# LIGHTHOUSE

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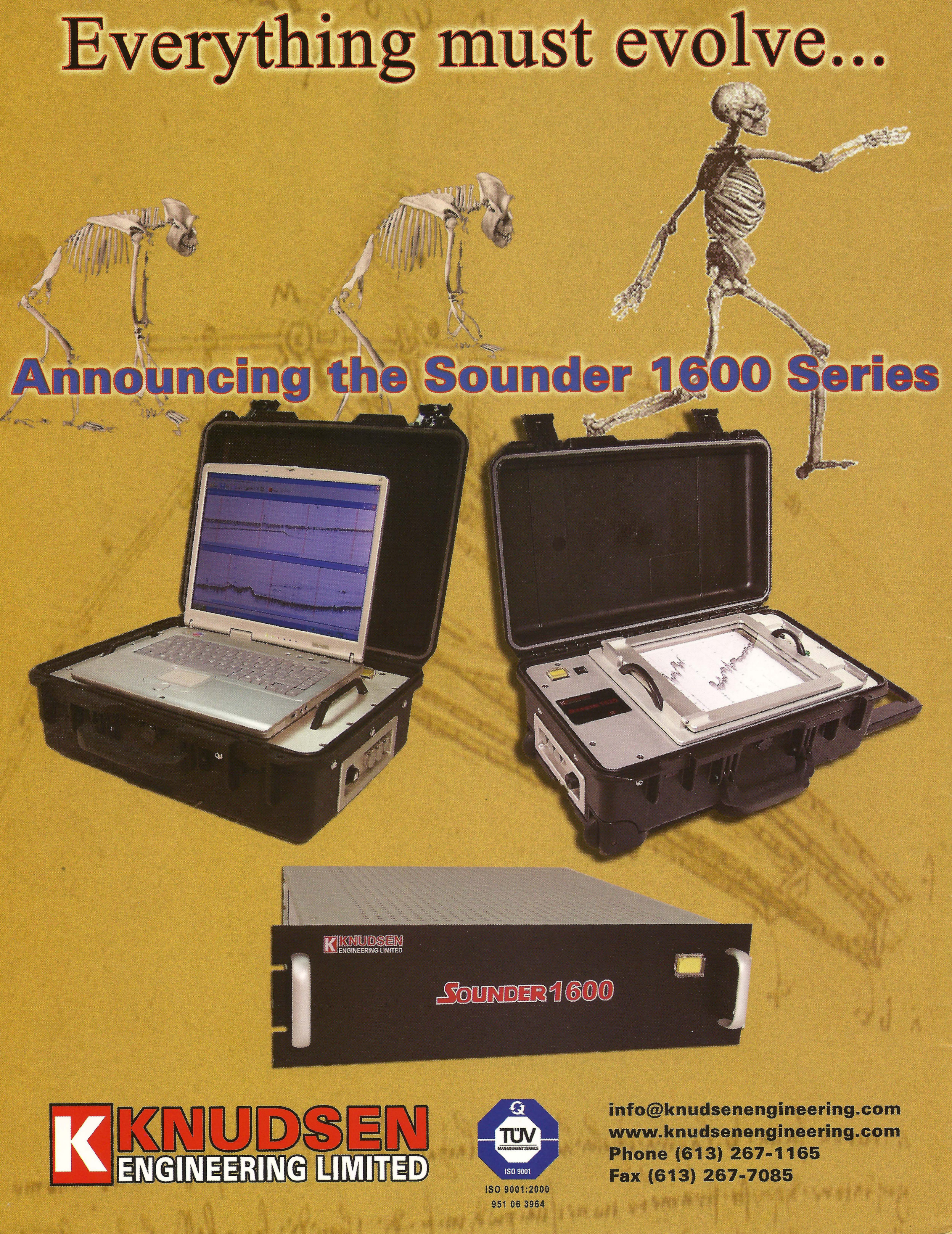

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Journal of the Canadian Hydrographic Association Revue de l'Association canadienne d'hydrographie

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# LIGHTHOUSE

Edition/Édition 70 • Spring/Summer Printemps/Été 2007




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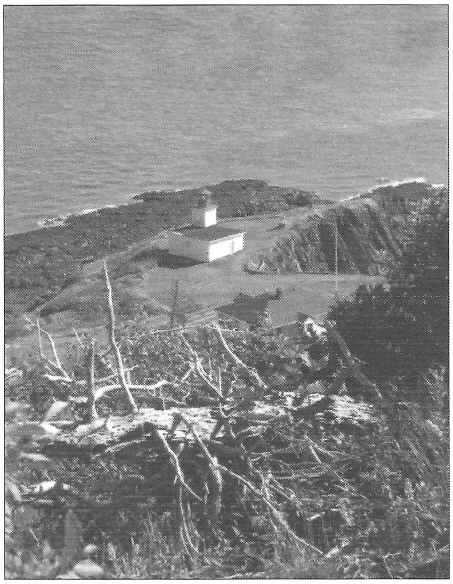

**Cape d'Or Lighthouse**
**Cape d'Or, Nova Scotia**
*Photograph credit: Reverend Mark Pretty*

## Cape d'Or Lighthouse

Located on the north shore of the Minas Channel, the Cape d'Or Lighthouse was built in 1922. A fog whistle had been in place as early as 1855 to give warning of the tidal rip. The light was automated and then de-staffed in 1989. The lightkeeper's house is now a restaurant and a guest house run by a local development agency. To encourage local tourism and to enhance the lighthouse visit, several walking trails have been established on the rugged grounds and steep cliffs. The surrounding area, in addition to having some of the highest tides and associated currents, is said to be home to many rare plants and birds, including the peregrine falcon (source: Nova Scotia Lighthouse Preservation Society website *www.nslps.com*).

For the Mariners
- List of Lights: 167
- Light Characteristics: White Flash 1 second, Eclipse 8 seconds
- Focal Height: 20.34 metres
- Nominal Range: 13NM
- Horn: blast 2 seconds, silent 3 seconds, blast 2 seconds, silent 3 seconds, blast 2 seconds, silent 48 seconds
- Chart 4010
- Charted Position: 45°17'27.01"N, 64°46'27.47"W

(Source: Canadian Coast Guard internal website)

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# Editor's Note / Note du rédacteur

The days are long. Here at the Bedford Institute of Oceanography, the fog has finally lifted to reveal empty jetties and ample spaces in the parking lots. The scientists and hydrographers are in the field. In Atlantic Canada, they have gone to the Bay of Fundy, to Cape Freels and on revisory in Cape Breton and Newfoundland. Similar yet unique endeavours have begun across the country; in the Great Lakes, the St. Lawrence River, the Queen Charlotte Basin and many more places. It is survey season. It is summertime.

This is Lighthouse Edition 70. Production began amidst a spring full of activity. The push is now on to print before Jim Weedon, the heart and soul of the journal, heads off on survey. The contributors have sent in their work in between surveys, leave, conferences, and business meetings. It seems that work keeps getting in the way of the story telling.

The United States Hydrographic Conference (USHC 2007) was held in May in Norfolk, Virginia. It was a well attended and worthwhile event, helping in part to celebrate the 200th anniversary of NOAA. The organizers gladly gave permission for us to use two papers that were presented there: Rob Hare's paper on Uncertainty Management in Hydrographic Surveys and Stephen Forbes and Doug Regular's paper on the NIF-SAR project. In addition, this issue has a paper on the Marine Electronic Highway by Randy Gillespie and one on issues related to vessel transits in the Arctic, by Ron Macnab.

It just so happens that all the papers in this issue are written by Canadians. The topics are both Canadian and International in scope. The authors come from the east and west coasts. Our thoughts and hearts turn northward to our third coast. The paper by Ron Macnab and the reminiscences at Nick Stuifbergen's retirement luncheon show that the influence of the North is much stronger and more resilient than our physical presence there would suggest. It is noteworthy that the International Polar Year has begun. Finally, in this quiet office, it is apparent that it is perhaps more than coincidence that the summer solstice coincided with World Hydrography Day. The hydrographers are afield on the longest day of the year. Let's hope they bring their findings and tales back in time for Edition 71 and to Canadian Hydrographic Conference-National Surveyors Conference (CHC-NSC) 2008 next spring in Victoria. Until then, have a safe and productive summer.

*Craig Zeller*

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# Message from the National President
# Mot du Président national

On February 19, 2007 I was notified of my election as the National President of the Canadian Hydrographic Association (CHA). I wish to thank the membership for the confidence that they have placed in me by electing me to lead our prestigious association.

As many are aware, 2006 marked the fortieth (40th) year since our association was founded and although no specific event was organized to celebrate this achievement, several of our Branches have now agreed to strike a lapel pin commemorating this occasion.

As we move forward into the next decade, it is my intention to provide leadership over the next three years that will see our association continue to grow and maintain our influential position in the field of Hydrography.

I challenge all our Branches to grow their membership by at least fifteen (15%) per cent this year, and ten (10%) per cent each year thereafter.

I would like to congratulate Dale Nicholson on his appointment as Director – Hydrography, of the Canadian Hydrographic Service - Central and Arctic Region in Burlington, Ontario and welcome him as a member of CHA - Central. Equally I would like to extend congratulations to Stephen Forbes on his appointment as Director, Canadian Hydrographic Service (Atlantic).

As I write this, our Association is being represented at US Hydro 2007 in Norfolk, Virginia, USA, by the Conference Chair and members of the Organizing Committee of CHC 2008, which will take place in Victoria, British Columbia, May 2008. While promoting the forthcoming conference they will be distributing gratis copies of Lighthouse Edition 69 published earlier this year.

The Lighthouse Committee is to be commended for their continued diligence in getting out the Journal and I ask each and every member to support them by way of contributing articles, Branch news, obtaining advertisements, or assisting the Committee in any way possible.

We continue to foster partnerships and joint activities with other professional organizations. I will be representing our Association at the 100th National Annual Conference of the Canadian Institute of Geomatics (CIG) in Toronto on May 23rd as they celebrate their 125 year anniversary.

In June, I will also represent the CHA at the Third National Surveyors Conference organized by the Association of Canadian Land Surveyors (ACLS) in Quebec City.

In tandem with our National Executive, I will be reviewing some specific activities that our Association is a part of and reporting on them to the membership at large, as time progresses. These include our relationship with the CIG – how we function as their Hydrographic Committee, with the ACLS, the Joint Task Force on certification of Hydrographers, our Canadian Hydrographic Association Award Program, strengthening our relationship with the Canadian Hydrographic Service, the Friends of Hydrography and resolving our governance structure – Articles of Incorporation or Constitution.

*George McFarlane*

# Message from the National President
## Mot du Président national

On m'avisait le, 19 février 2007, de mon élection au poste de Président national de l'Association canadienne d'hydrographie (l'ACH). Je désire remercier les membres de leur confiance en m'élisant pour diriger notre prestigieuse association.

Plusieurs ont noté que 2006 a marqué le 40e anniversaire de fondation de notre Association sans qu'aucun événement spécial ne soit organisé pour célébrer cette réussite, plusieurs Sections ont accepté de frapper une épinglette commémorant cette occasion.

En début de cette nouvelle décennie, mon intention pour les trois prochaines années est de fournir une direction qui verra notre association continuer d'accroître et de maintenir notre position d'influence dans le domaine de l'hydrographie.

Je mets au défi les Sections d'accroître le nombre de leurs membres d'au moins 15% cette année et de 10% les années suivantes.

Je tiens à féliciter Dale Nicholson pour sa nomination comme Directeur du Service hydrographique du Canada, région Centrale et Arctique, à Burlington, Ontario et à l'accueillir comme membre de l'ACH de la Section Centrale. Je voudrais également féliciter Stephen Forbes pour sa nomination comme Directeur du Service hydrographique du Canada, région de l'Atlantique.

En ce moment, notre Association est représentée à la US Hydro 2007 à Norfolk, Virginie, E-U, par le président et le comité organisateur de la CHC 2008, laquelle se tiendra en mai 2008 à Victoria, C.-B. Tout en faisant la promotion de la prochaine conférence, ils distribueront gratuitement l'édition 69 de la revue Lighthouse publié plus tôt cette année.

Le comité du Lighthouse est digne d'éloges pour sa diligence sans faille à produire la revue et je demande à chaque membre son appui en contribuant par des articles, des nouvelles des Sections, la recherche de publicitaires ou en assistant le Comité de toutes les façons possibles.

Nous continuons d'encourager les partenariats et les activités conjointes avec d'autres organisations professionnelles. Je représenterai notre Association le 23 mai à Toronto à la 100e conférence annuelle nationale de l'Association canadienne des sciences géomatiques (l'ACSG) qui fêtera son 125e anniversaire.

Je représenterai aussi en juin l'ACH à la 3e Conférence nationale des arpenteurs organisée par l'Association des Arpenteurs des Terres du Canada (AATC) à Québec.

Conjointement avec notre exécutif national, je réviserai certaines activités dont notre Association fait partie et je ferai des rapports d'étape à nos membres. Celles-ci incluent nos liens avec l'ACSG – comment nous fonctionnons comme leur comité hydrographique, avec l'AATC – la lourde tâche conjointe sur la certification des hydrographes, le programme de la bourse d'étude de l'ACH, le renforcement de nos liens avec le Service hydrographique du Canada, les Amis de l'hydrographie et la résolution de notre structure de gouvernance – les articles de l'Incorporation ou de la Constitution.

*George McFarlane*

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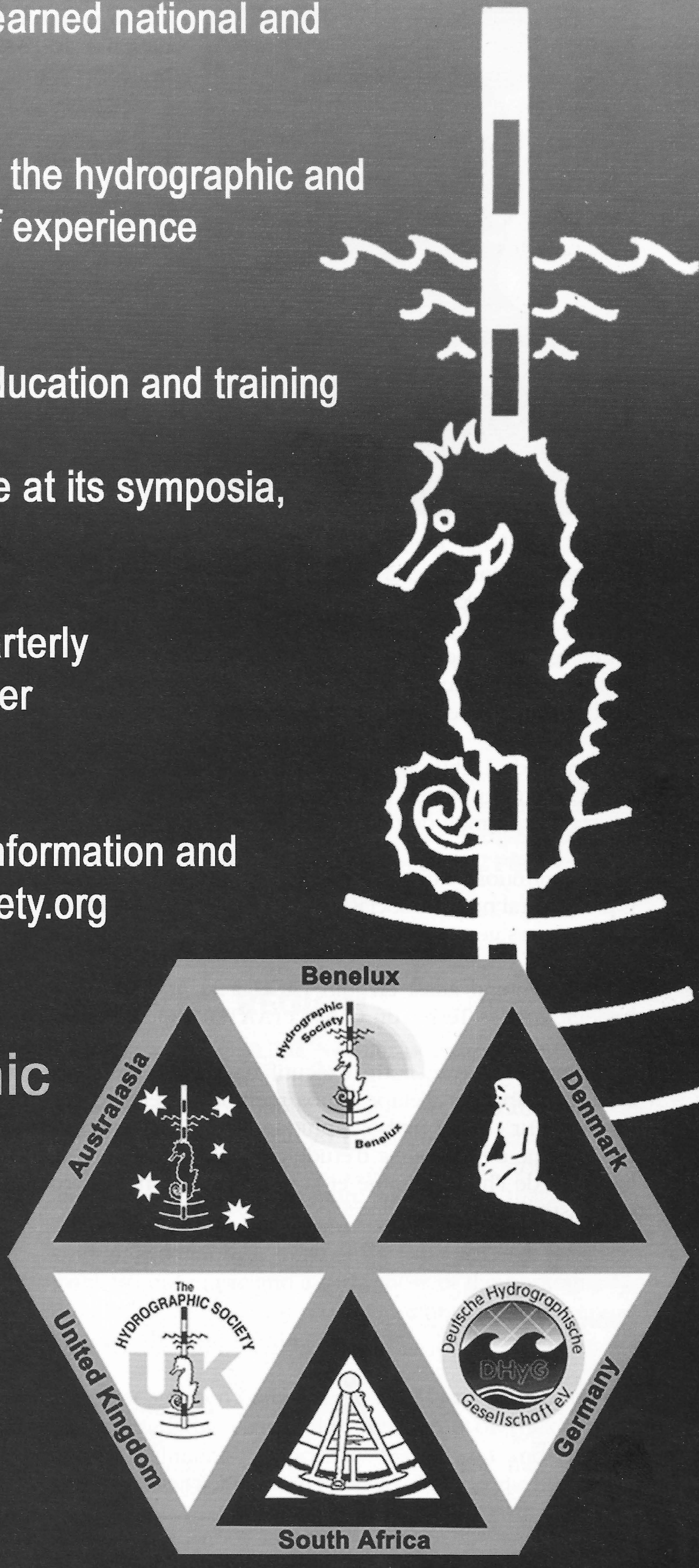


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# Uncertainty Management in Hydrographic Surveys

By: Rob Hare, Canadian Hydrographic Service (Pacific Region), Sidney, BC

With the introduction of the 4th Edition of IHO Standards for Hydrographic Surveys (S-44) in 1998, the concept of accuracy attribution for soundings started to become entrenched in the hydrographic consciousness. Total Propagated Error (TPE) subsequently has become part of the hydrographic lexicon.

The estimation of random error contributions to position and depth errors in soundings for both single-beam and multibeam echosounders is reasonably well understood.

Much work has been done and numerous papers have presented ways to use depth and position accuracy attributes as an aid in automated outlier detection in dense data sets.

Methods of calibrating echosounders for systematic offsets have existed for decades. More recently, methods of detecting and correcting small residual systematic effects in multibeam echosounders have been presented.

These efforts have largely been done in isolation from the other uncertainty management elements – a three-pronged approach that looks at random, systematic and accidental errors separately.

With the 5th Edition of S-44 now in circulation to IHO member states for approval, it's an appropriate time to look holistically at the management of uncertainty from survey design through to its representation to end-users. This paper examines Uncertainty Management (of random, accidental and systematic errors) in hydrographic surveys. In addition, how Uncertainty Management fits within a quality management system will be presented.

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*[Editor's note: This paper was presented at the 2007 United States Hydrographic Conference.]*

## Introduction

A number of factors have motivated the author to write this paper. For over 5 years the Canadian Hydrographic Service (CHS) has been certified under a recognized quality management system (QMS): ISO 9001:2000 [Palmer et al., 2007]. Part of the planning process under this QMS utilizes project management approaches. Management of quality or its converse, uncertainty is a natural fit with either of these models as will be shown. Yet, the author is often surprised by the confusion of staff when it comes to the control of error sources and the overall quality management of projects. Perhaps because the author has been researching uncertainty for almost 15 years, it was easy to assume that everyone understands the fundamental principles of uncertainty management.

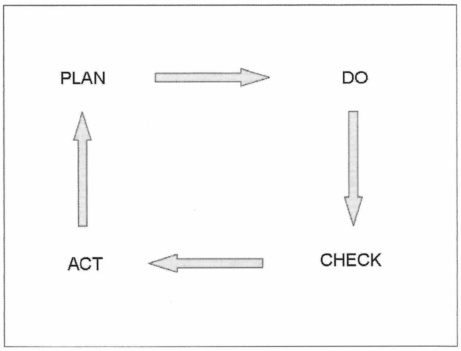
Recently, the author was asked to prepare and deliver lectures on uncertainty management to junior hydrographers and cartographers at a national course. This opportunity forced a certain amount of reflection on past years papers and presentations, researching the works of others and collecting the author's own thoughts on the subject. One of the closing statements in a "Soapbox" column from the June 2004 issue of Sea Technology [Wells, 2004] hit quite close to home for the author: "It is clear that communicating chart uncertainty to users is a critical issue." A first step towards this eventual outcome is the management of uncertainty in hydrographic surveys.

## Background

A number of management tools are used in the planning of operations and projects undertaken by a hydrographic office (HO). These include having a strategic business plan tightly coupled with a human resources plan and a financial plan – a budget. For larger projects, normally some form of project management approach is used in order to keep costs under control, assign resources to tasks and make sure that the project will be completed on time and budget with the deliverables demanded by the client. For an HO certified under the ISO 9001:2000 standard, it also requires adherence to quality principles and the use of a structured QMS.

## Quality Management

Quality management is sometimes defined by: the Plan-Do-Check-Act model, or "Say what you do"; "Do what you say"; and "Prove it." But a recognized QMS is much more than this. It forces an organization to know what its clients want, to measure performance against predefined targets (baselines) and to demonstrate continual improvement. It requires a structured approach to management of all facets of the organization. It requires that all processes follow the 'plan-do-check-act' model.

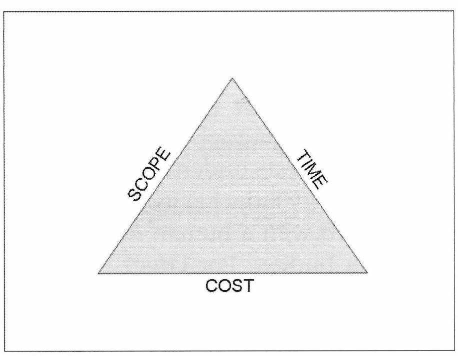



Fundamental QMS elements include:

- Customer Focus
- Strategic Planning and Leadership
- Continuous Improvement and Learning
- Empowerment and Teamwork
- Performance Measurement

## Project Management

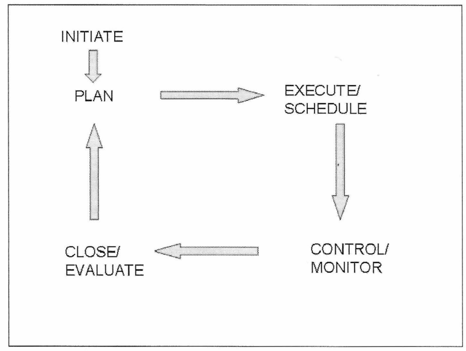
Project Management is often summarized by a triangle composed of Time, Scope and Costs (or resources). A change to any one side of the triangle will affect the other two sides. Similar to quality management, the steps involved in project management include Plan-Execute (schedule)-Control (monitor)-Close (evaluate). Monitoring is done against predefined performance targets to ensure the project is on time and on budget, among other project goals defined collectively between the client and the supplier.




Project Management is sometimes seen as the integration of the following elements:

- Scope definition
- Time (milestones, target dates, deadlines)
- Cost
- Quality
- Human Resources
- Communications
- Risk management
- Procurement

Since projects have a defined start and end, Project Management differs from Quality Management in the initiation step. Quality Management is continuous; Projects must come to a close. That should never stop us from learning from each project (evaluate) such that we improve on the next one.




One can examine the synergy between Quality and Project management by looking at the following grid.

| INITIATE | PLAN | EXECUTE | CONTROL | CLOSE |
|---|---|---|---|---|
| | | Schedule | Monitor | Evaluate |
| Scope | Client needs, Specifications | | | |
| Time | | | | |
| Cost | | | | |
| Quality | | Q.A. | Q.C. | Continuous improvement |
| Human Resources | | Teamwork | | |
| Communications | | | Performance targets | Deliverables |
| Risk management | Levels of service | | | |
| Procurement | | | | |
| | PLAN | DO | CHECK | ACT |

## Uncertainty Management

Uncertainty Management (UM) plays by similar rules, or at least it should. Any project that proceeds without a UM plan is doomed to failure. The management of uncertainty consists of several steps and elements. The main UM steps are:

- Define performance targets, e.g. through survey specifications;
- Pre-analysis (survey design), where an estimate of the error contributions from random error sources is made in order to determine whether the equipment proposed for the survey will allow the resultant survey to meet or exceed specifications;
- Control of errors through equipment calibration and good survey practices, including monitoring system performance while data collection is underway (sometimes called real-time Quality Assurance (QA)[1]);

[1] There is an accepted definition for QA that is somewhat at odds with its use in this paper - See Annex A

- Evaluation (sometimes called post-mission Quality Control (QC)[2]), where the survey results are analysed to determine whether surveys specifications have been met; and
- Documentation, where individual objects, such as soundings, navigational aids, etc., are given uncertainty attributes, and/or the metadata elements of uncertainty for the whole survey project are documented so that potential users may determine if the data set is fit for their particular purpose.

The main uncertainty elements are:

- Systematic errors or biases, which are due to system offsets or environmental effects that have not been properly accounted for by proper survey procedure such as system calibration, regular sound speed casts, good tidal models, etc.;
- Random errors, which are due to noise in the measurement process used and sometimes due to small unmodeled residual systematic biases; and
- Outliers or accidental errors, which might be due to system failures or environmental conditions that are beyond our ability to control.

### Survey specifications (Set performance targets)

For most surveys, the survey specifications are either provided by the client, or determined from, e.g. International Standards for Hydrographic Surveys – S-44 [IHO, 1998]: the Order of survey being determined largely from the depth of water or the navigational context of the area to be surveyed – e.g. draft and volume of vessel traffic, types of cargo, risk of grounding, etc. Oftentimes, and fortunately for many HO, the client is more than satisfied with the results produced by adhering to S-44 or similar derivative national standards [e.g. CHS, 2005].

Some HOs have taken this determination one step further, by using risk classifications to prioritize a national survey and/or charting program, which may also take into consideration the dynamic conditions of the seafloor, especially in areas of mobile bedforms, rapid siltation, dredging and dumping, extreme weather events, etc., the length of time since the last surveys of the area and quality of the survey data on which the charts are based [e.g. OCS, 2006; Simões de Oliveira et al., 2007; CHS, 2007]

From this it can be seen that UM can be tied directly to national business planning, service standards and the clients' needs to manage risk by understanding the quality of the information upon which they must base their navigation decisions. Think of it as establishing an uncertainty budget from which to conduct all survey operations. In many ways it will help define the scope, time and costs of a project.

### Pre-analysis (Plan)

Pre-analysis is an oft-used tool by the surveying profession [e.g. Mackenzie, 1985; Myres, 1990; Hare, 1995]. Knowing ahead of time what instruments to use, the observational methods, the number of measurements and the geometric strength needed to meet desired specifications can save the costs of reobservation. After an assessment of "can we meet the specification?" it is not too late to change any of the elements in order to come in under budget. Most commonly, though, observational methods and number of measurements are what gets modified to meet specifications, since the cost of purchasing new equipment is often not possible, although as shown above, procurement is a planned step in the project management process.

It should be noted here that there are other elements of pre-analysis beyond meeting accuracy specifications. S-44 Orders also have requirements for seafloor coverage and target detection that must be evaluated to determine if the equipment and methods are suited to the task. These elements can be assessed before the mission, but also need to be monitored during data collection and again in post-mission to ensure specifications are met.

### Control of errors (Do, Check)

As mentioned above, there are three types of uncertainty that must be controlled. Hopefully, with the pre-analysis step we have adopted survey procedures and chosen equipment that will control the random errors as best as we are able. Systematic errors need to be controlled by careful calibration of sensors on board e.g. standard patch test [Herlihy et al., 1989] or other method [e.g. Godin, 1997; Riley, 2000; Wang et al., 2004; Bjørke, 2005], good survey practice e.g. regular sound speed casts, good tidal control through deployment of gauges, use of RTK GPS, precisely measured sensor coordinates and orientation, precisely measured latencies between sensors, well-calibrated sound speed sensors, etc. Control of outliers is not something that can be planned, but through the steps below outliers large enough to cause a problem can generally be isolated and removed.

### Real-time quality assurance (Check/Monitor)

The next step is to conduct the survey, using the calibrated equipment and methodology defined in the previous steps. Wells [2003] outlines a number of essential (E) and useful (U) steps that can be performed during data collection that will help to identify outliers and systematic artefacts so that corrective action can be taken before too much bad data is collected and while the survey is still underway:

- Track control (E)
- Coverage display (E)
- Cross-track profile (E)
- Along-track (beam-by-beam) profile (U)
- Backscatter mosaic (U)
- Sun-illuminated seafloor topography (U)

2 There is an accepted definition for QC that is somewhat at odds with its use in this paper - See Annex A

Reed et al. [1999] shows how random error estimation in real-time can be used to monitor collected data against specifications and notify the operator through alarms when preset tolerances are exceeded. Near real-time gridding of collected data, with all corrections applied, can be compared to independent (e.g. historical, other vessel, different day) bathymetry as a way of isolating systematic biases (e.g. incorrect draft, bad sound speed profile).

It is important to ensure both internal (within system) and external consistency (independent system cross check) of the data. Swath to swath checks can identify problems with patch test values, incorrect sound speed profiles, incorrect tide files or failure to apply tides, bad time stamps, etc. But independent checks can catch incorrect draft setting or failure to apply a draft correction – or worse, applying it backwards. Don't laugh – this happens all too frequently.

Corrective action might include some adaptation of the planned survey procedure proposed under the pre-analysis step, e.g. more overlap, reduced vessel speed, narrower swath width, more frequent sound speed casts, etc. Oftentimes, observations of a different type are needed to resolve what one system cannot. Field validation eliminates the need for costly rework [Varma et al., 2002].

### Post-mission quality control (Check/Evaluate)

It is important to note that in many cases, the prevalence of inexpensive processing power means that much of what was once conducted "back at the office" can now be done aboard ship within hours or even minutes of the data collection. This is a good thing. Visualization of multiple days, platforms and lines simultaneously can help to identify small residual systematic errors (e.g. [Hughes Clarke, 2003]) that can be corrected for the most part through the application of small sensor time offsets or sensor scale factors.

Field Quality Control consists of examining on-line and near-real-time processed data to assess the fidelity of the results:

- ship track parallel: imperfect water column, patch test, tides;
- ship-track orthogonal: dynamic error sources – the wobbles (dynamic error residuals)

Time delay, pitch, heading, roll and sound speed (static) error residuals can be resolved through a standard patch test [ibid., 2003]. There are also approaches to correct for small dynamic offset and ripple errors through time referencing [Jalving et al., 2005]. This should be conducted at the Control of Errors step.

Numerous methods exist for almost fully-automated detection of outliers while still in the field [e.g. Hare et al., 2004; Calder, 2003; Debese, 2001]. Assessment of the contribution of all measurements, with their associated uncertainty, to the uncertainty in the bathymetric model of the seafloor can be estimated. That is, we have at least a preliminary idea, while still in the field, whether our survey has indeed met specifications or whether we must collect additional data before pulling the plug. In some cases, the use of additional sensors may be required to resolve queries where insufficient information is available for reliable decision making. As an example, the multibeam sonar information is inadequate to detect reliably the mast head of a wreck and a diver examination or drop camera may be needed to confirm least depth and position.

Other methods exist for proving (or conversely disproving) whether specifications have been met. A tiling approach to statistical estimation of depth uncertainty (i.e. the standard deviation of measured depths within a tile or grid cell) is an empirical method that can be used to validate the theoretical (forward error propagation) approach. When used together with forward error propagation, tile statistics can be used to confirm that correct weights have been used in the estimation of position and depth uncertainty and that a tile size appropriate to the seafloor rugosity has been chosen. One would expect to see good agreement between empirical and theoretical approaches over a flat seafloor, but to see some error growth over steep slopes or where the seafloor rugosity causes fluctuations in depth measurement not accounted for through measurement error models. One thing most tiling approaches do not consider is the depth and position error in each sounding within the tile and how that needs to be weighted within the calculation of the mean (or median) and standard deviation of the tile. Tiling/gridding algorithms have a heavy dependence on removal of systematic biases and outliers or the tile statistics will be skewed.

### Performance measurement (Check, Act)

Under an ISO QMS, continuous improvement is facilitated through ongoing performance measurement. Once a post-mission quality evaluation has been completed, the results can be compared directly with our pre-mission design specifications. If we have stuck with our UM plan one would expect all performance targets to be met. But we all know that even the best laid plans can go awry. Careful evaluation of the reasons for missed performance targets (examination of root causes) is the Check and Act part of the ISO QMS continuous improvement feedback loop.

### Documentation - Quality assessment and disclosure (Act, Prove it)

To the client or the world - the potential users of the data - arguably the most important aspect of any data set is establishing its fitness-for-purpose [e.g. Monahan et al., 2002; Wells and Monahan, 2002]. Mariners may wish to know the vertical uncertainty of the depths upon which a chart is based and over which they must navigate. On the other hand, mariners may assume that if the depths are on an official chart they must be right. If that is the case, the HO is obliged to inform the mariner in an intuitive way about the quality of the charted information.

Any claim that a data set met the standard and is fit for the intended purpose needs to be backed up with objective evidence [Wells and Monahan, 2002]. Proof that a UM plan was developed and followed throughout calibration, acquisition, real-time QA and post-mission QC steps; that an appropriate treatment was given to random, systematic and accidental errors; and that appropriate and recognized standards [e.g. NIST, 2000] were applied to the estimation of combined uncertainty in the data set are minimum requirements for this proof.

Metadata (data about data) in a standard and recognizable form, that is easily web-searchable by user-specified criteria, such as positional or depth uncertainty, needs to accompany each data set. This requirement is built into ISO metadata standards, which are linked with several product standards in development, e.g. S-100 [Alexander et al., 2007; Sebastian, 2003], BAG [Calder, 2005]. Metadata is becoming almost as important as the data itself as more users see myriad applications for spatial analysis and information generation through GIS and Web-Map Servers (WMS).

## Discussion

New CHS hydrographic Survey standards have been recently released publicly [CHS, 2005]. The accompanying CHS Survey Management Guidelines are nearly complete. In the latter, there is a focus on most of the UM elements discussed in this paper. That is fortunate since to date, there has been little focus on UM in the draft 5th Edition of S-44. Nor is there much help provided in the 1st Edition of M-13, the Manual on Hydrography [IHB, 2005].

There are guidelines for quality control and data processing being developed as annexes to the 5th Edition of S-44. In the author's opinion, the time is right to include with this a recommendation that all HO undertake UM planning as part of any survey program. This guidance could then be incorporated into the next edition of M-13.

Hopefully by having some guidance in place, less time will be spent subjectively clipping the fuzz off multibeam data sets that is merely measurement noise. More time will be spent focusing on identification, verification and removal of outliers. Time won't be wasted discarding data in swath overlap areas where there are mismatches, where it would be better spent diagnosing the systematic errors that caused the problem (root cause analysis) and taking steps (corrective action) to address them.

Monahan and Monahan [2001] propose a Retroactive Quality Evaluation (RQE) step as part of the quality control cycle. Calder [2006] shows how such RQE might be carried out for historic data sets and some of the problems one might expect to encounter. This seems a necessary step in addition to UM of all new survey data, since we can not expect to replace all legacy hydrographic data sets in our lifetime. If you don't estimate uncertainty, how can you integrate and validate new and old data sets where they overlap? Having an uncertainty estimate for each overlapping data set makes it possible to make informed decisions about which to keep or supersede, or whether to use some integration of both. Overlapping data sets provide the added redundancy for objectively proving the combined data set is fit for purpose. Redundancy in data provides added quality assurance, the ability of the data to self-check. Not taking advantage of that is folly.

S-44 defines a minimum performance standard to which new survey data shall be collected. Many have argued for an agreement of this standard for hydrographic surveys with S-57 and Zones of Confidence. However, with knowledge of the evaluated uncertainty of collected data sets old and new, the integrated product data set may in fact meet no particular S-44 standard old or new. This makes it impractical to classify an integrated data set to a survey standard. However, the data set quality can still be categorized into one of the ZOC categories if that is what is desired.

Monahan et al. [2002] propose a number of methods in which uncertainty information might be communicated to the mariner or other end users better than the attempts the hydrographic community has made to date. All of these proposals rely heavily on having uncertainty estimates for all our data sets and data types. Ship's bridge and risk management is performed better with uncertainty for informed decision making. Undoubtedly, other GIS or spatial analysis provides better results with uncertainty information captured as part of each data set.

As mentioned earlier in this paper, the CHS has developed a risk-based approach to chart maintenance [CHS, 2007]. While this approach was originally based on a chart-by-chart assessment, it has since been modified to look at risk by geographic area units. This seems logical, but perhaps it could be taken one step further. Several HO have used a risk assessment of their source data as the driver for developing a national survey plan. The risk assessment can be based on age of data as a surrogate for poorer quality positioning, depth measuring technology limitations and temporal change. If a retroactive quality evaluation of the source data sets was performed, admittedly no small task for many countries, the classification of risk could be more objectively assessed. The approach of Velberg [1993] could be used to add an additional uncertainty due to seafloor change, e.g. in areas of siltation. An estimation of seafloor dynamics can be made using deformation analysis on a series of archive surveys [Dorst et al., 2006]. The process requires aligned gridded data sets with the uncertainty at each grid node. If the rate of change of the seafloor in an area was known, resurvey frequency could also be built in to the national survey plan based on clients' requirements or survey specifications. The availability of new survey data could then be used as the driver for the national charting plan.

## Summary

Uncertainty Management should be viewed as one of the most important tools in the management toolbox of any HO, or for that matter, any organization that collects spatial information through a measurement process. After all, all measurements contain uncertainty. With an Uncertainty Management Plan we can truly say what we will do, do what we have said we will do and ultimately prove it (statistically), providing documented evidence to the end user – our clients and stakeholders, mariners and everyone else – that our data is indeed fit for their purpose.

Extending our use of uncertainty to product creation and long-range planning has added benefits. Granted the focus of this paper has been on bathymetric uncertainty estimation (to which much of the literature is devoted and standards developed), but there is no reason why this could not be extended to all chart data types. Our QMS demands that we do no less.

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## Annex A

ISO 9000:2000 defines Quality Assurance as 'providing confidence that requirements will be met'.

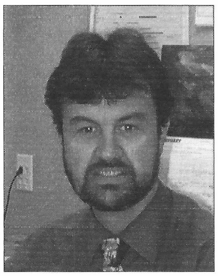
Quality Assurance (QA) is defined as a set of activities whose purpose is to demonstrate that an entity meets all quality requirements. QA activities are carried out in order to inspire the confidence of both customers and managers, confidence that all quality requirements are being met. [PRGL, 2006]

Quality Control (QC) defined as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problems are solved. [PRGL, 2006]

From these, QC can be seen to be monitoring and corrective action. The entire UM process can be considered QA and QC is merely a component of this.

The author has worked with both CHS (QC has been and end-of-line process) and NAVOCEANO (RTQA is quality monitoring of data acquisition sensors) – this has resulted in a bias for the particular terminology that appears in this paper.

## About The Author...



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# Transits by Foreign Vessels in Canada's Northern Waters: More than the Safety of Navigation is at Stake

By: Ron Macnab, Geological Survey of Canada, (Retired)

The past thirty years have seen a notable increase in foreign shipping in the Canadian Arctic, as indicated by a growing number of successful transits of the Northwest Passage. If this trend continues, Canada's hydrographers may be called upon to apply their skills to a range of mapping activities that could go well beyond the traditional charting of hazards to navigation, and which could provide important supporting information for critical decisions that relate to the protection of the northern marine environment.

## Introduction

In the foreseeable future, diminishing ice cover in the Arctic could inspire the world shipping community to seek expanded access to Canada's northern waterways for the conveyance of international cargo and for other purposes. Within the current legal context and faced with prospective economic and political imperatives, it might prove difficult for Canada to deny other countries the use of these waterways. However, existing legislative provisions appear to offer a range of practicable measures for regulating increased vessel traffic while ensuring the safety of navigation and the protection of the northern environment.

Among other things, the effective management of the Northwest Passage and of the vessels plying this waterway will require detailed knowledge concerning the archipelagic seabed, its coastlines, and its land-sea interactions. In many cases, the need for this information will transcend the construction of traditional mariners' charts (be they paper or electronic): with expanding vessel traffic, reliable and comprehensive bathymetric observations will be essential for dealing with a growing and increasingly complex number of environmental, societal, and regulatory issues.

The process of acquiring and delivering this type of knowledge will rely on the kinds of skills that are routinely wielded by members of the hydrographic profession. If foreign shipping continues its present rate of increase in the Northwest Passage, Canada's hydrographers can expect to become major contributors to a multifaceted knowledge base that will underpin the effective management of this waterway.

## A brief history of foreign transits in the Northwest Passage

Few foreign vessels transited the Northwest Passage for the better part of the last century. Beginning in 1903, the Norwegian explorer Roald Amundsen took three years to become the first mariner to sail the Passage aboard the *Gjoa*. There were no further foreign transits until 1957, when three US icebreakers made the crossing. Then in 1969, the US supertanker Manhattan supported by a coterie of accompanying icebreakers made a round trip between the US east coast and Prudhoe Bay, Alaska; these voyages comprised a total of five transits.

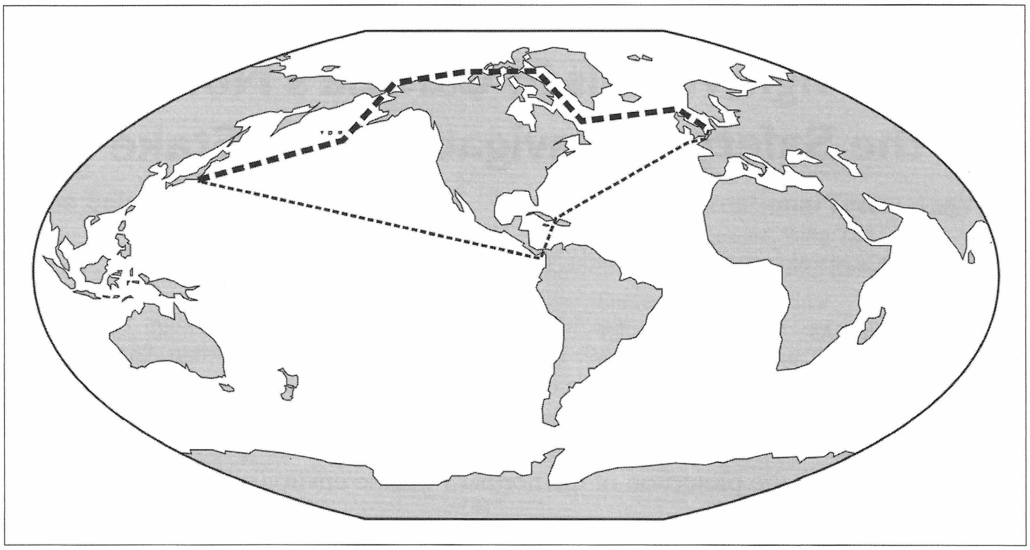
1977 to 1983 marked a period when a different breed of mariner took up the challenge of the Passage: known as 'adventurers,' four privately-owned yachts made the transit in voyages lasting from one to five years. Fifteen more made the voyage between 1986 and 2004. The owners and crews of these vessels have to be regarded as true sailing enthusiasts, eager to push their personal limits and to test the endurance of their craft.

In 1984, another class of vessel began threading its way through the Archipelago's channels and inlets: ocean liners and passenger-carrying icebreakers bringing tourists who were keen to see the North for themselves. Three vessels plied the tourist route between 1984 and 1988. From 1992 to 2005, this trickle grew into a minor stream, with 26 vessels catering to the tourist trade by capitalizing on the appeal of the Northwest Passage.

During these years, other types of vessels traversed the Archipelago: icebreakers (mainly US) on transit, escort, or research duty, and vessels such as icebreaking tugs engaged in commercial operations. From 1985 to 2005, there were 12 such transits.

## Bathymetric mapping for the safety of navigation

The CHS Chart Catalogue lists about 360 nautical charts for the Arctic Region, developed from soundings and other information recorded on about 1300 field sheets. These numbers would suggest that the region has been well mapped, but it would be naïve to assume that all the archipelagic waterways have been surveyed to modern hydrographic standards: administrative circumstances and operational conditions, e.g. limited funding, ship



*A comparison of shipping routes between Western Europe and Southeast Asia, via the Panama Canal (12,600 nautical miles, thin dashed line), and the Northwest Passage (7,900 nautical miles, thick dashed line). (From the Fall/Winter Issue of Meridian, the Newsletter of the Canadian Polar Commission)*

availability, short survey seasons, weather, ice, equipment issues, etc., have tended to direct most survey operations towards high-traffic areas.

Increased shipping in the Arctic would no doubt instigate more hydrographic mapping operations for the purpose of identifying hazards to navigation, and contributing to the development of traffic management schemes. Much of this mapping would likely be devoted to the needs of larger, faster commercial vessels intent on transiting the region safely and in the shortest possible time. There could also be a need to identify and map sheltered bays and inlets where vessels could seek shelter in the event of bad weather or mechanical breakdown.

Considering the growth in tourist traffic, it is conceivable that some future survey operations could focus on the development of 'scenic routes' and secure anchorages throughout the Archipelago, thus opening side channels for safe transits by passenger liners and adventurers.

Surveys of the sort outlined above are well within the mandate of the Canadian Hydrographic Service. As will be seen later, there is also a case to be made for an expanded CHS contribution to surveys in certain regions where safety of navigation has not been a traditional concern: in deep waters where surface vessels are unlikely to run aground, and in coastal zones where the morphology of the seabed transmutes to the topography of dry land. By quantifying parameters such as bottom roughness, survey operations in these regions could yield knowledge that was immensely useful for forecasting the dispersal patterns of spilled oil and other waterborne vessel waste.

## The disposal of vessel waste

It is the rare vessel that travels the ocean without leaving some trace of its passage, largely in the form of waterborne waste. In the relatively confined channels of the Northwest Passage, such waste has little ocean space in which to disperse. Therefore it is likely to contaminate local waters and to foul nearby coasts, contributing to the degradation of an ecosystem that until now has preserved many of its pristine characteristics.

Waterborne waste can result from a variety of activities and can assume several forms. Routine operations, such as the discharge of oily machinery waste and the washing down of oil tanks, dump enormous amounts of contaminants into the ocean every year. In fact, it has been estimated that worldwide, the routine disposal of waste oil in the ocean dumps four to six times the amount of oil that is spilled accidentally through groundings, collisions, or structural failures.

Large accidental oil spills attract a lot of attention because they are highly visible, and their immediate impacts are often catastrophic. However routine operational discharges are far more insidious: not only are they more voluminous overall, but they are also widely dispersed while remaining mostly invisible. In principle, operational discharges are regulated by an international code, however in practice it would appear that not all vessel operators adhere to the regulations.

Ballast dumping is another significant source of waste, carrying with it the risk of introducing invasive species in areas where they quickly overwhelm indigenous fauna and throw local ecosystems off balance.

Reflecting the growth of the cruise industry, the disposal of trash and sewage from large passenger liners is an increasingly serious problem. Carrying passenger populations that frequently match the size of small towns, these vessels generate enormous amounts of trash and sewage that too often end up in the ocean. Passenger liners, in fact, have been described as 'floating sewage plants.' In the Northwest Passage, it would not be difficult to anticipate the long-term effect of uncontrolled dumping of shipboard offal in restricted areas where it would inevitably drift ashore. Nor would it be unrealistic to predict a significant impact on local fauna: seabirds in particular often mistake floating plastic debris for food, and ingest vast amounts. To be fair, cruise ships are not the only villains in this unfolding tragedy: much waterborne debris originates from other types of vessels, and from sources on land.

No catalogue of vessel waste would be complete without mentioning the emissions that emanate from the smokestacks of oil-burning ships: nitrogen oxides (NOx), sulfur oxides (SOx), and particulate matter (PM). Unregulated to all intents and purposes, these emissions affect more than air quality: entrained by precipitation, they can also be transported to ground and sea levels where they affect local chemistry; in that sense, the geographical scope of their impact is determined initially by regional weather patterns, and over the long term by tides and currents. In any case and in conjunction with emissions from land-based sources, they contribute ultimately to changes in global weather patterns and to habitat degradation.

## Bathymetric mapping for other purposes

It was mentioned previously that the prospect of increased foreign shipping could foster a requirement for mapping areas that do not exactly fit hydrography's traditional purview. For instance, detailed relief maps of the deep seabed, taken in conjunction with well-resolved bathymetry in shallow water and in the nearshore, would provide crucial boundary conditions for making better tide and current predictions throughout the Archipelago, along with improved ice forecasts. Such predictions and forecasts would be beneficial not only to vessel operators seeking the safest and most economical routes: they would be useful also for anticipating the dispersal and deposition of spilled material, which in turn would facilitate the planning of mitigation measures and the effective deployment of cleanup crews.

In the coastal zone, the seamless merging of ocean bathymetry and land topography would likely require an overlap of ship and airborne mapping techniques. This would enable the construction of a continuous morphological surface from the seabed to dry land, which would have direct application to modelling the effects of natural phenomena and human activities that impact the land-sea interface, e.g. flooding, ice rafting, shoreline erosion, sea level change, beach fouling, etc.

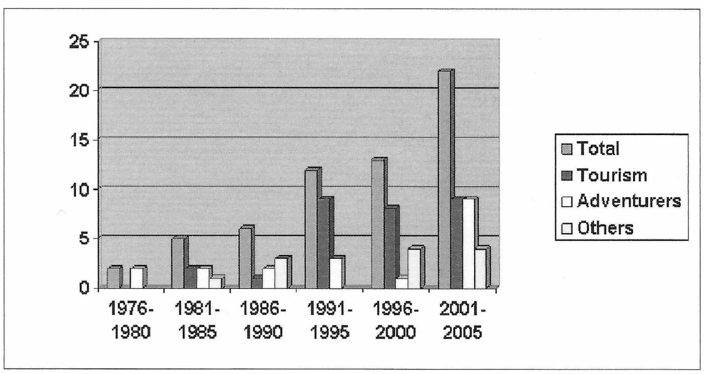
If a comprehensive program to map the land-sea interface were ever initiated, it would be a wise act of environmental stewardship to include concurrent baseline observations of the state of the coastal zone, in order to facilitate the recognition and assessment of subsequent change or damage. In an ideal world, this baseline work would be completed while the archipelagic waterways were still in a relatively pristine condition, and before the growth of shipping left its inevitable mark on the coast.

## Ocean mapping in support of domestic and foreign operations

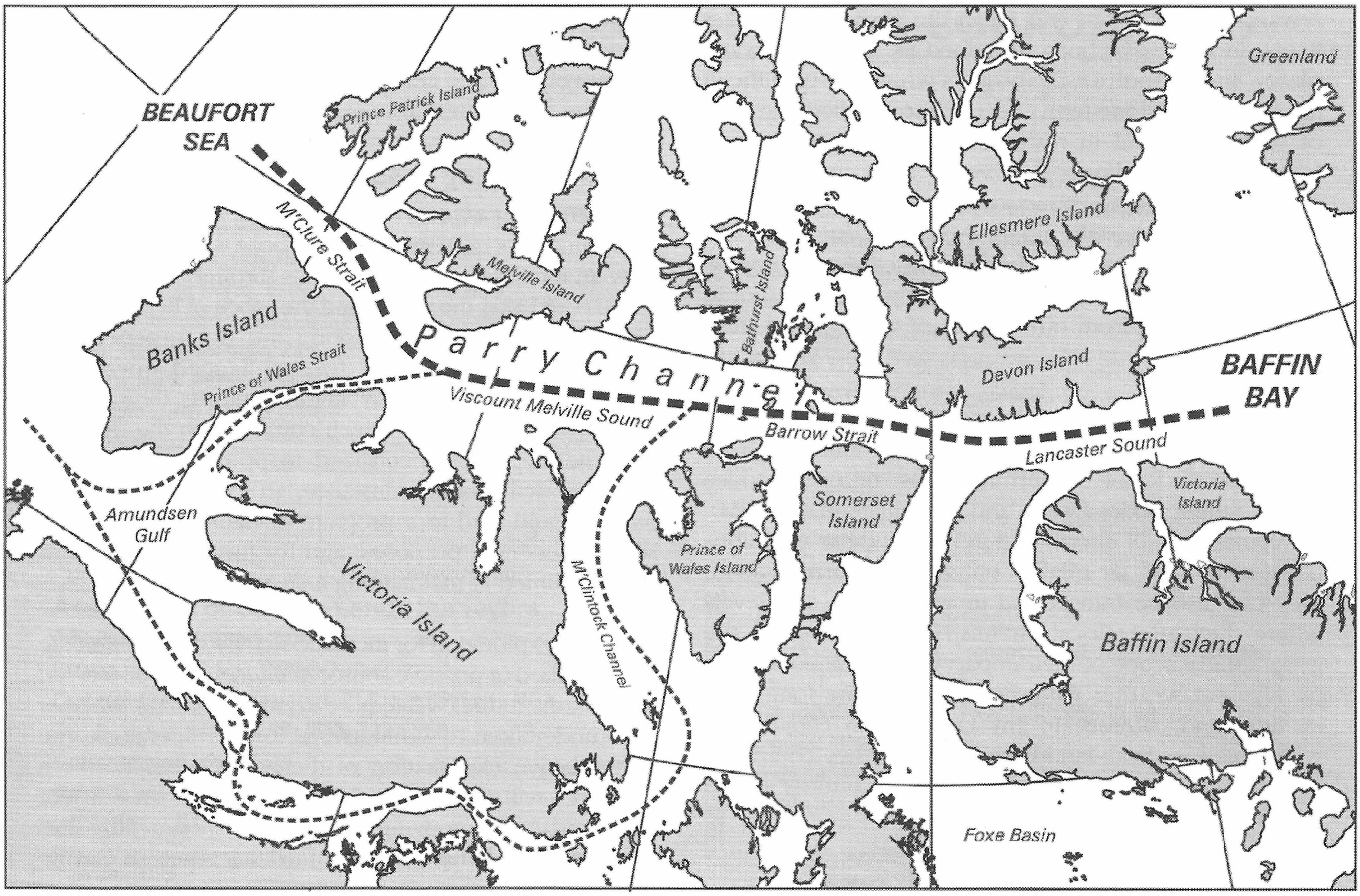
The primary focus of this essay has been to consider briefly how an increase of foreign transits through the Canadian Arctic could alter the nature and the scope of hydrographic operations. Also worth noting are the prospects of additional Canadian- and foreign-flagged operations that would not necessarily involve transits through the Northwest Passage, but which could widen the demand for other types of specialized mapping in support of industrial activities. For instance, an expanded northern fishery could lead to a program of habitat mapping for stock assessment purposes, and for the development of policies aimed at maintaining a sustainable harvest.

Similarly, exploration for methane-rich hydrates within the Arctic seabed (a possible source of energy in an oil-starved world of the future) will require detailed mapping, whether it be undertaken by Canadian or foreign operators. The cost-effective exploitation of these and other northern resources will depend on the availability of an efficient infrastructure for moving material from extraction sites to coastal or offshore loading facilities where it can be

| Five-year interval | 1976-1980 | 1981-1985 | 1986-1990 | 1991-1995 | 1996-2000 | 2001-2005 |
|---|---|---|---|---|---|---|
| *Total* | 2 | 5 | 6 | 12 | 13 | 22 |
| *Tourism* | | 2 | 1 | 9 | 8 | 9 |
| *Adventurers* | 2 | 2 | 2 | 3 | 1 | 9 |
| *Other* | | 1 | 3 | | 4 | 4 |

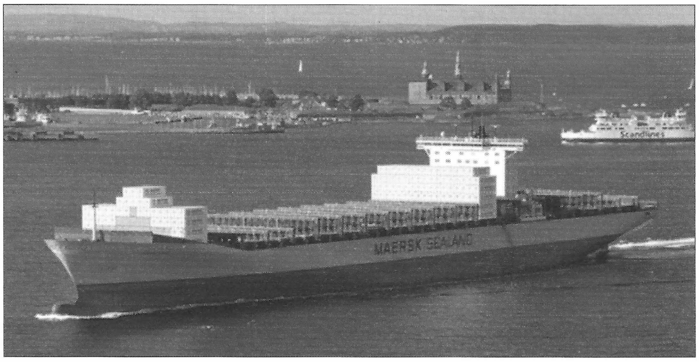



***In the thirty years since the mid-70s, foreign vessel traffic in the Canadian Arctic has increased more than tenfold: from two in 1976-1980 to 22 in 2001-2005. In the Table and Graph above, 'Tourism' refers to passenger and icebreaking vessels that have transited the Northwest Passage during the course of sightseeing expeditions. 'Adventurers' are privately-owned sailing yachts. 'Others' are icebreakers on transit, escort, or research duty, and vessels such as icebreaking tugs engaged in commercial operations.*** *(Statistics from Pharand, 2007)*




*Map of the Canadian Arctic Archipelago displaying Parry Channel, along with its constituent bodies and tributary channels. The thick dashed line represents a potential route for international shipping if permitted by ice conditions in M'Clure Strait. The thin dashed lines illustrate two alternative routes for bypassing M'Clure Strait, but these might be less attractive to international shipping concerns on account of their increased length and more restricted waters. (From the Fall/Winter Issue of Meridian, the Newsletter of the Canadian Polar Commission)*

*The Argo Merchant aground off Nantucket Island, December 1976, in the process of losing some 27,000 tons of fuel oil. Accidental oil spills such as this are rightly perceived as catastrophic, but in fact they represent only a fraction (ranging from one quarter to one sixth) of the total oil that is dumped into the ocean on an everyday, operational basis by vessels engaged in bilge cleaning or in the discharge of machinery wastes. (Photo from the response/restoration website of NOAA)*



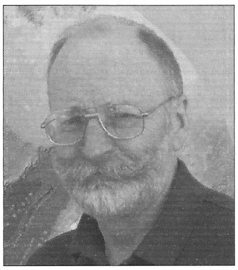

*The Albert Maersk, commissioned in 2004 and capable of carrying nearly 7,000 20-foot containers. In 2006, an even larger sister ship was launched: the Emma Maersk, the largest container ship in the world, capable of carrying up to 11,000 containers. Could either of these vessels set course some day for northern waters? (Photo from the website of the Maersk Line)* transferred to market-bound vessels. The builders of this infrastructure will need to take into account the barriers that are posed by rugged terrain on land, and by similarly complex seafloor morphology.

Increased activity in the north, whether it involves Canadian or foreign vessels, may entail the establishment of shore facilities that require reliable and wide-reaching communications systems; this could entail the laying of undersea cables, preceded of course by detailed surveys to determine the optimum routing.

## Conclusion

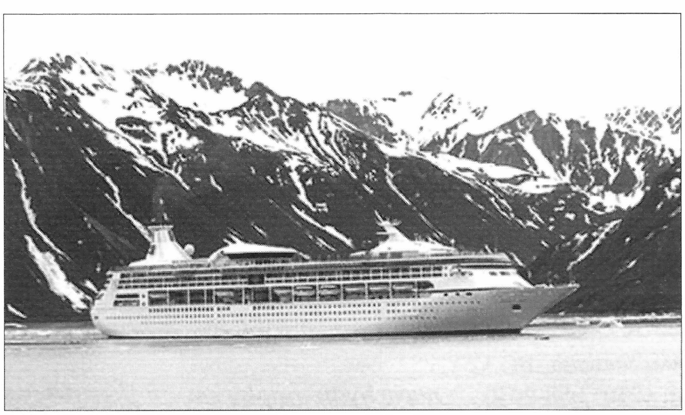
To sum up: it seems reasonable to conclude that the growing presence of foreign vessels in the Canadian Arctic, coupled with the prospect of increased domestic activity, will likely spawn a keen interest in developing detailed and comprehensive bathymetric information that goes beyond ensuring the safety of navigation. In this context, it would appear that an expanded role awaits Canada's northern hydrographers. There is no doubt that they possess the skills and the expertise that will enable them to rise to the challenge. LH

## About The Author...



**Ron Macnab**, a retired marine geophysicist and former DFO Science Alumnus, maintains an active interest in ocean mapping and in the implementation of UNCLOS Article 76 in different parts of the world. He is a member of the Canadian Polar Commission, chairman of the IASC/IOC/IHO Editorial Board for the International Bathymetric Chart of the Arctic Ocean (IBCAO), and past chairman of the IAG/IOC/IHO Advisory Board on the Law of the Sea (ABLOS).

*Remains of a seabird which perished after ingesting a quantity of plastic debris that it mistook for food. The casualty rate for wildlife is unlikely to decrease as long as vessel operators consider the ocean to be a convenient dumping ground for shipboard garbage. The Arctic Ocean may not be as afflicted now as the rest of the world's oceans, however the risk exists for further proliferation. (Photo from the website of bestlifeonline.com)*



*Harbinger of a growing trend: a passenger liner sailing close inshore to give all on board a close-up view of the northern scenery. (Photo courtesy of Larry Mayer and NOAA)*

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

(Established. 1992 / Établie en 1992)

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

Application Criteria

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

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

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

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

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

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

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

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

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

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

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

Critères d'admissibilité:

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

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

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

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

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

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

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

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

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

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

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

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

# Marine Electronic Highway: Concept and Opportunities

By: Randy Gillespie, Marine Geoscientist

Marine Electronic Highway (MEH) is a concept that was first introduced in Canada in the mid-1990's following the Exxon Valdez accident. The concept is based on the use of GPS, electronic charts, Automatic Identification Systems (AIS) and other navigation technologies to improve navigational accuracy and, hence, safety of shipping.

The MEH concept was subsequently introduced to the World Bank and Global Environmental Facility as a framework to improve safety of shipping in the Malacca Straits, currently the busiest seaway in the world. Discussions with the governments of Singapore, Malaysia and Indonesia ensued, and the International Maritime Organization (IMO) were engaged as the 'executing agency' for a demonstration project. The result, after many years of discussion and negotiation, is an MEH demonstration project for Straits of Malacca and Singapore, funded by the Global Environmental Facility (GEF).

In the meantime, others have begun the process of applying the MEH concept to other waterways, most notably the Gulf of Honduras and Western Indian Ocean (Mozambique Channel). In each case the programs are similar in concept to the Malacca/Singapore MEH, although the scope and priorities of each is slightly different.

Canada is well placed, technically, to respond to opportunities arising from these major programs. However, the size and complexity of these programs, combined with the political and bureaucratic nature of the approval process, means that a strategic, public-private partnership approach is needed in order to maximize commercial success.

## MEH Concept

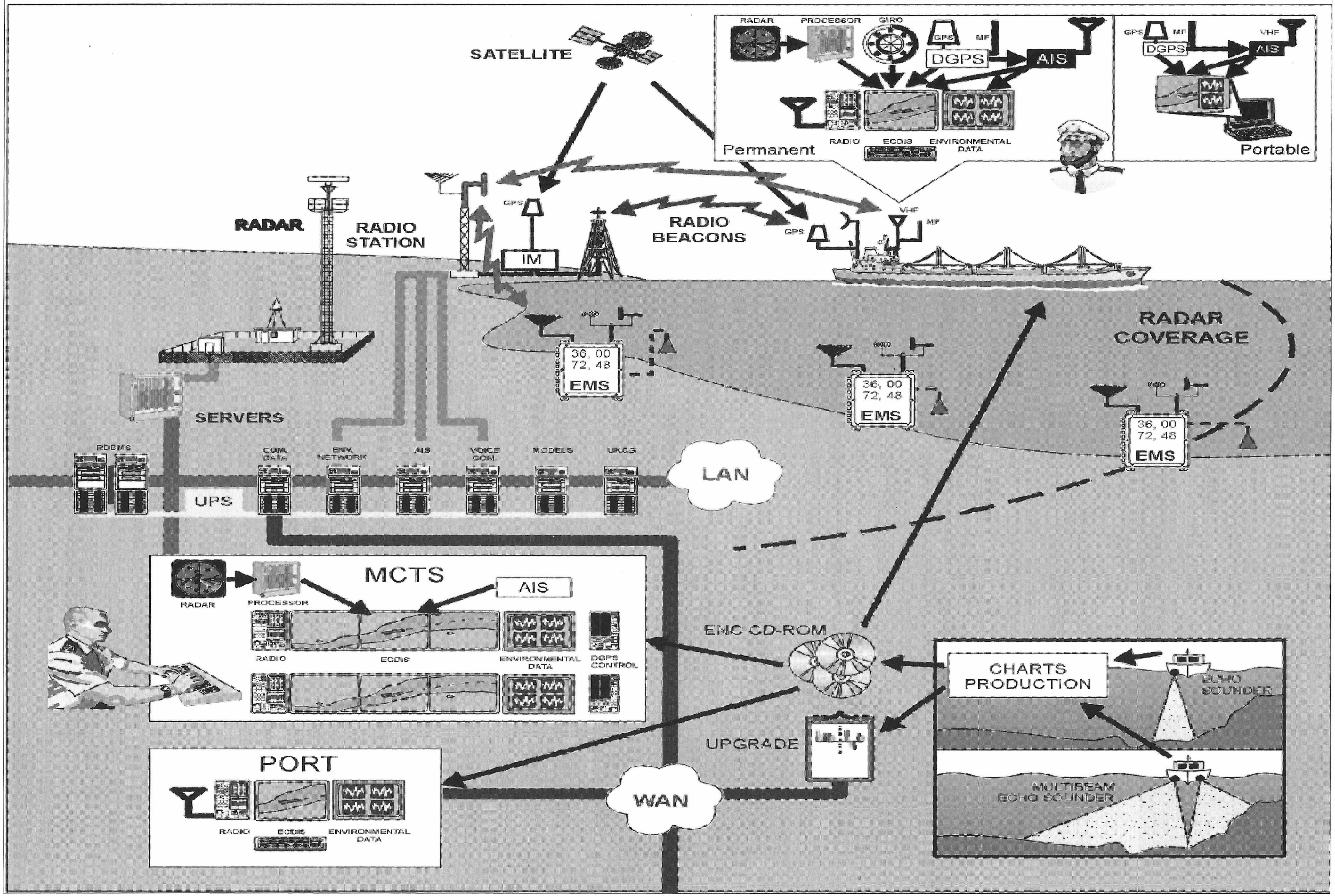
According to Transport Canada, marine electronic highway is "a broad term describing the enabling effect of technology employed to assist in the real time navigation of ships utilizing the provision of information on weather routeing, tides, currents, winds, waves and ice." The World Bank describes MEH as "a global information infrastructure ... which enables precision navigation, enhanced environmental protection of marine and coastal habitats and regional knowledge transfer." This latter definition is more in keeping with the increasingly accepted notion of the MEH concept.

Marine electronic highway represents the integration of detailed bathymetric data, electronic navigational charts (ENCs), electronic chart display and information systems (ECDIS), real-time environmental monitoring networks (wind, water levels, currents, waves), automatic identification systems (AIS), wide area telecommunications networking (largely wireless) and various data models and applications to deliver useful information in a timely fashion to a broad base of maritime users. GIS is a spatial data analysis tool that is being widely used by environmental and natural resource managers for storing and analysing spatial and temporal data on coastal and marine resources and ecosystems. However, it is also recognized that while GIS provides the software tools to analyse spatial data and produce information products, the majority of people who need this information are not themselves experts in the use of GIS. Thus, the value of deploying an integrated suite of information technologies to serve the information needs of a cross-section of non-expert users (i.e. an 'information infrastructure') is obvious.

It should be noted that MEH is but one in a long line of marine navigation 'information infrastructure' concepts that includes:

- INNAV (CDN)
- Marine Geospatial Data Infrastructure (MGDI) (CDN)
- Integrated Marine Information Infrastructure (CDN)
- Physical Oceanographic Real Time System (PORTS) (US)
- Information Seaway and SmartBay (CDN)
- Motorways of the Sea (EU)
- e-Navigation (UK)

# Information infrastructure (MEH)



The MEH goal may be summarized as: "Simple access by mariners to data and information that support safety and efficiency of marine operations and protection of the marine environment and resources". This goal may be alternatively stated as: "To deliver the right information to the right person at the right time" (pers comm, Capt. John Pace). In other words, any person with a legitimate need for data or information must be able to acquire it quickly regardless of where it is or where that person is physically located. In addition, each user should be able to add to the picture as operations develop or situations change.

Easy access to up-to-date information leads to better tactical and strategic decision-making:

- Safe and efficient marine transportation
- Environmental protection
- Marine resource management
- Maritime security

*[Note: It is noteworthy that maritime security was not a priority benefit in the early days of MEH development, but has steadily moved up the priority ladder in light of recent events (9/11 and increased incidents of piracy on the high seas).]*

In order to be successful in a global context, MEH implementation should follow a number of basic principles:

- An integrated, interoperable, extensible, service-based infrastructure providing secure access to maritime data and information services.
- A series of regional networks within a global architecture.
- Built to internationally recognized standards (ISO, S-57) and specifications (OGC, IEC).
- Incorporating existing data and information systems (e.g. ENC's, DGPS, AIS, VTS)
- Following the principle of 'Collect data once, use many times' (e.g. hydrographic charts)

## Background:

When the *Exxon Valdez* grounded in 1989 it caused one of the worst maritime oil spills in history. It was subsequently shown that if the vessel had been using an electronic chart system (at that time, electronic charts and electronic chart systems were conceived, but not yet developed) then such system could have triggered as many as four separate alarms to warn the ships officers of a problem, and the accident may have been avoided.

In 1991, the Canadian Hydrographic Service (CHS) undertook the first systematic programme to support the development and production of electronic charts for Canadian waters. This programme was driven in part by the Exxon Valdez debacle, and in part by demand from the shipping industry on the St. Lawrence and Great Lakes. Through this programme, Canadian industry took a leadership position in the production of electronic chart data and in the development of electronic charting systems.

In 1995, following more than two years of operational experience in Canadian waters, Canada Steamship Lines (CSL) reported that every one dollar invested in electronic charts and real time GPS navigation technology resulted in a savings of eight dollars through improved safety of navigation (lower insurance costs) and improved efficiency of operations.

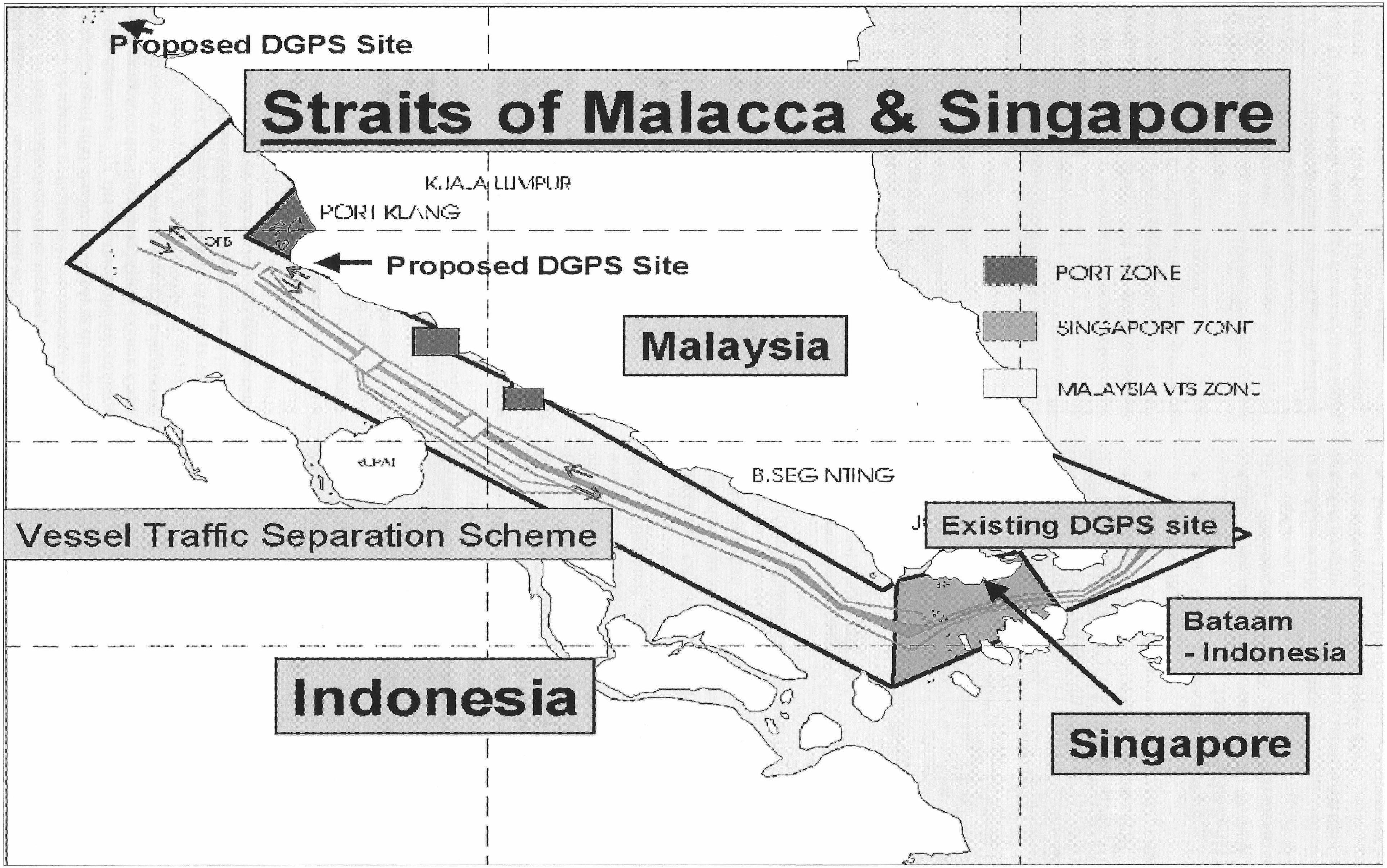
The term 'Marine Electronic Highway' (MEH) was coined by Neil Anderson, Director – Research, Canadian Hydrographic Service, in the early 1990's. The concept centred on the use of emerging electronic chart and electronic charting system technology to improve safety of navigation at sea. By the late 1990's, in large part due to efforts by CHS and Strategic Ventures Corporation (New Brunswick), US$25M had been nationally allocated by the Global Environmental Facility (GEF) for an MEH project in the Straits of Malacca and Singapore. In September 2006 the International Maritime Organization (IMO) finally announced funding support in the amount of US$6.86M equivalent from GEF for the Straits of Malacca and Singapore MEH pilot project. In addition, funding was recently announced for a MEH-type project in the Gulf of Honduras.

## Matching capability with opportunity:

Most elements of the MEH already exist and in many cases, Canadian companies, government agencies and universities are recognized leaders in the development and commercialization of these technologies.

Component technologies and services (and corresponding Canadian suppliers) include:

- GPS/DGPS – ICAN (NL), Nautel (NS), Seaforth Engineering (NS)
- Hydrographic surveying – Fugro Jacques Geosurveys (NL), Canadian Seabed Research (NS), Terra Remote Sensing (BC), Optech (ON), Seaforth Engineering (NS)
- Multibeam sonar data acquisition/processing – Fugro-Jacques Geosurveys (NL), Canadian Seabed Research (NS), CARIS (NB), Quester Tangent (BC), Helical Systems (NS), IVS3D (NB), CIDCO (QC)
- Electronic Charts – NDI (NL), GeoNet (PE)
- Electronic Chart Systems – ICAN (NL), Offshore Systems (BC)
- Electronic Chart Production Software – CARIS (NB)
- Real time monitoring (water levels, currents, etc.) – Satlantic (NS), AXYS (BC), Multi-Electronique (QC)
- AIS – ICAN (NL), Xanatos (BC)
- Geographic Information Systems – CARIS (NB)
- SatComm – Stratos Global (ON)
- Spatial Data Infrastructure – Cubewerx (QC),


Proposed DGPS Site
Straits of Malacca & Singapore
K.JA.A LUMPUR
PORT KLANG
Proposed DGPS Site
Malaysia
PORT ZONE
SINGAPORT ZONE
MALAYSIA VTS ZONE
B.SEG NTING
Vessel Traffic Separation Scheme
Existing DGPS site
Bataam
- Indonesia
Indonesia
Singapore

Swiftsure (BC), Holonics (QC), Intelec (QC); Sunertek (QC)
- Training – multibeam sonar (data acquisition/processing), ENC production, seabed classification, oil spill response, etc., etc., etc.

In addition to opportunities for Canadian SME's to supply goods and services to emerging MEH projects and programs, there is also a significant role for universities and government agencies. In particular, the Ocean Mapping Group at UNB, Innovation Maritime/ISMER (QC), the Marine Institute (NL) and the international business development centres at Acadia and Memorial University of Newfoundland could play important roles in supporting research and training at various levels. As well, the Government of Canada, particularly the Canadian Hydrographic Service and Geological Survey of Canada, have important roles not only in relation to their technical expertise, but also because of government-to-government linkages that may be required. Efforts by government agencies to strengthen regulatory and institutional frameworks can result in country-to-country relationships that often translate into commercial work for private sector interests.

## International Project Opportunities:

### Straits of Malacca and Singapore

The marine and natural resource managers of the ocean and coastal areas of South East Asia are experiencing significant and urgent challenges, including movement of populations to coastal areas and steady increases in maritime traffic. [The Straits of Malacca and Singapore are the busiest sea-lanes in the world, handling over 60,000 vessel transits each year]. The ensuing threats to the coastal and marine environment from ship-based wastes, non-indigenous species introduction, improper ballast water discharge, and shipping accidents due to an aging navigation infrastructure are all of concern. The MEH program is aimed at using innovative technological tools to create, network and maintain a marine information infrastructure that can greatly assist both public and private sector stakeholders. The highly congested maritime traffic lanes and environmentally rich coastal areas of the Straits of Malacca and Singapore led to the identification of critical and manageable areas as the initial focus of what can become a regional system, stretching from the Persian Gulf through the Chinese Seas to the Yellow Sea and the Sea of Japan. The principal objective of the GEF-funded demonstration project is to implement, through an 'appropriate institution' a regional MEH, commencing in the Straits of Malacca and Singapore, which will be an essential tool for marine pollution prevention, marine pollution control, marine environmental planning and management, as well as safety of navigation (Note: no reference to security). The MEH will serve as a global information infrastructure prototype that enables precision navigation, enhanced environmental protection of marine and coastal habitats and regional knowledge transfer.

*[Source: http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/ENVIRONMENT/EXTCMM/0,,contentMDK:20538130~menuPK:1261591~pagePK:148956~piPK:216618~theSitePK:407926,00.html]*

### Gulf of Honduras

The goal of this project is to reverse the degradation of the coastal and marine ecosystems within the Gulf of Honduras, by enhancing the control and prevention of maritime transport-related pollution in the major ports and navigation lanes, improving navigational safety to avoid groundings and spills, and reducing land-based sources of pollution draining into the Gulf.

Specific objectives of the project are to:

i. create and consolidate a regional network for land-based and maritime pollution control within the Gulf of Honduras, including the formulation of institutional and economic arrangements that will assure the sustainability of the action program;

ii. develop the long-term capacity for gathering, organizing, analyzing and disseminating marine environmental information, as a complement to the Meso-American Barrier Reef System Regional Environmental Information System;

iii. enhance navigational safety in key ports and approaches with the goal of reducing marine environmental pollution associated with both operational and accidental discharges at sea;

iv. improve environmental management in the regional network of five ports within the Gulf of Honduras through preparation and implementation of environmental management investment and action programs, including demonstration pilot activities and involvement of the private sector.

A key outcome anticipated is the replication and regional adoption in Central America of innovative technologies for pollution prevention and control by the private and public sectors. In particular, expanded regional communication networks for navigational safety and surveillance and enhanced capacity for processing of hydrographic data and production of electronic navigational charts (ENC's). Efforts will be made to build regional interest in establishing a *marine electronic highway* as an essential tool for marine pollution prevention and control and environmental protection of highly sensitive ecosystems.

*[Source: http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=578783*
and
*http://www.gefonline.org/ProjectDocs/International%20Waters/Regional%20-%20Gulf%20of%20Hondurus%20Maritime%20Transport%20Pollution%20Control/10-08-04%20GEF_Project_Executive_Summary_RS-X1009.DOC]*

### Western Indian Ocean:

The growing population and expanding urbanization and economic activity in the coastal zones are increasingly placing marine and coastal resources under threat. The shipping lanes along the East African coast are among the busiest in the world, carrying over 30 percent of the world's crude oil supplies. At any given time, hundreds of oil tankers, many of them very large crude carriers, transport crude oil from the oilfields of the Persian Gulf and Indonesia to Europe and the Americas via the Mozambique Channel. Over 5,000 tanker voyages per year take place in the sensitive coastal waters of Comoros and Madagascar and along the coast of East Africa, passing in close proximity to the World Heritage site of Aldabra Atoll (Seychelles). Oil and gas exploration programs operating in the region add to the risks. A large oil spill could severely harm the economies of Mozambique, South Africa, Tanzania, Kenya, and the small island developing states by damaging fishing grounds, beaches, and diving and deep-sea fishing areas; disrupting shipping; and shutting down activities that depend on seawater intake.

Countries of the region recognize that they cannot protect their shared marine and coastal resources working alone. Rather they need to work together to improve the safety of navigation through regional waters and to enforce regulations intended to protect fishing and other marine resources from excessive exploitation. They also need assistance to pilot new technologies that have the potential of significantly improving the safety of navigation at a reasonable cost, such as a MEH. The project will help governments achieve their objectives by supporting the creation of a mechanism of regional cooperation and by piloting a MEH.

The design of the MEH has been chosen to take advantage of advances in technology that improve the navigational decision-making of mariners and reduce the costs to levels that make their use feasible in even poor regions. It will be comprised of an integrated system of electronic nautical charts, continuous real-time positioning information, aids to navigation, automatic identification system (AIS), transponders, and provision of real-time meteorological, oceanographic, and navigational information. Ship masters will use the information to guide their ships safely through these busy shipping lanes. Shore-based authorities will use the information to precisely identify and track ships. The marine electronic highway will therefore be a valuable tool for preventing and controlling marine pollution and ensuring the safety of navigation. It will also be a valuable tool for monitoring fishing activities and for enforcing regulations and international agreements intended to ensure sustainable management of fisheries and other marine and coastal resources.

*[Source: World Bank Project Brief on a proposed grant from the Global Environmental Facility Trust Fund in the amount of US$11 million dollars (on behalf of governments of Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa and Tanzania) for a Marine Highway Development and Coastal and Marine Contamination Prevention Project, July 18, 2005.]*

## Selected Bibliography:


### Straits of Malacca and Singapore:

MEH Concept Document (IMO):
http://www.imo.org/includes/blastDataOnly.asp/data_id%3D3668/marineelectronichighwayarticle.pdf

WB/GEF Project Information Document:
http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2006/07/20/000104615_20060720094732/Original/PID010201July106.doc

WB/GEF Project Appraisal Document:
http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187511&siteName=WDS&entityID=000160016_20060516105612

IMO General Procurement Notice:
http://www.imo.org/includes/blastDataOnly.asp/data_id%3D14959/GPN-IMOFVWP.pdf

### Gulf of Honduras:

IDB Project Page:
http://www.iadb.org/projects/Project.cfm?project=RS-X1009&Language=English

IDB Project Document:
http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=578783

GEF Project Database:
http://www.gefonline.org/projectDetails.cfm?projID=963

COCATRAM Project Page:
http://www.cocatram.org.ni/gulfofhonduras/index_eng.html

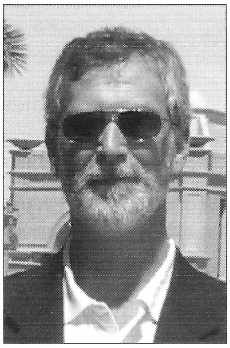
COCATRAM Project Brief:
http://www.cocatram.org.ni/gulfofhonduras/docs/pwd/project_brief_eng_03252004.pdf

IDB Procurement Plan:
http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=775123

### Western Indian Ocean

World Bank Project Brief on a proposed grant from the Global Environmental Facility Trust Fund in the amount of US$11 million dollars (on behalf of governments of Comoros, Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa and Tanzania) for a Marine Highway Development and Coastal and Marine Contamination Prevention Project, July 18, 2005. [Document available via www.ccmc.nf.ca/NOTICES]

## About The Author...



**Randy Gillespie** is a marine geoscientist with over 20 years experience in offshore surveys, satellite and airborne remote sensing, marine ICT sector development, project and program management and international business development. He currently serves as Vice President of Canada Centre for Marine Communication (CCMC) (www.ccmc.nf.ca) and as Managing Editor of the Journal of Ocean Technology (www.journalofoceantechnology.com). Randy has served as a member of the National Action Committee on Ocean Mapping (NACOM) and the Atlantic Coastal Zone Information Steering Committee (www.dal.ca/aczisc), where he introduced the concept of a Coastal and Ocean Information Network – Atlantic (COINAtlantic). He is a past member of the Management Board for GeoConnections, a 5-year, C$60M program to develop the Canadian Geospatial Data Infrastructure (www.geoconnections.org). In addition, he co-founded and served as co-chair of the Marine Advisory Committee for GeoConnections I. He is a member of the Professional Engineers and Geoscientists of Newfoundland and Labrador Board of Examiners, a past member of the Board for the Alliance for Marine Remote Sensing (AMRS) (www.waterobserver.org) and a Past President of the Canadian Institute of Geomatics (CIG) (www.cig-acsg.ca).

**DID YOU KNOW...**

**Captain James Cook**

Following French attacks on fishing colonies on the south coast of Newfoundland during the Seven Year's War, the British sent Captain James Cook to survey the area. He spent five seasons surveying Newfoundland (1863-67). His work was of such a high standard that some of his soundings are said to still be shown on modern charts. [Source: various sources including, http://www.captcook-ne.co.uk].

**DID YOU KNOW...**

**Odd Numbered Chart Scales**

Original charts for eastern Canada were drawn to a scale that measured inches or fractions of an inch to the nautical mile. In consequence, natural scales were oddly numbered, for example, a scale of 1:108,836 was drawn 'two-thirds of an inch to the nautical mile'. Modern charts are drawn to scales using multiples of 10. A scale of 1:60,000 is common for east coast charts. [Source: The Chartmakers: The History of Nautical Surveying in Canada].

# The New Initiatives Fund-Search and Rescue (NIF-SAR) Project

By: Steve Forbes, Doug Regular and Craig Zeller, Canadian Hydrographic Service (Atlantic Region)

*[Editor's note: This paper was presented at the 2007 United States Hydrographic Conference]*

## Introduction

The Canadian Hydrographic Service (CHS) has been aware, for many years, of a serious lack of modern coastal information on Canadian charts along the Labrador Coast, particularly from Nain to the Button Islands. There are instances of missing or improperly positioned rocks and islands and some coastal features such as fjords that do not have adequate shoreline on current CHS products. They were often created as provisional or reconnaissance charts years ago.

This situation is hazardous to mariners and those involved in Search and Rescue (SAR) missions. Current priorities, resources, and funding have seriously curtailed the effort necessary to address charting this frontier region to modern standards using traditional methods. Therefore, a different approach was needed.

The New Initiatives Fund (NIF) came into being in the late 1990's "to fund worthy proposals to address identified needs in the SAR system for which funding is currently not available from other sources." The fund consists of two components; the financial contribution from NIF and the financial or equivalent in-kind contribution from the proponent. These projects typically run from one to a maximum of three years.

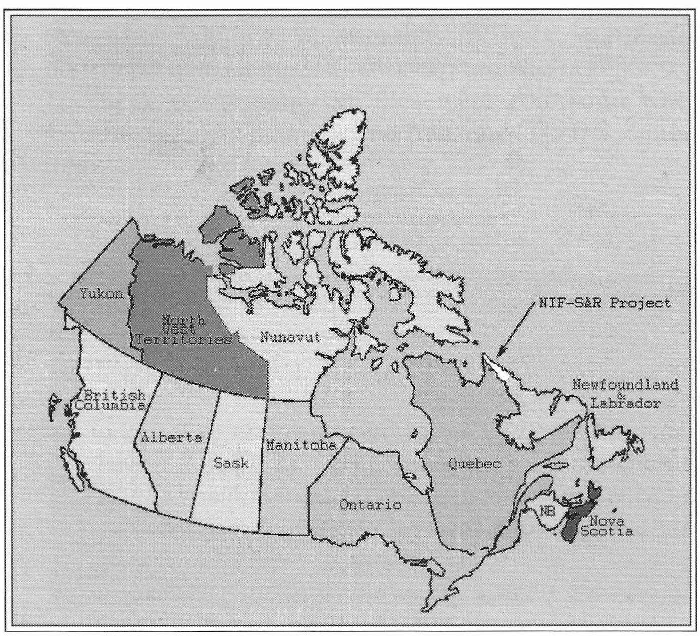



*Figure 1 - Area shaded in white depicts the NIF-SAR Project*

CHS Atlantic Region submitted a multi-year project proposal to NIF in 2002 to address the chart related SAR deficiencies along the Labrador coast. The original proposal called for the use of Radarsat imagery but further analysis determined that the resolution and accuracy would not be acceptable for CHS charting standards at a scale larger than 1: 60,000. In a follow up proposal, the option of using air photography was investigated and it was found that, by using GPS-controlled high resolution aerial photography to map the coastline from Nain to the Button Islands, the expected accuracy was an acceptable ±6m. This three year proposal received approval in 2003. However, due to inclement weather which delayed the collection of the aerial photography, the project was extended for one year.

Figure 2 shows the Labrador coastline and the proposed flight lines to collect the aerial photography used to generate the digital shoreline.

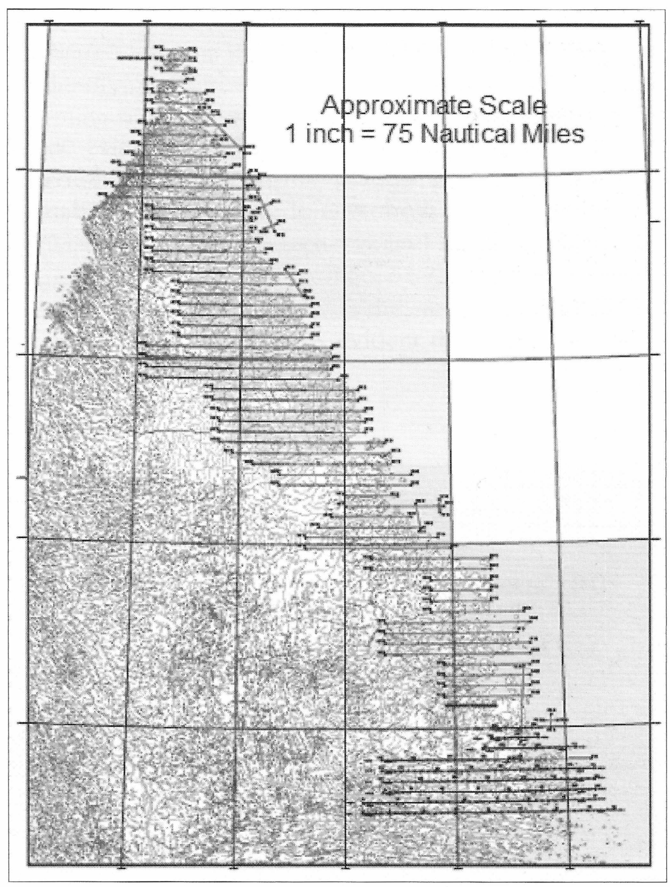



*Figure 2 - The Area to be Surveyed and the Proposed Flight Lines for Aerial Photography. The total flight lines flown was 4,400 kilometres.*

As part of the project proposal, CHS Atlantic, the Survey and Mapping Division (SMD), Newfoundland and Labrador and NIF developed a Memorandum of Understanding (MOU). CHS Atlantic had successfully contracted the SMD office in past years to deliver vector shoreline information for Newfoundland and Labrador derived from aerial photography. Their specific role in this project under the terms of the MOU was to provide the technical support, survey and survey equipment necessary to establish the ground control and targets for the aerial photography as shown in Figure 2. In addition they would contract the equipment (aircraft, camera, etc.) to fly the photography and digitally process the photographs to derive and deliver the 1:50,000 vector map sheets to CHS Atlantic. The principal agencies and their responsibilities are shown in Table 1. The Appendix depicts the production flow of the NIF-SAR Project.

| Agency | Affiliation(s) | Role |
|---|---|---|
| National Search and Rescue Secretariat (NSS) | Department Of National Defence (DND), Canadian Coast Guard (CCG), Royal Canadian Mounted Police (RCMP), Transport Canada, Environment Canada, Parks Canada | Project Sponsor |
| Canadian Hydrographic Service (CHS) | Department of Fisheries and Oceans | Project Lead, Hydrographic Surveys, Tidal data acquisition, NIF-SAR product production |
| Surveys and Mapping Division (SMD) | Province of Newfoundland and Labrador | Sub-contract project management, photography, photogrammetry, control, triangulation |

*Table 1 - Agencies and their roles.*

The CHS objectives were to:

1) Deploy five water level stations for a period of at least 30 days to establish vertical datum in these remote areas for proper vertical definition of the high water line.
2) Create five 1:100,000 scale navigation products from the 1:50,000 scale map sheets. These products would contain only shoreline.

*Figure 3 - Ground control established for aerial photography. Okak Bay, Labrador, July 2003.*

## Water Level Data Collection

Tide gauges were installed at Cape Chidley, Hebron Fjord, Brownell Point, Eclipse Channel and Williams Harbour to collect tidal data from which the elevation datum of Higher High Water Large Tide was established to determine the high water line (HWL). They were in place for periods ranging from 4 days at Brownell Point (destroyed by polar bears) to 169 days at Eclipse Channel.

The region's tides are formidable: Ungava Bay has a tidal range of 15.2m, just slightly less than the highest tides in the world at Burntcoat Head in the Bay of Fundy. These tides influence the north eastern coast of Labrador resulting in tidal ranges from 6.5m at Port Burwell in the north, to 2.4m at Hebron in the south. The large tidal ranges made distinguishing underwater features from the photography very challenging, especially if it was high water at time of exposure. Identifying as many navigational hazards as possible from the photos was paramount for providing a safe passage for vessels navigating these previously uncharted or poorly charted waters.

One major challenge for the operation of the tide gauges and for all field operations during this project was the local wildlife. The polar bears in the area were curious and destructive, resulting in missing GPS receivers, batteries and battered or inoperable water level gauges. Even precautionary measures such as securing the gauges as shown in Figure 4, or building enclosures to protect the equipment were not sufficient to completely discourage the bears.

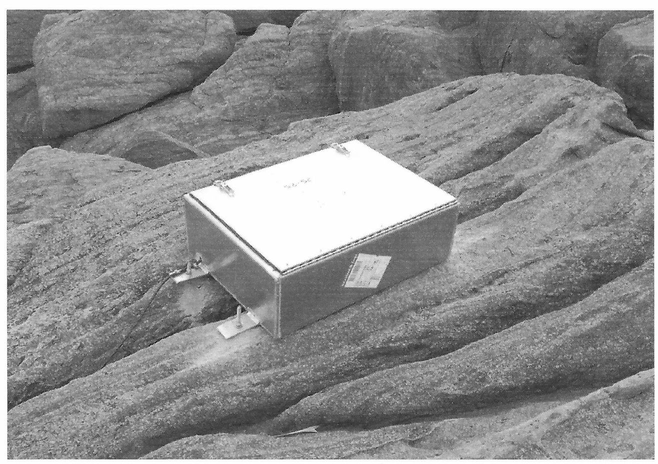


*Figure 4 - Example of tide gauge at Brownell Point bolted to a rock outcrop.This gauge was destroyed by polar bears after this picture was taken.*

## Aerial Photography Collection

The 4,400 km of aerial photography was flown by Air Borne Sensing Incorporated of Toronto, Ontario, using GPS and Inertial Measurement Unit (IMU) corrected photography. These aerial photos are 80cm pixel resolution and collected at a scale of 1:40,000. The final calculated accuracy was 2m which exceeded the CHS requirement of 6m accuracy. These photos were scanned, aerial triangulation (375 models) was performed and shoreline mapping was captured from these aerial photos through contracts managed by SMD. The Newfoundland Surveys and Mapping Division 'tiled' the data into 1:50,000 Universal Transverse Mercator (UTM) map sheets or tiles to match the geographic limits of the existing National Series of Topographical Maps and converted them to CARIS® NTX format – using standard topographic mapping feature codes.

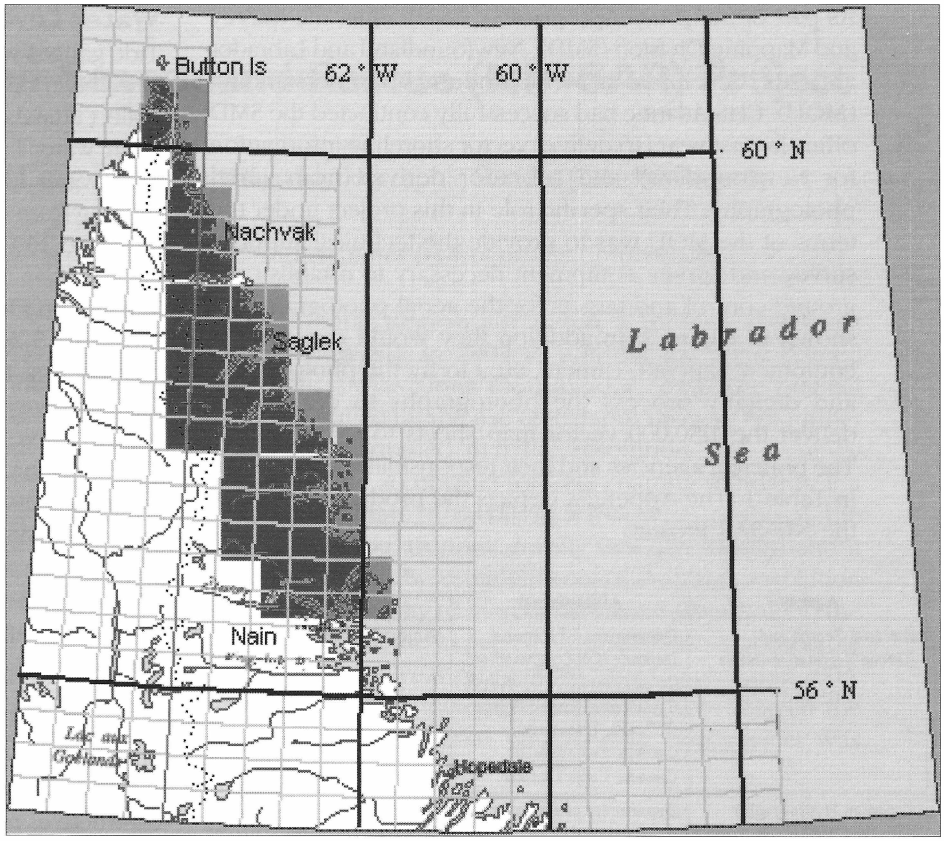



*Figure 5 - Sections shaded in dark gray and medium gray represent the delivered vector tiles.*

In total 55 raw CARIS® NTX vector tiles and approximately 1500 aerial photos in TIFF format were delivered. Of the 55 vector tiles, 39 were required for the new NIF-SAR products and the remaining tiles were archived for later review to augment the modern charting initiatives south of this project area. Fifty percent of the aerial photos were black and white and the remaining photos were in colour with file sizes of 256 megabytes and 750 megabytes respectively. The colour photography was a requirement for Parks Canada as a stakeholder in the aerial photography for this portion of Labrador. The 1500 TIFF images required approximately one terabyte of storage. This volume of data presented file processing and archiving challenges. CHS project staff reviewed the data for integrity, converted the data to CHS source format and the quality control/ aerial photo review was completed.

## Data Integrity Review

This process involved a quick comparison of raw vector files with the aerial photographs to determine if the horizontal positioning and data capture was acceptable. To check positioning, the files were compared with existing topographic maps and horizontal control values from CHS field data.

It became evident that the contractor lacked expertise in identifying features within the inter-tidal area. More unsettling was the absence of many High Water Line (HWL) features (islands). CHS does not have photogrammetric processing capabilities so it was decided to create examples of this missing data through image captures of the aerial photos and vector files and return them to the contractor for reprocessing. Figure 6 shows the raw data from the contractor. Figure 7 is the same area shown on the aerial photography. It is evident that some off lying rocks were not captured.

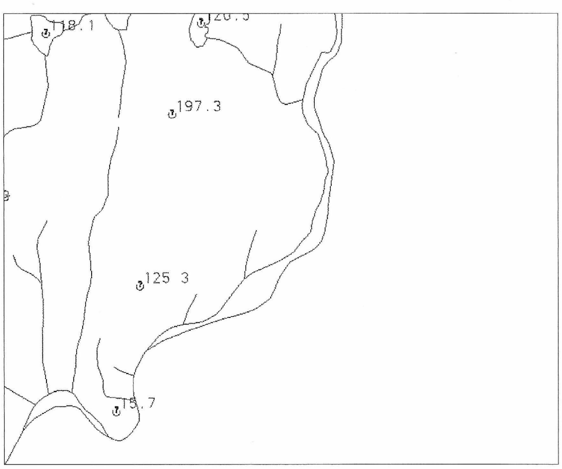
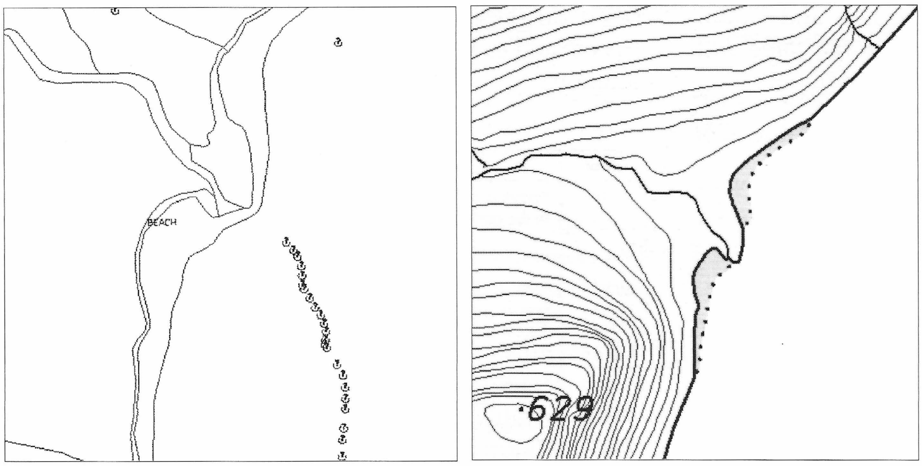



*Figure 6 - Raw data from the contractor.*

*Figure 7 - Same area shown on the aerial photography.*




*Figures 8a and b - The file from the contractor showing a string of features is shown on the left. On the right, the edited file with features removed. Examination of aerial photograph determined that they were not real.*

The contractor was instructed that even if they were unsure of a feature within the inter-tidal area (due to turbidity in the water) they should capture the feature. The CHS could then make a determination as to the validity of that feature and if warranted remove it. It is easier to delete a feature, if the CHS' best determination was that it did not exist, than to try to digitize the information accurately from the aerial photograph. CHS has at its disposal the existing topographic maps, older source data, navigational charts, newer multibeam surveys and trained field hydrographers to support the validation of the existence of inter-tidal features.

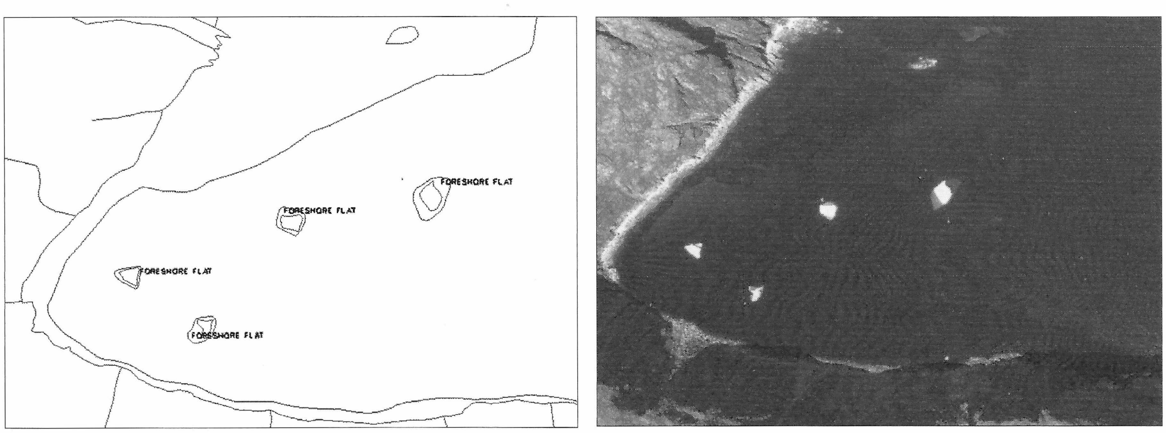
Figures 8a and 8b depict a series of features, oriented roughly north-south, that were determined to be artifacts and these were removed from the file. Although the aerial photos appear to show features in this area, it was determined that this was turbidity in the water and the feature was removed from the file.

Another example is the data capture of obvious icebergs in the area. Figure 9a shows the raw data from the contractor with the digitized "islands" in the bay. The aerial photo of this same area (Figure 9b) clearly shows these features are icebergs; hence the "islands" were removed from the file.

The rework of the first delivery had fewer omitted features but the vector map sheets still did not properly represent the features visible on the aerial photographs Due to time constraints and the requirement for a CHS review it was decided, for this scale product (1:100,000), to capture missing data features from the photos and construct the NIF-SAR products. These new features were flagged so that they could be photogrametrically captured by the contractor for use in large scale charting.

## Converting to CHS Source Data Standard

The 1:50,000 scale vector files were delivered as a conversion from ESRI ArcView .SHP (or 'shape' files) to CARIS® NTX and included a list of ESRI feature codes and their respective definitions. The CHS was required to identify the required data and convert those feature codes to the CHS source data standard. Each file contained up to 22 feature codes but only 10 were needed for CHS charting and the remainder were removed. The feature codes that were not required either had no significance for vessel navigation (e.g. marsh areas or symbols) or consisted of topological information specific to SMD data formats (e.g. polygon labels or text). Once feature codes were converted or removed, the header files were reviewed




*Figures 9a and b - Raw data from the contractor and the digitized "islands" are really icebergs.*

to ensure they contained proper projection and datum parameters and to incorporate the digital file titles and CHS specific source document identifying numbers.

## Data Validation

The vector files were validated by comparing them with the scanned raster aerial photography data using a dual monitor system, with each file shown in its respective application i.e. CARIS® and Adobe Photoshop.

A feature that was digitized by the contractor was removed from the file if CHS determined that it did not exist. The removal was done only after evaluation and comparison of all available data sources (charts, field data and topographic maps). If a feature had to be added, then the aerial photos were rubber sheeted to fit the vector tiles using conspicuous shoreline, as horizontal control points, that were easily identifiable on both the aerial photo and vector data.

Determining the existence or non-existence of features above the high water line was a more reliable and conclusive process because they could easily be identified on the aerial photo. However, features below the high water line were far more difficult to verify and other data (e.g. charts, topographic maps or field surveys) were used to help make a final determination. The use of older charts presented additional challenges:

1. The charts were on unknown horizontal datums.
2. The earlier positioning methods were inaccurate and the relative positions of features could be in error by as much as one nautical mile.
3. Doubtful dangers that had been previously charted were never adequately positioned and/or had their existence confirmed.

Based on these challenges, a decision table (Table 2) was created to help identify the 'condition' and preferred 'solution':

| Case | Condition | Solution |
|---|---|---|
| 1 | Feature is on the new validated shoreline but not on the existing topographic maps or CHS chart. | Use it. Qualifications like Existence Doubtful (ED)or Position Approximate (PA) can be used if uncertain of horizontal positioning. |
| 2 | Feature is above the high water line on the CHS chart or topographic maps but not on the new shoreline. | Delete it. |
| 3 | Feature is below the high water line on the CHS chart but not on the new shoreline or aerial photograph. | Keep it. Qualifications like ED or PA can be used if uncertain. |
| 4 | Feature is on the CHS chart and topographic map and also shown on the new shoreline, but with different symbology on each (i.e. Underwater rock on topographic map, island on chart and dry rock on new shoreline). | Use the new shoreline position with chart representation. |

*Table 2 - Conditions and Solutions.*

The existence of any questionable feature was resolved through comparison to existing topographic mapping, field data, navigational charts and sailing directions. Figure 10 is an example of condition 3, it depicts an underwater rock that is labeled as Existence Doubtful (ED) because it could not be proven that it didn't exist, even though no sign of this feature is seen on the aerial photo. The only sounding data available for the area is shown on the chart and is sparse. Since it could not be disproved it was carried over from the existing chart (CHS 4764) onto the NIF-SAR product until a field survey can be conducted.

The opposite situation was an underwater rock that was positioned with a recent field survey and could not be seen on the aerial photo. The example on the next page (Figures 11a, 11b and 12) depicts a 1.7 metre sounding on a CHS field sheet that was positioned in 2003. The aerial photo clearly shows the small island but no sign of the

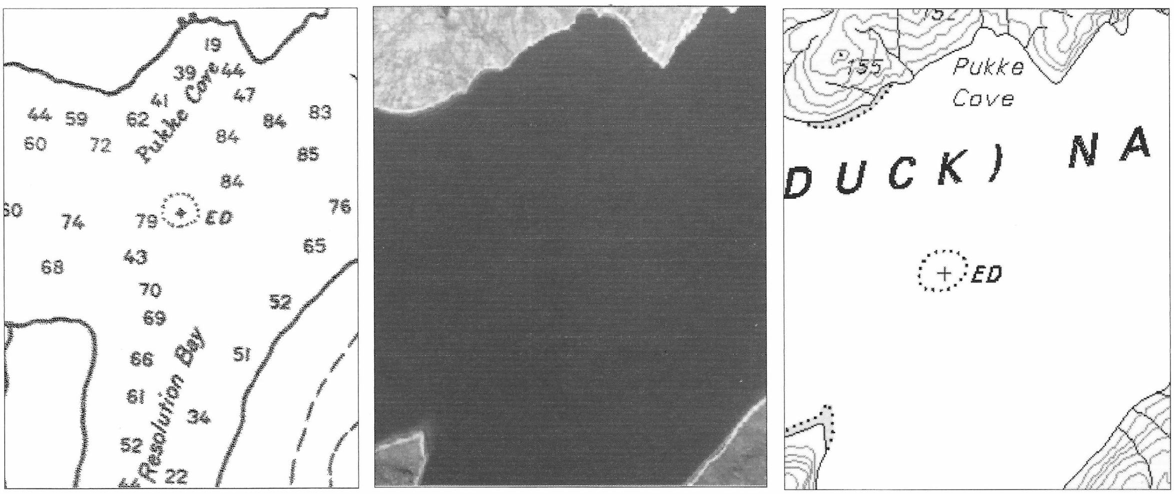
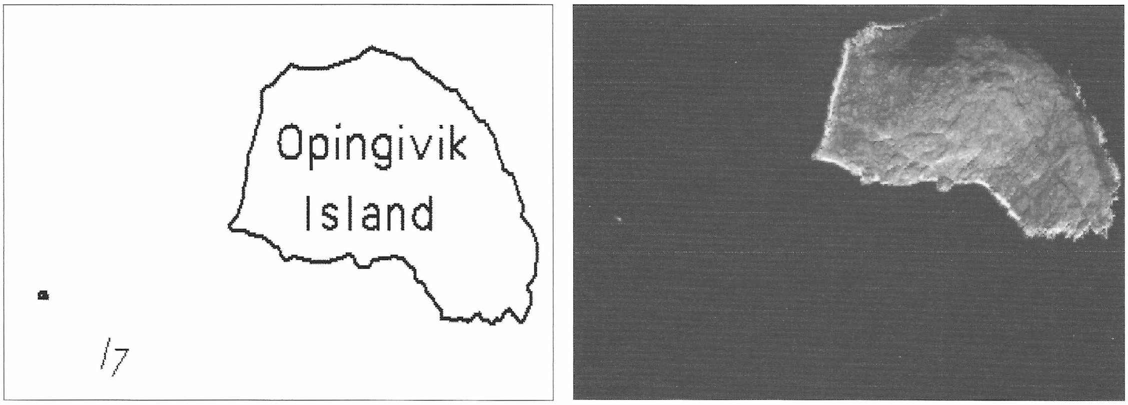



*Figure 10a, b and c - At the left is existing chart 4764, at center is an aerial photograph and the new NIF-SAR Product on the far right. No evidence of the rock was found on the photo, and no new data exists to disprove it. Hence this feature was carried forward onto the new product, until it can be field verified.*




*Figures 11a and b - Field Sheet showing the 1.7m depth positioned in 2003. There is no indication of an underwater rock on the photo.*

underwater rock. Since we are not showing the soundings on the NIF-SAR product this depth or rock was carried forward and portrayed as a crosshair symbol.

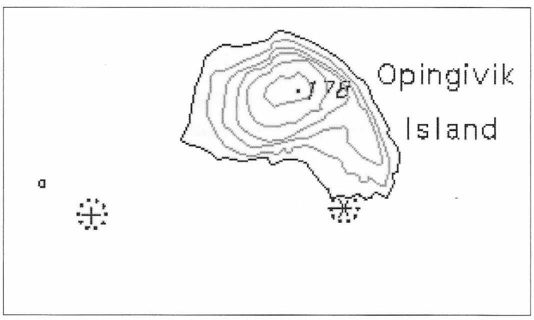



*Figure 12 - To be safe, this feature was carried over to the NIF-SAR product from the CHS field sheet.*

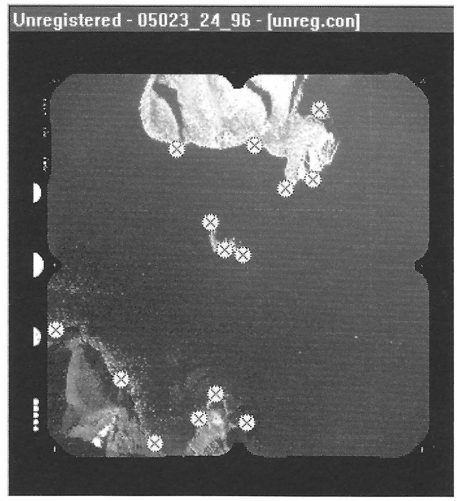



*Figure 13 - Unregistered photograph.*

The software application used to register the aerial photographs with the vector files was CARIS® Control Point Picker (CPP). Common shoreline points were identified on the photo and vector shoreline. These points were used to rubber sheet the photograph to the vector file. The registered photograph could then be placed in the background, visible through the vector file so that the required features could be digitized. The images in Figures 13, 14 and 15 show CPP images of the unregistered aerial photograph, the corresponding vector file, and the resulting registered photo behind the vector file.

Figure 16 depicts a test of the digitizing accuracy performed for the CHS rubber sheeting by comparing a field positioned rock (gray) against the same rock digitized from an aerial photograph rubber sheeted to fit the shoreline that was received from the contractor (black).

The rock was field positioned in September 2003 by the *CCGS Matthew* using Differential GPS and has coordinates 57-47-07.452N, 61-54-25.172W. The same rock, shown in red, digitized by the CHS from the rubber sheeted aerial photo has coordinates 57-47-07.467N, 61-54-24.659W.

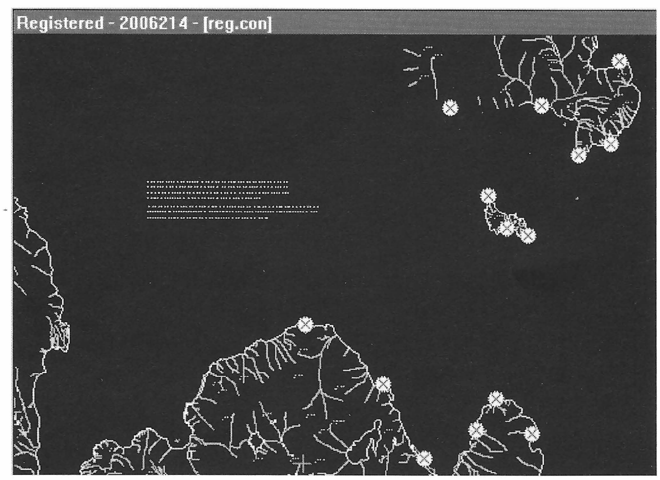



*Figure 14 - Same area on new vector shoreline.*

This difference is 8.5m and at the final product scale of 1:100,000, it represents a 0.085mm discrepancy. This was not a comprehensive test but it indicated that with well defined evenly distributed shoreline points the subsequent data capture can provide good results.

On project completion, 107 photos were registered and over 700 features were digitized from those photos.

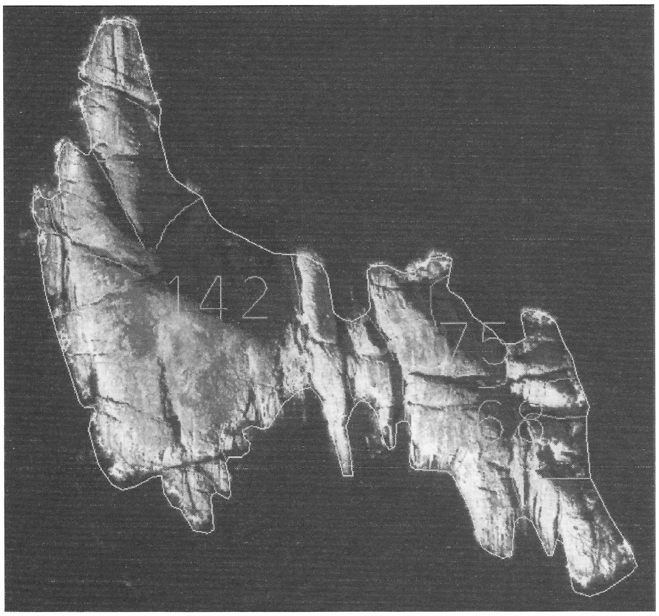


*Figure 15 - Registered photograph with vector shoreline.*

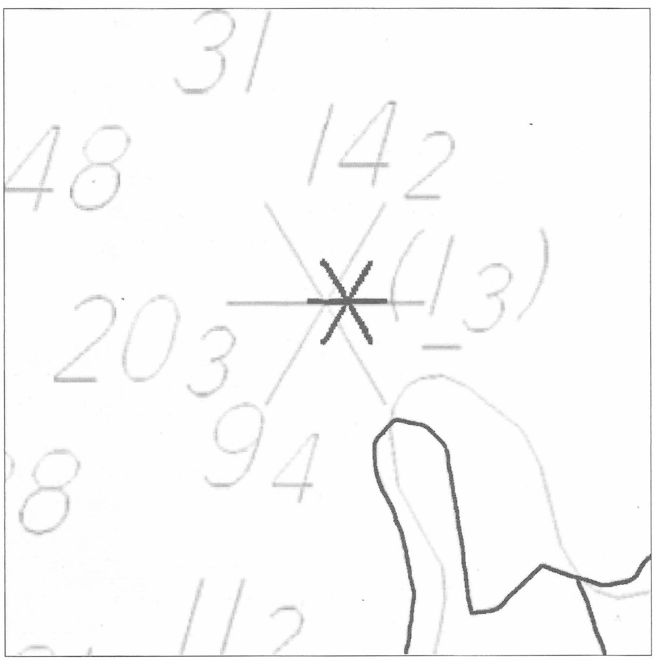


*Figure 16 - Gray data from CHS field sheet 1001405 surveyed in September 2003 using Differential GPS. Black data from aerial photograph. Shoreline (black) digitized via contractor, rock (*) digitized by CHS 'rubber sheeting'.*

## The NIF-SAR Product

Once the 1:50,000 vector map sheets were validated against the aerial photographs the construction of the products began. The 1:50,000 vector files were used to create five 1:100,000 scale products for the National Search and Rescue Secretariat (NSS). These NIF-SAR Products were constructed using CHS ISO standard chart production procedures and chart specifications; however, these products are not official CHS charts for general public use. Rather, they are specifically designed for Search and Rescue Efforts. They are designed to be used in conjunction with the existing charts and provide accurate GPS positioning, radar or pilotage techniques for Search and Rescue operations.

These products will not contain any bathymetric data because the recently collected multibeam data had not been processed in time for incorporation. The existing chart data could be rubber sheeted to fit the new product but this would make it even less accurate. This interim solution will suffice until the CHS charts are produced using the NIF-SAR product as a map base with the new multibeam bathymetry added. This not only allows for enhanced navigational safety but, once the base is completed, it is now only a matter of adding the bathymetric data. This should allow a more timely release of the new CHS charts.

Figure 17 depicts the new NIF-SAR Products that will eventually become the official CHS charts.

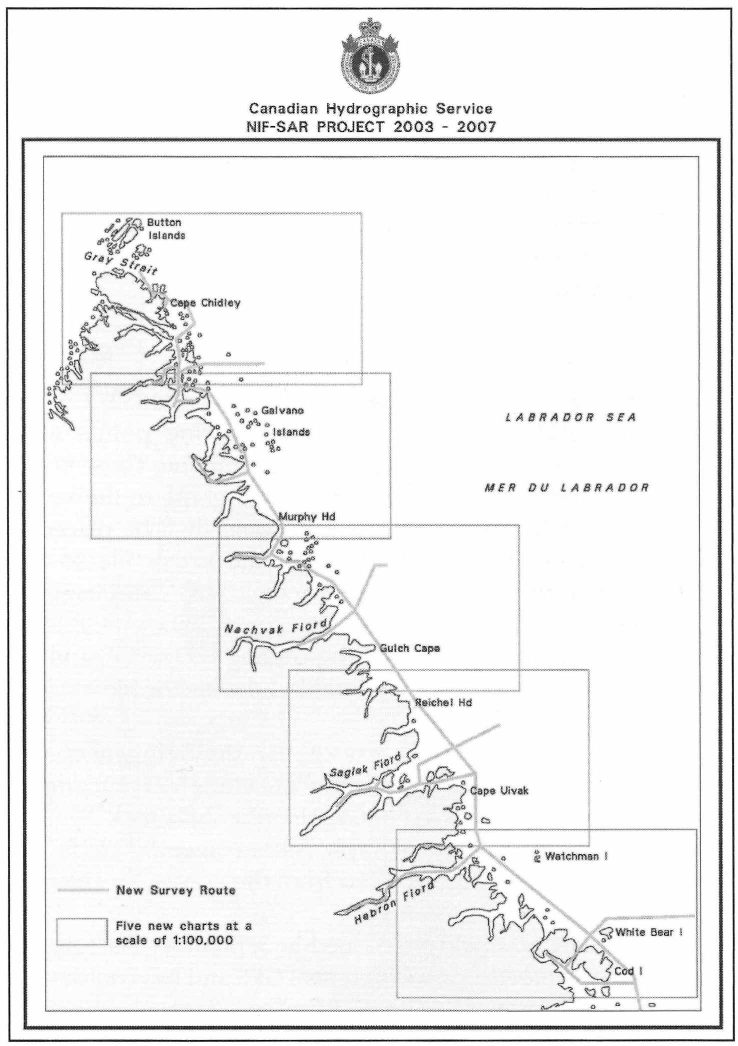



*Figure 17 - Final Products of the NIF-SAR Project shown as outlined boxes.*

## A Practical and Flexible Approach

The goal of this project was not to make state of the art, full bottom coverage charts. Rather it was to make the charting of the area better, by using resources leveraged through a partnership approach. As a consequence of that it was necessary to be able to adapt to the schedules and requirements of other partners. The aerial photography is divided between colour and black and white to suit the requirements of participating agencies. The lead agency used contractors most familiar with topographic mapping; contracts were let according to the fiscal and logistic realities of the lead agency. So, some flexibility in scheduling production was required.

This approach yielded high resolution images, suitable for photogrammetric compilation at a surprisingly low cost. However, the need for clear skies resulted in significant delays.

This also meant that the low water line could not be captured and in the spirit of co-operation and economics a compromise was necessary.

Communication amongst partners is essential, at both the managerial and technical levels. One issue that arose was the contractor's difficulty in determination and classification of foreshore features. A hydrographer's concept of sunken rocks, pinnacle rocks, rocks awash and islands are not intuitive to a photogrammetrist who is only familiar with the "+" symbol rock. In hindsight, making sure the contractor was aware of these kinds of issues, either via a start up meeting and/or closer communications during the data capture stage would have been a more efficient approach for the project.

## Challenges and Lessons Learned for Future Projects

The remote location of the aerial photography survey presented a number of logistical and practical challenges.

The helicopter fuel necessary to support the ground control and targeting for the aerial photography project each season, in this remote area, necessitated caching fuel in the summer program to support flying the next year.

The timeframe for flying photography in the Northern Labrador area is roughly the end of July to early September. As the survey progressed northward the transit time to and from the survey area increased considerably.

Another constraint was the useful window for establishing ground control and targets. The white targets (Figure 2) needed to be established after the snow cover melted (mid to late July) and the photography had to be flown before the return of snow (mid to late September).

As noted earlier even the Polar bears were uncooperative as they severely hampered CHS' ability to collect GPS and water level information at the various water level sites. Mysteriously, portable GPS units and 12 volt automobile batteries appear to be items that attract the attention of polar bears. They were destroyed or removed by the bears from several sites even though the equipment was "bear proofed" and ruggedly secured to the rocky terrain.

The greatest challenge of all was the weather in this part of the north. Any aerial photography acquired in the region during the late fall and winter often included ice and snow coverage that made shoreline interpretation difficult and inaccurate. Even the summer can have weeks of inclement weather. Poor weather persisted during the first two seasons resulting in only fifty per cent of the aerial photography being completed during this period. This necessitated a one year extension of the project for a total of four years. The data collection was completed at the end of year three.

Field conditions were not the only challenge the CHS faced with the project. As mentioned, the CHS lacked the capability to create photogrammetric models and had to rely on rubber sheeting of the photographs to capture important features. This produced good results. However, any feature that did not have an acceptable amount of surrounding shoreline for control could be in error by up to five millimeters (250m). Fortunately this error was halved when the source vector tiles were scaled down to be incorporated in the NIF-SAR product (1:50,000 to 1:100,000). The data capture by the CHS was necessary because the contractor did not have the expertise or the extra data available to make a determination about certain features. The additional features subsequently identified by CHS as critical were sent back to the contractor for redigitizing using their photogrammetric models. In retrospect, it would have been advantageous to have had a briefing with the contractor clearly defining the CHS cartographic requirements before data capture had begun. This would have eliminated a significant amount of rework.

In summary, the remote location, weather, very narrow survey window, wildlife and lack of expertise of both CHS and contractor presented significant challenges and prolonged the projected completion date for the project.

## Current Status of the Project and Next Steps

Three of the five NIF-SAR products have been produced to date. The field crews will be in Labrador this season [from mid-August to mid-September 2007] to survey and collect bathymetry data for large scale insets that were identified through consultation with a group of stakeholders. The new sounding data will be added to the NIF-SAR product/base to produce bathymetric charts with these safe navigation corridors and selected insets to support navigation in constrained areas. The current plan is to have these charts completed for the 2008 shipping season.

## Conclusions

The Labrador coast is poorly charted in many areas, leading to serious safety concerns for all mariners traversing these waterways. The situation is made worse by the fact that Search and Rescue efforts are also hampered by these below standard charts. The delivery of provisional charts with modern and historical bathymetric data incorporated and with accurate shoreline will greatly enhance the safe navigation in the Nain to Button Islands region. They will provide the CCG and associated agencies with high resolution shoreline for SAR operations.

The success of this project has been the direct result of a cooperative initiative with the Fisheries and Oceans New Initiative Fund sponsor, Canadian Coast Guard, the Canadian Hydrographic Service, Atlantic Region and the Survey and Mapping Division, Department of Environment and Conservation, Newfoundland and Labrador. LH

## Acknowledgements

The authors would like to thank all those who contributed to the compilation of this paper. Special mention needs to be given to Steve Grant, the Tidal Section at BIO, the Field Surveys Division at CHS Atlantic, Alex Giannelia of Airborne Sensing Corporation, Neil McNaughton and his team at SMD, NL Department of the Environment, Mr. Bob Burke, Esquire, and all those other names we have may have omitted.

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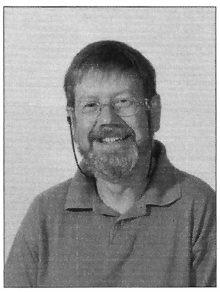
S. Forbes, J Griffin, R. Palmer, New Initiatives Fund Search and Rescue Project Labrador, *BIO Annual Review 2005*, Natural Resources Canada, Dartmouth, Nova Scotia, 2006

Steve Forbes, Remote Sensing Shoreline for Northern Labrador, *SARSCENE The Canadian Search and Rescue Magazine, vol. 13 #3, page 14, Fall/Winter 2003.*

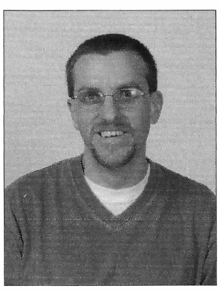
### About The Authors...



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

Stephen accepted an acting assignment as Manager, Nautical Publications in 2001 and applied for the position Manager, Nautical Publications, CHS Atlantic in 2005 and was successful and appointed to the position in 2006.

In 2006, he applied for the Director, Canadian Hydrographic Service (Atlantic) and was appointed to the position in January 2007.

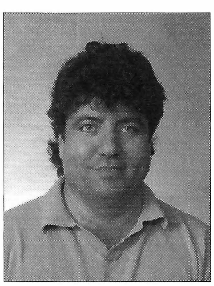


**Douglas Glenn Regular** graduated from the Cabot Institute of Applied Arts and Technology with a Diploma in Surveying Engineering Technology.

He joined the Canadian Hydrographic Service Newfoundland regional office in 1990 as a Multi-Disciplinary Hydrographer.

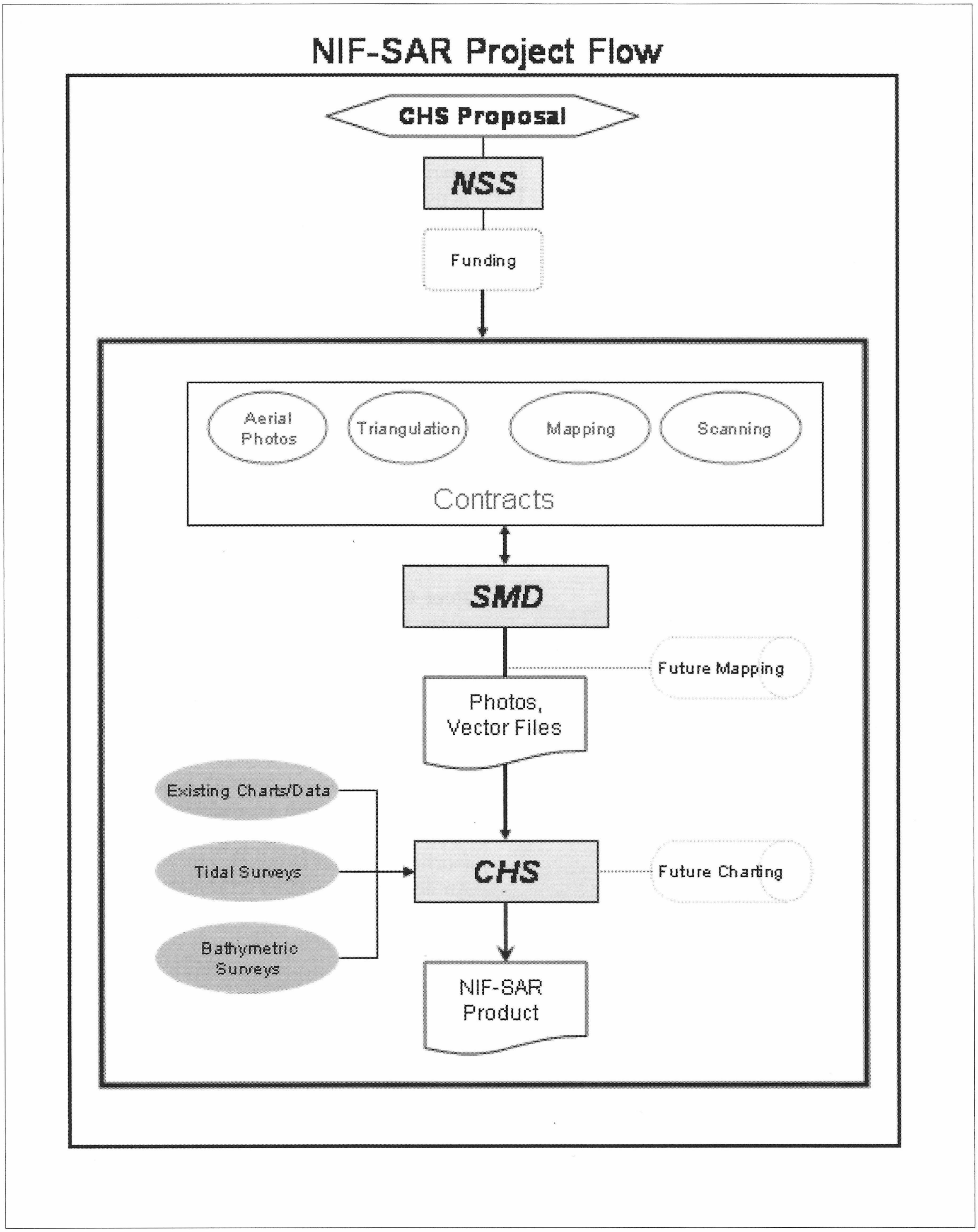
He was seconded to Nautical Data International in 1994 for a period of one year to develop and quality control the BSB ENC production process. After secondment, he continued to quality control the BSB product for a period of 6 years while working with the CHS in digital chart construction.

Doug was deployed to Bedford Institute of Oceanography in 2000 to continue work with the CHS on digital cartographic construction and data collection in the field. He was a team member of the 2 year On-Datum Project where 154 charts were shifted to NAD83, updated for current source data and bilingualized. Doug is currently a team member of the NIF-SAR Project developing shoreline products for northern Labrador.



**Craig Zeller** is a Mutli-Disciplinary Hydrographer with the Canadian Hydrographic Service (Atlantic Region). A team member on the NIF-SAR project, Craig has 20 years experience in various geomatics endeavors in both the public and private sectors.

## Appendix


NIF-SAR Project Flow
CHS Proposal
NSS
Funding
Aerial Photos
Triangulation
Mapping
Scanning
Contracts
SMD
Future Mapping
Photos, Vector Files
Existing Charts/Data
Tidal Surveys
Bathymetric Surveys
CHS
Future Charting
NIF-SAR Product

FIG

## Go F.I.G.ure

by Andrew Leyzack

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

### FIG Advisory Committee of Commission Chairs (ACCO)

It has been said that the commissions are the engine of FIG. Collectively the chairs of each commission interact with FIG Council and our membership at large via the FIG Advisory Committee of Commission Officers (ACCO). This report, although not specific to Commission 4 has been prepared to provide our stakeholders with a better understanding of how FIG's commissions aid in the direction of the FIG.

Last fall, a new ACCO was established to serve out a new four-year term, from 2007-2010. Subsequently, the first face-to-face meeting of the ACCO held in February 2007 for all newly appointed Commission Chairs (who are the members of ACCO) to receive direction from FIG Council, work towards finalizing their work plans, participate in some strategic planning and prepare for Working Week in Hong Kong. On the FIG tab, ACCO members from Australia, Canada, Denmark, Finland, Germany, Greece, Hungary, Slovakia and the UK gathered in Bratislava, Slovakia which was chosen as a meeting place because of its central location and affordable venue. The Chamber of Surveyors and Cartographers in Slovakia kindly co-hosted the meeting which provided a unique forum for the Commission Chairs to identify opportunities to collaborate on joint working groups and future activities. Furthermore, the ACCO was asked to consider the merits of introducing a formal system of peer review which would serve the interests of authors contributing to FIG conferences and the establishment of an FIG Virtual Journal.

### Commission Disbursements and Grants

FIG's total annual budget for special project and publication grants is currently €15K. Additionally, each commission is allocated an annual disbursement of €2.5K to support their activities.

### FIG Council and Commission Work Plans

While each commission operates in accordance with its own work plan, the strategic direction of all commission activity is guided by the FIG Council Work Plan and policy. For example, at the recommendation of Council, it was agreed that all Commissions would appoint an FIG Standards Network liaison as well as a Commission 2 (Professional Education) liaison. A central theme of the Council Work Plan is capacity building. This is significant to all Commissions and in the case of Commission 4 serves as one of the basis for our cooperation with the IHO via the FIG Task force on Institutional Development. The link between Council and the Commissions is personified by FIG Vice President Matt Higgins (former chair of Commission 5) who is Council's representative on ACCO, and Dr. Chryssy Potsiou (chair of Commission 3), the ACCO representative on Council.

### Peer Review of Papers

At the February ACCO meeting, Dr. Rudolph Staiger (chair of Commission 5) presented a proposal to implement a voluntary Peer Review System for papers *for conferences*. Key to this proposal was the provision of a service by FIG to cater to those authors whose academic and professional development needs require that their work be peer reviewed. A "blind review" process for grading papers was proposed with consideration given to a two-tiered approach to serve both conferences and a possible virtual journal, the latter requiring a more stringent review model. An ad hoc, Peer Review System workgroup (chaired by Dr. Staiger, with ACCO members from commissions 2, 3, 4, 5 and 9 participating) was established to report back by May 2007 on the guidelines and format of a review process.

### Virtual Journal

President Enemark has proposed the creation of an FIG Virtual Journal as a means to publish peer reviewed papers; virtual because of the immense cost of producing and distributing a hard copy journal. The journal could contain the products of the peer review process for FIG conferences provided they pass through a more intensive, "next-step" peer review process for the journal. Furthermore it has been proposed that the FIG Surveyor's Reference e-Library would continue to collect all papers accepted by FIG conferences and that the Virtual Journal would contain only peer-reviewed papers; and that the FIG monthly e-Newsletter would continue to publish the

Article of the Month to accommodate high quality papers where the author elects not to submit their work to a peer review process.

**Conclusion**

The Advisory Committee of Commission Officers (ACCO) is composed of Geomatics Professionals from national (government) organisations, academia and industry. While the current membership representation within the present ACCO appears to be weighted more towards academia, I am glad to report that Commission 4 is entering this new work term with a more equal balance of representation within our executive.

Collectively ACCO represents all the major surveying disciplines and with direction from FIG council, we will have the capacity to respond to emerging issues of concern to our stakeholder within the international community. Within the scope of Hydrography, Commission 4 is focusing on issues relevant to industry, academia, National Surveying and Mapping organisations as well as National Hydrographic Offices. FIG is both a scientific and a technological organization and one of the main products of FIG is the development of good practice resulting from the collective research and development of participating member nations. For Commission 4, this deliverable extends not only to the broader Hydrographic community but includes the "grass-roots" surveyor.

*Andrew Leyzack* C.L.S
Commission 4 Chair
Email: leyzacka@dfo-mpo.gc.ca

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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 and where there are vulnerable or protected marine areas."

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

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

- ***Receive three copies of each issue of Lighthouse (published twice annually).***
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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).

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## ASI Group Ltd

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

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

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

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

For further information please contact:

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# Corporate Members
# Membres corporatifs

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

The Association of Canada Lands Surveyors (ACLS) is a federally enacted self-regulating professional association with 540 members located across Canada who have expertise in all disciplines related to geomatics. It's a true professional home for hydrographers.

L'Association des Arpenteurs des Terres du Canada (AATC) est une corporation professionnelle de juridiction fédérale. Elle comprend 540 membres répartis sur tout le territoire canadien qui oeuvrent dans toutes les disciplines de la géomatique. C'est un véritable domicile professionnel pour les hydrographes.

For further information please contact:

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Website: *www.acls-aatc.ca*

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## C & C Technologies

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

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

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

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

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

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

## ESRI Canada Limited

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

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

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

For further information please contact:

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

## HydroService AS

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

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

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

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

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

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

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

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# Corporate Members
# Membres corporatifs

## 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*

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## Kongsberg Maritime

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

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

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

For more information regarding Kongsberg Maritime please contact:

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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*

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## RESON Inc.

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

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

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

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

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

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

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# Corporate Members
# Membres corporatifs

## Triton Imaging Inc.

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

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

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# News From Corporate Members
# Nouvelles de Membres corporatifs

## IXSEA Opens New Office in Germany and Appoints a Regional Sales Manager

In order to strengthen our activities in the scientific market and to branch out further into other industries such as defence, the company today (7th June) announced the appointment of Arne Hoof as Sales Manager based in the new IXSEA subsidiary in Hannover, Germany.

Arne will be developing the market for IXSEA products and managing sales in Germany.

Arne holds an Engineering Diploma in Geodesy from the Univeristy of Hannover and a Certificate of Academic Proficiency in Hydrographic Surveying from the University of New Brunswick, Canada. He previously worked in customer support and software training and as project engineer at Hamburg Port Authority with CARIS Geographic Information Systems bv.

"We are pleased to welcome Arne as our new Sales Manager for Germany. Arne has an affinity with the industry and understands the German market and customer needs. He is close to our German customers and will provide them with the best support", said Maarten van Beelen, Managing Director of IXSEA GmbH.

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**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.**

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## EDS, CARIS and LSC Group Selected for UKHO Hydrographic Database Solution Contract

Fredericton, New Brunswick (March 22, 2007) –EDS, as a prime contractor, and CARIS, as the sub-contractor, today announced their selection for the supply and support of a Hydrographic Database (HDB) system to the United Kingdom Hydrographic Office (UKHO).

Through the HDB Project, EDS and CARIS will deliver a workflow management system together with Bathymetry Database and Hydrographic Production Database (HPD) software to manage and create paper and electronic chart products. This combined solution will provide a flexible system as part of a wider program for the UKHO.

This unique workflow-oriented and database-driven approach to data management and production will bring significant business benefits to the UKHO in production optimization and efficiency.

**About EDS**
Electronic Data Systems Corporate (EDS) founded in the USA in 1962 has led the Information Technology industry for over 40 years, employing some 120,000 staff in 60 countries. With in-depth involvement in UK Government and Defence, their broad range of services is widely deployed. They provide consultancy, systems development, systems integration, systems management and business process management services to meet Land, Sea, Air and Joint requirements.

**About CARIS**
Established in 1979, CARIS is the leading developer of geomatics software for hydrographic and marine industries. Its products are selected by esteemed military agencies, survey companies, port and waterway authorities and academia among others. Professional Training, Consultancy and Technical Support services offered by CARIS differentiate it in the industry and this is reflected in the success and satisfaction of its customers.

CARIS software and the CARIS logo are registered trademarks of CARIS. Other brands and product names are registered trademarks or trademarks of their respective holders. © 2006 CARIS. All rights reserved.

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For more information, press only: Sheri Flanagan, CARIS, (506) 458-8533, sheri.flanagan@caris.com.

## ATLAS Elektronik Selects Triton AUV Suite™ Software

Watsonville, CA, USA -- April 16, 2007. Triton Imaging, Inc. announced today that ATLAS Elektronik has selected the Triton AUV-SuiteTM software for use with their SeaOtter MkII autonomous underwater vehicle demonstrator. The MkII is an advanced version of the SeaOtter Maridan AUV designed for military applications such as mine detection and countermeasures, covert intelligence, surveillance and reconnaissance, and rapid environmental assessment.

The Triton AUV-Suite, purchased through Triton Imaging's agent in Germany, J. Bornhoeft Industriegeraete GmBH, will be used for post-mission analysis of the commercial sensor suite such as multibeam, sidescan, and in some configurations, sub-bottom profiler. The Triton AUV-Suite, which has been recommended by the U.S. COMINEWARCOM for use on "any shipboard U.S. UUV system," includes a broad range of applications for the display, processing, and interpretation of sonar data collected from AUV platforms. This software provides a proven COTS solution into which advanced processing technologies such as CAD/CAC, SAS, and change detection are easily integrated.

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

# Friends of Hydrography

## □A Canadian Volunteer Group□

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

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

Please browse the many pages of the site to get a sense of the historical aspects of hydrography and the Canadian Hydrographic Service (CHS). If you ever worked with the CHS, or had friends who did, search the site for the names. If you don't find the name please contact 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 frequently.

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*

# 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 announce 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.

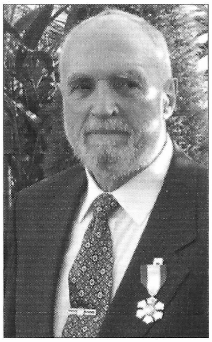
We are anticipating over 50 exhibitors and a number of workshops will be scheduled for Monday, May 5th.

Please visit www.chc2008.ca for additional information regarding the technical program, workshops, on-the-water demos, exhibitors, social program, sponsorship opportunities and conference hotel.

Brian Port
Conference Chair

| **Important Dates**: | |
|---|---|
| Nov 2, 2007 | Deadline for abstracts |
| Dec 14, 2007 | Decision notification |
| March 28, 2008 | Deadline for papers |
| April 25, 2008 | Deadline for presentations |

Conference contact information:
Telephone: (250) 363-6741
Fax: (250) 363-6841
Email: info@chc2008.ca



**Helmut Lanziner – Canadian Electronic Chart Pioneer**

For his contribution to technological innovation and the development of the electronic chart, not only was Helmut Lanziner awarded the Transport Canada Marine Safety Award in May of 2005, but he was also appointed to the Order of Canada. His investiture into that order was on December 15, 2006.

Enthusiasm, vision and perseverance best characterise Helmut Lanziner as he pursued the development and business of electronic charts. Today the electronic chart is an accepted and essential tool of the mariner. Helmut first visualized electronic charts during his early experiences in the Beaufort Sea working for the oil industry. To put that idea into reality Helmut founded Offshore Systems Ltd. (OSL) which he operated for many years. In its early days OSL was an unchallenged world leader in electronic chart systems. Step by evolutionary step, Helmut as the visionary entrepreneur introduced system and functional improvements with each OSL version. Relative motion, heads-up display, and then the radar overlay, are features which he incorporated that made the interpretation of sensor data much quicker and easier. Many a night, Helmut could be found on the bridge of a ferry or container ship while underway, tweaking his latest version for best performance.

Helmut was also very active convincing the industry and government agencies of its benefits to safety and navigation. He played a significant role as a Canadian participant in the promotion and development of the international electronic charts standards.

Helmut Lanziner is undoubtedly to be counted among Canadian pioneers.

## CENTRAL REGION

In November the Bayfield Institute welcomed Dale Nicholson from Atlantic Region as the successful candidate in the Director, Hydrography capacity. Congratulations Dale and welcome back!

We also had a Manager's competition and it has still not been completely settled but we did have Tom Rowsell from our Dartmouth office gracing our halls for a period of time in the later winter-early spring though he came to the sad conclusion that the Maritimes was more to his liking; sad to lose you Tom!

On those who have moved on to brighter horizons, John Medendorp, Mike Powell and Brian Power have all retired from active service. We wish them all the best and many years of good health as they enjoy their well-deserved leisure time.

Notable announcements since our last update were three births: Heather MacArthur, Janis Chubb and Jason Bartlett's wife all had babies. Scott Youngblut's daughter turned one and everyone is doing really swell! On the impending list is Tim Janzen's wife Barbara. Congratulations to all!

On the survey side of things, four hydrographers from Central & Arctic were joined by one from the Atlantic office for the first of the UNCLOS winter surveys based out of Alert. Rumour has it that the weather was less than cooperative so we will look forward to their final report.

Some of us are busily preparing for the May 14th departure for Revisory survey. We will be revising some Lake Ontario, St. Lawrence River, Lake Huron and Georgian Bay charts. And hopefully more! A small multibeam survey job in Windsor is also in the plans. Preparations are busily underway for the annual Fathom Five survey at Tobermory, the Eastern Arctic survey in Hudson Bay aboard *CCGS Terry Fox*, and the Beaufort Sea survey aboard *CCGS Nahidik*.

Charts that have been issued include:
Lake Superior chart 2308 Michipicoten Island to Oiseau Bay, Arctic chart 7779 Dease Strait, Trent-Severn chart 2023 Peterborough to Buckhorn/Stony Lake, Trent-Severn chart 2026 Lake Scugog and Scugog River, 2202 Port Severn to Parry Sound.

## ATLANTIC REGION

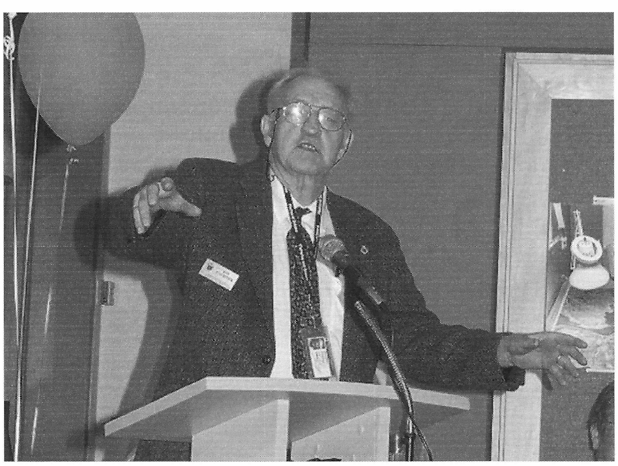
On Monday May 30, the Needler Boardroom at BIO was filled with celebrants marking a most rare occurrence; after 46 years of public service, Nick Stuifbergen was retiring from the Canadian Hydrographic Service. It was billed as a low-key affair – potluck, a few stories, and a good bye. It was much more special than that. Friends, family, colleagues came from near and far. They conversed and grazed amongst some of the finer pot luck fare, with background music and a slide show of the photographic highlights of Nick's three continent, 2/3 of a century journey through life thus far.

Director Stephen Forbes served as Master of Ceremonies. He guided the crowd through some of Nick's many accomplishments, particularly his elegant and practical mathematical solutions in the field of electronic navigation.

His work on the development of Loran lattices for nautical charts and the use of custom techniques for the recovery of off datum charts are but two examples of his near peerless work. Some of those peers and mates of days gone by paid tribute to Nick: Mike Eaton and Dave Wells in person and Steve Grant, Ross Douglas and Adam Kerr via correspondence. As a group together, they are a Canadian example of world class accomplishment in the field of navigational safety that echoes strongly to this day.

The luncheon produced many kind words, amusing stories and very thoughtful mementoes and several "non-gifts" including one presented by Wendy Watson Wright, the ADM Science. Nick had requested that, in lieu of gifts, a donation be made to the Mission to Seafarers. Accordingly, Dave Wells's inquiries and generosity helped to secure a television for the mission. Nick will be present at a future ceremony to acknowledge this greatly appreciated gesture.

In the end, the climactic words were left to Nick. He addressed his friends with a Toastmaster's prowess and spoke of his pride, satisfaction, and honour to have had such a wonderful career. The milestones of his life were recounted. It was evident how strong an impression the North had made upon him. His closing recitation was based on a northern adventure. It was a mix of rollicking Stomping Tom Connors with undertones of a South African chant. Peerless work best left to be reprised in his memoirs. Well done Nick.



*Nick Stuifbergen*

[It is appropriate to note that Nick was late leaving on his last day and unlike Elvis, Nick has not left the building. He has chosen to begin his retirement by accepting an Alumnus Emeritus position with DFO which began the very next morning. Free from the confines of work-a-day life, Nick plans to occupy himself by revisiting those mathematical problems that were previously enticing but set aside in deference to more pressing matters. A paper in an upcoming edition of Lighthouse is a distinct possibility].

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## PACIFIC REGION

The 2007 field season is starting (May) to ramp up with the annual training survey drawing to a close. The *Otter Bay* c/w EM3002 and MVP-30 is nearly ready for the first surveys of the season (Sandheads and Squamish). These surveys will be repeated again in the fall and contribute to ongoing NRCAN research into slope stability and mass wasting events (submarine landslides). CHS has also been consulting with the BC Pilots on rates of siltation near Squamish terminals and trying to set a level of service for frequency of resurvey to ensure safe passage.

The EM3002 on the *Otter Bay* was upgraded to log full water-column backscatter last year. This year we have added sub-bottom profiling (SBP) capability with a 2x2 transducer array and a Knudsen chirp SBP owned by NRCAN. Now all multibeam surveys will have the added benefit of the complementary bottom penetration profiles which have proved to be a great asset in the definition of habitat for species management. Both SIS and POS/MV have been upgraded to the latest versions and are fully compatible with an operational RTK positioning system and True Heave for precise work.

Additional Otter Bay projects include more work filling holes close to IOS in support of NRCAN mapsheets and to replace antiquated CHS bathymetry from the 1950s; responding to reported hazards to navigation coast-wide; and more support for the Kitimat Gateway charting project on the Central and North coast of BC. The fast response craft *Echo* and *Shoal Seeker* will also be deployed on some of these high-priority surveys.

Revisory and Sailing Directions surveys will be carried out in support of Fraser River charts and another Revisory survey is planned for the New Chart of Kyuquot.

The *Vector* will depart for Queen Charlotte Basin in early July, not returning until mid-September. Once again, She will support 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.

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. At IOS, improvements to servers and web interfaces are allowing both internal and external clients to get access to observed water levels when they need them.

## ATLANTIC BRANCH

Since our last update, the CHA Atlantic Branch has had a quiet year, with the AGM taking place in February, 2007. During the past months, the outstanding bureaucracy from CHC 2006 was successfully concluded, with all bills paid and accounts closed. As a reminder, the conference website is still live, with access at: www.chc2006.ca - those interested may still download papers, proceedings and pictures from CHC 2006.

A number of CHA members attended the US Hydrographic Conference in Norfolk, Virginia during the week of May 14 to 18, 2007. Additionally, CHA Atlantic is looking forward to participating in celebrations for World Hydrography Day on June 21, 2007. The branch is looking to contribute an informative display in relation to this event in order to further the understanding of hydrography, or possibly sponsor a BBQ.

## PACIFIC BRANCH

We here at CHA Pacific have had quite a busy spring. We started the spring, or should I say later winter with the CHA Curling bonspiel. This was the first year the event had been held in many years. We had 40 members and guests out for 3 hours of curling at the Glen Meadows Golf and Country club. The day started with some practice and curling tips for those of us who had never curled. We then ended up playing 3 four end games. The unusual aspect was the scoring. The score was based on the roll of the dice at the conclusion of the end. This determined if the score was based on traditional scoring methods, or other scoring like number of rocks through the house, or number of rocks to not make the hog line. This scoring system made the event fun for all curlers and non curlers. The winners of the event were the team of Sarah MacDonald, Tracey Prentice, David Tammadge, and Erwin Lee. It was considered quite a coincidence that the organizer of the event, Sarah MacDonald, was also the skip of the winning team. Can you say Fix? Thanks to Sarah for organizing the event and thanks to the sponsors.

We held our AGM in January of this year. Thanks to the people who came out and to the people who ran for the executive.

We recently held a brown bag talk with Rob Hare, Manager Hydrographic Surveys, CHS Pacific Region. He gave us a talk on Uncertainty Management in Multibeam surveys. This is the same talk he presented at US Hydro recently. *[Ed. Note: See page 7 of this edition of Lighthouse for the paper.]*

Speaking of conferences many CHA members are the organizing committee members for the CHC 2008 conference coming next May to Victoria. We are very excited to be co hosting the event for the first time with the ACLS, National Surveyors Conference. CHC-NSC08 will be the first time that land and sea have come together to discuss some common issues. The organizing committee had been very busy for the past year and planning is well under way. Stay tuned to lighthouse and the website for more details as we get closer to the conference date.

We now start to plan for World Hydrography day and a busy summer as many of our members and executive head out to the field.

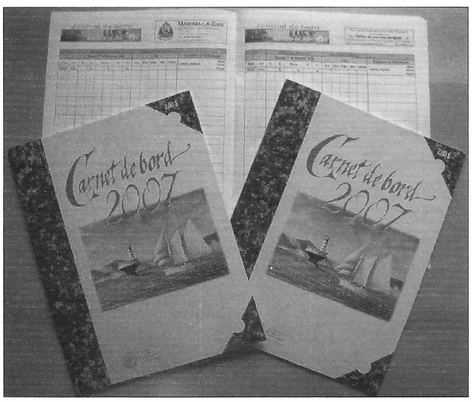
**DID YOU KNOW...**

**Copper Engraving Plates**
With the advent of the offset printing press, by 1937 only four charts were published using the traditional copper engraving plates. The last CHS copper engraver retired in 1947 and the craft was never again used. It is rumoured that many of the disused copper plates were used to reshingle the parliament buildings in Ottawa.
[Source: The Chartmakers: The History of Nautical Surveying in Canada].

## QUÉBEC BRANCH

La Section du Québec est à sa deuxième année d'un plan quinquennal pour restructurer son aspect financier. Il faut continuer à établir des ponts pour le renouvellement des membres et des membres corporatifs. Le tout s'enligne dans la bonne voie.

Nous avons publié notre 16e édition du Carnet de bord en 2007. Ce carnet contient un journal de bord et une foule d'informations utiles pour les plaisanciers comme les services offerts par les marinas et les signaux conventionnels utilisés lors d'une plongée.




Le niveau des ventes du Carnet de bord ainsi que de cartes marines et topographiques est en lente croissance et exige toujours un travail soutenu pour atteindre et garder la rentabilité de façon durable.

Il y a un projet en cours avec le Service hydrographique du Canada, région du Québec, pour faire venir la baleinière hydrographique SURVEYOR de la Section Centrale à l'été 2008 pour les 400 ans de fondation de la ville de Québec. La Section devra développer d'autres projets comme ce dernier pour rechercher des appuis de partenaires et de membres corporatifs dans le domaine de la géomatique et finalement susciter leur intérêt.

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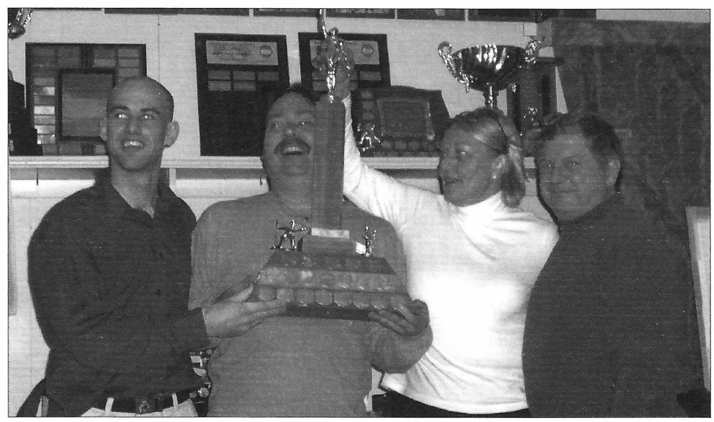
## CENTRAL BRANCH

### 36th Annual $H_2O$ Bonspiel

Another year has come and gone and now the curling season is in full swing, this year the Canadian Men's Curling Championship, the "Tim Hortons Bier" took place in Hamilton and set the stage for the *Canadian Hydrographic Association's* 36th $H_2O$ annual curling bonspiel.

This year's 2007 annual $H_2O$ Bonspiel took place at the *Grimsby Curling Club* on Saturday the 17th of February. There were sixty-four enthusiastic curlers that showed up to enjoy a day of curling and with the expectation of seeing their names engraved on the first and second place trophies. The objectives of bonspiels are to promote the fun of curling and encourage families and friends to come out and enjoy the sport. This year's curling committee was pleased to have one of our long time sponsors "Seaway Marine Transport" from St. Catharines ON accept our invitation to curl and we hope the team of Doug, Kelly Joe and Janis will return next year.

Congratulations to this year's first place winners goes to the rink of Greg Thiel – skip, Richard Brown – vice, Simon Rocheford– second and Joyce O'Keefe as lead.



Congratulations are also extended to the Second Place winners, Russ Springer as Skip, Less Springer as Vice, Marie Fontaine as Second and Pat Szczucki as lead.

On behalf of the Canadian Hydrographic Association many thanks are extended to this year's bonspiel committee of Earl Brown and Brian Power for their continued hard work in making this annual curling event a success. As well, we wish to thank our sponsors for their generosity and contining support. This year's prize table had an excellent selection of goodies for all curlers. Our sincere thanks to the following sponsors:

Canadian Hydrographic Association
Canadian Hydrographic Service
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HYPACK Inc.
Fugro Jacques GeoSurveys Inc.
IIC Trchnologies
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Seaway Marine Transport
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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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Advertising material must be supplied by the closing dates as digital Tiff 600dpi files. Proofs should be furnished with all ads.

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

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

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

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## CLOSING DATES / DATES DE TOMBÉE

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

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

## RATES / TARIFS

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

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

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LIGHTHOUSE publishes material covering all aspects of hydrography.
Authors submitting manuscripts should bear the following points in mind:

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


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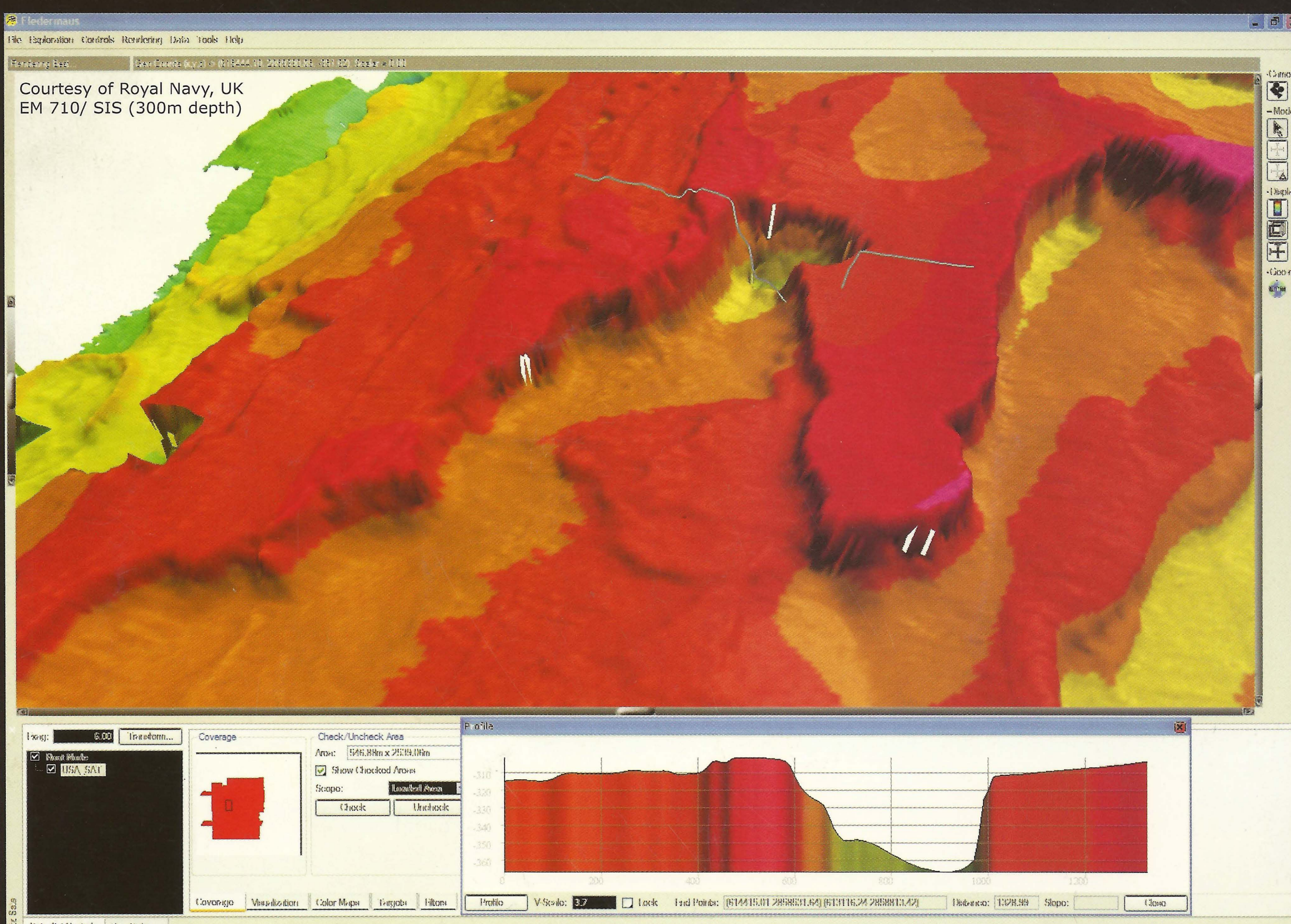


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