise le Gardien des altitudes pour son projet du suivi des réajustements de la croûte terrestre. Ce serait un beau lien avec cet ancien projet mené par la Section.

Rates / Tarifs

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

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

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

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

RATES / TARIFS

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Authors submitting manuscripts should bear the following points in mind:

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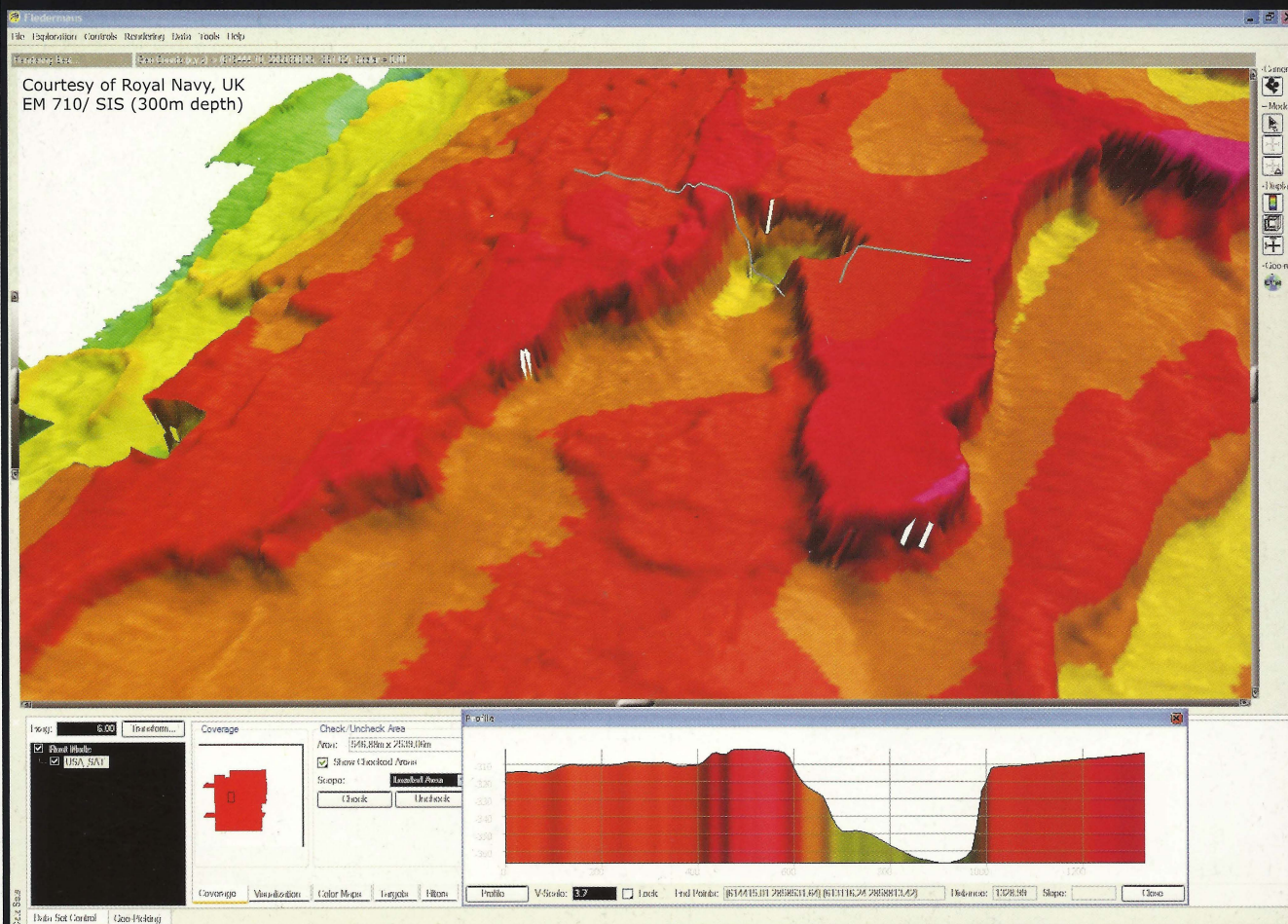
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