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Lighthouse

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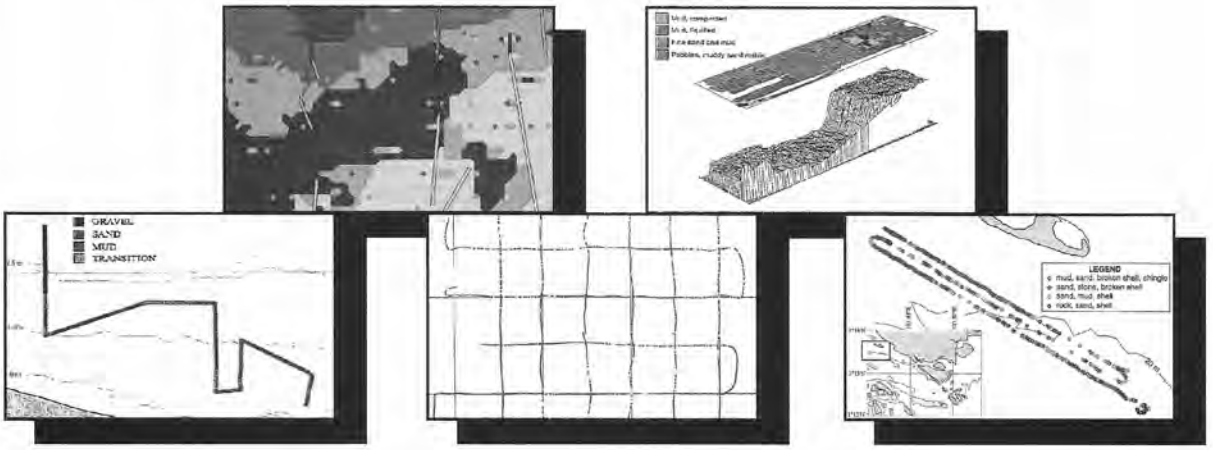

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JOURNAL OF THE CANADIAN HYDROGRAPHIC ASSOCIATION
REVUE DE L'ASSOCIATION CANADIENNE D'HYDROGRAPHIE

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Back issues of Lighthouse, Editions 24 through 55 are available at a price of $10 per copy. Please write to the Editor.

Les éditions 24 à 55 de la revue Lighthouse sont disponibles au coût de 10$ par copie en écrivant au rédacteur en chef.

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Regular Features/Chroniques

Closing dates for articles / Date de tombée des articles

Spring Issue	February 1/1er février	Édition du printemps
Fall Issue	September 1/1er septembre	Édition de l'automne

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Message from the National President
Mot du Président national

Ken McMillan

As we quickly approach the millennium, some things never change. During the normal course of business, I encounter many individuals who are reticent to commit to a new piece of equipment or a new methodology, or there is a misunderstanding about the technology. Recently I was asked by a land surveyor about using a fishfinder type echosounder which had an NMEA 0183 string output. He wanted to link a GPS (raw) to the data logger for his total station as well as the sounder output. He expected that he would be able to log sufficient data in his data logger for an area on the water equivalent to what he could survey on land! He was forgetting the fact that while he could see the land topography, and would obviously pick up more shots where required, he was not able to "see" the bottom. In another case, a surveyor was interested in using a multibeam system to survey a pipeline crossing. He felt that he could just drop the system in the water and get a 3D terrain model as output!

As hydrographic technology has changed, so has the need for changes by the hydrographer. It is essential that training and learning be continued throughout our careers. Lighthouse is only one medium which can be used to inform and update us on new technology. As more and more people search for information on the Internet, the quality of the information has to be considered. The Canadian Hydrographic Association is committed to 'furthering the knowledge and professional development of its members.' Some exciting initiatives are underway to investigate how the CHA can use distance learning to further educate our members.

Editor's Note / Note de la redactrice

Terese Herron

We have three papers in this edition. One of historical interest on a Spanish Chart of Vancouver Island in 1791, the establishment of a hydrographic bureau in Egypt and something of interest to all field hydrographers, the maintenance and use of lead acid batteries. I hope you enjoy these papers.

CHA as an organization has passed the thirty year mark and may be looking toward getting back to her roots. That is training and education. As the year passes we hope to pass on any advancement in this direction. The CHA is a co-sponsor in CHC'98 and is holding a workshop Monday, March 9th. I hope many CHA members will be present at the conference. The conference will provide us with information on some of the new technology that is upon us.

As many of you are aware the director of Hydrography for Central and Arctic Region CHS, Earl Brown, retired in June 1997. Earl has always been and still is a strong supporter of Lighthouse and of the CHA. The Central Branch presented Earl with a life membership at their Branch AGM held December 11th, 1997. On page 44 you will find a short summary of Earl's career and retirement dinner. On behalf of the Lighthouse team, we wish Earl all the best in his retirement from the CHS.

I am, as always on the search for papers for Lighthouse....if you would like to submit one please forward it to the editor via E-mail (herront@dfo-mpo.gc.ca) or mail a hardcopy. (address on first page).

Student Award Letter

July 14, 1997

To: The Canadian Hydrographic Association,

I wish to express my thanks for your support! Over the past few years I have gradually developed a strong interest in the geomatics industry, especially in digital mapping and imaging. Hence, I look forward to completing a university degree in Geomatics Engineering at the University of Calgary and pursuing an interesting, fast-paced, option-filled career. Your organisation's support in me and my learning interests will always be greatly appreciated.

Thanks again,
Osgood Vogler

Award Announcement

Lachapelle Wins Kepler Award at GPS97

Dr. Gérard Lachapelle, Professor and Head of the Department of Geomatics Engineering, The University of Calgary, received the Johannes Kepler Award, given annually for sustained and significant contributions to satellite navigation, at the GPS-97 conference of the U.S.-based Institute of Navigation (ION) held in Kansas City, September 16-19. The coveted award was presented by Mr. Gaylord Green, chairman of the ION Satellite Division.

Dr. Lachapelle has performed pioneering work related to the development of new methods, algorithms and software and to novel applications of the Global Positioning System. His involvement with GPS began in 1980 with Sheltech Canada, a division of Shell Canada Resources Ltd. He was a founding member of Calgary-based Nortech Surveys (Inc.) Canada, and Norstar Instruments. Much of the work done during the above period was related to marine positioning and performed with the support of the Canadian Hydrographic Service. Dr. Lachapelle pursued his research activities at The University of Calgary which he joined in 1988. He and his graduate students have published over 125 papers on the subject and won some 20 awards. He has also been involved extensively with the continuing education of industrial and government lab research engineers in North America and Europe. The various software he has contributed to is licensed to scores of organizations around the world.

Abstracts / Résumés

Some Anomalies In A Spanish Chart
Of Vancouver Island 1791
by
N. Doe

In 1791, a year before Captain Vancouver arrived on the west coast to begin his great survey, a chart was compiled by members of the Spanish navy at their post at Nootka which showed the full extent of their surveys to date of the coast of Vancouver Island and of the adjacent mainland. Many of the details of this chart, except for place names, were subsequently incorporated into Vancouver's work. Unfortunately, not many of the log books and journals of the few who worked on this historic chart have survived. In this paper a computer-aided analysis of the chart and of its errors is described. The primary purpose of the analysis was to see if improvements could be made in the identification of locations on the chart which cannot now be identified with any certainty. This was not completely successful for reasons explained in the paper, but the analysis did reveal some of the techniques that the Spanish cartographers of the time must have used.

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Establishment of a hydrographic bureau in Egypt
by
J.-M. Gervais

In 1988 the Canadian and Egyptian government joined efforts and initiated a long term project aimed at the protection and development of the River Nile Water system. The project was funded by both the Canadian International Development Agency (CIDA) and the Egyptian government. One phase of the project was the establishment of a hydrographic office within the Nile Research Institute, an establishment dedicated to the development, protection, conservation and better management of the Nile River. In the fall of 1994, SNC Lavalin Inc., contracted by CIDA to manage and monitor the overall project, asked the Canadian Hydrographic Service (CHS) to propose and monitor a plan of action in order to realize this phase of the project. A Quebec Region CHS staff member, acting a technical consultant, was on hand in Egypt throughout the project. This paper describes the work done and the methods and equipment used to achieve this goal.

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Maintenance and Use of Lead Acid Batteries in
Hydrograghic Applications
by
A. Thompson, B. Hinds and L. Dorosh

CHS Pacific Region has decreased downtime and data loss from instruments that use lead acid batteries for primary power source or as a back-up power source. Wise selection of batteries that are tailored to the application and proper maintenance will increase reliability of the systems powered by them at the same time as reducing the cost of ownership.

Anomalies Sur Une Carte Marine Espagnole
De L'Île De Vancouver De 1791
par
N. Doe

En 1791, un an avant que le Capitaine Vancouver arrive sur la côte Ouest pour débuter son levé hydrographique, une équipe de la marine espagnole avait compilé une carte à leur poste de Nootka qui montrait l'état complet à cette date de leur relevé de la côte de l'île de Vancouver et du continent adjacent. Plusieurs détails de cette carte, excepté le nom des lieux, ont été incorporés dans les travaux de Vancouver. Malheureusement, il reste peu de documents disponibles provenant des personnes qui ont travaillé sur cette carte historique. Via l'informatique, cet article décrit l'analyse de cette carte et de ses erreurs. Le but principal de cette analyse était de vérifier si des améliorations pouvaient être apportées à l'identification des lieux sur la carte, lesquels ne peuvent être identifiés présentement avec certitude. Ceci n'a pas été un franc succès et les raisons sont expliquées dans cet article. Par contre, l'analyse a révélé quelques techniques que les cartographes espagnols du temps ont sûrement employées.

Page 7

Mise sur pied d'un bureau hydrographique en Égypte
par
J.-M. Gervais

En 1988 les gouvernements du Canada et d'Égypte ont joint leurs efforts afin d'initier un projet à long terme ayant pour but de protéger et de développer le fleuve Nil. Les fonds nécessaires pour ce projet provenaient de l'Agence canadienne pour le développent international (ACDI) et du gouvernement égyptien. Un des volets du projet consistait à établir un bureau hydrographique à l'intérieur de l'Institut de Recherche du Nil, dédié au développement, à la protection, à la conservation et à une meilleure gestion du fleuve Nil. À l'automne 1994, SNC Lavalin Inc. engagé par l'ACDI pour gérer l'ensemble du projet, a demandé au Service hydrographique du Canada (SHC) de mettre sur pied et de gérer ce volet du projet. Un représentant du SHC, de la région Laurentienne (Québec), s'est rendu en Égypte pour la durée du projet en tant que consultant technique. Cet exposé décrit le travail accompli ainsi que les méthodes et les équipements utilisés afin de réaliser le projet.

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Entretien et usage des batteries à l'acide au plomb pour les
applications hydrographiques
par
A. Thompson, B. Hinds and L. Dorosh

Le SHC, Région du Pacifique, a diminué les pertes de données et les pannes des instruments utilisant les batteries à l'acide au plomb comme source d'énergie principale ou de relève. Le choix du bon type de batteries en fonction de l'usage ainsi que leur entretien augmenteront la fiabilité des systèmes tout en réduisant les coûts d'opération.

The "Best" battery for an application depends on a number of factors in addition to the capacity such as the required reliability, operational temperature range, method of transportation to the site, maximum discharge and charging rates.

Maintenance tools for batteries have changed over the years from hydrometers to microprocessor controlled battery chargers, digital voltmeters and instrumentation that measures Ampere-hour capacity.

Discussed in the article are: battery selection criteria, characteristics of four common types of lead-acid batteries, charging considerations and maintenance recommendations.

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La « meilleure » batterie pour une application dépend de nombreux facteurs tels que la capacité, la fiabilité requise, l'écart des températures d'opération, la méthode de transport au site et les taux maximaux de décharge et de recharge.

Les outils d'entretien des batteries ont changé, passant de l'hydromètre au chargeur de batterie contrôlé par microprocesseur, au voltmètre numérique et aux instruments mesurant la capacité en ampère-heure.

Cet article présente les critères de sélection des batteries, les caractéristiques de quatre types courants de batteries à l'acide au plomb, les conditions de charge et les recommandations d'entretien.

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Application for Membership
Formule d'adhésion

I hereby make application for membership in the Canadian Hydrographic Association and if accepted agree to abide by the constitution and by-laws of the association.

Je désire devenir membre de l'Association canadienne d'hydrographie en tant que et si ma demande est acceptée je m'engage à respecter la constitution et les règlements de cette association.

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XXI FIG Congress

The FIG Congress in Brighton, United Kingdom (July 19-25, 1998) marks the 30th anniversary of the creation of Commission 4. To commemorate this event, Commission 4 has developed an interesting program of technical sessions, technical tours and social events. The technical sessions will cover the following areas of interest: Hydrography in Developing Nations, Electronic Charting, Multibeam Sounding Systems, Hydrographic and Tidal Systems, Hydrography and Education, Datums and Boundaries, Hydrographic Applications of Positioning and Measurement and Coastal Zone Management.

The technical tours will include a visit to the Port of London Authority Hydrographic offices as well as a tour of the new vessel traffic management system. In addition, there will be an opportunity to tour a Royal Navy Hydrographic Survey Vessel which will be visiting Brighton during the Congress.

The social event that will celebrate the 30 year anniversary of Commission 4 will consist of a Riverboat Dinner cruise on the River Thames. For more information on the Congress, visit the Web site at: http://brighton.co.uk or contact Paul Smith at RICS Conferences: Tel. +44 1713934960.

FIG Surveying Database

FIG has developed a database of surveying courses at the Bachelor and Masters degree level and has now made this information available on the Internet. The database includes information from more than 40 countries and can be accessed at : http://www.i4.auc.dk/sedb. The site provides details about 350 surveying courses at 200 surveying institutions including:

- Description of course content and duration
- Type of degree
- Number of students and faculty
- Address and key contacts
- Links to course home pages

FIG hopes that access to this type of information will facilitate an international exchange of students and faculty and encourage international cooperation in the surveying community.

Go FIGure

by/par Dennis St. Jacques

XXIe congrès de la FIG

Le congrès de la FIG qui se tiendra du 19 au 25 juillet 1998 à Brighton, Royaume-Uni, marquera le 30e anniversaire de la création de la Commission 4. Pour commémorer cet événement, la Commission 4 a développé un programme intéressant de sessions techniques, de tournées techniques et d'événements sociaux. Les sessions techniques couvriront les champs d'intérêt suivant : L'hydrographie dans les pays en voie de développement, la cartographie numérique, les systèmes de sondage à multifaisceaux, les systèmes hydrographiques et de marées, l'hydrographie et la formation, les datums et les frontières, les applications hydrographiques de positionnement et de mesures ainsi que la gestion de la zone côtière.

Les tours techniques incluront une visite au bureau de l'autorité portuaire hydrographique de Londres ainsi que de leur nouveau système de gestion du trafic maritime. En plus, il y aura une opportunité de visiter un navire de sondage de la Royal Navy qui sera en visite à Brighton durant le congrès.

L'activité sociale qui célébrera le 30e anniversaire de la Commission 4 consiste en un souper sur un bateau de croisière sur la Tamise. Pour en savoir plus sur le congrès, visitez le site Web au « http://brighton.co.uk » ou communiquer avec Paul Smith au +44 1713934960.

Base de données d'arpentage de la FIG

La FIG a développé une base de données sur les cours d'arpentage au niveau du baccalauréat et de la maîtrise et a rendu l'information disponible sur Internet. La base de données inclut de l'information provenant de plus de 40 pays et peut être consulter au « http://www.i4.auc.dk/sedb ». Le site donne des détails sur environ 350 cours d'arpentage provenant de 200 institutions et inclut :

- Description du contenu du cours et de la durée ;
- Niveau universitaire ;
- Nombre d'étudiants et falculté ;
- Adresses et contacts ;
- Liens avec les pages d'accueil des cours.

La FIG espère que l'accès à ce type d'information facilitera l'échange internationale d'étudiants entre faculté et encouragera la coopération internationale dans la communauté de l'arpentage.

Some Anomalies In A Spanish Chart Of Vancouver Island 1791

N. A. Doe

Background

The mountainous, rain-forested coasts of British Columbia's Vancouver Island and the adjacent mainland have been inhabited for thousands of years by people skilled in the art of coastal navigation, but it was officers of the Spanish navy who were the first to use precision surveying instruments to compile a comprehensive chart of the area. The work of the Spanish began in the summer of 1789 and was completed three years later when Dionisio Alcalá Galiano and Cayetano Valdés made the first uninterrupted circumnavigation by Europeans of Vancouver Island.[1] The newly-arrived British captain, George Vancouver, with a little chagrin, but with due acknowledgment, included much of the Spanish work in his own chart which would otherwise have been bereft of detail except for the continental shore which he was meticulously surveying in the hope of finding a northwest passage to the Atlantic Ocean.[2]

Prior to the arrival of the Malaspina expedition in August 1791, the Spanish surveys were directed by the commandant of the naval post at Nootka, a position held by Estéban José Martínez until he was replaced by Francisco de Eliza following the famous international incident at Nootka in 1789.[3] Martínez was an enthusiastic advocate for the exploration of the waters around Vancouver Island, even claiming that he had been the first to discover, or perhaps we should say rediscover, the Juan de Fuca Strait in 1774.[4]

The principal surveying expeditions were commanded by José María Narváez (1789), Manuel Quimper (1790), and Eliza (1791). When Captain Alejandro Malaspina arrived at Nootka in August 1791 on his Captain-Cook-style, around-the-world expedition, he spent time exploring and charting the environs of Nootka, and assigned to Galiano and Valdés the task of completing the work the following year.

The charting began with Narváez taking the small schooner SANTA GERTRUDIS LA MAGNA[5] (32 tons) down the outer coast of Vancouver Island from Nootka as far as Port San Juan, confirming the reports of the fur traders of the presence of a large passage to the east. The following year, Quimper with Gonzalo López de Haro and Juan Carrasco in the sloop PRINCESA REAL[6] (65 tons) explored both shores of the Juan de Fuca Strait as far as the San Juan Islands. And in 1791, an expedition led by Eliza with José Antonio Verdía and Juan Pantoja y Arriaga in the cargo ship SAN CARLOS (196 tons), and Narváez and Carrasco in the schooner SANTA SATURNINA[7] (32 tons) explored what is now called the Strait of Georgia, sailing as far north as Texada Island and within sight of Discovery Passage and the islands of Desolation Sound.[8]

The chart that details... dated 1791

The results of the several surveys prior to the major Spanish and British expeditions of 1792 were compiled at Nootka into a chart *Carta Que Comprehende...* [Chart that details...]. This chart is variously known as the Eliza chart (because he was the commandant and it has his name on it),[9] the Carrasco chart (because he may have done most of the drafting),[10] or the Narváez chart (because he added the part of most interest to the present-day inhabitants of the Vancouver area of British Columbia). The chart is identified by the historian Henry Wagner[11] as #779 and a particularly good reproduction of it can be found in a publication by the Naval Museum in Madrid.[12] Most book-sized, black-and-white reproductions, including the one shown here as Figure 1, give a poor indication of the work that must have gone into compiling the chart, or of the fascinating detail that it contains.

There are of course some noticeable differences between the Spanish and modern charts of the area, shown here in Figure 2. Most, but not all of the coastal trends are rotated up to 10° counterclockwise in the early chart so the direction of the axis of the main island tends to be more W-E than the NW-SE it actually is;[13] the chart of the San Juan Islands is understandably, given the limited time and resources of the Spanish expeditions and the number of islands in the archipelago, somewhat confused; the southern portion of the east coast of the main island is delimited by the Gulf Islands, a detail that remained uncorrected until the canoeing expedition of Governor James Douglas in 1852;[14] and there are much-commented-upon errors in the vicinity of the present city of Vancouver, where Point Roberts (Sp. *Isla de Zepeda*)[15] and Point Grey (Sp. one of the *Islas de Lángara*) are depicted as islands with a large stretch of water between them and the mainland to the east.[16,17] There is also a conspicuous engraving error on the longitude scale of the Madrid copy of the chart, but not on others, which has all points east of 18°W (San Blas) marked 30' too far west.

Identifying the unidentified

One of the frustrations of students of the brief Spanish history of Vancouver Island is the relative scarcity of

records left by the first Europeans to visit the coast. In part this was due to the long-established reluctance of the Spanish Government to release information for fear that it would attract attention to a region which, in the imperialistic fashion of the time, they claimed, but could not control. It was also probably in part, as the British Columbian historian Tomás Bartroli has suggested, due to the fact that most people aboard the Spanish ships were illiterate. Although factions in the British establishment were also in favour of secrecy, the British nevertheless brought the northwest coast to the world's attention through the published writings of Captains Cook and Vancouver and those that sailed with them.[18]

Some brief narratives of the surveying expeditions that were engaged in charting Vancouver Island prior to 1792 have survived, but particularly disappointing is the lack of any first-hand account of the voyage made by Narváez with Carrasco and Verdía into the Strait of Georgia (Sp. *Gran Canal de Nuestra Señora del Rosario la Marinera*) in 1791. This historic voyage was evidently made under poor sailing conditions in the schooner SANTA SATURNINA and the expedition's longboat. According to Pantoja who stayed behind with Eliza in the SAN CARLOS, the larger vessel towed the smaller whenever the wind was good, but when the wind failed the schooner had to be towed by oarsmen in the longboat.[19] The precise route that Narváez took is unknown and charts like the *Carta Que Comprehende...*, the *Plano Reducido...* of Gonzalo López de Haro [Wagner #813], and sketches by Eliza [Wagner #784] and Pantoja [Wagner #796] are all that we have to go on.[11] Several locations on these charts cannot now be identified with any certainty.

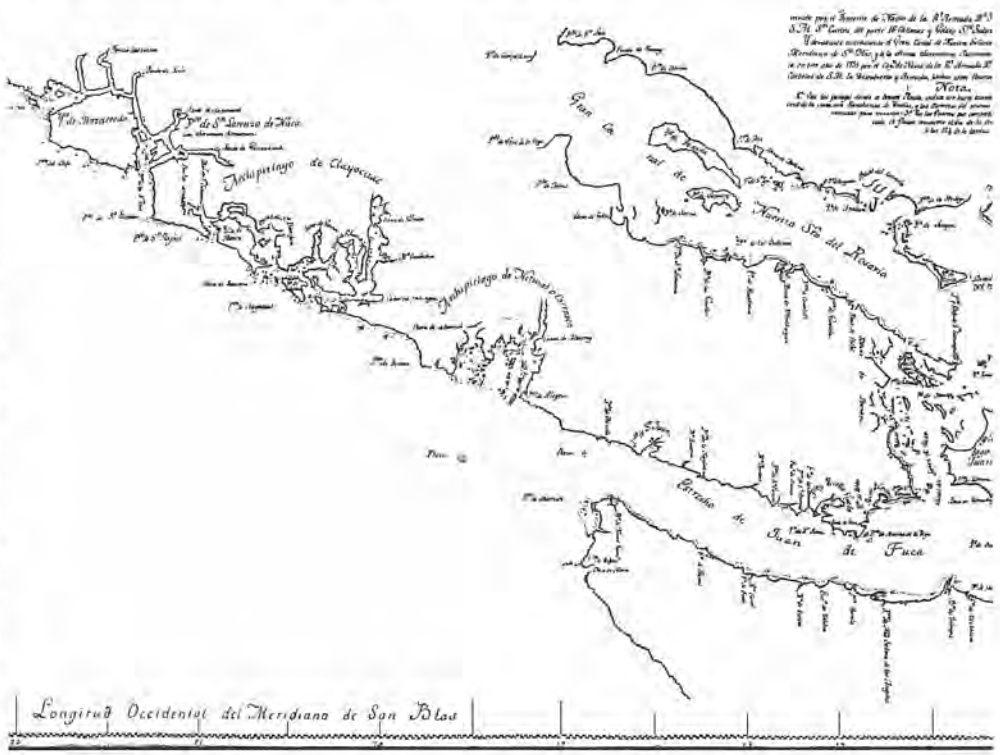

Figure 1. Carta Que Comprehende... a Spanish chart of the southern part of Vancouver Island and the adjacent mainland compiled in 1791, a year before Captain Vancouver's arrival on the coast.

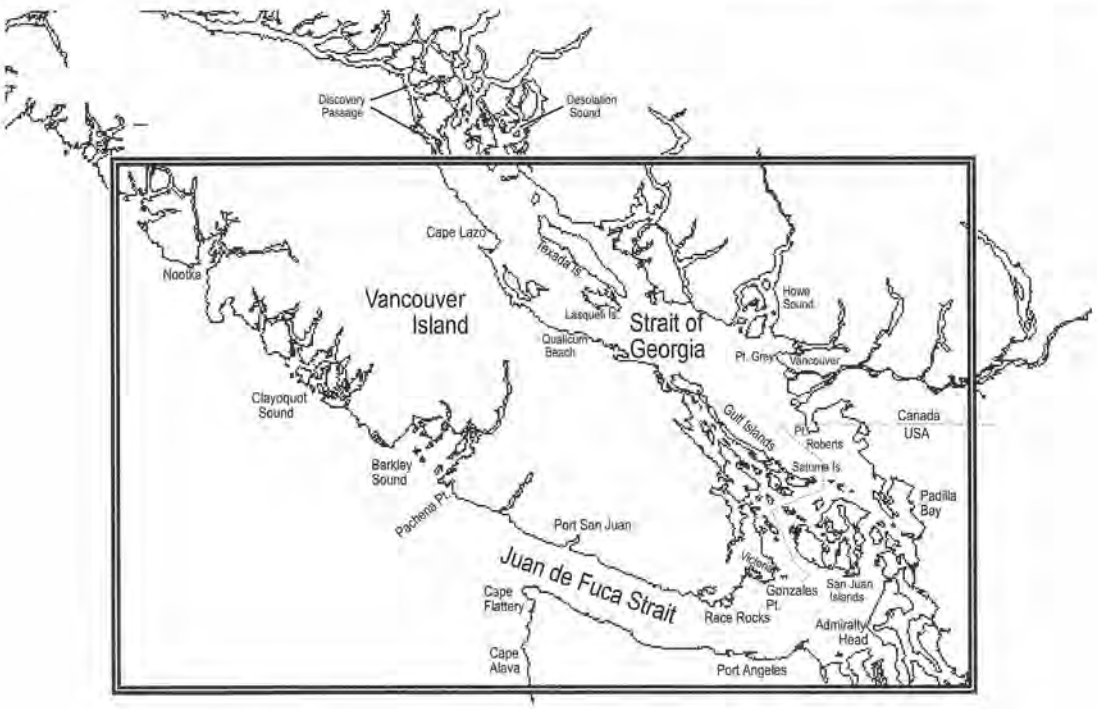

Figure 2. The modern equivalent of the Spanish chart.

A speculation by the author some years ago was that by using a computer to correct the cartographic errors, it might be possible to use identifiable locations to give more precise coordinates for unidentified locations than has been done in the past. The general idea was that by "morphing" the chart from its original form to the modern equivalent, unidentified points would be carried along with known points to their correct position. One could think of the process as putting the old chart (Figure 1) on a rubber sheet, stretching it here and there until the identifiable locations are brought to their correct positions as indicated by a modern chart (Figure 2), and then looking to see what the distortions to the sheet had done to locations on the old chart which are difficult to identify. As it turned out, this idea was a little too optimistic, but in making the attempt some interesting discoveries were made about the chart and the methods of the Spanish cartographers that assembled it.

Surveying errors

The errors that might be expected in a chart of this type can best be described by outlining the (probable) coastal surveying methods that were used in the late-18th century. The basic technique was for the ship to take up a position (*station*) and take the compass bearings of prominent features. The ship would then move along the coast to a new station, and again take the bearings of the prominent features identified at the first station. The line joining the two stations constituted a *baseline*, and if its length and orientation were known, the intersections of the bearings taken at the two ends of the baseline were sufficient for the features to be plotted on the chart. This is the process known to surveyors as *triangulation*, and there are many variants of this basic technique.[20] The errors that occur in charts constructed by triangulation can be put into four categories, namely, errors of scale, triangulation errors, errors of orientation, and errors in geographic location.

Errors of scale: In the 18th century, the accurate measurement of distance at sea was difficult. If a ship was conducting the survey alone, the length of the baseline had to be determined from measurements of the ship's speed, and the time it took to move from one station to another. When the wind was variable, or there was an appreciable tidal current, measurements of speed were difficult to make and it is conceivable that when time was short and conditions were bad, the surveyors simply resorted to using their considerable skill at judging the distance by eye. If two ships were involved, one at each station, there were tricks that could be employed such as measuring the angle subtended by the other ship's mast with a sextant, or firing a gun and measuring the time between the flash and the report. None of these techniques, however, were particularly accurate.

Errors in the length of the baseline were directly reflected in errors in the scale of the chart. If a single baseline was used, as was often the case for harbour surveys for example, all distances on the chart would tend to be either over- or underestimated, but the shape of the surveyed region would not be distorted. However, if a running survey was made, one would expect fluctuations in scaling errors as one proceeded from one baseline to the next down the coast. Scaling errors in running-surveys are a lot harder to identify than in fixed surveys, particularly if the locations of the original baselines are not known. Apparent scaling errors can also easily be generated by other types of error.

Triangulation errors: This kind of error is the result of a compass-bearing measurement error. The bearing could be that of a feature being charted, or that of the other end of a baseline. If a single ship was conducting the survey, measuring the bearing of one station from another had all the attendant difficulties of measuring their distance apart.

Triangulation errors tend to be random in nature and are virtually impossible to correct in any systematic fashion. Errors in bearing measurements were probably controlled by taking more than the bare minimum number of bearings so that they could be checked for mutual consistency. Although not intended primarily as a surveying instrument, sextants held horizontally are first-class instruments for measuring relative bearings and they were certainly used for this purpose. Because relative bearings could be measured very accurately, they can give important clues as to the identity of locations that have been mischarted because of faulty distance estimates or compass directions.

Errors of orientation: All bearings were measured with respect to compass north and the determination of *variation*, which is the difference between compass north and geographic north, was an important activity of the surveying teams. The result of an incorrect determination of variation was an otherwise undistorted rotation of the chart segment when it was incorporated into a larger chart which had geographic north as its reference. Chart orientation errors of more than a degree or two as a result of an incorrect determination of variation are relatively rare in professionally surveyed charts of the period. Parts of the *Carta Que Comprehende...* have serious orientation errors, but, as we shall see, for the most part these are the secondary effect of another type of error.

Errors in location: These are errors in latitude and longitude. Although the determination of latitude was a routine operation for 18th-century navigators, the determination of longitude was a much more complicated and time-consuming business. The usual practice for charts of small areas was to establish the latitude and longitude of just one point on the chart and then to construct latitude and longitude scales based on distance measurements from that point. Of course, charts of larger areas,

such as that covered by the *Carta Que Comprehende...*, were composite charts, and the various independently-surveyed segments could only be accurately juxtaposed if their latitude and longitude scales were correct, which commonly was not the case.

The prime meridian for longitudes in the *Carta Que Comprehende...* is the meridian of the *Contadoría* of the Spanish naval base at San Blas in Mexico. The outpost at Nootka was, with unusual accuracy for longitude measurements, located correctly at 21°20' W of this meridian by Alejandro Malaspina.[21] The latitude of Nootka is marked as 49°34'N, which is just 1.5 nautical miles south of its correct value, a fairly typical latitude error at that time.

Analysing the chart–the method

The first approach to analysing the chart was to make a map of error vectors, that is a map showing at as many points as practical the direction and magnitude of the difference between the positions plotted by the Spanish and the corresponding positions on a modern chart. Without the aid of sophisticated professional cartographic software, or an advanced degree in topological analysis, this was proving for the author to be a very time-consuming and not very enlightening procedure until, eventually, a more manageable approach suggested itself. The essence of this approach was to examine the longitude and latitude errors independently, thereby rendering one complicated two-dimensional problem into two much simpler one-dimensional ones.

Figure 3A shows a plot of the longitude error[22] relative to that of Nootka in the *Carta Que Comprehende...* of points along the west coast of Vancouver Island starting at Nootka, the graph origin, on the left and ending near Gonzales Point at the southern tip of the island on the right. Because this stretch of coastline tends SE, a left-to-right movement in this graph corresponds both to a west-to-east and to a north-to-south movement; however, in Figure 3A, only the west-to-east movement is relevant.

Starting at about Estevan Point west (and north) of Flores Island, an easterly longitude error rises sharply and linearly as one progresses down the coast (left to right on the graph) to just beyond Pachena Point. At Pachena Point, the easterly-error trend abruptly stops but resumes at San Juan Point and continues, although at a different rate from the more northern section, to Gonzales Point in the south (top right). Although not readily apparent because it occurs along a relatively featureless part of the coast, a few miles of coastline between Pachena and San Juan Points has actually gone "missing" from the chart, or is at least severely squashed.

Figure 3B shows a plot of the latitude error for the same stretch of coastline as in Figure 3A, and now it is possible to think primarily in terms of north-to-south movement.

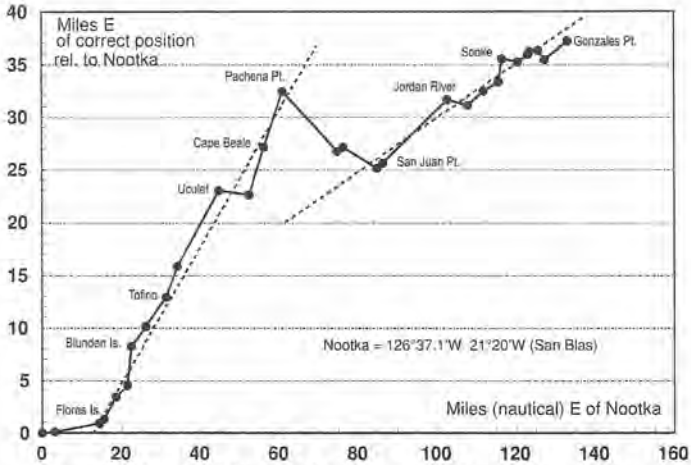

Figure 3A. West Coast of Vancouver Island - longitudes

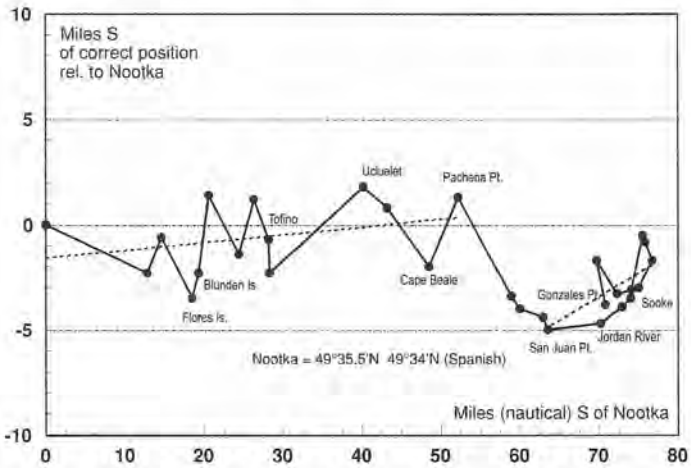

Figure 3B. West Coast of Vancouver Island - latitudes

In sharp contrast to the plot of the longitude error, the latitude error is dominated by randomly distributed position errors. There is only a small, barely discernible, progressive error as the coast is followed from north to south (left to right); nevertheless, the distinctiveness of the error curve for places north (left) of Pachena Point and south (right) of San Juan Point can still be seen. Note that the x-axis to y-axis ratio is the same in all the graphs in this paper so that scaling errors, indicated by the slope of the dotted trend lines, can readily be compared; a positive (upward) slope indicates that the coastline has been drawn too big, a negative (downward) slope that it has been drawn too small.

Figures 3A and 3B taken together suggested that the chart might be made up of segments, all the points of each segment being subject to the same independent longitude and latitude (linear) scaling errors, indicated by the dotted trend lines, and the same independent longitude and latitude offset errors, indicated by the intersection of the trend lines with the vertical axis through zero on the left. If true, it appeared that correcting the chart would be a simple matter of removing the offsets, and restoring for each segment the correct longitude and latitude scales, leaving only the random position errors that scatter the points about the trend lines.

It is important to note here that while the random errors usually amount to no more than two or three nautical miles, the scaling errors are serious. In Figure 3A for example, in order to remove the errors, the longitude scale needs to be reduced by 28% for the western (northern) segment on the left, and 21% for the eastern (southern) segment on the right, and the most serious errors resulting from incorrect scaling exceed 35 nautical miles. Note also that the choice of scaling unfortunately sometimes exaggerates the relative importance of the random triangulation errors, as in Figure 3B. For the purposes of this paper, these should be ignored.

A number of pairs of plots similar to Figures 3A and 3B were made, the most important of which will be described below, and these enabled the chart to be broken up into about 18 segments. [Not shown for space reasons.] Because of the statistical nature of the analysis it is quite possible that some points have been assigned to the wrong segment, and that the number of segments is not correct; nevertheless, the author believes that this disassembly of the chart reflects moderately accurately the way it was put together.

The Spanish method?

Before directing attention to the segmentation process, we should perhaps pause briefly to consider what the successful correction procedure tell us about the techniques of the Spanish cartographers. What the cartographers appear to have done is to assign geographic coordinates (longitude and latitude) to two points within each segment, and then stretch or shrink the segment as required, independently, in the x (longitude) and y (latitude) directions, until the two points are at their assigned positions.[23] In theory, except in special cases, this procedure is not correct as the following sketches may help make clear.

In the first of the two sketches in Figure 4, a symbolic chart segment (top left), representing a segment that requires correction, has been transformed by scaling and rotating (top right). This type of correcting transformation is an idealized version of what one would expect to be required for chart segments that had been incorrectly scaled and oriented.

In the second (lower) sketch in Figure 4, the correcting transformation has been made by independently changing the x-axis and y-axis scales of the figure on the left until the baseline A''B'' has exactly the same length and orientation as the baseline A'B' shown in the first (upper) transformation. Clearly, although as far as the baseline is concerned the transformations are the same, they are not so for the rest of the segment; the second transformation does not preserve the shape of the figure, as it should, whilst the first transformation does.

For chart segments that are almost straight lines, there is, in practice, not much difference between the two transformations and it may well be that the Spanish cartographers knew this and, because they were in a hurry to complete the chart, they used the computationally-much-simpler second transformation rather than the first.

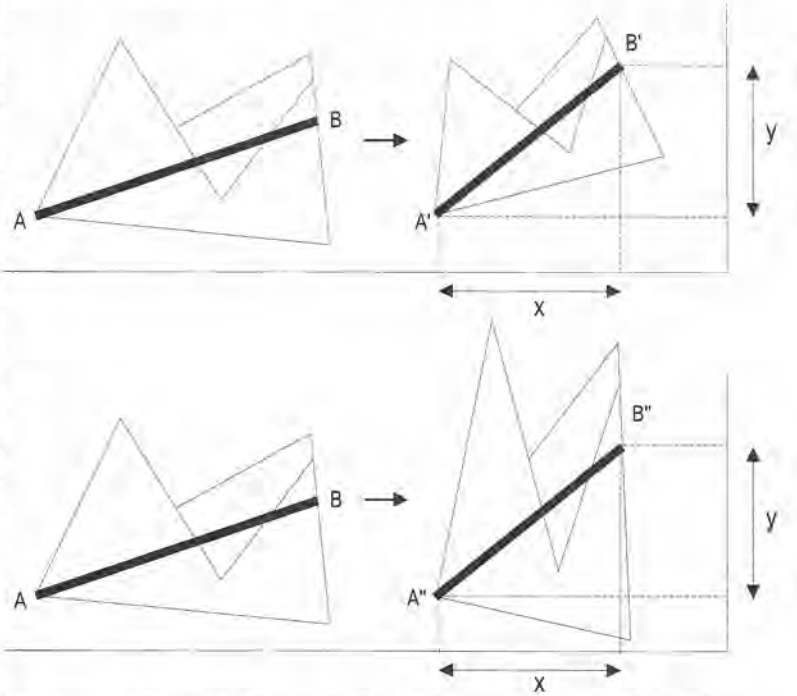

Figure 4. Two non-identical transformations that as far as the baseline AB is concerned are identical.

Whatever the case, the author's assumption is that, because independence of the longitude and latitude errors is such a common characteristic of the chart, the second transformation is the one that the Spanish cartographers actually used.[24]

Segmenting the chart–the results

Some of the most important results of the search for segments are illustrated in the following four pairs of graphs.

Figure 5A shows a plot of the longitude error for points along the east coast of the island, starting at Cape Lazo near the present-day Comox on the left, and finishing at the southern end of Saturna Island in the Canadian Gulf Islands on the right. The characteristics of this plot are very different from those for the west side of the island shown in Figure 3A. Here, there is no appreciable longitude error down the length of the east coast, other than the fact that the whole coastline is shown about 33 nautical miles too far east.

Figure 5B shows a plot of the latitude error for the east coast. This graph completes the contrast between the east and west coasts by showing that whereas there are few latitude errors along the west coast as shown in Figure 3B, the east coast shows a progressive latitude error from north to south (left to right) as one progresses down the

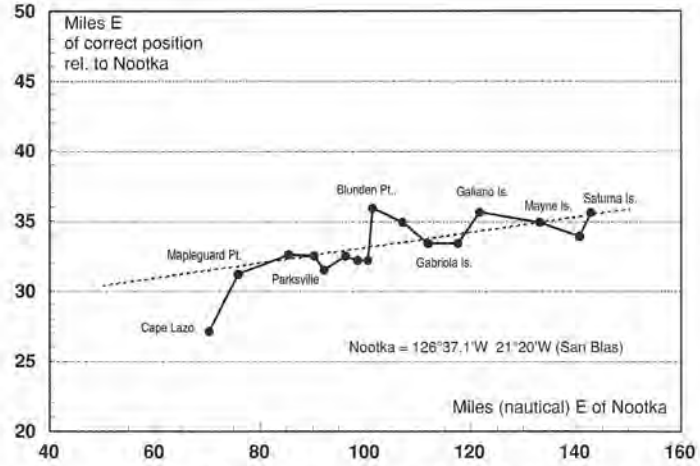

Figure 5A. East Coast of Vancouver/Gulf Islands - longitudes

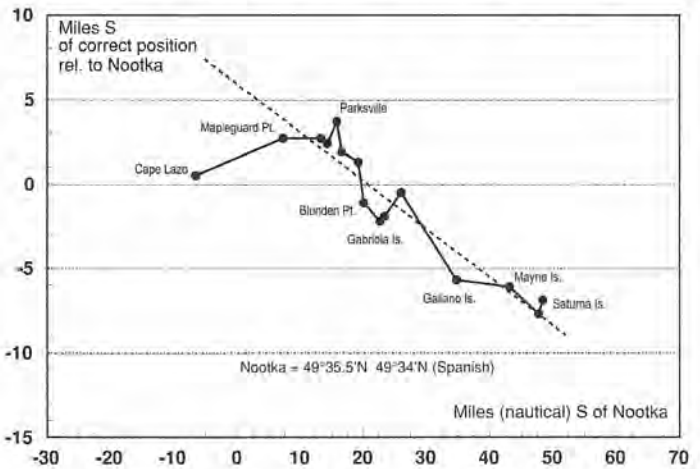

Figure 5B. East Coast of Vancouver/Gulf Islands - latitudes

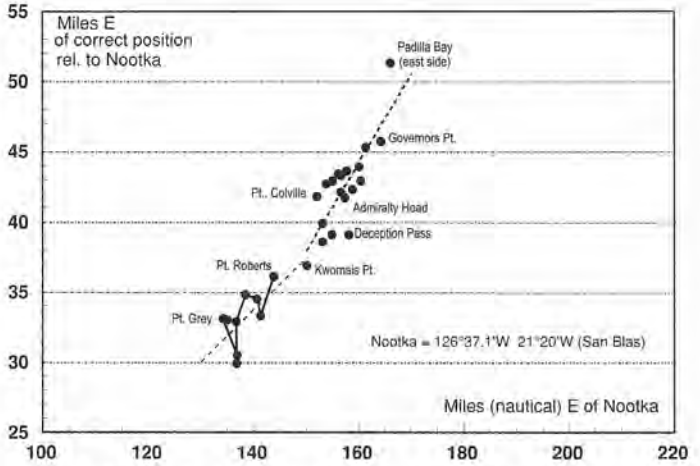

Figure 6A. East Mainland Coast - longitudes

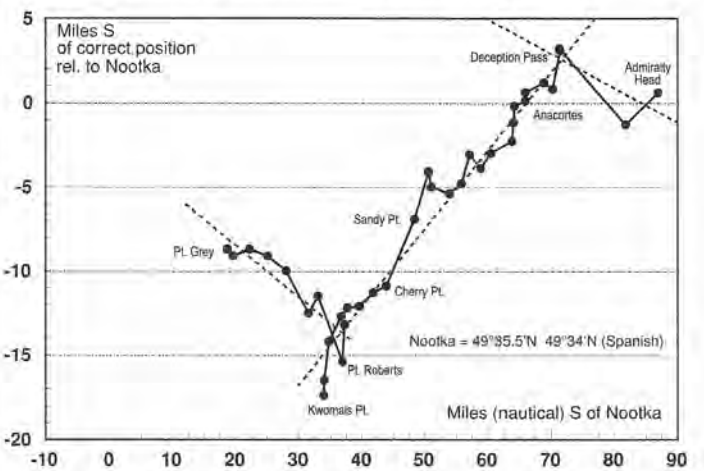

Figure 6B. East Mainland Coast - latitudes

coast. The longitude scaling error on the west coast, and the latitude scaling error on the east coast complement each other and give the depicted coastline of Vancouver Island its counterclockwise tilt. One can conclude from Figures 5A and 5B that, unlike the west coast, the east coast constitutes just one segment of the chart, except perhaps for the portion around Cape Lazo at the northern end of the charted coastline (far left of the graphs).

Figure 6A shows the longitude error plot for the east mainland coast from Admiralty Head in Washington State to Point Grey in Vancouver, British Columbia. Because this coastline runs north-south, it is difficult to accurately identify the trend line, but any doubt that the mainland coast and the Fraser estuary region from Point Roberts to Point Grey are different segments is removed by Figure 6B. Figure 6B also identifies the coastline between Deception Pass and Admiralty Head (top righthand corner of the graph) as part of another segment.

Figure 7A shows the longitude error for the coastline between Point Roberts and the northern end of Texada Island on the left. The plot confirms the visual impression that Howe Sound has been severely "squashed" in the longitude direction as indicated by the downward sloping trend line; this segment is also quite clearly separate from that for the Fraser estuary which in contrast has been "stretched" in the longitude direction. Once north (west and left) of Gower Point, the error characteristic is similar to that of the east coast of Vancouver Island shown in Figure 5A. Note that Lasqueti Island appears to be a few miles misplaced relative to the larger Texada Island. Figure 7B shows the latitude error which is again similar in nature to that for the east coast of Vancouver Island shown in Figure 5B.

The final pair of plots, Figures 8A and 8B, show the errors for the Olympic Peninsula on the south side of the Juan de Fuca Strait. Because of the predominately east-west trend of this coast, the latitude scaling error in Figure 8B is difficult to determine; however, the two figures do suggest that the south mainland coast is part of the same segment as the south end of the west coast of Vancouver Island shown in Figures 3A and 3B. Note also in both Figure 8A and 8B the probable separateness of the small segment of coast between Admiralty Head and Deception Pass, as was noted in Figure 6B.

The final product

In all 18 segments were identified, some of which were small. In each case a linear regression analysis of the relationship between the old and modern longitudes and

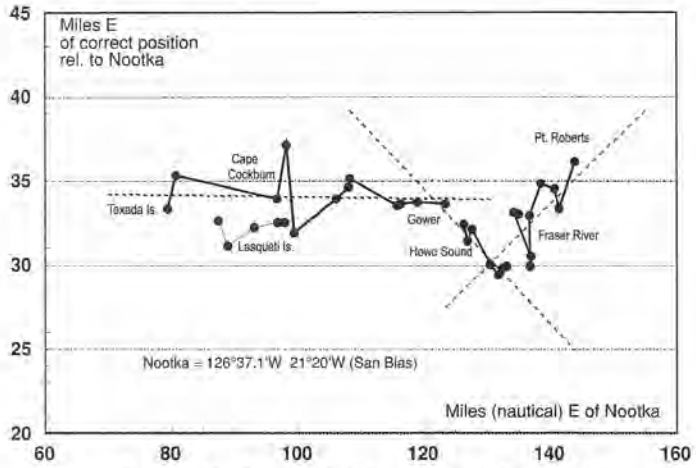

Figure 7A. North Mainland Coast - longitudes

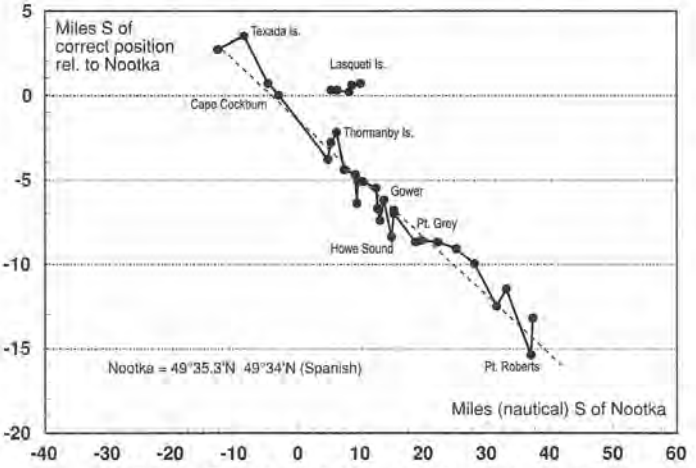

Figure 7B. North Mainland Coast - latitudes

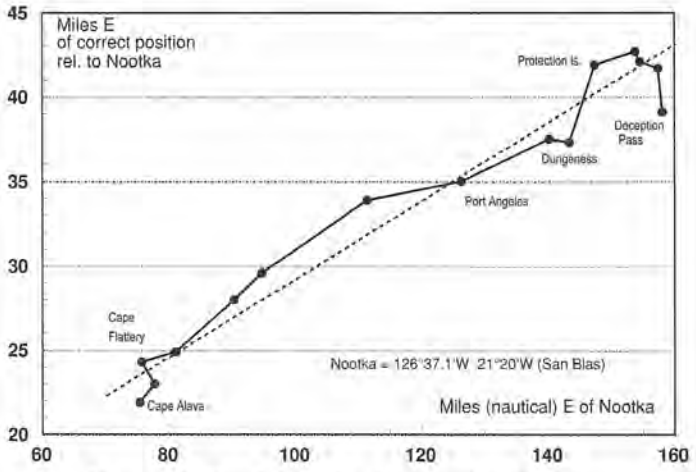

Figure 8A. South Mainland Coast - longitudes

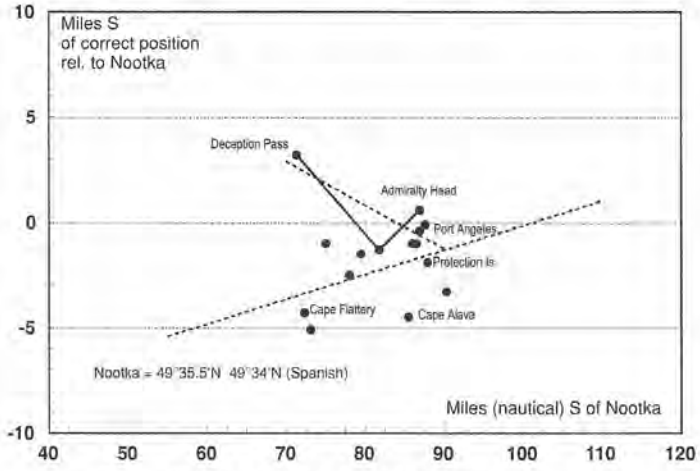

Figure 8B. South Mainland Coast - latitudes

latitudes was made to determine how to correct the scaling and positioning of the segments.[25] After rescaling and repositioning, each segment was checked for an orientation error which was determined by rotating the segment about the corrected mean longitude and latitude of the segment until the sum of the squared distances between the selected points and their actual locations was as small as possible. In nearly all cases no significant improvement could be had by rotating segments once their longitude and latitude scales were correct, the exceptions being Howe Sound and Burrard Inlet as will be discussed below.

The final result is shown in Figure 9. In several cases, a corrected segment does not join smoothly with the adjacent segment, but these disconnections, which are in no case very serious, have been left uncorrected in order not to introduce subjective "fiddling" into the correction procedure. The only exception to this was the nudging of Texada Island a mile or so to the north to prevent it "colliding" with Lasqueti Island. The Spanish clearly observed the Sabine Channel between the two islands, though the lack of cartographic detail in the channel suggests that they did not pass through it; only local errors in the shape of the two islands causes the segment corrections to close the channel.

Comparing Figure 9 with Figures 1 and 2, it seems fair to say that the correction procedure, although relatively simple, goes some way towards transforming the Spanish chart to its modern equivalent. Improvements are particularly noticeable along the east mainland coast which is characterized in the original by a steadily increasing northerly error as the present-day boundary between Canada and the United States is approached. This distortion is most conspicuous at the northern end where the coastline is depicted as cutting deeply into the present-day Delta and Surrey area of British Columbia. The most noticable longitude error is in the Padilla Bay area of Washington State, which is shown considerably larger than it should be as a result of its eastern shore being shown too far east relative to the remainder of the coastline.

One noticeable flaw in the original chart was the relative sizes of Lasqueti and Texada Islands and it is interesting to note that the correction procedure has emphasized the incorrect charting of the NE coast of Texada Island.

Having achieved some success in analysing the errors in the chart, the next step was to look at areas where the original chart is difficult to interpret to see if the corrected chart makes interpretation any easier. Two areas were looked at in detail and a description of the findings follows.

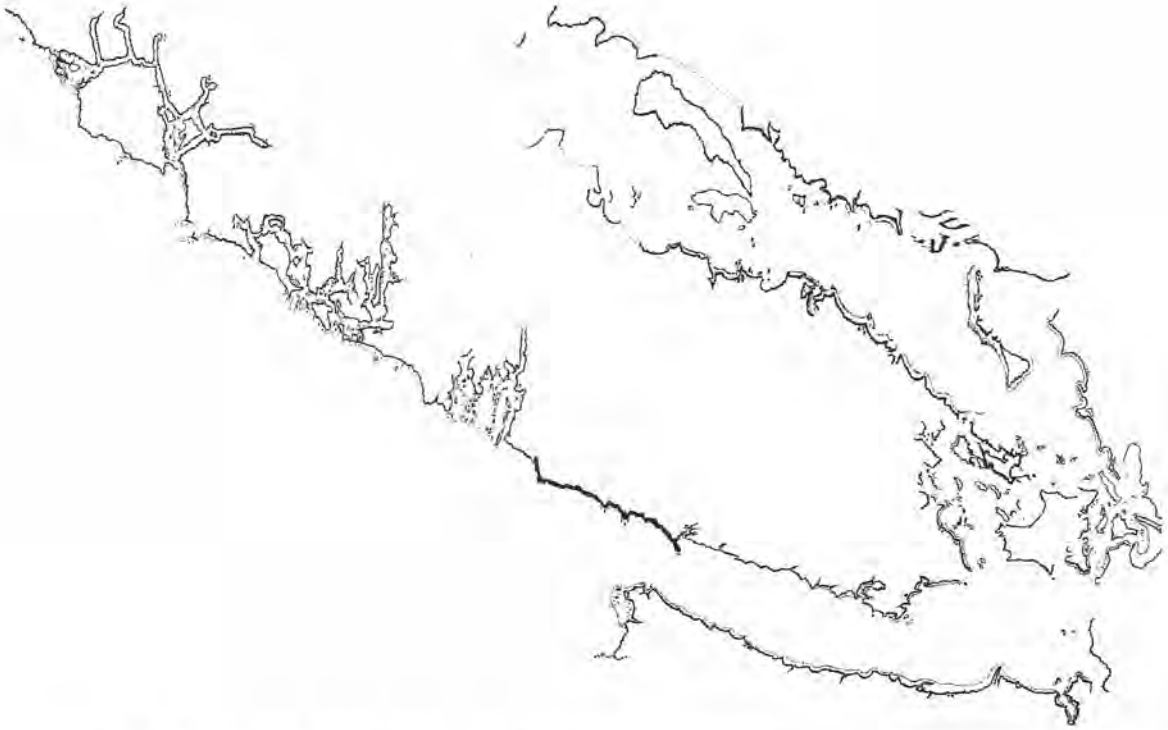

Figure 9. The Carta Que Comprehende... with each identified segment corrected for longitude and latitude scale and offset.

The Vancouver area–a modern reconstruction

Figures 10 and 11 show respectively the chart of the lower mainland area of British Columbia in its original form and in its reconstructed form.

Figure 10, which is an often-reproduced segment of the *Carta Que Comprehende...* , appears to contain, what must seem to anyone not familiar with the countryside around the Fraser estuary, an appalling error in that it shows a large, non-existent body of water stretching northwards from between Point Roberts (Sp. *Isla de Zepeda*) and Kwomais Point in Surrey (Sp. *Punta de San Rafael*) towards the Burrard Inlet. In fact, this is a perfectly understandable mistake by Narváez. The land between the north arm of the Fraser and Boundary Bay is delta land laid down since the end of the last ice age and is still just a few feet above sea level. Now agricultural land, but formerly wet meadows and marshes, this land is difficult to see from any distance away from the shoreline in Boundary Bay. Explanations for Narváez's error include the lowland around Point Roberts being flooded by the Fraser, being below the horizon, being shrouded in low-lying mist, or, the author's suggestion, being obscured by refraction caused by the sun drying out and heating up the air above the mudflats at low tide. All of these phenomena, except flooding which is prevented by modern dikes, often give the high ground at Point Roberts, quite strikingly, the appearance of an island, which undoubtedly it was just a few thousand small boat.

The third feature of interest is the rather peculiar representation of the Burrard Inlet and the identity of *Punta de la Bodega*. The contending schools of thought are that the point is Point Atkinson in West Vancouver, or that it is somewhere in Stanley Park, Point Ferguson, for example.[27] Henry Wagner, the historian who gave a lot of thought to such matters was an advocate for the Point Atkinson solution based on the proximity of the point to Point Grey,

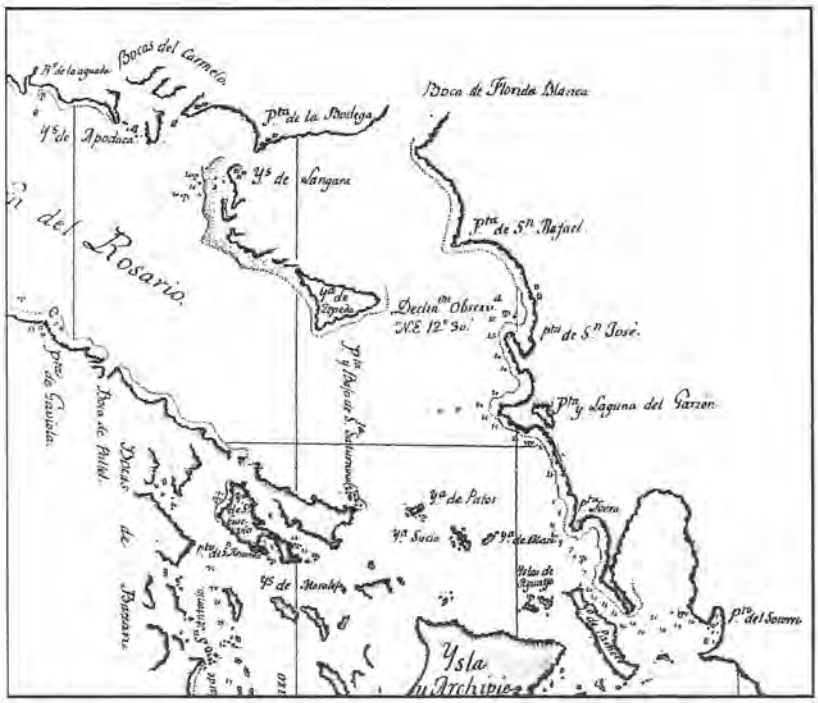

Figure 10. The original chart of the B.C. lower mainland area and adjacent coast in Washington State.

and the fact that Native habitations were located on the chart on the east side of the point.[28] It would have been difficult for somebody to observe a village on the east side of Stanley Park without that somebody also noticing that Point Grey is not a small island (*Punta de Lángara* as it was later to become, not, as marked on the 1791 chart, as *Isla de Lángara* or one of the *Islas de Lángara*). Unfortunately the cartographic evidence does not support the historian's choice; even in the uncorrected version of the chart the bearing of the *Punta* from the expedition's marked anchorage off Point Grey of 67º is seriously at odds with the true bearing of 15º. In contrast the bearing from the anchorage to, for example, Cape Roger Curtis at the south of Bowen island is almost exactly correct.

Correcting the segment of the chart showing the north shore of Burrard Inlet unfortunately proved not to be straightforward. Associating the segment with either the adjacent Howe Sound segment to the west, or with the Fraser estuary segment to the south, and correcting accordingly produced a nonsensical result. The author was therefore forced to make an exception to the general procedure, which was otherwise rigorously applied, for correcting the chart. What has been done to the north shore segment is, for reasons explained below, to leave its scale unchanged, but to rotate it 20° clockwise. This very neatly slides *Punta de la Bodega* into Stanley Park with the tip of the point close to the entrance to False Creek as shown in Figure 11. The eastward trending shoreline must have been deduced from the line of the North Shore Mountains which are visible from anywhere along the coast of the lower mainland south of Burrard Inlet.[29]

The reason for suspecting that the orientation of the north shore segment might be wrong is as follows. Firstly, the Fraser estuary segment, as can be seen in Figure 10, has a definite counterclockwise rotation to it compared to a modern chart. The independent longitude and latitude corrections that have been applied are in fact approximately equivalent to a 7% increase in the distance between Point Roberts and Point Grey together with a 20.5º clockwise rotation. Such a rotation is almost exactly what would be required if the whole stretch of coast had been charted with respect to magnetic north and not true north. The current (1996) variation in Boundary Bay is about 20°00'E and Captain Vancouver reported it to be 19°30'E in Birch Bay in 1792. That there may have been a mistake in the orientation of this segment of the chart is also suggested by the inscription inserted in nearby Boundary Bay which reads *Declin.m Observ.a N.E. 12°30'*.[30] This figure is quite wrong. Although the compass variation, or declination as it is called here, does vary by a few degrees over long periods of time, there is no evidence that in historical times it fell to as little as 12°30'E. This mistake possibly indicates some confusion over orientations for the Boundary Bay and Fraser estuary region, and possibly also, as suggested above, for the north shore of Burrard Inlet.

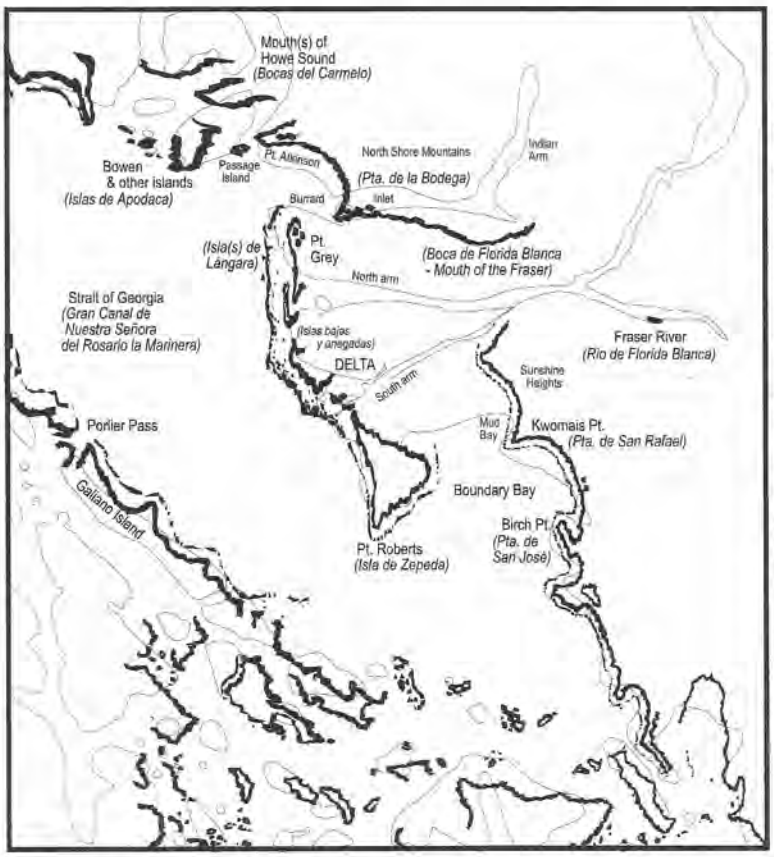

Figure 11. The corrected chart of the lower mainland area superimposed on a modern chart (lighter lines).
The inscription "low-lying and waterlogged islands" (Ys bajas y anegadas) does not appear on all copies of the chart. Some copies have Point Grey as "Isla de Langara", not one of several islands (Islas...).

Why Narváez failed to observe, or why he rendered unrecognizable, Jericho and Kitsilano beaches east of Point Grey and on the south side of English Bay to the west of Stanley Park is a mystery that unfortunately even a mathematician is unlikely to be able to solve.

The northern end of the Strait of Georgia–a modern reconstruction

The second area studied in detail was the north end of Georgia Stait, shown in Figure 12.[31] The chart's toponyms on the Vancouver Island side of the strait are generally agreed–*Punta de Lazo de la Vega* (Cape Lazo), *Punta de Araus* (somewhere on Denman Island), *Bocas de Valdés* (Baynes Sound), and *Islas de Lerana* (Hornby and close-by islands)–but what of *Isla de Campo Alange*, *Punta de San Luis*, *Punta de Romay*, *Punta de Camino*, and the *Boca de Flórez* between *Alange* and *San Luis* on Haro's version of the chart [Wagner #813]? Even Galiano may have been puzzled as to the identity of these places when he revisited the area in 1792 because none of these names appear on his charts.

What is certain is that the expedition travelled up the east side of Texada Island at least as far as Cape Cockburn (Sp. *Punta Arze*) a few nautical miles south of the Jervis Inlet,

Figure 12. The corrected chart of the north end of the Strait of Georgia with a modern chart in the background.

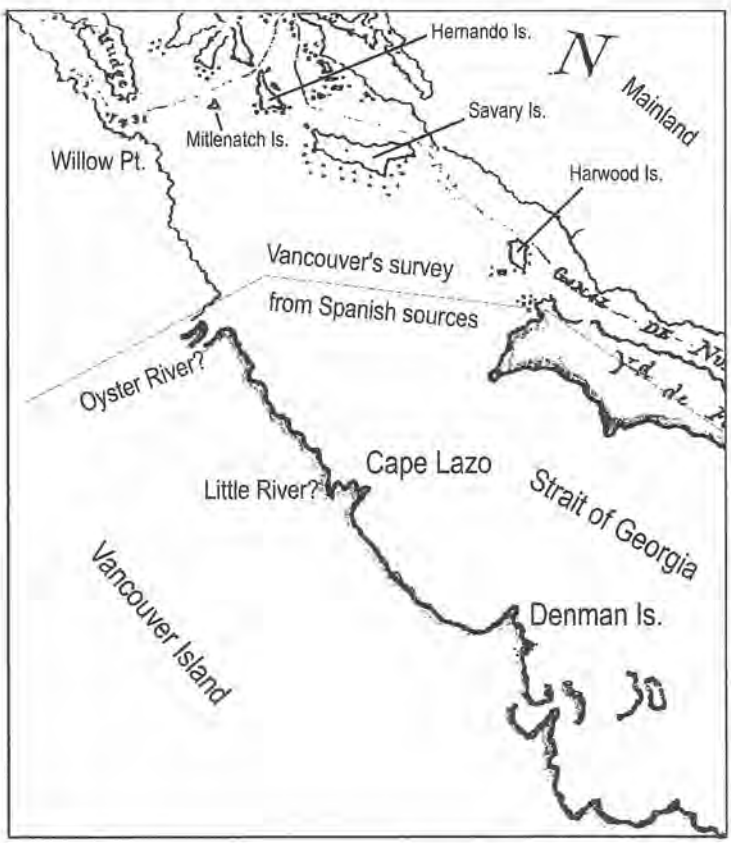

Figure 13. Baker's 1792 chart of the north end of the Strait of Georgia showing areas surveyed by the Spanish.

which was missed. They then, it is conjectured, turned back, rounded the south side of Texada Island, and again travelled NW. In order to be able to distinguish Harwood Island from Texada Island they must have reached the 124º38'W meridian, and they must also have crossed the line between Favada Point and Cape Lazo for they saw correctly that Texada was an island. A good possible reason for the poor positioning of Harwood Island and also Savary Island is that they did not travel far enough north to get effectively more than one compass bearing on each of these islands. The poor charting of the northern tip of Texada Island, especially on the eastern side, also suggests that they did not progress much further north than Favada Point (latitude 49°44'N, 10 nautical miles or so north of Nootka). From there they presumably proceeded SE, not passing too close to Hornby Island which is scarcely recognizable on the chart as such, and then south to the western end of Qualicum Beach on Vancouver Island, a place called *Punta de Leonardo* possibly just to the east of the present-day mouth of the Little Qualicum River where there is a small anchor marked. From there southward, the charting is detailed and fairly accurate.

As did the north shore of Burrard Inlet, the segment depicting the northern part of the strait presented some problems in that the segment did not seem to belong to either the segment containing Texada Island and the northern part of the mainland coast, or to the eastern side of Vancouver Island; corrections based on either of these segments produced unintelligible results. The correction to the segment actually used has been based on an analysis, using the same principles as applied everywhere else except Burrard Inlet, which uses the known positions of Cape Lazo, Cape Cockburn, Baynes Sound (Mapleguard Point), and the northern part of Texada Island.

The result neatly identifies *Isla de Campo Alange* as being either Mitlenatch Island, or, supposing a faulty distance estimate, Cape Mudge.[33] Haro's version of the chart [Wagner #813] gives weak support to the Mitlenatch Island theory by showing *Campo Alange* to be a small island, although Mitlenatch is even smaller than shown.[34] Cape Mudge is scarcely visible in poor conditions from the latitude of Cape Lazo, yet it cannot be discounted as being the *Isla*. To Commander Richard Mayne in 1860 "... Cape Mudge appear(ed) as an island in the middle of the Gulf, presenting a high steep face to the southward (actually SE)"[35], exactly as shown by the Spanish chart.

Punta de San Luis is, according to Figure 12, probably Hernando Island, *Punta de Romay* is probably Savary Island, and *Punta de Camino* is probably Harwood Island. These correlations would make *Boca de Flórez* a

toponym for the Sutil Channel between Quadra and Cortes Island, particularly if observed from near the coast of Texada Island. This channel often has the appearance of being significant when seen from the south because the unbroken background of mountains is further away in this direction, and hence less clearly seen through the haze that is always present in any but perfectly clear weather.[36]

Figure 13 provides an interesting historical footnote to the question of the identity of *Isla de Campo Alange*. This sketch is a draft (#228) of Lieutenant Joseph Baker's. Baker sailed with Captain Vancouver and the draft shows areas of Vancouver Island surveyed by Peter Puget and Joseph Whidbey in the summer of 1792, and to the south and west, marked in red on the original, areas surveyed by the Spanish. The Spanish information given to the British can only have been gathered by the Narváez expedition of 1791, yet the depiction of the coastlines is somewhat different in detail from that of the *Carta Que Comprehende...*. Baker's demarcation line south of Willow Point is at the northern point of a double-entranced inlet (later changed to a bight), a feature that along this low and featureless stretch of coast, if it represents anything at all, can only indicate the area around the estuary of the Oyster River and perhaps the nearby lagoon on Kuhushan Point. The sketch is too poor to provide any direct help in interpreting the *Carta Que Comprehende...*; however, if the Spanish did indeed reach as far north as Kuhushan Point (latitude 49°53'N), albeit in poor weather and without being able to conduct a survey, then it becomes more likely that they would have seen the white, sandy cliffs of Cape Mudge and more likely that it is this cape that they named *Isla de Campo Alange*.

Conclusions

The author would be the first to agree that this analysis of the errors in the 1791 chart is not perfect, nor is it entirely objective in spite of the use of a computer to compile the corrected chart. The original objective of using known locations to help locate unknown ones has only partially be achieved because, as was discovered in the course of the analysis, errors of a particular type tend to be confined to segments and unknown locations tend to be in segments of their own. Nevertheless, the author would contend that progress has been made, particularly through the introduction of numerical analysis. It has also been interesting to have gained some insight into what the navigators must have been up to in the busy days of the fall of 1791 at Nootka as they prepared the chart for delivery to their superiors in Mexico before the onset of winter.

Acknowledgments

I should like to thank my one-time colleague David Clarke who provided much advice and technical assistance with the scanning and subsequent graphical processing of the chart; it is doubtful that without his help this work would ever have been completed. Thanks are also due to John Crosse of Vancouver who supplied me with photocopies from his collection of copies of unpublished charts from the Spanish era, particularly the copy of the *Carta Que Comprehende...* held in the Library of Congress, Washington, and to J. E. (Ted) Roberts of Victoria who is an authority on the activities of the Vancouver expedition in 1792. Ted kindly provided me with a copy of Lieutenant Baker's sketch and examined the expedition's logbooks on my behalf.

End Notes and References

1. Vancouver Island is about 250 nautical miles long from southeast to northwest but because of the large number of islands and deep inlets, the shoreline is much longer. This is typical for the province as a whole. British Columbia probably has as much as 15,000 nautical miles of shoreline, even though the northern and southern coastal borders are only 520 nautical miles apart.

2. The compliment was returned; Galiano's 1792 chart of Vancouver Island includes details of Admiralty Inlet, Puget Sound, and other mainland inlets never visited by the Spanish, particularly on the north side of Queen Charlotte Strait.

3. Martínez, it may be recalled, seized several "foreign" vessels for illegal trading, an impertinence that almost caused a full-scale war between Britain and Spain. See Cook, Warren L., "Flood Tide of Empire—Spain and the Pacific Northwest 1543—1819", pp.146—270, Yale University Press, 1973. Also Bartroli, Tomàs, "The Spanish Presence on the Northwest Coast", B.C. Historical News, Vol.4 No.2, pp.11—22, Feb. 1971.

4. The strait was allegedly first discovered by Juan de Fuca, born Apóstolos Valerianos, in 1592, but the truth of this claim is disputed. The single piece of evidence supporting the claim is a report by Michael Lok of a conversation Lok had with the elderly Greek pilot in Venice, published in 1625. Cook, *Ibid* [3], pp.539—543.

5. The SANTA GERTRUDIS LA MAGNA may have been the repaired and renamed NORTH WEST AMERICA built at Nootka by John Meares in 1788 and seized by Martínez from Meares' associate Robert Funter in 1789. The Spanish claim however was that the NORTH WEST AMERICA had been abandoned by the traders and was an almost worthless wreck.

6. The PRINCESS ROYAL (Sp. PRINCESA REAL) was seized from the British trader James Colnett by Martínez and taken to San Blas. The ship had been brought back to Nootka following loud noises of protest from London with the intention of returning it to its owner, but since Colnett was not there, Eliza decided to borrow it.

7. The possible relationship between the SANTA SATURNINA, SANTA GERTRUDIS LA MAGNA, and NORTH WEST AMERICA ranges all the way from them being the same vessel, albeit disassembled and later reassembled, to

them being three entirely separate vessels. See Pethwick, Derek, "First Approaches to the North-West Coast", p.215, Douglas & McIntyre, Vancouver, 1976.

8. Wagner, Henry R., "Spanish Explorations in the Strait of Juan de Fuca", Fine Arts Press, Santa Ana, California, 1933.

9. A common view of commentators is that Eliza scarcely deserves the honour as all of the work appears to have been done by his pilots.

10. This is the opinion of the respected historian Wagner; however, Pantoja himself reported that he worked on the charts at Nootka in the late summer of 1791 with Narváez and Verdía while Carrasco returned to San Blas in the SANTA SATURNINA. See Wagner, "Spanish Explorations ...", pp.152—153 and pp.194—195.

11. Wagner, Henry R., "The Cartography of the Northwest Coast of America to the Year 1800", 2 vols. Berkeley, California, 1937.

12. Higueras Rodriguez, Maria Dolores, "Northwest Coast of America—Iconographic Album of the Malaspina Expedition", pp.28—29, Museo Naval de Madrid, 1991. The Naval Museum has two copies which differ slightly (Higueras Rodriguez, *Catálog crítico de los documentos de la Expedición Malaspina del Museo Naval*, 1985-1990, Ref: III.E [1 bis] #1739).

13. Galiano, who arguably was the most competent surveyor on the coast in this period, noted this error in the chart along the west coast of Vancouver Island in a report to the viceroy in Mexico. It was also probably Galiano who reported, correctly, that the cause of the error was a 38' mistake in the longitude of the Spanish outpost of Nuña Gaona (Neah Bay) relative to that of Nootka. *Ibid* [8], p.210.

14. Douglas, James, "Report of a Canoe Expedition along the East Coast of Vancouver Island", Journal of the Royal Geographical Society, 24, pp.245—248, 1854.

15. *Isla* (island) is the modern spelling of *Ysla*, often abbreviated on 18th-century Spanish charts to Y^{a}. Similarly, *Islas* (islands) appears as Y^{s}, *Punta* (Point) as P^{ta}, and *Puerto* (Port) as P^{to}. *Boca* (mouth) is the entrance to an inlet, or the estuary of a *río* (river).

16. Matthews, J.S., "Narvaez 1791—Discoverer of the Boca de Florida Blanca (Mouth of the Fraser River)", Vancouver Historical Journal, 4, January 1961. The Delta area of Greater Vancouver was undoubtedly flooded annually by the Fraser River before it was diked, but I think widespread encroachment by the sea ceased long before the end of the 18th century.

17. Bartroli, Tomás, "Genesis of Vancouver City—Explorations of its site 1791, 1792 & 1808", pp.36—49, Marco Polo Books, Vancouver B.C., 1997.

18. An additional factor is that many records of the Spanish expeditions, including the Journals of Malaspina, remain untranslated into English to this day. See Higueras Rodriguez, Maria Dolores, "Sources for Assessing the Contribution of the Malaspina Expedition to the History of the Northwest Coast", pp.53—59, in "Spain and the North Pacific Coast", Inglis R. (ed.), Vancouver Maritime Museum, 1992.

19. *Ibid* [8], pp.173—174.

20. For a good review of late 18th-century coastal survey techniques see David, Andrew, "Vancouver's Survey Methods and Surveys", in "From Maps to Metaphors", Fisher R. and Johnston H. (ed.), University of British Columbia Press, pp.51—69, 291—293, 303—305, 1992. The techniques used by the Spanish would have been very similar to those described by David; however, in general the Spanish surveys were conducted with considerably less man-power than those of the British, and consequently the Spanish may not so often have had the time to accurately measure the lengths of their baselines.

21. The correct value for the longitude of the observatory tent at Friendly Cove on Nootka Island is 20°20.6'W (San Blas) which is 126°37.1'W (Greenwich). Both Cook (1778) and Vancouver (1792) made many astronomical observations at Nootka Sound, but because they relied solely for their longitude determinations on tables in the British Nautical Almanac which were faulty, both failed to match the accuracy of the Spanish.

22. For the purposes of analysis "nautical miles east" were taken to be minutes of arc of longitude east multiplied by 0.66. This is a flat-earth assumption that is only strictly true at latitude arccos(0.66) = 48°42'. It makes no practical difference to the results.

23. Malaspina specifically mentions this technique in his instructions to José Espinosa y Tello at the start of a survey of the Nootka Sound region in 1791. See Cutter, Donald C., "Malaspina and Galiano—Spanish Voyages to the Northwest Coast 1791 & 1792", p.84, Douglas & McIntyre, University of Washington State, 1991. Longitudes must have been determined by dead reckoning from an established position, it being quite impractical, without a modern GPS, to make a series of accurate, independent determinations of longitude as a survey progresses. Latitudes would have been determined in the same way, although latitude is relatively easy to measure directly by astronomical observation and so it would have been possible for the surveyors to occasionally check their dead-reckoning estimates.

24. Although it is not possible to correct the chart in a scrupulously accurate manner because we do not know what the original scales of the chart segments were, the author's research has shown that after correcting the

Island Segment number	long.	lat.	orient	lat./long.	lat. x long.	
3	0.99	0.92	-0.2°	0.9	0.9	Cape Cook, Brooks Peninsula
1	0.84	1.14	0.0°	1.4	1	Bunsby Islands to Esperanza
2	0.85	1.02	3.2°	1.2	0.9	Nootka Island inner coast
4	0.62	0.93	-0.4°	1.5	0.6	West coast - north
15	1.43	2.09	-1.0°	1.5	3	West coast - small middle segment
5	0.79	0.79	-0.4°	1	0.6	West coast - south
9	0.84	0.77	-1.8°	0.9	0.7	Gulf/San Juan Islands
14	0.95	1.4	-0.6°	1.5	1.3	East coast
10	0.78	0.78	-3.2°	1	0.6	East coast - northern tip
17	0.79	0.95	0.6°	1.2	0.8	North Strait of Georgia
Mainland Segment number	long.	lat.	orient	lat./long.	lat. x long.	
16	0.92	1.11	-0.6°	1.2	1	Lasqueti Island
13	0.99	1.55	-0.4°	1.6	1.5	North coast & Texada Island
12	1.65	1.13	-10.2°	0.7	1.9	Howe Sound
18	1	1	-20.0°	1	1	Burrard Inlet
11	0.64	1.39	0.8°	2.2	0.9	Fraser estuary
7	0.6	0.67	0.2°	1.1	0.4	East coast
8	0.44	0.63	-1.2°	1.4	0.3	East coast - Padilla Bay
6	0.81	0.85	0.8°	1.1	0.7	Olympic Peninsula

Table 1: Chart Correction Details

longitude and latitude scales, very little further improvement in the match between the chart segments and the corresponding segments of modern charts can be effected by arbitrarily scaling and rotating the segments. This observation is perhaps a consequence of the fact that so many of the chart segments are fairly linear pieces of coastline for which the second transformation, correctly applied, is almost as good as the first.

25. Table 1: Chart Correction Details
Each chart segment, with arbitrarily assigned segment number in column 1, has had its original longitude (horizontal) and latitude (vertical) distances corrected by multiplying them by the factors given in columns 2 and 3. Column 4 (orient) gives the angle through which the "corrected" segment has subsequently been rotated (CCW positive). Column 5 (lat./long.) is the aspect ratio of the scaling factors (>1 indicates "stretched" vertically and/or "squashed" horizontally). Column 6 (lat. x long.) gives the area correction (>1 indicates area increase compared with the original chart).

Except on the equator a degree of latitude represents a greater distance over the surface of the Earth than does a degree of longitude; hence, the result of drawing a chart which afforded to degrees of latitude only the same weight as degrees of longitude is a chart which would require a lat./long. aspect ratio correction at the latitude of Vancouver Island of about 1.5. Interestingly, 10 of the 18 lat./long. ratio corrections in the table above are in the expected range 1.0 ±0.2, but another 6 are in the range 1.5 ±0.1. Does this perhaps indicate that in their haste to complete the chart there was sometimes some fundamental confusion on the part of the Spanish cartographers over scales?

26. Matthews, *Ibid* [16], pp.29—40. For a considerably more conservative interpretation of the evidence, see Bartroli, Tomás, "Discovery of the Site of Vancouver City by José María Narváez in 1791", pp.15—17, University of B.C. Library Special Collections, Revised version: October 1986.

27. Matthews, *Ibid* [16], pp.58—88. Major Matthews' account of the exploration of English Bay in 1791, although highly readable, is mostly conjecture ("incidents presumed to have occurred" in his words). The *Carta Que Comprehende....* is the only primary source of information that there is.

28. There were Native villages on the east side of practically all of the possible sites for *Punta de la Bodega*. The one in Stanley Park was called *Khwaykhway* (*Whoi-whoi* in earlier texts) and was destroyed in 1888 when the park was created and many of the inhabitants had contracted smallpox. Another contending village, *Wh'mullutsthun* (*Homulchesun* in earlier texts) was located on the east bank of the Capilano River. See Macdonald, Bruce, "Vancouver—A Visual History", pp.10—11, Talonbooks, Vancouver B.C., 1992.

29. The *Boca de Florida Blanca* is a fanciful representation of the supposed mouth of the Fraser River at the end of Burrard Inlet. The identification seems to be a matter of either disagreement or confusion between the expeditionary members. Pantoja, who did not travel with Narváez into the Georgia Strait but who was a member of the Eliza expedition, in one of the few written accounts writes correctly that near to *Isla de Zepeda* (Point Roberts) there must be a copious river on account of the freshness (sweetness) of the water, *Ibid* [8], p.186; however, Pantoja's commander Eliza writing to the Viceroy of New Spain (Mexico) in almost the same words says quite wrongly that the river was located between *Bocas del Carmelo* (Howe Sound) and *Punta de la Bodega*, i.e. in Burrard Inlet, *Ibid* [8], p.151. In Haro's version of the chart [Wagner #813] probably drawn with Carrasco and Pantoja's help[32], *Boca de Florida Blanca* is called *Boca de la Bodega*; it is also shown thus in Pantoja's sketch [Wagner #796]. It would be interesting to know what Narváez thought, but we have no record of his opinion. For an authoritative discussion of this point see Bartroli, *Ibid* [17], pp.161—163.

30. The usual navigational term for the difference in azimuth between compass north and geographic north is variation (Sp. *variación*), and this term is used everywhere on the chart except Boundary Bay. Declination (Sp. *declinación*) is the term usually used by scientists for the same quantity, suggesting that the annotations on the chart regarding the direction of magnetic north were not all made by the same person.

31. Note that parts of the coast that are shown as featureless lines and were clearly not surveyed or even observed in this area of the chart are shown dotted. These lines were omitted in Haro's version of the chart [Wagner #813] drawn in San Blas in January 1792, quite possibly in direct consultation with the two expeditionary members who had sailed south in 1791.[32]

32. After completion of the survey in August 1791, Carrasco sailed directly to San Blas from the Juan de Fuca Strait in the SANTA SATURNINA. Pantoja sailed for San Blas from Nootka in October 1791 with Ramon Antonio Saavedra y Giraldes in the SAN CARLOS. Eliza remained at Nootka until July 1792, when he also left for San Blas in his frigate NUESTRA SEÑORA DE LA CONCEPCIÓN, presumably in the company of the pilot Narváez who had been assigned to this vessel. *Ibid* [8], p.181. The movements of Verdía after he assisted in preparation of the chart at Nootka in 1791 are not known to the author.

33. Wagner identifies *Isla de Campo Alange* as being without doubt Hernando Island. *Ibid* [8], p.39. This certainly looks possible on the uncorrected chart, but the judgement ignores the displacement and scaling errors of the closely associated mainland coast.

34. If Mitlenatch Island is *Isla de Campo Alange*, its smallness is a characteristic that might not have been appreciated by the marqués del Campo de Alange who was Spanish ambassador to London at the time.

35. Mayne, Richard Charles, "Four Years in British Columbia and Vancouver Island", p.176, John Murray, London, 1862.

36. The author made a visit recently to Cape Lazo and took the ferry across to Powell River to check the appearance of the various islands in the northern part of the Strait of Georgia when viewed from a distance in hazy weather. Mitlenatch Island was obviously an island and, although less than a mile across, was conspicuous on account of its pale brown and treeless rocks; Hernando could be seen, though it was no more obviously an *Isla* than other islands that have been identified as *Puntas*; Savary was very conspicuous on account of its high, white cliffs; and it was difficult to see how anyone could fail to identify Harwood as an island, although its dark-green trees nowadays stand out against the background of the pulp-mill town of Powell River in a way that it clearly would not have in the late-18th century. Cape Mudge, which just might be *Isla de Campo Alange*, was scarcely visible from this far south. All of the more distant skyline is dominated by hills and mountains, some high, and it would be well nigh impossible to discern anything of the topography of the Desolation Sound and the Discovery Passage area from the Cape Lazo latitude.

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River Nile Protection and Development Project

by J.-M. Gervais
edited by J. Meunier and P. Hally

Introduction

The Nile River is the product of the White Nile River, 3,700 kilometres in length, which gets its source in Central Africa (Burundi and Rwanda) and the Blue Nile, 1,700 kilometres in length, which starts in the mountains of Ethiopia. Both these rivers converge at the city of Khartoum in Sudan. From there the Nile River winds northward for approximately 3,000 kilometres until it reaches the Mediterranean Sea.

Map of Egypt

The Nile River, within Egypt's borders, is approximately 1,300 kilometres long. Since time immortal, the Nile flowed and each Spring its waters would flood the Nile Delta, bringing water and nutrients to the fertile land. It is only within this last century that man has developed the proper tools to control the river and use the water all year round rather than once a year. Harnessing the Nile River was first attempted in 1902 with the construction of the Aswan dam at the southern end of the River, approximately 1,050 kilometres south of the Mediterranean Sea. Twice, the height of this dam was increased to allow for more water to be retained. The potential of this vast amount of water for the generation of electricity was realized and lead to the construction of the new High Aswan Dam in 1964. It was erected 8 kilometres south of the old dam, permanently altering the Nile River. Its immediate effect was the widening of the Nile River caused by the accumulation of billions of gallons of water south of the dam wall and extending into neighboring Sudan. This newly created reservoir was later named Lake Nasser. There are now 5 barrages dispersed along the River Nile that control the flow of the water, the latest of which was built in 1994 near Esna to replace the existing dam and add electricity generation capacity.

In 1988, the Canadian and Egyptian governments joined efforts and initiated the River Nile Protection and Development (RNPD) project designed to protect and develop the River Nile system. The objectives of the project were to provide better utilization and management of the Nile River water, strengthen and consolidate the various research institutes involved in monitoring the Nile River, coordinate the gathering of the various field data, prepare various studies in priority areas and implement pilot project schemes. The project started in 1988 and was completed in June of 1992. During that period there were thoughts, at one point, of obtaining hydrographic data to update the existing topographic and bathymetric data obtained between 1978 and 1981 by Kenting Earth Sciences Limited, Ottawa, Canada, but there were not enough funds to complete this task within the mandate of the original project. This, however could be realized with the extension of the RNPD project for another four years.

Phase two of the project, RNPD II, was initiated in August of 1993 and is scheduled to run through part of 1997. The project concentrated on four major areas through the establishment of four new technical components: the Nile Water Strategic Research Unit, the Central Laboratory for Environmental Quality Monitoring Unit, the Barrage Safety Monitoring Unit and the Hydrographic Survey and Mapping Unit (HSMU). CHS was involved with the last component from the time of its inception in November 1994 to the end of the field training program in March of 1997.

Why was there a need to create a hydrographic office when Egypt already has an official hydrographic bureau called the Navigation and Hydrographic Department within the Egyptian Ministry of Defense, Naval Forces, with official representation at the International Hydrographic Office (IHO)? For one, the existing hydrographic office is a military office and is therefore very protective about the information it collects and secondly, it concentrates only on the Mediterranean and Red Seas without any consideration for the Nile River. There was therefore

a need for a civilian hydrographic office in order to properly fulfill the mandate of protecting and improving the Nile River system.

The RNPD II project is jointly funded by the Canadian International Development Agency (CIDA) of the Government of Canada and the Water Research Center of the Ministry of Public Works and Water Resources of the Government of Egypt. Total project expenditures in terms of the Canadian contribution provided by CIDA was estimated to be 12.3 million dollars and the Egyptian contribution was estimated at 3 million dollars. A total of approximately 1.7 million dollars was allocated to the establishment of HSMU . The project was co-managed by an Egyptian Executing Agency made up of personnel of the Water Research Center and a Canadian Executing Agency represented by personnel of SNC Lavalin Inc. (Canada), contracted by the Government of Canada through CIDA to represent the Canadian government in Egypt.

CHS and RNPD II

To fulfill the mandate of establishing the Hydrographic Survey and Mapping Unit within the Egyptian Government, SNC Lavalin sought the expertise of the Canadian Hydrographic Service to prepare and submit a plan of action which would result in the establishment of a hydrographic unit. SNC Lavalin had already approached Photosur Géomat Inc. to provide technical assistance, training and a procurement plan for the establishment of a data management and mapping division within the Hydrographic Survey and Mapping Unit. The original idea was to provide most of the training through subcontracting while having the CHS, represented by personnel from Quebec Region, supervise and monitor the work progress.

It is with this framework that in November of 1994, P. Hally of CHS, Quebec Region and B. Magg of Photosur Géomat Inc. traveled to Egypt to assess the situation in order to produce a plan of action. D. Hains, then Regional Director, CHS Quebec Region, joined them in early December. During their visit, various meetings were held to discuss the organizational structure of HSMU, the personnel required to make such a unit work, the training required, the equipment needed and the methodology to be used in order to achieve the set goals. Estimates for the budgets needed to provide the necessary training and acquire the various equipment were discussed with SNC Lavalin. Meetings were also held with other Egyptian agencies, such as the Egyptian Survey Authority, to discuss potential cooperation and joint activities in order to permit HSMU to efficiently achieve its goals. Staff members were interviewed and an assessment of existing equipment was made. The outcome of this visit was the production of an implementation plan report, detailing the organizational structure of the unit, a course syllabus, the methods of work to be used and the equipment to be purchased to establish a working hydrographic unit within the Nile Research Institute. The Implementation Report, submitted jointly by CHS and Photosur Géomat Inc. was submitted to RNPD II in February of 1995 and approved in April of the same year.

By the end of April, most of the details pertaining to the personnel to be involved in the project were finalized. For the hydrographic survey training it was decided to have a representative of Quebec Region, Jean-Marie Gervais, on permanent assignment in Cairo to coordinate, supervise and monitor the work progress and to provide the technical expertise for the realization of the field survey. This was done in three phases. In phase 1, May 28 to July 20, 1995, the plans set out in the Implementation Report were set in motion and part of the training courses were given. In phase 2, August 20 to November 9, 1995, most of the hydrographic survey training courses were completed and the field survey preparations were undertaken. The practical field training program was completed in phase 3, from March 17 to May 16, 1996. Patrick Hally, Quebec Region's Development officer was the overall project manager for CHS's involvement and traveled to Egypt at the beginning of phases 1 and 3 while the author of this paper, was present in Egypt for the three periods listed above. Jean-François Meunier of Photosur Géomat Inc, provided the data management and mapping training during the period of August 20 1995 to April 24 1996.

Hydrographic Survey and Mapping Unit (HSMU)

The Nile Research Institute (NRI) was created in 1991. It is one of several institutes within the Water Research Center of the Ministry of Public Works and Water Resources. HSMU was established within NRI with the mandate of gathering hydrographic data and producing navigational charts. Three divisions were created within HSMU: the Survey Division, the Data Management Division and the Mapping Division. The Survey Division is responsible for the gathering of bathymetric and other hydrographic related data necessary to produce nautical charts. It is responsible, in coordination with the Egyptian Survey Authority, for all geodetic related matters such as densification of horizontal control and performing any datum coordinate transformation required for field survey activities. It is also responsible for water level matters such as the determination of sounding datum and the gathering of water level data in order to reduce depths to a minimum safe navigational datum. The Data Management Division tasks consist of collecting, digitizing and georeferencing pertinent existing graphic data such as the Kenting topographic surveys and integrating new hydrographic sounding data with the aim of structuring and maintaining a seamless continuous digital geographic database. It also has the responsibility of making this data available to various agencies for use in multi-disciplinary applications. The Mapping Division is responsible for the production of navigation charts of the River Nile. The map production process also involves the production of specifically requested thematic maps for multi-disciplinary purposes.

HSMU is managed by a unit manager who is also the director of NRI, and an assistant unit manager who takes care of the day to day business of the unit. The Survey Division has a division head who is also the hydrographer-in-charge during field missions and has a support staff of six (6) engineers. The Data Management Division is made up of a division head and a staff of two (2) engineers while the Mapping Division is made up of a division head and a staff of one (1) engineer. It was planned that the personnel from the Survey Division would be deployed in the other two divisions during the off season.

Training Program

The personnel that make up HSMU are all university graduates, of which there is one Ph.D. in sedimentology, one Masters in sedimentology, one Masters in soil mechanics, five B.Sc. in civil engineering and five B.Sc. in surveying. Three of the staff members were in the process of completing their Masters degree and one was working on his doctorate at the onset of the RNPD II project. Some of the staff were already knowledgeable in the techniques of gathering bathymetric data using Mini Ranger and producing computer plots using Autocad, but the concept of systematically gathering hydrographic data and reducing depths to a chart datum for the production of nautical charts was relatively new to them.

Hydrographic Survey and Mapping Unit

HSMU was set up to become a true hydrographic organization capable of producing hydrographic surveys and nautical charts according to International Hydrographic Office (IHO) standards. To achieve this, an intensive training program was developed in order to render the staff operational and productive. The training plan was based on internationally recognized standards of competence and the CARIS geographic information system of Universal Systems Limited was chosen as the underlying data management and mapping system. The basic idea was to train the staff in the classroom and produce, with technical supervision, a hydrographic survey and subsequently a navigational chart during the duration of the RNPD II project. The classroom training program was organized in a modular format to respond to the availability of both the training staff and HSMU personnel. The training program was set up in three modules, of which the contents are listed below.

Surveying Module:

Course	Duration (Days)	Given by	Start	Finish
Geodetic Survey and DGPS positioning	20	M. Baraka, Ph.D. Geodesy, associate Prof. U. of Cairo	5/2/95	2/3/95
Currents and Water Levels	5	G. Carrera, Ph.D. Geophisics Consultant, Geomertrix Int.	4/6/95	8/6/95
Navigation and Seamanship	10	P. Canniccioni, Captain Prof. Institut de Marine du Québec	11/6/95	22/6/95
Hydrographic Surveys	15	J.-M. Gervais, hydrographer CHS, Quebec Region	25/6/95	13/7/95
Hydrographic Data acquisition	4	S. Duffy Consultant, Quester Tangent Inc.	20/8/95	23/8/95
Hydrographic Data Processing	4	S. Duffy Consultant, Quester Tangent Inc.	24/8/95	29/8/95
Field Survey Training	60	J.-M. Gervais, hydrographer CHS, Quebec Region	24/3/96	17/5/96
GPS Field Training	30	M. Baraka, Ph.D. Geodesy, associate Prof. U. of Cairo	11/11/95	10/12/95

Data Management and Mapping Module:

Course	Duration (Days)	Given by	Start	Finish
Map production	8	B. Magg, Consultant Photosur Géomat Inc.	24/7/95	3/8/95
Caris GIS	26	J.-F. Meunier, Consultant Photosur Géomat Inc.	7/9/95	12/10/95
Caris GDM	8	J.-F. Meunier, Consultant Photosur Géomat Inc.	15/10/95	24/10/95
Caris SAMI	4	J.-F. Meunier, Consultant Photosur Géomat Inc.	25/10/95	30/10/95
Caris DTM	2	J.-F. Meunier, Consultant Photosur Géomat Inc.	31/10/95	1/11/95
Marine Cartography	10	R. Lepage, marine cartographer CHS, Ottawa	13/11/95	23/11/95
Various other Caris functions	18	J.-F. Meunier, Consultant Photosur Géomat Inc.	28/11/95	21/12/95
Micro Station	1	Local Consultant	31/12/95	31/12/95
Conventional cartography	8	J.-F. Meunier, Consultant Photosur Géomat Inc.	2/1/96	11/1/96
Digital Cartography	2	J.-F. Meunier, Consultant Photosur Géomat Inc.	14/1/96	15/1/96
Ortho photography	8	J.-F. Meunier, Consultant Photosur Géomat Inc.	16/1/96	25/1/96
Quality Control	1	J.-F. Meunier, Consultant Photosur Géomat Inc.	31/1/96	31/1/96
In house training	60	J.-F. Meunier, Consultant Photosur Géomat Inc.	1/2/96	24/4/96

Computer Module:

Course	Duration (Days)	Given by	Start	Finish
Systems, programming and Oracle	5	J.-F. Meunier, Consultant Photosur Géomat Inc.	27/8/95	31/8/95

The courses were given at the Nile Research Institute situated in El Qanatir approximately 25 kilometres north of Cairo, on the Damietta (east) branch of the Nile delta. The theoretical portion of the Surveying and the Computer modules were given to all the staff. The group was then divided in two. The Survey Division staff attended the practical portion of the Survey module, while the personnel from the Data Management and Mapping Divisions attended the courses in the Data Management and Mapping modules. It had then been planned that, while the CARIS and GIS courses were being given, the Survey Division staff would go into the field to gather

bathymetric data. This would then provide the Data Management and Mapping Divisions with the necessary bathymetric data to continue on with the practical portion of their course.

Nile Research Institute

As it turned out, Murphy's law, which states: »If anything can go wrong, it will », came into play. There were various problems which delayed the field portion of the training program. The major stumbling block was the delay in receiving the VHF frequencies required for the radios and for the broadcast of the DGPS corrected positions to the survey launches. There were also delays in obtaining some of the equipment required for the field work. The Data Management and Mapping module also had problems. Delays were suffered due to software problems within the CARIS package which had recently been modified to work on a Unix platform. There were also delays in obtaining, from the Egyptian Survey Authority, the digital files of the optical scans of the Kenting topographical sheets, to be used as the base data for the nautical charts. Eventually, all these delays balanced out and the Data Management and Mapping Divisions were able to obtain field data to proceed with the practical portion of their course. The only drawback is that the HSMU training program had to be extended beyond the scheduled dates.

Survey location

It was decided to concentrate the hydrographic survey on the stretch of the Nile River between the new Esna Barrage and the next downstream barrage near the town of Nag Hammadi. Situated in between these two barrages, at the southern extreme is the city of Luxor, second to Cairo as a tourist attraction and the home for approximately 100 tour boats or floating hotels (floatels) which carry tourists on cruises between Luxor and Aswan. Luxor is also the home of the spectacular Karnak and Luxor temples and overlooks the Valley of the Kings and Queens. It was felt that a hydrographic survey in this area would provide new and updated data for this busy stretch of river and would also provide information concerning the effect the new barrage at Esna was having on the riverbed especially in the immediate vicinity of the old barrage. The town of Esna was chosen to set up the survey headquarters. This site offered very good accommodations for the staff and allowed for the establishment of a field office in government owned facilities or *guest houses* which at one time served as living quarters for the Italian engineers assigned to the construction of the new barrage.

Field Survey preparations

Most of the planning and preparation for the field portion of the hydrographic training was done during the period of August 20 and November 9, 1995. The exact location of the field survey was confirmed and a reconnaissance trip was made to visit the survey site and the accommodations for the field office and the staff, estimated to be around 25 people. Survey instructions were written detailing the work to be done and the methodology to be used. An extensive equipment and supplies list was finalized and all items requiring purchasing were submitted to RNPD II management. Job descriptions were written for the Hydrographer-in-charge, the engineer hydrographers and the technicians involved in the survey.

The survey launches were prepared and the Quester Tangent ISAH data loggers and peripheral equipment were field tested by S. Duffy, the Quester Tangent representative. The HYPS data processing system was also tested prior to his return to Vancouver. The firmware versions of these apparatus were not the most recent, and as it turned out, had to be returned to Canada for upgrading after an unsuccessful attempt to perform the upgrade by the Egyptian technicians.

An abridged instruction manual was written describing the specific use of ISAH, Quester Tangent's data acquisition and data logging system. The emphasis was put on setting up the data logger for use with Wild's DGPS positioning system and an Odom digital echo sounder. A second manual was written giving step-by-step instructions on how to process the bathymetric data using Quester Tangent's HYPS data processing system.

In order to properly perform a hydrographic survey, two components had be clearly established prior to leaving for the field. One of these components was the establishment of the vertical datum so that the bathymetric data could be reduced to a low water datum. From the Aswan High Dam to the Nile River Delta, there are over 60 water level gauges that monitor water level fluctuations. Daily water levels were obtained for the 29 water level gauges

that are situated between the Aswan High Dam (approximately 850 km from Cairo) and Nag Hammadi (approximately 525 km from Cairo). Using data for the period between 1968 and 1993, Low Water Datum and High Water Level Datum were calculated for each of the 29 gauges. The remaining work of determining water reduction zones between two adjacent water level gauges was done in the field prior to starting the sounding operations. Each of the water level gauges in the sounding zone was positioned using GPS. The difference in sounding datum between any two adjacent gauges was calculated and, if the difference was greater than 0.2 metres, reduction zones were calculated. The slope between any two gauges was assumed to be constant and the limits between each reduction zone were divided equally along the distance between the two gauges.

The second component which had to be established prior to leaving for the field was the establishment of horizontal datum. The Egyptian Survey Authority uses the Helmert 1906 ellipsoid as their reference surface for the horizontal control. The positions obtained from GPS were based on WGS84. It was concluded that the existing control points in the survey area would have to be re-surveyed using GPS. This would provide the necessary data to produce the algorithms to translate coordinates from one system to the other. It would also provide the means to compare the new bathymetric data to the data obtained from the Kenting surveys done in 1981. In September 1995, a short reconnaissance field trip was undertaken to try and recuperate as many Kenting control points as possible and thus evaluate the amount of work necessary for the establishment of a sufficient number of control points required for the hydrographic survey.

By the end of October 1996, it became evident that the field survey training would have to be postponed until all the necessary equipment was in the hands of HSMU. It was then suggested to split the field work training and undertake the horizontal control field work right away, thus allowing for more hydrographic training once the hydrographic field training was started.

Horizontal Control field survey training

With this in mind the staff of the Survey Division along with Dr. Mustafa Baraka, responsible for the GPS training, set off to Esna on November 11, 1996. The objective of the mission was to establish a horizontal control network from 10 kilometres south of Esna to 10 kilometres north of the Nag Hammadi barrage, a total distance of approximately 200 kilometres. The control points would later be used to select a good location for the installation of a tower equipped with a GPS receiver connected to a radio transmitter thus providing GPS differential corrections for the positioning of the hydrographic launches. As mentioned earlier this network was to include all the Kenting control points found along the way. The final network consisted of 13 recovered Kenting points and 71 newly constructed points spaced approximately 5 km apart and divided more or less equally on either shore of the Nile River. All the control points were permanently marked using RNPD aluminum markers cemented in concrete bases constructed at each site. Each marker was permanently identified using a logical numbering system similar to the one used in the CHS. Observations were conducted using 4 Leica Wild GPS CR244 controllers equipped with SR299 antenna. Standard methods of observations and checks necessary for DGPS horizontal work, as prescribed by Dr. Baraka, were followed. The network was tied to two first order control points in the Luxor area whose coordinates were already known in WGS84, having been observed and adjusted by the Egyptian Survey Authority some time before. Data processing for field data and for later adjustments was done using the SKI software provided by the Leica Wild controllers. The report *Report on Establishing the Horizontal Control DGPS Network for Esna-Nag Hammadi Reach*, produced by HSMU, gives a full account of the work done and the methods used.

The mission was a success. It served as a field training exercise for the HSMU personnel and provided the necessary horizontal control points required to carry out the bathymetric survey. More importantly, the positions of the recovered Kenting control points are now known in both WGS84 and Helmert 1906, thus providing enough information to develop an algorithm for the conversion of any control point from one system to another.

Hydrographic field survey training

The bathymetric survey finally got under way in March 1996. During the week of March 17 all the necessary equipment, supplies and survey documentation were collected, packed and loaded in a truck. The vehicles to be used in the field and the survey launches were made ready. The personnel list was finalized and travel arrangements were made for the 28 people assigned to the survey. The caravan with the support personnel left for Esna on March 23. It was quite a hectic week considering that a survey of this magnitude had never been prepared before by the group. The survey engineers from the survey division and the CHS consultant arrived in Esna on March 24.

The first week was used to set up the field survey office in one of the guest houses. The computer or processing room required special attention. The entire electrical wiring system had to be verified, and the loads balanced so as not to overload the circuit breakers. All the wall plugs had to be grounded to a steel rod outside the guest house to protect the electronic equipment. The computers were plugged into uninterrupted power supplies to regulate the voltage and as a precaution against power failures which happen quite frequently in that part of the country.

The first week was also used to prepare the survey launches for sounding operations. Each launch was equipped with an Odom Echotrac MKII DF 3200 digital echo sounder, a Leica Wild GPS CR244 controller, a Racal Delta Link radio receiver and antenna connected to

the GPS to provide differential positioning, a Quester Tangent ISAH data logging system including a plotter and a printer and a Motorola GP 300M high frequency radio. The second week was used to install a 15 metre Texas tower equipped with a radio antenna at the field office. The Motorola GP 300M base radio was powered using a Lenbrook Energy Systems 12 volt solar panel system. Tests were conducted and adjustments on the Delta Link were required to insure that the differential corrected positions were in fact being obtained properly in the launches. Once satisfied that the GPS and the radio link were working correctly, a 15 metre Millar tower equipped with a GPS antenna and a Delta Link transmitter were installed over a horizontal control point situated on one of the docking piers in Esna. Power for both units in the tower was provided by a second Lenbrook 12 volt solar panel system. All of the field personnel participated in these activities to familiarize themselves with the equipment and its installation, considering that most of this equipment, with the exception of the GPS receivers, had never been manipulated before by the group.

Field training started at the beginning of the third week. Participants took turns in the launches and familiarized themselves with the various equipment. They were shown how to run regular sounding lines perpendicular to the shoreline, check lines perpendicular to the regular lines and finally how to run shoal exams. In the field office, one of the engineers, designated as the data processor, familiarized himself with Quester Tangent's HYPS hydrographic data processing system consisting of a SUN SPARCS 5 station with a 4.2 Gb hard disk, a 4mm external tape drive, a color monitor, an optical tape drive, a printer and a HP-DraftPro Plus plotter. The software included Quester Tangent's single beam hydrographic data processing package as well as a complete CARIS interface package.

The hydrographic work was done at a scale of 1:5,000. At the end of each sounding day, the data collected on the optical disk from each survey launch was transferred on the SUN. For each file, the positions were plotted on screen and any erroneous data deleted. The depths were also plotted on screen and compared to the depths obtained on the graph. All erroneous depths were deleted. The depths were reduced to sounding datum using the daily water level reading from the appropriate water level gauge(s). The depths and the positions were then merged and the file converted into an NTX format. The processing system provided the tools to merge the NTX files into an existing field sheet file, to contour the data, to verify on screen the depths obtained from the regular sounding lines against the check line data, to pick out shoals and eventually to compare the shoal exam data against the original data. For each of the field sheets, the data was overplotted using the CARIS software and final field sheets were drawn for presentation. The individual cleaned NTX files, without overplot, were sent to the cartographic staff in El Qanatir in order to for them to start manipulating real data for the eventual production of nautical charts.

Data analysis was probably the hardest task to teach. The concept of identifying doubtful data and recognizing what to look for in order to detect bad data can only be acquired through experience but the participants were nevertheless made aware of the various pitfalls and some of the tricks required to identify erroneous data. Some time was spent in identifying shoals and areas requiring more depths in order to properly define the depth contours.

The field survey was divided into two periods of 30 days with a one week return trip to Cairo in between. This break coincided with one of Egypt's major civic holidays. During these two periods, one field sheet was completed and the regular sounding and check lines were completed for three other sheets. The CHS consultant left towards the end of the second period, confident that the survey could continue on its own. It turns out that the survey crew made a third outing without any major problems.

Data Management and Mapping Divisions Training

The Data Management Division has the task of managing and transforming hydrographic data while the Mapping Division is responsible for the production of bathymetric charts. Photosur Géomat International (PGI), Montreal Canada was responsible for the installation and the integration of the hardware and software equipment, for the training of the personnel in the Data Management and Mapping Units, and the monitoring of the production of a nautical chart. Both units shared a computer network consisting of two (2) SUN Sparc-20 with 4 GB of disk storage, five (5) Pentium PCs, an exabyte tape reader, a CD-Rom reader, an HP plotter and a Calcomp digitizing table in order to accomplish the various tasks of map making and data management. Digital cartography was done using CARIS software while data management was achieved using the Oracle database management software.

Training of the Data Management and Mapping Unit consisted in concepts of computers, operating systems, programming and database management in order to introduce the staff to the UNIX computer environment under which they would be working. The different modules of the CARIS geographic information system, the underlying base of data input, data editing, data management and output generation were then covered. Courses were also given on cartographic principles, both traditional map production and digital map production, including concepts of digital image processing and ortho-photography. Quality control was stressed and procedures put in place. The formal training was

followed by production training where the staff was supervised in producing a nautical chart from the data acquired by the Hydrographic Division.

Project management procedures, system management procedures and chart compilation procedures were written and have been put in place for the HSMU unit. An intensive training program and a hands on practical project was given to the data management and cartographic staff. J. F. Meunier, PGI consultant, spent the better part of 9 months in Egypt to successfully accomplish theses tasks. The result of the hands on project was the production of a draft nautical chart of the Esna area compiled using source data digitized from 1:10,000 Kenting maps, from heads-up digitizing of ESA orthophotos, from data extracted from 1:5000 vectorized Kenting maps and from shoreline data and compiled bathymetric data obtained from the hydrographic field survey. Mr. Meunier also provided invaluable assistance in setting up the computer equipment and the computer room in the field office in Esna.

René Lepage, training officer from CHS headquarters gave a one (1) week course in Automated Marine Cartography using CARIS and supervised a one (1) week practical training exercise. He also provided some assistance in setting up some of the CARIS parameters specific to the production of hydrographic charts.

Personnel from the Data Management and the Mapping Divisions of HSMU came back to Canada in June of 1996 for a visit of the CHS facilities in Quebec Region and in Headquarters to put in perspective all they had learned and to acquire further training on automated marine cartography given again by René Lepage.

The personnel of the Data Management and Mapping Divisions now have the necessary equipment, reference documentation and the basic training to accomplish their respective tasks.

Conclusions

The mission was a success. The Nile Research Institute now has a functional Hydrographic Survey and Mapping Unit capable of acquiring, processing and transforming data into bathymetric charts. The unit's staff successfully acquired the necessary classroom and practical training to carry out the necessary work. The equipment on hand should permit the unit to manipulate and manage the collected data and build up a satisfactory data bank capable of delivering a variety of data products to the Egyptian scientific community.

About the Author / À propos de l'auteur

Mr. Jean-Marie Gervais *joined the Canadian Hydrographic Service in 1969. For the major portion of his career he worked as a field hydrographer and later, hydrogrographer-in-charge of various field surveys. His interest in personnel training gave him the opportunity to successfully merge field training with field production surveys which later permitted him to participate in similar projects in Jamaica and Egypt. He is presently involved in special projects with the Laurentian Region of the C.H.S.*

Monsieur Jean-Marie Gervais *s'est joint au Service hydrographique du Canada en 1969. Pour la majorité de sa carrière, il a travaillé comme hydrographe de terrain et par la suite comme hydrographe-en-charge de divers levés hydrographiques. Son intérêt en formation du personnel lui a permis d'amalgamer, avec succès, la formation terrain aux levés de production qui, plus tard, lui a donné l'opportunité de participer à des projets similaires en Jamaïque et en Egypte. Il est présentement impliqué dans des projets spéciaux avec la Région Laurentienne du S.H.C*

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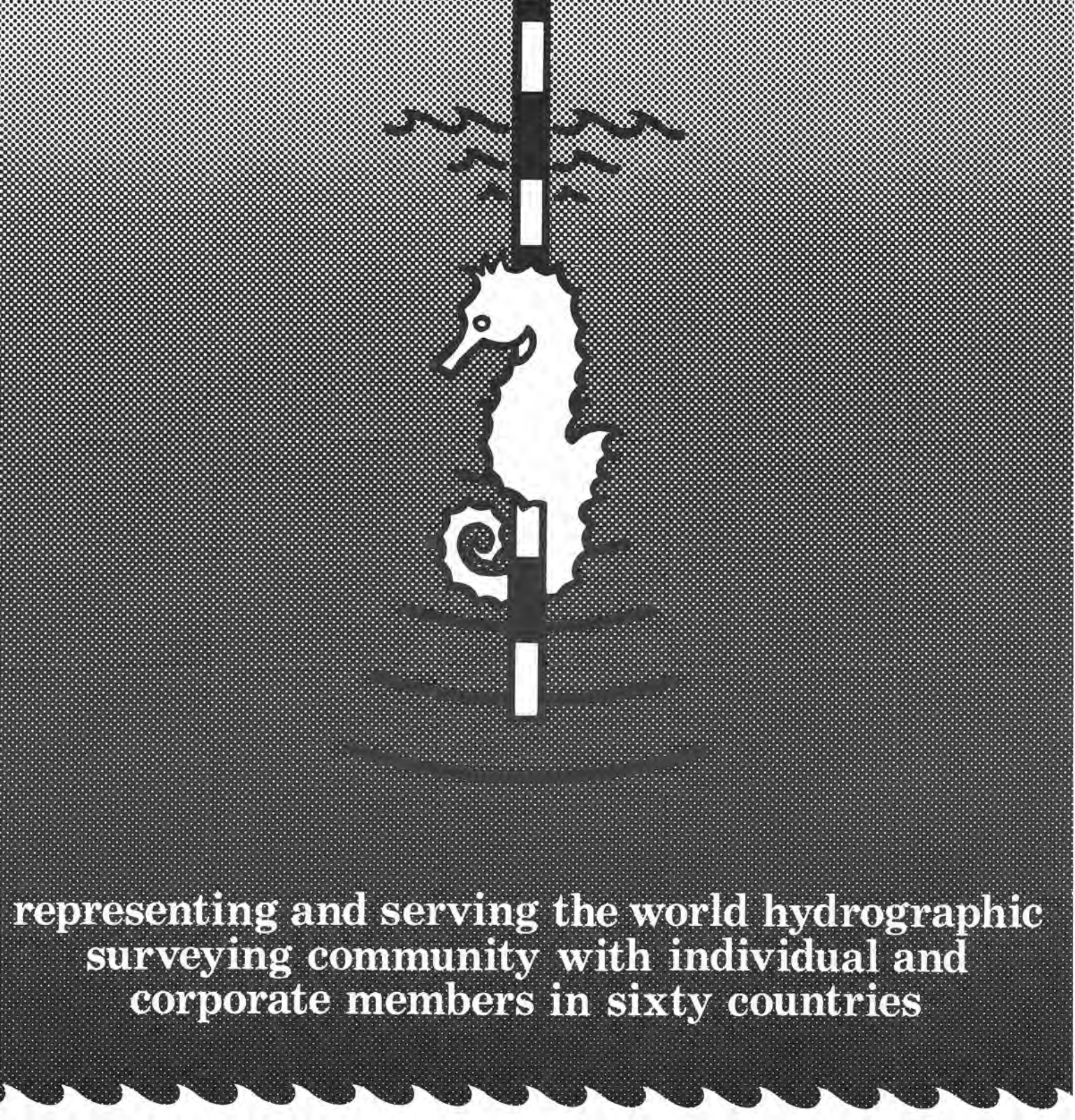

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Maintenance and Use of Lead Acid Batteries in Hydrographic Applications

A. Thomson, B. Hinds and L. Dorosh

Introduction

The purpose of this article is to share our observations that reliable power and maximum service life of a lead acid battery occur when the user has an thorough understanding of:

- power requirements for the application.
- short and long term maintenance procedures for batteries.
- the characteristics affecting battery performance.

Applications of batteries for field hydrography

One source of downtime in hydrographic field operations is caused when batteries powering equipment fails to produce the expected output. The cause of these premature battery failures are often due to poor battery maintenance or improper application of the battery type.

DGPS reference stations including a RF datalink for the differential corrections, GPS monitor stations and tide gauge sites all require reliable power. Electronic instrumentation installed at remote sites will usually require batteries and on site recharging. Solar panels, thermal electric generators or wind powered generators are often used at these remote sites if reliable AC power is not available.

Sites occupied for brief periods can be powered by a constant-loss power system where the storage batteries are the only source of power and no re-charging capability has been installed. Knowing the capacity of each battery allows the hydrographer to put the best batteries in the most inaccessible locations and have confidence in the installation. Knowledge of the actual capacity of the batteries and the power consumption of the instrumentation allows the hydrographer to accurately calculate how long the site will remain operational. This knowledge is similarly useful where the primary power source experiences a power outage (i.e.: Loss of AC power or number of cloudy days where powered by solar panels).

Uninterruptible Power Supplies (UPS) are often used to power computer systems in the field and office. Electrical noise, brown-outs, power bumps and outages can damage the processing equipment or cause the loss of data. Most UPS systems use sealed gelled lead acid batteries to provide the source of power during outages. The user needs to know the capacity of the UPS batteries to calculate how long the UPS system will provide standby power to a known load. The battery capacity degrades with time, even when properly maintained. Does your UPS still provide your instrumentation with the protection you require from power outages?

Lead Acid Batteries

Lead acid batteries are the most widely used battery chemistry for powering hydrographic instrumentation. Lead acid batteries have a high power density (large amp hour rating for the battery volume), are cost effective, and commonly available.

As with other battery chemistries the performance of a lead acid battery starts to degrade when initially filled with electrolyte. Degradation in performance is inevitable. However, the rate at which it degrades is measurable and can be minimized with simple maintenance procedures.

There is a wide range of lead acid battery construction available from manufacturers specifically designed for very different applications (engine starting, deep discharge RV applications, UPS applications, standby power). Because of the wide range of available products the purchaser of batteries must be knowledgeable to purchase the most appropriate battery for the application.

Advantages of Lead Acid Batteries

- lowest cost per amp hour.
- most commonly available, especially in larger capacities (20 amp hours and up).
- one of the highest power density ratios (the amount of power stored in a given volume).
- do not suffer from memory effect as is the case with NiCad batteries. When maintained correctly they can be kept in a fully charged state and can be expected to produce full output when required.

Disadvantages of Lead Acid Batteries

- Heavy.
- High self discharge rate. Most lead acid batteries **will loose about 1% of its rated capacity per day** with no load attached to the battery. Self discharge is caused by electrochemical changes within the battery and usually can be reversed if the battery has not been left in a completely discharged state for too long.
- Our tests have shown that batteries will lose about 10% of their initial capacity in the first two years of service when well maintained. Poorly maintained batteries will lose more capacity. The capacity con

tinues to decay yearly but at a greater rate as the battery ages. **The loss of capacity is not reversible.**
- Some types of lead acid batteries vent both corrosive and explosive gasses during recharging, so cannot be used in confined spaces without proper ventilation or special recombinant battery caps.
- Must be placed in an upright orientation when used, shipped and stored. to prevent spillage of the very corrosive liquid electrolyte. With the exception of Gel Cell batteries they can not be shipped by air if filled with electrolyte. Gel cell batteries can also be used in most orientations.

Classes of service

Lead acid batteries can be designed for three classes of service:
- Deep-discharge service. Best for constant loss applications when they power equipment until the battery is fully discharged (as in RV applications).
- Float service. Used in installations that have a continuous charging system such as an UPS or a starting battery for an engine. Leaving this class of battery completely discharged for periods as short as one day can cause irreversible damage.
- Maintenance-free service. Conventional lead acid technology with a sealed case design preventing electrolyte loss during recharging.

Chemistry

There are many different lead acid battery chemistries available. They each have different characteristics as identified in Table 1.

1. Conventional Liquid Electrolyte Batteries has reserve liquid electrolyte stored above and below cell plates and is not sealed.
2. Starved Electrolyte and Absorptive Glass Mat batteries have a porous cell separator between battery plates containing all the electrolyte. Lead-tin grid alloys are available which can increase the service life to as much as 20 years. Great Northern Batteries (GNB) are the primary supplier of this technology of battery.
3. Gel Cell where the battery electrolyte is jellied and non spillable. The battery is completely sealed.
4. Lead Calcium batteries use a lead calcium alloy for the internal grids which reduces the internal resistance of the battery. Low internal resistance is useful when starting engines where several hundred amps of current is required for short periods, but is not necessary in standby applications where deep cycling is required. The lead calcium alloy is stronger and allows manufacturers to use thin battery grids to increase surface area thereby generating larger cold cranking ampere rating for starting engines. **Lead calcium batteries are the worst choice for deep discharge applications if they are not immediately recharged.** During deep discharge calcium oxide forms on the grid surface which is a barrier to the active material, permanently impeding its ability to be recharged. Lead calcium batteries require specially designed chargers with higher float voltages. Using the incorrect charger (i.e.: one intended for conventional batteries) will shorten the service life of the battery significantly.

Battery Purchasing Considerations

When purchasing the "best" battery for an application the user must know the power and charging requirements, then rank the importance of battery characteristics accordingly.

Batteries are often rated for **Cold Cranking Amps** (C.C.A.). This rating is the number of amps that the battery can produce for brief periods until the battery reaches a terminal voltage of 9.5 volts. It is a useful rating for the battery's ability to start engines only and means little in most hydrographic applications where the current draw from a battery is just a few amps.

The **Reserve Capacity Rating** (usually rated in minutes) is the number of minutes the battery can supply a 25 amp load until the battery terminal voltage reaches 9.5 volts. This rating is useful for UPS battery applications where the batteries supply a significant load for long periods.

The **Amp Hour Rating** is a SAE standard for measuring the capacity of a battery based on a 20 hour discharge period. The battery is discharged at a fixed rate until it reaches a terminal voltage of 10.5 volts. This rating is the most applicable for batteries used in remote hydrographic installations. For survey purposes, the discharge period can be calculated by dividing the Amp hour rating by the load current.

Features of a well constructed battery

Once the appropriate battery technology has been selected mechanical specifications should be considered.

Construction

Verify with the supplier or manufacturer that their batteries have:
- plate collectors and inter-cell jumpers which are welded or forged. They are superior to unreliable pressed or crimped connections.
- forged terminal posts are to reduce acid wicking and black-posting.
- thick grids which are physically strong, corrosion resistant and hold more active material. Thick lead grids will make the battery heavier.
- grid patterns with sloping cross bars to readily release gas bubbles expose more active material and assist in recovering capacity during charging.

Packaging

- Strong comfortable handle for carrying while deploying the batteries on shore. A strong handle also provides a convenient anchor for survey equipment installed at windy locations.

- Bottom with exposed ribbed reinforcing gives good non-skid capability and protection from sharp rocks.
- Consider maximum battery weight to prevent back injuries.
- Battery posts: terminal posts with wing nuts. The use of alligator clamps should be avoided where possible.
- High impact case with strengthened corners and superior seal integrity.
- Approved for air transport in International Air Transportation Association (IATA) restricted articles, dangerous goods act and regulations for transport via air. (Gel Cells only)

Characteristic	Conventional	Gel Cell	Starved Electrolyte	Lead Calcium
Initial cost	Lowest	High	High to highest. See note 5	Mid priced
Air transportable	No	Yes	Not approved at this time	No
Deep Discharge	Good	Best	Good	Poor
Float Service	Best	Good	See note 5	Good
Cyclic Use (i.e.: with Solar Panels)	Good	Good	Best	Good
Power Density	Good	Good	Best	Good to Best
Float (Charging) Voltage	13.2 to 14.4V	13.2 to 13.5V	13.2 to 14.1V	14.1 to 14.7V
Charging Voltage Tolerance	Very Tolerant	Critical See note 3	Somewhat Critical	Tolerant See note 2
High Temp Performance (Over 30C)	Best	Poor	Good	Good
Low Temperature performance	Good	Good	Best	Good
Service life	Long for quality batteries	Medium-long	Medium to Longest See note 5	Medium
Maintenance free	Available	Inherent with design.	Inherent with design.	Available
Rate of Self Discharge	Good	Excellent	Lowest See note 5	Excellent See note 4

Table 1 Lead Acid Battery Characteristics (see note 1)

Note 1: The table shows relative ratings only within this group of battery technologies.

Note 2: Lead Calcium batteries have a higher charging voltage (14.7V) than other lead acid batteries. A charger with a special setting for Lead Calcium batteries is required.

Note 3: Gel Cells require special chargers with lower charging voltages. Because of its sealed design and gelled electrolyte they are not tolerant to overcharging, permanent damage will occur.

Note 4: Lead calcium batteries are the worst choice for deep discharge applications if they are not immediately recharged within 24 hours.

Note 5: The GNB Aboslyte class of battery has lead/tin alloy grids which provides better cyclability and lower corrosion rates (longer life) and accounts for the lower float voltage,. There are a number of very different models available, check with the manufacturer to ensure you purchase the correct battery for your specific application. The single 2 volt cell batteries can have an expected in service life of 20 years, the conventional 12 Volt UPSolyte batteries have an in service life of 10 years.

Battery Maintenance Equipment

Most batteries now are "maintenance free" (sealed). To determine the state of charge on these types of batteries, intelligent chargers and instruments externally measuring battery capacity are required. A voltmeter will only provide an approximate idea of the state of charge of the battery.

Battery chargers

Most batteries are intolerant of incorrect charging currents and voltages. Quality battery chargers are the most economical. The cost of downtime and the value of the battery inventory requiring recharging exceeds the cost of quality chargers.

A quality battery charger will have the following features.

1. Protects the user and equipment by preventing arcing and igniting the hydrogen gas given off during charging by:

a) sensing short circuits and correct polarity, and not applying a charge if these conditions exist.

b) delaying charging until a secure connection is made to the terminals.

2. Constantly monitor battery condition during the recharging cycle permitting a higher state of recharge and increased service life of the battery. Power Mark™ chargers automatically sense battery size, state of charge and automatically apply four different charging modes:

a) **Sulfation recovery** charge cycle which automatically charges high impedance batteries.

b) **Bulk charge** cycle which quickly replaces energy in the battery using a constant current source.

c) **Equalize** charge cycle which de-stratifies ion distribution in the battery. This cycle also equalizes the charge of each cell in the battery (6 cells in a 12 V battery).

d) **Float or Maintenance** cycle that applies a constant voltage charge to replace standing losses without excess gassing.

3) The charger is temperature compensated which automatically adjusts the trip points for the four charging modes since battery characteristics change with the ambient temperature.

4) Has a low charging voltage ripple which reduces the gassing caused by voltage peaks that exceed the gassing threshold voltage of each cell. High frequency switch mode chargers or well filtered full wave designs can filter out excessive voltage peaks. This is very important in UPS applications where frequent charge and discharge cycles occur.

Solar panels

Solar panels outfitted with voltage regulators are employed as battery chargers at remote sites. The most efficient regulators for use with solar panels are series or shunt regulators that employ high frequency pulse width modulation. High quality solar panel regulators will also have temperature compensation allowing maximum charging of the battery with minimum gassing. The regulator should also have a blocking diode to prevent battery discharge through the solar panel during periods of low light. When this condition occurs the battery has a higher voltage than the panel and will discharge the battery through the solar panel.

Multiple panel and battery arrays are best connected using individual regulators for each panel and battery. The batteries are then connected in parallel using Schottky diodes as isolators between each battery bank. Connection in this manner will maximize the power available to the load and will prevent the regulators, panels, and batteries competing to regulate the battery voltage and will allow batteries of different capacities to power the load.

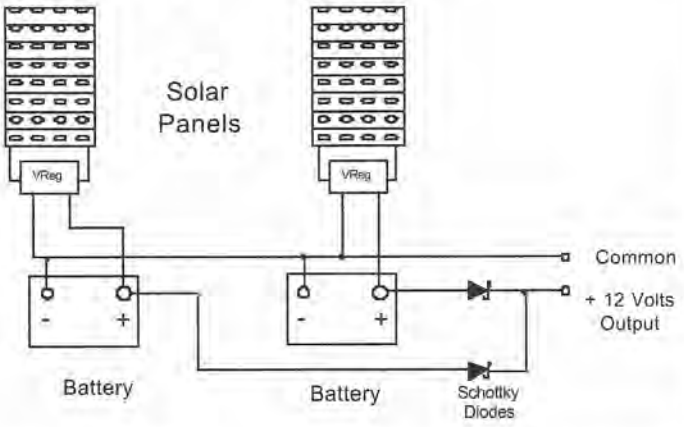


Figure 1. Wiring diagram multiple solar panels and batteries.

Battery Amp Hour Meter

The amp hour rating of a battery is the most important parameter for standby power applications for Hydrographic applications. Commonly available automotive load testers are inappropriate for testing batteries intended for deep discharge service. Load testers measure the cold cranking amp rating of a battery. This has little meaning in most hydrographic applications.

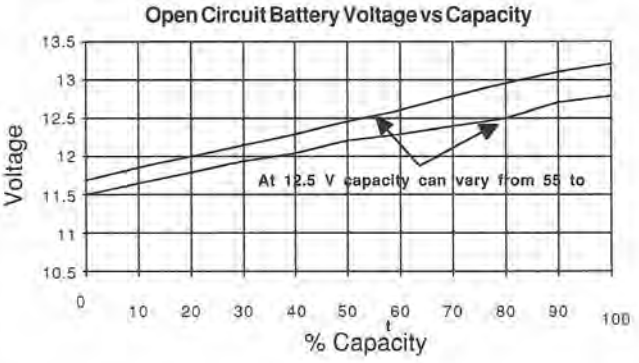
Due to the limited application for this type of information, we were unable to find an instrument on the market that would accurately measure the storage capacity of the battery. To measure battery capacity a Battery Amp Hour Meter was designed and built in-house to meet our requirements. The Battery Amp-Hour Meter measures the Amp-Hour capacity of any fully charged 12 volt battery by discharging the battery at a known rate and measuring the time to reach a terminal voltage of 10.5 volts.

The Battery Amp Hour Meter is also used to evaluate new chargers. Tests have demonstrated that good chargers consistently put more energy back into the battery without overcharging. Automotive battery load testers and voltmeters do not provide this information.

Voltmeters

Voltmeters are frequently used as a tool to measure battery condition. Considerations when using voltmeters are:

- **Voltmeters do not measure the storage capacity of a battery.** Measuring the open-circuit voltage of a lead acid battery is only a rough indication of its state of charge. No knowledge of the battery's actual capacity nor indication of any internal faults such as high impedance connections between cells is measured.
- The uncertainty in the state-of-charge measurement using a voltmeter reading can be as much as +/-10%.



The two traces above show the uncertainty using a voltmeter to measure capacity (state of charge). The uncertainty in the readings can be caused by:

- manufacturing differences.
- differences caused by the number and depth of discharge cycles during the service life.
- differences in the battery temperature.
- time elapsed from active use, or charging/discharging

Battery Maintenance Procedures

There are a number of steps that a user should follow to ensure batteries are maintained with the best state of charge. They are:

- Measure and record battery capacity when batteries are first purchased. This enables the user to monitor the ongoing performance of the battery with time.
- Proper battery care during a survey improves reliability
- Regular maintenance during long storage periods increases battery life
- Measure storage capacity (amp hour rating) annually.

We have found that a typical service life for lead acid batteries used for hydrographic applications has been about four years. Batteries are considered unserviceable when they drop below 50% of their original capacity.

Measure Battery Capacity When First Obtained

It is useful to measure the initial storage capacity of new batteries as soon as they are received for the following reasons:

- Immediately reject manufacturing defects. Some batteries tested only reached 90% of their rated capacity when new other manufacturers were measured at 115% of rated capacity.
- Provide an original capacity baseline for comparing subsequent measurements to assess a battery's condition.
- Compare capacity measured with manufacturer's claims for future purchase decisions. There is variation in storage capacity when the batteries are new and even more so after the batteries have been in service for a year.

Battery Care During a Survey Improves Reliability

- Fully recharge batteries as soon after use as possible to extend battery life. Where practical exchange exhausted batteries and recharge them immediately to extend battery life. A fully charged battery will be ready to use and has the lowest self-discharge rate.
- Recharge unused batteries while in the field every ten days to maintain them at 100% capacity, or recharge them just before deployment.
- Use a good battery charger that monitors battery condition and charges automatically.
- Avoid over charging of the battery. Ensure the charger trip voltage, from bulk charge to float, is temperature compensated and correct for the battery type under charge. Overcharging reduces the effectiveness of gelled electrolyte, and will boil off the electrolyte in other batteries (including maintenance free batteries). Severe overcharging buckles the plates, distorts or punctures separators and bulges hermetically sealed cases.

Maintenance During Long Storage Periods Increases Battery Life

- Remove dirt and salt residue with fresh water from the battery case, especially between the terminals. This removes any conductive path to prevent unwanted discharge and slows corrosion of the terminals.
- Clearly mark positive (+) and negative (-) terminals on the case to prevent reverse polarity connections of equipment or chargers.
- Store battery in a dry, ventilated non-freezing area (10-20 C).
- Self discharging **always** occurs. Recharge batteries during storage after 30 days at 26 C, 90 days at 10C. Recharging slows internal crusting of lead sulphate on the grids, this sulphation hardens with time and will lower battery capacity. The self discharge rate increases more rapidly as a battery ages.
- Measure battery capacity and write it on each battery at the start of each field season so field personnel can put the best batteries in the most inaccessible locations.

Measure Storage Capacity Annually

Annual measuring of the storage capacity of our battery inventory has these additional advantages:

- Defective batteries are replaced prior to surveys eliminating costly downtime in the field.
- Emergency battery purchases in remote locations are avoided .
- Batteries must exceed predetermined percentage of original capacity to be selected for field service.
- Batteries with high internal resistance or internal open circuits between cells are quickly identified and removed from service before causing costly down time in the field.
- Clearly label each battery with date of test and capacity in amp hours.

Results to Date with Improved Maintenance

Our experience has shown that batteries from quality manufacturers have a longer service life and that their initial capacity specifications are usually conservative. There can be quite a range in performance between batteries from the same manufacturer when the batteries are new. There is an even greater difference after the batteries have been in service for a year.

Reports from field operations show that down-time due to battery failure has been reduced since improving our maintenance procedures and by using intelligent battery chargers. We use microprocessor controlled chargers made by Power Mark™.

A smaller inventory of batteries is now maintained to meet the same needs for field programs. The hydrographer has confidence in the batteries they are given and no longer need to lug "spare" batteries into the field.

Correct battery technology is now purchased for specific applications. This has increased reliability and extended the operational life of batteries.

The Battery Amp Hour Meter enables us to examine battery manufacturer's samples and purchase batteries that are the best value (price vs. performance).

Our results have shown that not all chargers are equal. Microprocessor controlled battery charges that automatically adjust the rate of charge, measure the internal resistance of the battery and have the charge and float voltages temperature compensated are far superior and in the long run are more cost effective than low cost chargers.

About the Authors / À propos des auteurs

Larry W. Dorosh *is a senior electronics technologist with the Canadian Hydrographic Service. He graduated from BCIT in 1971, and has 26 years of experience in providing remote power systems for field survey applications for the Canadian Hydrographic Service. He and Alan Thomson are currently implementing a comprehensive remote power scheme for the Permanent Water Level Network on the west coast of Canada.*

Bill Hinds *graduated from BCIT in 1972, has worked for the Canadian Hydrographic Service for 25 years, providing electronic support for field and office activities. He has been the Head of Institute Electronics since 1987.*

Alan Thomson *graduated from BCIT in 1981 as an electronics technologist. Since then he has worked at the Institute of Ocean Sciences for the Canadian Hydrographic Service supporting their West Coast and Arctic surveys.*

For more information please contact/Pour plus de renseignements contactez:

CHS Pacific Region, Institute of Ocean Sciences, Sidney, BC,
Phone:(250) 363-6313 E-mail:ewh@ios.bc.ca, a_thomson@ios.bc.ca

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June 8 - 11, 1998
Ottawa Congress Centre
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A Conference combining:

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SPATIAL DATA INFRASTRUCTURES

Geospatial Data on the Information Highway

An international conference to examine the policies, initiatives, technologies and applications leading to national and international spatial data infrastructures

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Technical Program

The Conference program will have five tracks exploring spatial data infrastructures (sdi) and one track which will link these to the field of geomatics:

- national spatial data infrastructures
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- SDI data frameworks
- geomatics applications
- SDI related standards
- SDI partnerships and policy solutions

Workshops / Demonstrations

Monday, June 8, 1998 organized/presented by sponsors, private sector firms, working groups.

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One session will be dedicated to the exhibition, along with many other opportunities during the conference for exhibitors to showcase their latest technology.

For current information and additional details, visit our Web site:

http://www.ccrs.nrcan.gc.ca/sdi98/

or contact:

Marion Fuller, Conference Manager
615 Booth Street, Room 650, Ottawa, Ontario, Canada K1A 0E9
Phone: (613) 996-2817 **Fax: (613) 947-7059** **E-Mail: sdi98@ccrs.nrcan.gc.ca**

Lighthouse Puzzler
Casse-tête du Lighthouse

by/par Beth Weller

Lighthouse Puzzler # 17

Several very distinguished persons were enjoying a management retreat at Honey Harbour. One special assignment found them working on interesting situations in home-town teams of two.

From these snippets overheard at the bar, can you figure out which team was working on missed deadlines?

The clues:

1. The team from Sarnia, which was not Fred, was not looking at deadlines.
2. Sheila was not from Sarnia, and, no, her project was not on missed deadlines.
3. Jim is from Winnipeg.
4. Jack, the Burlington team, and Ed and partner, were not on cost analysis.
5. Tim and his team mate live on the same street in Ottawa.
6. Joel, who was not from Sarnia, was working on personnel problems.

	Fred	Sheila	Tim	Ed	Burlington	Ottawa	Sarnia	Winnipeg	Personnel problems	Cost analysis	Quality assurance	Missed deadlines
Joel												
John												
Jack												
Jim												
Personnel problems												
Cost analysis												
Quality assurance												
Missed deadlines												
Burlington												
Ottawa												
Sarnia												
Winnipeg												

Solution to Spring Puzzler (#16)

All four people are mentioned in Clue 1. Jacqueline is not Power or Johnston or Miles (Clues 1, 2 & 4) so must be Gorski. Her team did not win the glasses, the dinner, or the watches (Clues 1 and 5) so must have won the shoe bags and placed Second (clues 1, 3, 5).

John placed fourth and won the dinner (Clues 3, 4, 5), so must be Power, which means that Andrew, being in third place, must have won the glasses and is Johnston, so Helen Miles placed first and won the watches.

International Members of the Canadian Hydrographic Association

Membership in the Canadian Hydrographic Association is open to anyone interested in maintaining a link with hydrography in Canada. People who live or work in other countries or who are not conveniently located to existing CHA branches can become international members with the same rights and privileges as other members.

As authorized under the CHA by-laws, the National President has arranged for Central Branch to continue administering the International section of the CHA membership. Under this arrangement we endeavour to ensure that all international members receive the same level of service. International members may also join the branch of their choice.

International Membership is $30.00 (Canadian) per year, or the equivalent in Sterling or US currency. This includes a personal membership certificate suitable for framing along with annual update seals as well as copies of our journal *Lighthouse* each spring and fall.

Each internatioanl member also receives the Central Branch Newsletter. This helps our far-flung members keep in touch between issues of our journal and also offers a forum for members to share views and concerns.

Commander Larry Robbins of the Royal New Zealand Navy is our international correspondent for the Newsletter and writes a regular column with items of interest to international members. Drop snippets of news to him at: 42 Knights Rd., Rothesay Bay, Auckland 1310, New Zealand, Tel/Fax (+64) 9 410 2626. All scraps are very welcome! And if you have special news or views you are most welcome to write something longer for the newsletter or *Lighthouse*. Letters to the Editor are also welcome.

1997 International Members of the Canadian Hydrographic Association

Reha Metin Alkan	Turkey
Cap't F. Angelini (ltN)	Italy
Peter Barr	Australia
Guenther Bellach	Thailand
Ing. Fosco Bianchetti	Italy
Giuseppe Biscontin geom.	Italy
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Luis Leal de Faria	Portugal
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Adam J. Kerr	Monaco
Karl Wm. Kieninger	U.S.A.
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Charles David Meador	U.S.A.
Capt. Keith Millen	United Kingdom
Rumlan Bin Mukhtar	Malaysia
Rear Admiral Steve Ritchie (Ret'd)	Scotland
Cdr. Larry Robbins	New Zealand
Paul Sanson	France
Dr. Shiahn-wein Shyue	Taiwan
Reid W. Stanford III	U.S.A.
Paul Stern	United Kingdom
Jack L. Wallace	U.S.A.

Hints To Authors

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

1. A typewritten, double-spaced copy (including tables, legends for figures and a list of references) on A4 size paper should be submitted.

2. It is possible to submit papers on 3.5" floppy discs formatted for either PC or Mac. Ascii, WordPerfect and Word files are among those accepted.

3. Papers should be in either French or English and will be published without translation.

4. Illustrations should be sent flat and should be prepared with due consideration to probable reductions to page or column width. Specifically, map and plan material should possess a scale bar rather than a representative fraction to allow for such reduction.

Sustaining Members
Membres de soutien

Sustaining membership allows companies closely linked with the hydrographic field to become more involved with the activities of the CHA and to maintain closer contact with users of their products. Through LIGHTHOUSE these Sustaining Members are also able to reach a world-wide hydrographic audience. The benefits of Sustaining Membership include:

- a certificate suitable for framing;
- three copies of each issue of Lighthouse;
- copies of the local Branch newsletters, where available;
- an invitation to participate in CHA seminars;
- an annual listing in Lighthouse;
- an annual 250 word description in Lighthouse; and
- discounted advertising rates in Lighthouse.

Annual dues for CHA Sustaining Membership are $150.00 (Canadian).
Current Sustaining Members are listed below.

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contact: Gail Gabel *(affiliation - CHA Pacific Branch)*

Garde côtière canadienne
104 rue Dalhousie, Suite 311
Québec, Québec
Canada G1K 4B8 Téléc: (418) 648-4236
contact: Claude Duval
(affiliation - ACH Section du Québec)

l'Institut maritime du Québec
53 St-Germain Ouest
Rimouski, Québec
Canada G5L 4B4 Téléc: (418) 724-0606
contact: Claude Jean *(affiliation - ACH Section du Québec)*

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contact: Art Silver *(affiliation - CHA Central Branch)*

Quester Tangent Corporation
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Sidney, British Columbia
Canada V8L 3S3 Fax: (250) 655-4696
contact: John Watt *(affiliation - CHA Pacific Branch)*

Seatex Inc.
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Suite 2500
Seattle, Washington
U.S.A. 98101 - 3263 Fax: (201) 295-1424
contact: Karl Wm. Kieninger
(affiliation - CHA Central Branch)

Kongsberg Simrad Mesotech Systems Ltd.
202 Brownlow Avenue
Dartmouth, Nova Scotia
Canada B3B 1T5 Fax: (902) 468-2217
contact: John Gillis *(affiliation - CHA Central Branch)*

terra surveys ltd.
1962 Mills Road,
Sidney, British Columbia
Canada V8L 3S1 Fax: (250) 656-4604
contact: Rick Quinn *(affiliation - CHA Pacific Branch)*

L'Institut maritime du Québec

Du 20 juin au 10 août 1997, de 9 h à 17 h, du mercredi au dimanche, les personnes intéressées pourront effectuer une visite guidée d'une durée d'une heure de l'Institut maritime du Québec et visiter l'exposition *Les Machines à explorer la mer, d'hier à aujourd'hui.*

L'Institut maritime du Québec, sa Fondation et la Corporation du Musée de la mer de Pointe-au-Père unissent leurs efforts pour offrir aux visiteurs, que l'on attend nombreux dans la région cet été, et aussi à la population en général, la possibilité de découvrir avec un guide l'Institut, ses laboratoires, ses ateliers, ses simulateurs de navigation au radar et de salle des machines. De plus, c'est avec beaucoup d'intérêt qu'ills pourront visiter l'exposition *Les machines à explorer la mer, d'hier à aujourd'hui,* au Centre de formation en plongée professionnelle de l'Institut. Celle-ci regroupe plusieurs maquettes grandeur réelle de machines anciennes conçues pour explorer, parfois avec plus ou moins de succès, le fond de l'océan, des appareils et des équipements de plongée modernes: scaphandre rigide articulé, sous-marin d'observation. Les visiteurs pourront aussi assister à des activités dans le bassin de plongée du Centre de formation en plongée professionnelle.

La tenue de ces activités est facilitée par une subvention de Développement ressources humaines Canada, dans le cadre du programme Placement Carrière-Été 1997.

L'admission
Les visiteurs devront débourser 2 $ pour une visite guidée et 3 $ pour l'exposition *Les machines à explorer la mer,* les enfants de moins de 12 ans, 1 $ pour la visite et 1,50 $ pour l'exposition. Pour toutes les activités, un adulte déboursera 4,50 $ et un enfant 2 $. Les groupes de 15 personnes et plus pourront profiter d'un rabais de 20% sur les tarifs réguliers.

THE CANADIAN HYDROGRAPHIC ASSOCIATION AWARD
FOR DESERVING STUDENTS

LA BOURSE ASSOCIATION CANADIENNE D'HYDROGRAPHIE
POUR LES ÉTUDIANTS MÉRITANTS

Rules for eligibility:

1. The applicant must be a full time student registered in an accredited survey science program (the program must have a Geographic Information System, Cartographic, Land or Hydrographic Survey components) in a university or technological college anywhere in Canada. The Administrator of the Award program will determine the eligibility of the program.

2. The award will be available only to students who are in their second year of study in the degree or diploma program that conforms to the basic subject topic. The applicant will be required to submit a transcript of his/her first year marks at the time of application. The marks must indicate an upper level standing in the class and an average 70% in the subjects taken.

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 value of the award is $2,000.

5. The Applicant will be required to write a short paragraph explaining his/her financial need in a clear, concise, manner on the application form.

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

7. The award applications will be submitted to the Adminstrator of Canadian Hydrographic Association Award Program by the end of June to the following address:

   Barry M. Lusk, Manager
   Canadian Hydrographic Association Award Program
   4719 Amblewood Dr.
   Victoria, BC
   V8Y 2S2
   Phone: (250) 658-1836

8. Each year, in July, an individual, who meets the qualifications and deadline will be chosen from the list of applications received. The award will be given to the successful applicant during the first week of August so that he/she may reasonably plan their next financial school year.

9. The successful applicant will be issued with a special Canadian Hydrographic Association certificate, duly framed, at the time the award is made. A duplicate certificate will be hung in the CHA offices.

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

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

Critères d'admissibilité:

1. Le candidat doit être un étudiant inscrit à temps complet dans une université ou un collège canadien à un programme de sciences qui inclut les systèmes d'information géoréférencée, les levés hydrographiques ou terrestres. L'administrateur de la bourse déterminera l'éligibilité du programme d'études.

2. La bourse s'adresse aux étudiants qui seront à leur deuxième année d'étude respectant les sujets de base. Le candidat doit soumettre une copie de son relevé de notes de sa première année avec sa demande. Les notes doivent être supérieures à la moyenne et avoir une moyenne de 70 % dans les sujets suivis.

3. La bourse est remise au candidat qui, de bonne foi, démontre des besoins financiers et qui respecte les performances académiques exigées ci-haut.

4. La valeur de la bourse est de 2000 $.

5. Le candidat doit écrire un court texte, clair et concis, décrivant ses besoins financiers sur le formulaire de la demande.

6. Le candidat doit soumettre une lettre de référence d'un officiel de l'université ou du collège où il a suivi son cours. Cette lettre de référence doit inclure l'adresse et le numéro de téléphone de l'officiel.

7. Les demandes doivent être soumise à l'administrateur de la bourse Association canadienne d'hydrographie pour la fin du mois de juin à l'adresse suivante:

   Barry M. Lusk, Administrateur
   Bourse Association canadienne d'hydrographie
   4719 Amblewood Dr.
   Victoria (Colombie-Britannique)
   V8Y 2S2
   Téléphone: (250) 658-1836

8. Le récipiendaire est déterminé en juillet parmi les demandes reçues qui rencontrent les exigences et les délais. La bourse est remise durant le première semaine d'août afin de permettre au récipiendaire de planifier financièrement son année scolaire.

9. Le récipiendaire reçoit un certificat encadré de l'Association canadienne d'hydrographie dont un duplicata est suspendu à leur bureau.

10. Une lettre d'appréciation du récipiendaire est publiée dans l'édition suivante de notre revue professionnel "Lighthouse".

11. L'étudiant récipiendaire peut recevoir la bourse qu'une seule fois.

Book Review / Critique de livres

R.M.S. Nascopie: Ship of the North
&
The Ottawa-St. Lawrence Navigator

F. Oliff

Two new releases from The Golden Dog Press recently crossed my desk, courtesy of Terese Herron, with a request to review them. The books, both by Doug Gray, formerly of the Coast Guard, deal with the varying aspects of the nautical world.

R.M.S. Nascopie: Ship of the North is a chronological look at the life of an icebreaker in the early part of this century. Her career for the Hudson's Bay Company and Canada during wartime make for an interesting story-a de rigeur read for Arctic and history buffs alike.

On the other hand The Ottawa-St. Lawrence Navigator is a boating guidebook; a who's who and what's where of these two famous waterways. It is a useful handbook full of, among other things, amusing anecdotes about the rum-running trade during the American Prohibition.

I try to digest everything I can get my hands on relating to adventures in Canada's North and the Fur Trade, so the subject of the Nascopie appeals to me. I did not know a lot about this steamship, employed in the task as Royal Mail Ship (hence R.M.S.) yet its name was familiar having seen her mentioned in the Peter C. Newman trilogy about the Hudson's Bay Company (HBC) and, more recently, Sleeping Island by P.G. Downes. The Nascopie's primary task was to stock the outlying HBC posts lying around the coast of Hudson and James Bays. This meant loading trade goods from the company wharf in Montreal and then via Hudson Strait into the often ice-choked waters of the Bay.

The author makes an apology for the inclusion of a technical section but no apology is necessary. In fact, because the Nascopie was a special ship designed for a specific purpose, I think the inclusion is of great interest and benefit. She was custom-built for the HBC with the intention of putting her into situations no other ship plying Canadian waters was capable of dealing with; she handled them marvellously.

The inclusion of excerpts written by the captain are excellent and revealing. Some of the episodes experienced by the ship and her crew during wartime and peacetime are truly remarkable. A long-time employee of the HBC in Rigolet, Labrador, who knew the Nascopie well, has said "...[it is] a serious attempt to tell the story as it actually happened, neither romanticizing nor politicizing it". It is hard not to be romantic or nostalgic but the author does this without being "weepy" or sentimental. A good example of this is how the author, who clearly has some fondness for the ship, deals with her sinking.

This book is highly recommended to anyone with an interest in ships or Arctic history. A good editor, however, would have cleared up some of the typos, spelling and grammatical errors that I find upset the course of an otherwise wonderful presentation.

Unfortunately, another book by Doug Gray in this issue's review, The Ottawa-St. Lawrence Navigator, has the same problem. Yet, it imparts a lot of useful information to novice and seasoned boaters alike. It is essentially a guidebook and unfortunately reads like one. The only section I can honestly say I enjoyed was the inclusion of a Rum Runners tale at the end of each chapter. This is not to say that it is poorly written or badly presented (in fact the opposite is true); it just isn't as interesting to me as reading about, oh say, the Nascopie! So while the dutiful volunteer read the book, it was strictly read for this review (as I find reading guidebooks like this not as entertaining as say, oh, reading about the Nascopie).

Such volumes have their place and their purpose and anyone contemplating a water voyage of the Ottawa or the St. Lawrence rivers would do well to arm themselves with this book and the information contained therein before loading the boat on the trailer. The tales of the privateers who plied these waters in the commerce of the day might entertain you!

Special Note:
January/February 1998 Issue of *UpHere* magazine features an article chronicling the finding of *R.M.S. Nascopie* (pictured below) which sank July 21/47 off Cape Dorset, N.W.T.

INTERNATIONAL HYDROGRAPHIC BUREAU

publishes twice a year, in March and September, an English and a French edition of

◆ THE INTERNATIONAL HYDROGRAPHIC REVIEW ◆

This publication contains articles of topical interest on hydrography, oceanography, cartography, navigation, photogrammetry, geodesy and allied subjects, radio aids, automation, new instruments and techniques. The September issue is also devoted to specific topics.

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The Catalogue of the IHO can be obtained gratis by writing to the

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1998 ASPRS-RTI Annual Conference
American Society for Photogrammetry & Remote Sensing
and Resource Technology Institute
March 30th - April 4th, 1998
Tampa Convention Center ; Tampa, Florida

Committee Meetings - March 30th - April 1st
Full-day Workshops - March 31st - April 1st
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An international conference to examine the policies, initiatives, technologies and applications leading to national and international data infrastructures.

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Phone: (613) 996-2817 Fax: (613)947-7059
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Oceans '98
Engineering for Sustainable Use of the Oceans
Acropolis Conference Center, Nice, France
September 28th - October 1st, 1998

This Oceans will be set under the theme of Engineering for a Sustainable Use of the Oceans, which is also the main theme for the European Union Marine and Science Technology (MAST) programme.

Visit our site: http://www.ifremer.fr/oceans98
or contact:
Georges Bienvenu & Pierre Sabathé
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525, Route des Dolines, BP 157
06903 Sophia - Antipolis, France

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HYDRO 99
January 5th - 7th, 1999
Plymouth, UK
Information Management
The UK Branch of the Hydrographic Society announces the next in the series of International HYDRO conferences dating back over two decades. These have addressed a variety of topical themes concerned with the development of the profession. On the verge of the new millenium this conference will be dedicated to the field of INFORMATION MANAGEMENT and all it entails.

For Information:
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University of Plymouth
Drake Circus
Plymouth, PL4 8AA, UK
Telephone: +44 (0)1752 232410
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Passport
ICA/ACI 1999
August 14th - 21st, 1999
Ottawa, Ontario, Canada
11th General Assembly of the International Cartographic Association
19th International Cartographic Conference

Touch the Past, Visualize the Future

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THE HYDROGRAHIC SOCIETY OF AMERICA

U.S. HYDROGRAPHIC CONFERENCE '99
MOBILE, ALABAMA
April 26-29, 1999

CALL FOR PAPERS

U.S. HYDRO '99 is a continuation of the series of hydrographic conferences, workshops and exhibitions that alternate between the United States of America and Canada. Each of the three meeting days will have a general theme: Inshore Hydrography, Offshore Hydrography and Data Presentation, respectively.

We invite you to submit a one-page abstract describing new concepts, developments and applications of hydrography. The papers will be presented over the three days of the meetings. The papers must be original and should not have been published or offered for publication elsewhere. Papers are to be orally presented. English will be the official language.

Please ensure that the abstract summarizes the objectives, methodology, results and conclusions of your work. At the top of the page list all authors and their affiliations and provide a point of contact with mailing address, phone, telefax, and e-mail information.

The abstract should be submitted by e-mail (text only, no attachments) to the Program Chair, Karl Wm. Kieninger by 1 July 1998. Authors will be notified of the receipt of the abstract. Notification of acceptance will be sent by 1 October 1998. Final manuscripts are due by 1 February 1999.

Karl Wm. Kieninger, Hydro Marine Inc. :
E-mail Hydromarine@compuserve.com Phone: (201) 295-1443

Additional Information on U.S. HYDRO '99 and The Hydrographic Society can be found on our web page: http://www.USAhydrosoc.org).

News From Industry
Nouvelles de l'industrie

• Kongsberg Simrad Mesotech Ltd. •
Dartmouth, Nova Scotia, Canada

In June and July, 1997 Kongsberg Simrad, the Norwegian marine electronics group, received orders for deep-water multibeam echosounder systems with a total value of $6,000,000.

The customers are the U.S. survey company C&C Technologies; subsea contractor Stolt Comex Seaway; French research institution IFREMER; and the newly formed U.S. company Bell Geospace. The new Kongsberg Simrad equipment is to be used in heavy-duty applications including submarine cable lay, offshore petroleum exploration and production (E&P) and general oceanographic research.

• Knudsen Engineering Limited •
Perth, Ontario, Canada

Knudsen Engineering Limited is pleased to announce the latest addition to their growing product line of high performance Knudsen 320 Series Echosounders. The new **320 B/R** rackmount has been designed with a 10kW transmit capability for full ocean depth requirements. Clients purchasing this new sounder include the Scripps Institution of Oceanography, Moss Landing Marine Laboratories and Antarctic Support Associates.

Knudsen Engineering anticipates a growing market for the new deep water system due to its high performance capability and attractive low cost.

• Quester Tangent Corporation •
Sidney, British Columbia, Canada

Quester Tangent announces the newest model in its line of hydrographic data acquisition systems, the QTC VIEW or Seabed Classification System. The QTC VIEW is an acoustic instrument providing digital real-time seabed classification for a broad range of applications in fisheries, hydrography, dredging and environmental sciences. Features of this unit include: rugged, compact packaging; easy installation and use, enhanced graphical user interface, automated calibration over any survey area; and Windows™-based logging and display software included.

For more information contact Quester Tangent Corporation, Marine Technology Centre, 9865 West Saanich Road, Sidney, B.C. V8L 5Y8, by telephone at (250) 656-6677, Fax (250) 655-4696, E-mail: sales@questercorp.com, or on the Web at http://www.questercorp.com.

• Racal Survey •
Chessington, Surrey, UK

A new high accuracy Differential GPS system has been launched by Racal Survey to meet the needs of survey professionals working offshore. The SatFix receiver has been introduced as a fully integrated, wide-area DGPS system that provides the user with all the advantages of Racal's worldwide high power, spot beam satellite Differential GPS services. The receiver features an in-built virtual reference station to deliver positioning accuracies of better than 1 metre within the reference station network.

• Racal-Thorn Defence •
Chessington, Surrey, UK

The Moroccan Government has placed a 2.2 million pound contract with Racal for an advanced system to manage and track fishing vessels in its waters. The system will be used to monitor the activities of some 400 craft working in Morocco's squid fishery in an area extending up to 200 miles from the country's coastline. The Racal Locator system will also be used to track 15 naval patrol vessels and 14aircraft operated by the Air Gendarmie. It is believed that when completed, it will be the technically sophisticated Fishery VMS (Vessel Monitoring System) in the world.

• International Association of Lighthouse Authorities •
Stamford, Lincolnshire, UK

The Ninth International Symposium on Vessel Traffic Services will be held in the year 2000 and hosted by the Maritime and Port Authority of Singapore. Details are currently being prepared and a further announcement will be made in due course. We at IALA are most grateful to the Maritime and Port Authority of Singapore for agreeing to host this event and we look forward to a successful Conference on this highly important topic.

The International Association of Lighthouse Authorities (IALA) was founded in 1957 and has as its members the Lighthouse Authorities of 84 countries.

For further information on VTS 2000 and on IALA, editors should get in touch with Paul Ridgway, Editor, IALA Bulletin, No. 3 The Green, Ketton, Stamford, Lincolnshire, PE9 3RA, UK Telephone: +44 1780 721628 or Fax: +44 1780 72198

• **Ocean Data Equipment Corporation** •
Walpole, Massachusetts, USA

Ocean Data is pleased to announce the introduction of the Bathy-500 Survey Echo Sounder. Ocean Data's Bathy-500 is a state-of-the-art electronic survey instrument used to generate precision depth recordings and digital data output.

The instrument features a built-in digitizer with RS232 and RS422 data output interface ports; user-selectable DC or AC input power; automatic chart annotation for date, time, depth and position data; non-volatile internal clock and important parameter setup memory; remote mark event input; and sealed keyboard and LCD for data entry and readout.

For further information, contact Robert Tarini at Ocean Data Equipment Corporation, 141 Washington Street, East Walpole, Massachusetts 02032; Telephone: (508) 660-6010; FAX: (508) 660-6061; E-mail: rtarini@oceandata.com Website: www.oceandata.com

• **Klein Associates, Inc.** •
Salem, New Hampshire, USA

Klein Associates, Inc., a leader in Side Scan and Sub-Bottom Profiling Sonar equipment, is proud to announce our second OPERATIONAL/MAINTENANCE TRAINING SEMINAR in 1997. This seminar is geared to the operator, as well as to the manager, who wants a better understanding of Side Scan Sonar techniques. The seminar will follow the standard system training format that we have successfully used for years. The course is a blend of equipment operation and sonar record interpretation taught by a recognized expert in side scan sonar operation.

The second seminar will be held September 23, 24, and 25. The fee for each attendee is $845.00, and includes training materials and lunch each day. All seminars will be held at the Klein facility in Salem, New Hampshire. Classes begin at 8:30 AM and end at 4:30 PM.

To receive a registration form for this seminar, please contact the marketing Department at Klein Associates, Inc. The registration form may be returned by fax to reserve space in the class. Klein will also assist you with hotel reservations or directions to the facility.

Klein will also be pleased to conduct this training course at customer locations and will quote such courses, on a case by case basis, to customer requirements.

In addition, **Klein Associates, Inc.** is proud to announce that we have assisted in the location of a World War I O-Class submarine that was lost during test dives on June 21, 1941, off the coast of New England. At the time, the submarine had just been reactivated from a long lay-up and had been recently overhauled to prepare it for the task of being a training platform, as the United States built-up for probable entry into World War II.

On the 15th of September, 1997 a final sonar search was made, and the location and detection was confirmed. Several dignitaries were on hand and a wreath was laid at the site in memory of the 33 men who lost their lives. For additional information contact Garry Kozak at Klein Associates, Inc., 11 Klein Drive, Salem, NH 03079, USA.; Telephone: (603) 893-6131, Fax: (603) 893-8807, E-mail: sonar@attmail.com,Internet:http://www.kleinsonar.com.

A low cost, single frequency, side scan sonar designed for professional level offshore operations in water depths to 1000 metres, is being offered by Klein Associates, Inc.

• **Trimble Navigation New Zealand Limited** •
Christchurch, New Zealand

Trimble Navigation is proud to announce the appointment of Mr. Brent O'Meagher to the Marine Business Unit at Trimble's head office (Sunnyvale, CA). He will be responsible for developing Marine Survey markets and supporting dealers. The products will include hydrographic survey (HYDRO), precise marine construction (Target) and Ship Trial systems.

Central and Arctic Region

Retirement

When a well-respected hydrographer and manager retires after 37 years, the occasion deserves a celebration of the achievements and contributions as well as a deserved thank you. Such was the gala on June 5, 1997 when about 200 colleagues and friends gathered at the Liuna Gardens in Stoney Creek, Ontario to pay tribute to Earl Brown on the occasion of his retirement from the Canadian Hydrographic Service (CHS).

Steve MacPhee presents Earl with the CHS crest

Earl, from Coleville, Saskatchewan, graduated from the Provincial Institute of Technology and Art (now SAIT) in Calgary in 1960. He joined the CHS in May of that year and performed numerous jobs over his career. Starting out as a field hydrographer in James Bay and Hudson Bay, he did much of his work on the Atlantic Coast and Great Lakes and even worked on surveys in the British Virgin Islands. He was always very proud to have served aboard the CSS Acadia, a legend in the CHS fleet of ships. After rising to the Hydrographer-in-Charge level and with the reputation of being a very fine hydrographer, he became Head, Hydrographic Development, Central Region in 1969. In 1973 he assumed the position of Assistant Regional Hydrographer, Central Region and was awarded his commission as a Canada Lands Surveyor in 1982. In 1988 he became the Regional Director of Hydrography for the Central and Arctic Region. He had a great interest in the Arctic and much of the charting in that area can be directly attributed to his interest and understanding of the requirements of the North. Earl had many, many accomplishments throughout all of these positions but is probably best known for being a great hydrographic surveyor and a great people-oriented manager. Not many can lay claim to this sort of distinction.

All of these events were acknowledged by about 15 presentations at his retirement function including a unique sketch of the sinking of the MV North Star IV, a vessel which Earl served on in 1961 until her demise. Presentations were made from the academic community, industry, other Government Departments and from his colleagues in the other Regions of CHS. His gift from 'the people' was a beautiful mahogany seaman's chest with the CHS crest etched in the cover. A most suitable memento.

The evening, under the the watchful eye of Bruce Wright, who served as Master of Ceremonies, was a delightful mix of memories, humour and roasting, all with a theme of appreciation and gratitude for Earl's contributions over his career. Linda Smith, Earl's Assistant and Secretary for a number of years, made an excellent presentation reviewing some of the qualities and characteristics

Earl is made an honorary crew member of *Surveyor*

that sum up the Earl Brown that most people have known over the years. The antics of Comedian Geoff Irwin whipped the crowd into a festive mood that continued for the remainder of the evening. Finally, Earl's response was a very thoughtful and sincere acknowledgement of all of the presentations and comments as well as a synopsis and recognition of the opportunities presented to him during his career in CHS.

Earl was joined at the head table by his wife Aline, Mr. Steve MacPhee, Dominion Hydrographer, Mr. Ray Pierce, Director General, Central and Arctic Region, Dr. and Mrs. John Cooley, Director of the Bayfield Institute and Mr. and Mrs. Ross Douglas, friends and former colleague. His two children, Darren from Vancouver and Michelle from Burlington, as well as his sister Irene from Edmonton and his brother from Picton, Ontario were part of the festivities.

A great promoter of hydrography and the comradery of those in the community, Earl dedicated much of his leisure time to various projects. He was Vice-President of Central Branch of the Canadian Hydrographic Association in 1967 and again in 1970 and he was National President in 1975. In recent years Earl was a strong supporter of Central Branch's Heritage Launch Project and participation in the 1993 Surveying and Mapping Conference. An avid curler and baseball fan, Earl always found time to promote or participate in all of the activities organized by the community.

We all wish Earl and Aline a very long and happy retirement. It is hoped Earl will continue to be active in the hydrographic community so that we may all benefit from his wealth of experience and sound judgement.

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Région Laurentienne

Nouveau directeur régional

En avril 1997, monsieur Denis Hains quittait le poste de Directeur régional du Service hydrographique du Canada, région Laurentienne, (SHC-RL) pour d'autres fonctions au sein du gouvernement du Canada. Madame Michelle Grenier a occupé le poste pendant la période intérimaire et, depuis le 8 décembre dernier, monsieur Jean-Yves Poudrier occupe le poste de Directeur régional du SHC-RL. Monsieur Poudrier a débuté sa carrière dans la fonction publique fédérale en 1976 alors qu'il joignait les rangs du SHC à titre d'hydrographe. En 1984, il s'est joint à Travaux publics Canada à titre de chef des levés hydrographiques et de dragage, et en 1993, il est devenu chef régional, Dragues, Dragage et Levés. De mai 1997 jusqu'à sa récente nomination, il a été affecté à un projet pilote parrainé par Travaux publics et Services gouvernementaux Canada et Pêches et Océans Canada, à titre de Gestionnaire, section spéciale de levés. Nous lui souhaitons la plus cordiale bienvenue et le meilleur succès dans ses nouvelles responsabilités.

Relevés bathymétriques au large des côtes de la Nouvelle-Angleterre

La Division de l'acquisition de données hydrographiques du SHC-RL a fait un relevé bathymétrique au large des côtes de la Nouvelle-Angleterre, pour les Levés géologiques américains (USGS) de l'Institut Woods Hole de Cape Cod, de la mi-novembre à la mi-décembre. Ce projet, en partenariat avec le groupe de cartographie océanique de l'université du Nouveau-Brunswick, utilise le sonar multifaisceaux EM1000 à bord du F.G. Creed et permet de produire rapidement des images du fond marin dans la Baie Massachusetts, à l'Est de l'Île Nantuckett, de même qu'au large de New-York et Long Island.

SINECO

Le SHC-RL travaille, en collaboration avec la section Modélisation de la Division des sciences océaniques, à améliorer la précision des prévisions des niveaux d'eau du Saint-Laurent du système SINECO. Ce nouveau modèle intègre les prévisions de débits aux barrages de Cornwall et de Carillon et éventuellement, les prévisions météo s'ajouteront. Une analyse est en cours afin d'intégrer la méthodologie de Smith et Thompson pour les prévisions allant de 0 à 48 heures et une interface est en élaboration pour interroger les différentes bases de données. Les résultats obtenus pour l'année 1996 sont encourageants puisque l'intégration des vents dans le modèle a fait diminuer l'erreur des prévisions de cinq centimètres. Bien que ce nouveau modèle ne soit pas encore tout à fait au point, il a été mis à contribution avec succès pour émettre des avis de débordement sur la route 132 en Gaspésie et à Québec pendant la tempête du 30 décembre 1997.

Technique On-The-Fly en temps réel (OTF-RT)

Le SHC-RL collabore avec la Garde côtière canadienne (GCC) afin de mettre au point une technique de réduction de niveau d'eau par la technique OTF-RT pour éliminer l'utilisation de planches à marées lors du sondage et du dragage du chenal maritime du Saint-Laurent. Une harmonisation des zéros des cartes et une table d'ondulation de ceux-ci en référence à l'ellipsoïde WGS84 sont en cours de réalisation pour en faire une surface de référence en glacis (Seamless Datum). Les premiers résultats sont encourageants et permettent d'entrevoir l'exportation de cette technique à d'autres régions ou pays dans un proche avenir.

Navigation électronique

Au cours du mois de décembre, monsieur Dan Pillich de SevenC's est venu rencontré des physiciens et des

hydrographes à l'Institut Maurice-Lamontagne (IML)pour discuter de l'intégration de nouveaux outils technologiques de visualisation électronique pour la navigation maritime au format international existant S-57 des TVO (Time Varying Objects, à savoir : courants, marées, glaces, etc.). Cette rencontre de travail a permis de préparer la participation des représentants de l'IML à une importante rencontre de niveau internationale tenoue à Monaco à la fin du mois de janvier 1998.

Visite de représentants argentins

Le 22 octobre, madame Michelle Grenier et messieurs Richard Sanfaçon et Bernard Tessier ont assisté au Centre océanographique de Rimouski à une conférence portant sur la privatisation des ports et des voies navigables en Argentine. La délégation était accompagnée par monsieur Sylvain Gélinas de la compagnie SOCOMAR International de Boucherville. Comme mentionné durant la présentation de monsieur José Luis Racciatti, directeur national des infrastructures portuaires de l'Argentine, plusieurs visites techniques devraient avoir lieu au cours des prochains mois au Canada. Ces visites auront pour but d'examiner certaines technologies utilisées par le SHC, de discuter des recherches entreprises en modélisation et de passer en revue les activités de la GCC et des ports canadiens.

Collaboration en hydro-acoustique - IFREMER

Messieurs Xavier Lurton, Jean-Marie Augustin et Laurent LeGal spécialistes en hydro-acoustique de l'IFREMER en France ont participé à une session de travail avec des représentants du SHC-RL en octobre 1997. Ils ont fait une démonstration sur station de travail Sun de leur nouveau système de traitement de données océanographiques et hydrographiques "CARAIBES". Un projet de collaboration correspondant à plusieurs champs d'intérêt commun dans les volets acquisition, traitement et gestion de données multifaisceaux a été discuté. Il serait réalisé en collaboration avec le Groupe de cartographie océanique de l'Université du Nouveau-Brunswick.

Réunion annuelle des CPS - Remise des prix RAMAR par le SHC

Chaque année, le SHC-RL est invité à participer à la réunion annuelle des CPS (Escadrilles canadiennes de plaisance) et à remettre les prix RAMAR aux escadrilles qui se sont distinguées en participant à ce programme. Divers prix sont donnés sous forme d'une plaque souvenir. Le SHC doit continuer à tisser des liens étroits avec ce groupe qui nous fournit, outre les rapports d'informations maritimes qui aident à la mise à jour des cartes, un lien privilégié avec un segment important de notre clientèle de plaisance. Cette année, la réunion avait lieu en novembre à Montréal au Reine Élisabeth et regroupait environ 400 membres.

Portable Multibeam Systems For Shallow Water and ROV Survey

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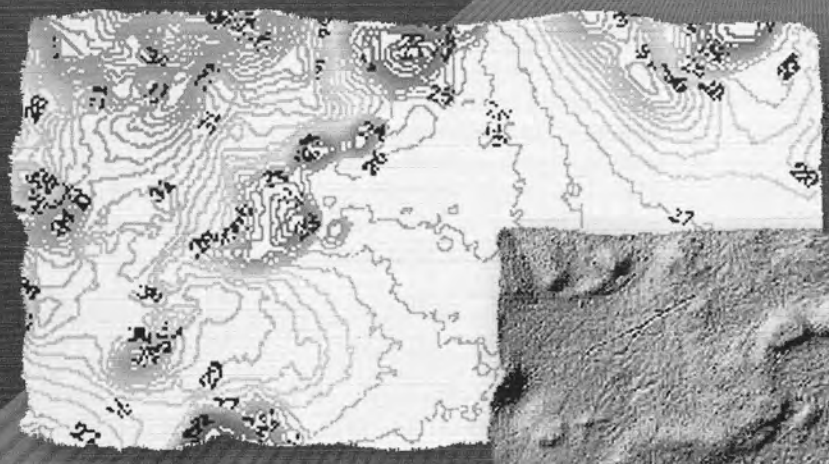
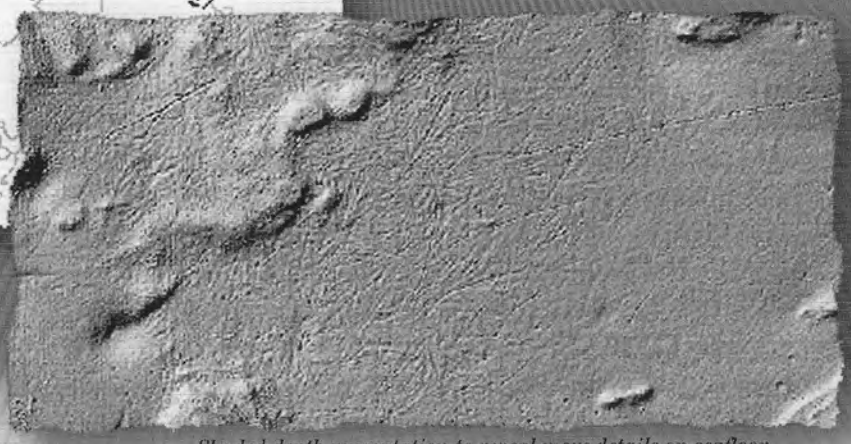


Survey in Halifax Harbor courtesy Canadian Hydrographic Service (CHS)

Contour map - EM 3000 built in software.



Shaded depth presentation to reveal more details on seafloor (possibly anchor tracks shown above) - EM 3000 built in software.

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- Multibeam imaging
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CHA News
Nouvelles de l'ACH

Central Branch

Now that the field season is over and field personnel are slowly drifting back to their desks, a new season begins. Field sheets will start to flow into the FQC office and the monthly meeting schedule will be fleshed out.

The summer barbecue was hosted by the Hinds Family on September 12 in Georgetown, Ontario. Mother Nature, though she didn't rain on us, was not very nice as it was unseasonably cold and windy. That did not stop the young 'uns from a spirited session of apple bobbing, including one youngster who tried to "fish" something off the bottom (immersing himself up to the shoulders in the effort

The third branch meeting was held April 24 at the Canada Centre for Inland Waters (CCIW) in Burlington. The video, By Icebreaker to the North Pole was shown to a large appreciative audience. This documentary chronicled the journey to the North Pole of the Canadian icebreaker CCGS Louis S. St. Laurent accompanied by the U.S. icebreaker Polar Sea.

The fourth branch meeting was hosted by Brian and Anna Power at their residence in Burlington. The requisite beer and pizza followed the viewing of a video on lighthouses of Georgian Bay, entitled "Alone in the Night".

The fifth branch meeting was held at the Herron residence in Waterdown. Mr. Leslie Sike a professional yachtsman presented a video on the first Canadian sailing yacht to cross Hudson Bay and enter the Port of Churchill. He and his crew aboard Aqua Star had a most interesting voyage.

The branch Annual General Meeting and Dinner was held December 11th at the Mimico Cruising Club. As usual the atmosphere was festive and an enjoyable evening was had by all who attended. The speaker for the evening was Leslie Sike, this time with an excellent presentation about sailing Aqua Star to Leningrad in 1989.

The 1998 Central Branch Executive:
Vice President - Fred Oliff
Secretary - Tim Janzen
Treasurer - Andrew Leyzack
Past Vice President - Terese Herron
Executive Members - Jim Berry, Al Koudys, Ed Lewis, Brian Power, Jackie Miles and Sam Weller.

Announcements of note are the recent (whilst on survey in the Arctic) engagements of Terese Herron to Shawn Cook (Coast Guard Newfoundland) onboard the CCGS Henry Larsen and Pete Wills to Patty Parkhouse (CHS Pacific) onboard the CCGS Nahidik. In addition, Jennifer Campbell and her husband Kent are pleased to announce their impending parenthood in the middle of March, 1998.

The Brew Jays, coached by Jackie Miles, finished 3rd in the CCIW softball league, avenging a loss in last year's final.

The Peter Rindlisbacher print The Burlington Races was won by Ken Dexel in the draw held at the barbecue September 12th.

The retirement of long-time CHS Central & Arctic Director and founding father of the CHA, Earl Brown, took place at a lavish gala held at Liuna Gardens in Winona, Ontario on the sixth of June.

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Pacific Branch

Social
As usual the CHA Annual Photo Contest was a smashing success. Held in the Milne Room at IOS in November, winners were chosen from the three categories. First place in the "At work" category was Dave Fisher's masterpiece "Hydroculture". First place goes to Kevin Conley in the "Scenic" category with his "Sidney by the Sea" taken with the Kodak DC120 digital camera. Also another first place goes to James Wilcox in the "Things" category with his beautiful photo of a "Classic Tug". Thanks to all who provided the goodies to eat and drink. Of course there was Dave Gartley's latest brew which was a particular favourite with many.

The Beer, Bun and Bellowing Bash was held with little fanfare in late November at the Legion Hall on Superior St. in Victoria. Winners of the coveted Sitting Bull trophy were Sandy Sandilands and Willie Rapatz. It appears there was little if any competition there to beat this pair. The competition other than drinking beer and eating included darts, shuffleboard and crib. Ideas for a different venue (perhaps bowling !!) and location for next year were tossed around at the last executive meeting. Any ideas????

Coming up soon is the ever popular CHA/Quester Tangent H2O Curling Bonspiel. The ice has been booked for Sunday February 15, 1998 at the Glen Meadows Golf and Country Club. Last year as you all remember the snowstorm took its toll on Glen Meadows and we had to move the Bonspiel to the Victoria Curling Rink. The bar and snack bar will be open for the duration of the tournament. Entrance fee has not been established yet, but it will be between $5 and $10. Lots of great prizes. Watch for posters in the new year!!

GPS Workshop
In conjunction with the Canadian Hydrographic Service Conference (CHC '98) the CHA is running a GPS workshop in March of 1998. Invited speakers to the workshop and CHA social include Gérard Lachapelle, Elizabeth Cannon, Amin Kassam, Fred Forbes, George Eaton and Denis Hains. A CHA social event will be held at the Maritime Museum in Bastion Square. We hope to be able to use the newly furbished Court Room above the Museum. Thanks to Dave Gartley, we have had some beautiful CHA Pilsner beer glasses delivered recently for this event. Food and beverage for the social have yet to be worked out

although services for the workshop will be provided by the Empress catering group. The Canadian Institute of Geomatics has contributed $500 to sponsor the Workshop lunch and coffee. Still looking for sponsors ...if you know of someone, some business???? Workshop materials such as binders, papers, pens, overheads etc. all need to be assembled for the 40 attendees.

Retirements
Long time CHA member Mike Woods retired from the Canadian Hydrographic Service after 33 years. A luncheon was held in November at the Glen Meadows Golf and Country Club in Mike's honor.

Mike joined the CHS as a deckhand on the old Wm. J Stewart in 1964. In 1970 Mike, his wife Donna and Doug Popejoy piled into their new Datsun and headed towards Ottawa to attend the step one Hydrography course. In 1980 Mike attended the University of Calgary returning every summer for the next four years to work with the CHS. Over the years Mike has surveyed from Vancouver Island to the Arctic including the MacKenzie River, with his name appearing on over 70 field sheets.

Mike's retirement was short-lived however, at his luncheon he informed everyone that he had secured a surveying job in New Guinea early this December. Mike flew out of Victoria on the 1st of December.

We all wish Mike the best for his retirement. I'm sure we will see him at all our CHA activities.

Miscellaneous
We were sad to hear the passing of two of our old colleagues, Jack Chivas and Trevor Jones in 1997.

A new executive was elected in December. Welcome back to Carol Nowak and James Wilcox.

The 1998 Pacific Branch Executive:
Vice President - Dave Gartley
Past Vice President - Rob Hare
Membership - Willie Rapatz
Treasurer - Bodo de Lange Boom
Secretary - Carol Nowak
Social - James Wilcox
Seminars - Alan Schofield
Publications - Brian Watt
Public Relations - Doug Cartwright

Canadian Hydrographic Association
A G M
Thursday March 12,1998
16:30 PST

See your local VP for details

Section du Québec

La Section a participé à l'Expo-Nature de Rimouski qui se tenait du 24 au 27 avril 1997. Près de 30000 visiteurs viennent annuellement à cette exposition pour connaître les dernières nouveautés offertes sur les activités de plein air du Bas-Saint-Laurent, de la Gaspésie, de la Côte-Nord et de l'île d'Anticosti. C'est une occasion privilégiée pour la Section de se faire connaître ainsi que son magasin de vente de cartes marines et topographiques en vue de la préparation des activités estivales. Le nouvel Atlas des courants de marée du fleuve Saint-Laurent produit par le Service hydrographique du Canada a été le produit vedette de la Section à cette exposition.

À chaque année, un des clubs de canotage récréatif de rivière invite dans sa région tous les autres clubs de la province de Québec pour tenir le rassemblement annuel de la Fédération québécoise du canot-camping. Lors de cette rencontre, des excursions sont aussi organisées pour faire connaître les rivières de la région. Cette année, le club de canot « La Cordelle » de Rimouski organisait ce jamboree annuel au Parc du Mont-Comi du 16 au 19 mai 1997. Nous avons participé à l'événement parce que plusieurs membres des clubs de canots font aussi de la voile, du kayak de mer ou d'autres activités de plein air. Cela a été une opportunité de faire connaître notre Association à ce regroupement de clubs et de discuter des intérêts que nous avons en commun.

Pour souligner les 500 ans de la découverte de Terre-Neuve par Jean Cabot, un convoi de voiliers parti des Grands Lacs était organisé pour rejoindre la baie de Bonavista de Terre-Neuve. Le convoi a fait une halte à la marina de Rimouski-Est le 23 mai 1997. Les administrateurs de la marina ont demandé à la Section d'être présent pour offrir des cartes et publications marines aux navigateurs ayant besoin de ces articles indispensables pour une navigation sécuritaire.

En début d'été, la Section du Québec a été un des commanditaires de l'expédition Kayakebek dont les profits étaient versés à la Fondation canadienne rêves d'enfants. L'expédition consistait en trois kayakistes qui ont relié Beauharnois à Gaspé en kayak de mer, soit une distance de 1000 km. Claude-André Léveillé, un des kayakistes, est venu au magasin de la Section pour prendre des informations sur le fleuve Saint-Laurent et pour faire connaître son projet. La Section a offert gracieusement les cartes marines et les tables des marées aux kayakistes afin qu'ils réalisent leur cause humanitaire en toute sécurité. Malgré qu'un des trois kayakistes ait dû abandonner à mi-chemin, le projet a tout de même été réalisé.

Nous avons participé au 30e Salon du livre de Rimouski du 30 octobre au 2 novembre 1997. La Section du Québec partageait un kiosque commun avec l'Institut maritime du Québec, la bibliothèque « Lire la mer » et des auteurs ayant publié des volumes traitant du milieu maritime et de ses traditions. Ce kiosque s'appelait « L'espace mer ». En plus de faire connaître l'Association et les services offerts à notre magasin, nous avons aussi fait des démonstrations sur la manipulation du sextant. Bien que nous soyons dans l'ère du GPS et des cartes électroniques, nous avons constaté que cet instrument attire encore la curiosité et la fascination des visiteurs, et ce, pour tous les groupes d'âge.

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1997 CHA Annual General Meeting
Réunion générale annuelle de l'ACH

Conducted by Teleconference
April 15, 1997
12:00 EDST, Burlington

Attendance: as per the site registers:

1. National President, Ken McMillan welcomed everyone to the meeting. Ken noted that Captain Vancouver, Prairie Schooner and Newfoundland Branch were absent from the meeting. All branches were provided with proxy forms, agendas and financial statements from the National Branch.

2. Agenda Item #1 - Receiving Reports of the Directors.
The following branch reports were presented:
Quebec Branch - B. Labrecque
Ottawa Branch - J. Box
Central Branch - T. Herron
Pacific Branch - A. Raymond

3. Agenda Item #2 - Financial Statements 1995
To accept the financial statements of the Corporation and auditor's financial report for the year ending 31 December, 1995. Motion to accept, T. Herron. Seconded, Rob Hare.
CARRIED

4. Agenda Item #3 - Financial Statements 1996
To accept the financial statements of the Corporation and the unaudited financial report for the year ending 31 December, 1996. Motion to accept, R. Hare. Seconded, T. Herron.
CARRIED

Some discussion took place regarding the Association's insurance extending liability coverage of branch sponsored social functions. It was stated that there is sufficient coverage.

5. Agenda Item #4 - Auditors
To appoint the Auditors for the year 1996 (S. Acheson, J. Kean, Ottawa and S. Weller, E. Lewis (Burlington) and the Auditors for the year 1997, S. Weller and E. Lewis.
Motion to accept, T. Herron. Seconded, J. Box
CARRIED

6. Agenda Item #5 - Board of Director's, Past National President
Bring forward an outstanding item from the 1995 Director's meeting to establish a position on the Board of Director's for the Past National President. A motion was presented by S. Hinds that the Past National President is to occupy the position of a non-voting advisor on the Board of Director's for a one year period. Motion to accept, S. Hinds. Seconded, R. Hare.
CARRIED

7. Agenda Item #6 - New Business
G. Macdonald's Book on the CHS, action item from the 1997 Director's meeting, K. McMillan and D. Pugh to formalize an agreement between CHA and CHS. This requires the CHA to enter into a service contract with the CHS in order to publish the book. K. McMillan reported that under the by-laws of our association, by-law 34 dealing with the execution of documents that the Director's by way of resolution, must appoint officers on behalf of the Corporation to sign specific contracts. Therefore, it is required that a resolution be passed by the Directors to appoint two officers to act on behalf of the Corporation to sign the professional service contract which would see the publication of the book.

Discussion followed and D. Pugh reported that the service contract between the CHA and CHS would involve the collecting of material, translation and publication of the book and that the CHS would support and work closely with the CHA to complete this project.

S. Hinds asked whether the CHA would be liable for material content of the book. D. Pugh reported that the issue regarding the stories presented in the book has been addressed and the CHA would not be liable for material content. The book is expected to sell for $30 - $40 with the revenues going to the CHA.

K. McMillan reported that only the Board of Directors are required to pass the resolution but felt that a formal resolution should be brought before the membership for discussion. S. Hinds asked if the resolution would be for the signing of contracts only. K. McMillan reported that the resolutions passed by the Board of Directors would be for the execution of only this service contract.

Motion: The Directors by resolution, appointed K. McMillan and B. Power as officers on behalf of the Corporation to sign specific contract. Motion to accept, T. Herron. Seconded, R. Hare.
CARRIED
by all Directors present at this meeting

Student Awards Funding
The funding for the student awards in the form of a renewable GIC has been put on hold until a discussion can be made regarding what level of funding is required to maintain and support the awards program.
ACTION: B. Lusk

Student Awards Financial Statement
Pacific Branch raised the question as to whether or not the financial statement for the Student Awards Program be reviewed by an auditor and if so, then an auditor should be appointed for 1997. K. McMillan agreed that it should have an auditor appointed. A motion was made that an auditor be appointed to review the financial statement of the Student Awards Program. Motion to accept, D. Thornhill. Seconded, B. Delange Boom.
CARRIED

A motion was made to appoint S. Weller and E. Lewis as Auditors for the 1997 Student Awards financial statement. Motion to accept, R. Hare. Seconded, B. Power.
CARRIED

Visit of the MATHEW
R. Hare asked if the CHA National or one of the branches would be involved in the MATHEW'S visit to Newfoundland this summer. Unfortunately, the distance and cost for the launch "SURVEYOR" and crew to participate in the festivities this summer was too great and no other plans have been made to date.

A motion was made to adjourn the meeting (13:10). Motion to accept, S. Acheson. Seconded, R. Hare. CARRIED

LIGHTHOUSE INDEX
1969-1997

Ed.	Year	Author	Title
01	1969	Calandra, A.	Our humour page
02	1970	Anonymous	Punchless cards
02	1970	Anonymous	Hydrographic system package
03	1970	Anonymous	Advice to the junior hydrographer
03	1970	Anonymous	Education and development section achievement testing
03	1970	Anonymous	The grandfather clause
03	1970	Anonymous	Syllabus for 1970 Hydrography II course
03	1970	Anonymous	Deep sea oil well system
03	1970	Anonymous	Of in-house educational programmes
03	1970	Anonymous	Concern
03	1970	Anonymous	Talking hydrographic
03	1970	Anonymous	Spectral, but not illusory
03	1970	Anonymous	The hot-line to Tadoussac
03	1970	Anonymous	The hotter-rods of Tadoussac
03	1970	Anonymous	Of even hotter-rods and Hydrodist
03	1970	McKinnon, N.J.	The value of experience
03	1970	Sandilands, R.W.	Is this a record? (shoal report)
03	1970	Smith, A.	GEBCO
04	1970	Anonymous	Test papers for 1970 Hydrography II Course
04	1970	Anonymous	Laser depth sounder
04	1970	Bolton, M.	Applications of the metric system to Canadian charts
04	1970	Fitzgerald-Moore, P.	The metric system
04	1970	Gamble, S.G.	The metric system
04	1970	Jacobs, A.F.	The metric system - notes for a position paper
04	1970	Knox, R.W.	The Mercator projection
04	1970	Ritchie, G.S.	The chart and the metre
04	1970	White, G.J.A.	Some thoughts on the metric system
05	1971	Anonymous	Unsolved mysteries of the past maps 11,000 years old
05	1971	Anonymous	What is history?
05	1971	Anonymous	St. Elmo's Fire
05	1971	Anonymous	Due to life in the Arctic...
05	1971	Anonymous	Satire anonymous
05	1971	Anonymous	A talkin' blues
05	1971	Anonymous	The great trailer caper or he must have been twins
05	1971	Anonymous	Dear Mort,
05	1971	Anonymous	Verity's last stand
05	1971	Anonymous	The W.C.
05	1971	Anonymous	Early navigation
05	1971	Anonymous	Data stream
05	1971	Anonymous	Why tell me
05	1971	Anonymous	The 90-proof habits of the CCIW control group, 1970
05	1971	Anonymous	Motorola R.P.S. trials and errors
06	1971	Anonymous	Ocean Station "P" weathership oceanography program review December 1970
06	1971	Anonymous	Hydrodist MRB 2
06	1971	Anonymous	Lake of the Woods survey for 1971
06	1971	Courtnage, R.D.	Conversion to the metric system
06	1971	Courtnage, R.D.	Great Lakes systems and Thousand Islands
06	1971	Crowley, J.V.	Ottawa River, 1971
06	1971	Eaton, R.M.	Navigation group formed at Bedford Institute
06	1971	Macnab, R. Smith, T.B.	CSS Baffin survey - Beaufort Sea 1970
06	1971	Marshall, R.	International Great Lakes Levels Board
06	1971	Shreenan, J.G.	Construction of velocity scales for ms 26b echo sounders on conversion to the metric system
06	1971	Weller, J.H.	The reluctant hydrographer
06	1971	Wright, B.M.	Minamata and mercury
06	1971	Wright, B.M.	Lower St. Lawrence survey, 1971
07	1971	Brown, E.	Preliminary results of Loran C on the Great Lakes
07	1971	Crowley, J.V.	A simple subtense system
07	1971	Eaton, R.M.	Satellite navigation
07	1971	Richardson, G.E.	Evaluation of the Klein Associates side scan sonar
07	1971	Sandilands, R.W.	The history of hydrographic surveying in British Columbia
07	1971	Thompson, E.F.	Navigational ranges survey
08	1971	Anonymous	Seanitions
08	1971	Anonymous	Murphy law
08	1971	Anonymous	CSS Vedette
08	1971	Brown, E.	Some Current Methods of the CHS for Processing, Storage and Retrieval of Bathymetric Data for the Great Lakes
08	1971	Huggett, W.S.	Technique for mooring underwater instruments on the continental shelf
08	1971	Lasnier, L.R.	Exchange programme comments
08	1971	Maunsell, C.D.	Who measures depth?
08	1971	Mortimer, A.R.	A note on the calibration of Decca 6F with minifix
08	1971	O'Connor, A.D.	The Yuasa 12 volt battery
08	1971	Rogers, A.R.	Talk presented to Pembroke Outdoor Sportsman's Club
08	1971	Silvey, W.	A tale of Mac
08	1971	Weller, J.H.	Our revisory summery
09	1972	Eaton, R.M.	Radio waves and sound waves for positioning at sea
09	1972	Freeman, N.J.	Guidelines for the Tides, Currents and Water Levels Unit, Central Region
09	1972	Goldsteen, G.H.	Report on visit to Dutch hydrographic offices
09	1972	IFYGL Staff	Marine Sciences Branch contributions to IFYGL
09	1972	Wade, G.E.	Seminar presentation at Canada Centre for Inland Waters
09	1972	Weller, J.H.	Cartoons
09	1972	Wright, B.M.	Minamata and mercury
09	1972	Wright, B.M.	Hydrodist in Central Region
10	1972	Anonymous	Inauguration of Britain's first hydrographic society
10	1972	Anonymous	Loss of steamer Kent
10	1972	Anonymous	Steamers Kent and London
10	1972	Falconer, A.R.	Cesium controlled Decca Lambda system
10	1972	Gervais, J.M.	Summary of 1971 field season with technical operations
10	1972	Goldsteen, G.H. Casey, M.J.	A simple method of making copies of field sheets in the field
10	1972	Kerr, A.J.	Canadian sailing directions - some recent and planned changes
10	1972	Richards, P.	Water crossing - Strait of Mackinac
10	1972	Weller, J.H.	Monumenting and description of survey stations
11	1973	Casey, M.J.	Lighthouse interview with G.E. Wade
11	1973	Chapeskie, R.E.	Warren Landing blues
11	1973	Crowley, J.V.	On the level
11	1973	Crowley, J.V.	Cartoon
11	1973	Marshall, H.	Cartoon
11	1973	Perrin, J.	Big increase in fatalities on the water
11	1973	Sandilands, R.W.	Thoughts of a field hydrographer
11	1973	Weller, J.H.	The happening at James Bay
11	1973	Wright, B.M.	Report on mini-fix operations in James Bay
CE	1973	Anonymous	Seanitions 71
CE	1973	Anonymous	Talking hydrographic
CE	1973	Crowley, J.V.	A simple subtense system
CE	1973	Eaton, R.M.	Satellite navigation
CE	1973	Goldsteen, G.H. Casey, M.J.	A simple method of making copies of field sheets in the field
CE	1973	Maunsell, C.D.	Who measures depth?
CE	1973	Sandilands, R.W.	The history of the Hydrographic Service in British Columbia
CE	1973	Wade, G.E.	Interest in the Arctic
CE	1973	Wright, B.M.	Minamata and mercury
CE	1973	Wright, B.M.	Hydrodist in Central Region
12	1975	Anonymous	The chart schemer's theme song
12	1975	Casey, M.J.	The Asia tragedy
12	1975	Eaton, R.M.	How is Satnav coming along these days?
12	1975	Kerr, A.J.	Antarctic survey - twenty years ago
12	1975	Macdonald, G.D.	Cook and Canada
12	1975	Sandilands, R.W.	CSS Pandora II
13	1976	Chapeskie, R.E.	Let's discuss hydrographic chart scales
13	1976	Gauthier, R.E. Saucier, R.	The General Bathymetric Chart of the Oceans, 5th edition
13	1976	Loncarevic, B.D.	Modern hydrography as seen by a geoscientist
13	1976	Maunsell, C.D.	The speed of sound in water
13	1976	Sandilands, R.W.	The survival of hydrography
13	1976	Smith, A.	Chart user survey
13	1976	Weedon, G.F.C. Gilb, T.P.	"Range Holes" and what to do about them
13	1976	Wells, D.E.	Datum transformations
14	1976	Anonymous	Epilogue to "Surveyor at the Centre"
14	1976	Ayres, J.	Argo revisited
14	1976	Blust, F.A.	The U.S. lake survey, 1841-1974
14	1976	Choo-shee-nam, R.I.	Some experiences with a Geodimeter 6 BL under hydrographic conditions
14	1976	Coons, R.	Generators - a one act play
14	1976	Crutchlow, M.R.	Tracked vehicle sounding over ice
14	1976	Doekes, C.	Use of INDAPS in Arctic surveying
14	1976	Eaton, R.M.	Loran-C at extended range for fishing and oceanography in Atlantic Canada
14	1976	Macdonald, G.D. Casey, M.J.	Integrated navigation system
14	1976	Sandilands, R.W.	There is a proper measure in all things (Horace)
15	1977	De Wolfe, D.L.	Tidal measurement program of the Bay of Fundy - Gulf of Maine tidal regime
15	1977	Deare, F.	Great Whale odyssey
15	1977	Eaton, R.M.	An accurate log for icebreaker type ships
15	1977	Forbes, S., Burke, R.G., White, K.T.	Digitization - how the Atlantic Region is approaching the problem
15	1977	Macdonald, G.D., Bryant, R. and Marshall, R.	Coastal survey in Africa using loran-C
15	1977	Sandilands, R.W.	I am become a name (Tennyson)
15	1977	Sandilands, R.W.	The Cook Bicentennial
15	1977	Tinney, B.	Automated tidal reductions
15	1977	Watt, J.V.	Towards a maximization of information recorded on hydrographic echograms
16	1977	Deare, F.	Laughin' on the Baffin
16	1977	Fenn, G.	Laser ranger evaluation
16	1977	Gilbert, R.	CSS Baffin mid-life refit
16	1977	Jerome, J.H., Bruton, J.E. and Harris, G.P.	The application of Landsat-1 digital data to a study of coastal hydrography
16	1977	Kerr, A.J.	Sailing strategy in the face of the Gulf Stream and North Atlantic current
16	1977	MacPhee, S.B.	An evaluation of the Sea Beam system
16	1977	Sandilands, R.W.	There is no new thing under the sun
16	1977	Stephenson, F.	An assessment of the permanent water level stations in the Canadian Arctic

Ed.	Year	Author	Title
16	1977	Stuifbergen, N.	Maxiran trials on the Scotian Shelf
16	1977	Thomson, D.B.	Hydrographic surveying at the University of New Brunswick
17	1978	Bruins, T.	On-line automation of a hydrological data acquisition system
17	1978	Hammack, J.C.	Landsat goes to sea
17	1978	McCulloch, T.D.W.	Canada's hydrographic role in FIG
17	1978	Monahan, D.	Geometrical probability and hydrography
17	1978	Prinsenberg, S.J.	Sound velocity distribution and its effect on sounded depths for Hudson Bay
17	1978	Tripe, R.L.K.	Navbox - a microprocessor-based navigation aid
18	1978	Crutchlow, M.R., MacPhee, S.B. and Knudsen, D.	Arctic hydrography - past, present and future
18	1978	Hemphill, M.A. White, K.T.	Evaluation of Motorola's Mini Ranger data processor and automated positioning system
18	1978	Kerr, A.J.	The Amoco Cadiz and all that
18	1978	Mooney, B.J.	The impact of Fundy tidal power on the hydrography of the area
18	1978	Sandilands, R.W.	Sydney's hydrographer
18	1978	Sandilands, R.W.	Feds solve 4 year old crime
18	1978	Stuifbergen, N.	Syledis - a new medium-range positioning system
18	1978	Watt, J.V.	Dependable digital depths
19	1979	Anonymous	Cushy shore jobs
19	1979	Monahan, D.	Municipal place names and hydrographers
19	1979	Sandilands, R.W.	Whose name was writ in water
19	1979	Woods, M.V.	The mini-ranger data processor automated positioning system - a useful tool for positioning sweeps
2	1970	Johnson, B.R.	Statistical analysis of pingo-like features in the Beaufort Sea
20	1979	Davies, P.	Arctic survey uses helicopter mounted spike transducer
20	1979	El-Sabh, M.I., Murty, T.S. and Briand, J.M.	Storm surge amplitudes in the St. Lawrence estuary
20	1979	Gottinger, R.	Computerized chart reproduction for scientific applications
20	1979	Macdonald, G.D.	The origin of 'The Origin of the Species'
20	1979	Mortimer, A.R.	Comments on the Internav Loran-C co-ordinate converter unit (CC-2)
20	1979	Sandilands, R.W.	Charlie Golf Foxtrot Quebec
21	1980	Eaton, R.M.	The Acadia goes to the Nova Scotia Maritime Museum
21	1980	Kerr, A.J.	The case of the poached lobsters
21	1980	Macdonald, G.D.	The man who had been right
21	1980	MacDougall, J.R.	Tellurometer MRD1 field evaluation
21	1980	McCulloch, T.D.W.	The hydrographic commission of FIG
21	1980	Thomson, D.B. Okenwa, E.G.	Analytical models for automated water level reduction of soundings
22	1983	Murty, T.S.	Sunspot activity and tsunamis in the Pacific Ocean
22	1980	Casey, M.J.	The field sheet as an inefficient medium
22	1980	Macdonald, G. D.	Sounding selection from a digital data base
22	1980	Mogg, M.J.	The 1980 H.M.S. Breadalbane Expedition
22	1980	Sandilands, R.W.	The Canadian Princess
23	1981	Crawford, W.R. Huggett, W.S.	The tidal streams surrounding Vancouver Island
23	1981	Crowley, J.V.	Subtense 2
23	1981	Eaton, R.M.	Range errors in microwave
23	1981	Gray, D.H. Monteith, W.J.	Integration of NAD 83 into the charting program of the United States and Canada
23	1981	Macdonald, E. Macdonald, G.D.	From a hydrographers sketchbook impressions of India
23	1981	Rockwell, G.	Large scale surveys with the Aga geodimeter 120
24	1981	Casey, M.J.	Improving the performance of the Motorola MRS
24	1981	Medendorp, J. Macdonald, G.D.	The marine Arctic route reconnaissance system
24	1981	Meyer, E.A.	"Smart" digitizer proven in Arctic
24	1981	O'Connor, A.D.	Pavlov's hydrographers
24	1981	Sallaway, P.	A review of digital terrain modelling applied to hydrographic charting activities
24	1981	Sandilands, R.W.	Charting the Beaufort Sea
24	1981	Wells, D.E.	Mathematics and computing syllabuses for hydrographers in Canada
25	1982	Anderson, A.D. Mobley, W.L.	Hydrographic surveying under adverse conditions
25	1982	Anonymous	Hydrographic school, Vasco da Gama
25	1982	Anonymous	Parable on fishless fishermen
25	1982	Cameron, W.M. Barber, F.G.	The joint Canadian-United States Beaufort Sea Expedition
25	1982	Casey, M.J.	Multi-ranging - an expensive solution to a simple problem
25	1982	De Wolfe, D.L.	Notes on the Bay of Fundy and Gulf of Maine current atlas
25	1982	Eaton, R.M.	Opinions - smoothing and multi-ranging
25	1982	Furuya, H.	The Canadian Hydrographic Service Hydrography I and Hydrography II courses
25	1982	Henderson, G.W.	The hydrographic survey of Fury and Hekla Strait
25	1982	Muir, L.R.	Quick Loran-C to geographic conversion
25	1982	Richardson, G.E.	Assignment Egypt
25	1982	Stoughton, H.W.	Water level transfers to determine geodetic elevations
26	1982	Casey, M.J., Monahan, D. and MacDougall, J.R.	Comparisons between acoustic and active and passive optical depth measuring systems
26	1982	Duffy, P.	Leaving home
26	1982	Freeland, H.J., Mackas, D.L. and Denman, K.L.	An upwelling gyre off the west coast of Vancouver Island
26	1982	Furuya, H.	The Canadian Hydrographic Service courses in Marine Cartography
26	1982	Hally, P.	Un survol historique de l'hydrographie au Canada francais
26	1982	Millette, P.	Experiences with a smart digitizer
26	1982	Murty, T.S.	Meteorology and oceanography in the Falkland Islands region
26	1982	Sandilands, R.W.	Reminiscences of the Admiralty Newfoundland survey
27	1983	Barber, F.G.	Steady bottom current in Hudsons Bay
27	1983	Burke, R.G.	The Canadian Hydrographic Service (Atlantic) sweep program
27	1983	Casey, M.J., Malone, A.K., Monahan, D.	Scanning Lidar bathymeter
27	1983	Cooper, A.H.	Nautical chart development
27	1983	Kerr, A.J.	Surveying the sands off Sable
27	1983	Lin, S.	Second Institute of Oceanography, China
27	1983	Macdonald, G.D., Boyce, F. and Macdonald, E.	Stories of Canada's lakes and rivers
27	1983	Stuifbergen, N.	Minifix winter trials in Northumberland Strait
28	1983	Beck, N., MacDougall, J.R. and O'Neill, R.A	Airborne GPS trials
28	1983	Casey, M.J., Monahan, D.	Contours & contouring in hydrography
28	1983	Cookson, J.	Oh say can you see
28	1983	Fisheries & Oceans	Gazetteer of undersea feature names 1983
28	1983	Gourley, M.J. Turpin, J.	Loran-C calibration of large scale charts
28	1983	Gray, N.S.	Reminiscences of a retired hydrographer
28	1983	Kielland, P.	Using the digital data base to see between the lines
28	1983	Malone, A.K.	Dolphin - on trial
28	1983	McLintock, G. Macdonald, G.D.	Bubble memory
28	1983	Milner, P.R.	The Microfix 100C
28	1983	Palmer, R.	Recovering datum reference
28	1983	Warren, J.S.	New bathymetry for the Queen Elizabeth Islands
29	1984	Eaton, G.H., Schuurman, K.W. and McLellan, J.F.	Utilization of doppler-inertial techniques for the establishment of survey control for hydrography
29	1984	Lachapelle, G., Eaton, R.M., Mertikas, S.	Impact of global positioning system on hydrography
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Canadian Hydrographic Association
Association canadienne d'hydrographie

The **Canadian Hydrographic Association (CHA)** is a non-profit, scientific and technical group of about 500 members with the objectives of:

- advancing the development of hydrography, marine cartography and associated activities in Canada;
- furthering the knowledge and professional development of its members;
- enhancing and demonstrating the public need for hydrography;
- assisting in the development of hydrographic sciences in developing countries.

It is the only national hydrographic organization in Canada. It embraces the disciplines of:

- hydrographic surveying;
- marine cartography;
- marine geodesy;
- offshore exploration;
- tidal and tidal current studies.

The Canadian Hydrographic Association is formally affiliated with the Canadian Institute of Geomatics. It is informally associated with the Hydrographic Society.

What the CHA Can Do For You

- advance your knowledge of hydrography, cartography and associated disciplines, and keep you abreast of the latest development in these disciplines;

- enable you to develop and maintain contacts with others involved with hydrography, nationally and internationally.

These benefits are provided through the publication of LIGHTHOUSE (one of only three journals in the world devoted exclusively to hydrography), through the sponsorship of seminars, colloquiums, training programs, national conferences, and branch and national meetings.

Lighthouse
The journal of the Canadian Hydrographic Association, LIGHTHOUSE, is published twice yearly and distributed free to its members. Timely scientific, technical and non-technical papers and articles appear in the journal, with authors from national and international academia, industry and government. Present circulation of LIGHTHOUSE is approximately 700.

Membership
Membership is open to all hydrographers, those working in associated disciplines, and those interested in hydrography and marine cartography.

Branch & Regional Activities
The Canadian Hydrographic Association has seven (7) branches located across Canada. National headquarters is located in Ottawa.

For further information write to:

National President
Canadian Hydrographic Association
P.O. Box 5378, Station F
Ottawa, Ontario
Canada
K2C 3J1

L'Association canadienne d'hydrographie (ACH) est un organisme sans but lucratif réunissant un groupe scientifique et technique de plus de 500 membres ayant des objectifs communs, comme:

- faire progresser le développement de l'hydrographie, de la cartographie marine et de leurs sphères d'activités au Canada
- permettre les échanges d'idées et le développement professionel de ses membres
- rehausser et démontrer l'importance de l'hydrographie auprès de public
- assister au développement des sciences de l'hydrographie dans les pays en voie de développement

Au Canada, l'Association est la seule organisation hydrographique qui embrasse les disciplines suivantes:

- levé hydrographique
- cartographie marine
- géodésie marine
- exploration extra-côtière
- étude des marées et courants

L'Association canadienne d'hydrographie est affiliée à l'Association canadienne des sciences géomatiques, et non-officiellement liée à la Hydrographic Society.

Ce qu'elle peut faire pour vous
L'ACH vous offre des avantages tels que:

- parfaire vos connaissances de l'hydrographie, de la cartographies et des disciplines connexes, tout en vous tenant au courant des nouvelles techniques et des derniers développements réalisés dans ces domaines;

- établir et maintenir des contacts avec ceux qui oeuvrent en hydrographie, au niveau national et international.

Ces avantages sont transmis par l'entremise de LIGHTHOUSE (une des trois revues au monde traitant exclusivement d'hydrographie) et par la tenue de séminaires, de colloques, de programmes de formation et d'assemblées régionales et nationales.

Lighthouse
La revue de l'Association canadienne d'hydrographie, LIGHTHOUSE, est publiée deux fois l'an et distribuée gratuitement aux membres. Des articles scientifiques, techniques et non techniques, provenant du milieu de l'industrie ou du gouvernement autant national qu'international, apparaissent dans cette revue. Le tirage actuel de la revue est d'environ 700 copies.

Comment devenir membre
Le statut de membre est offert aux hydrographes et à tout ceux oeuvrant ou ayant un intérêt dans des disciplines associées à hydrographie ou à la cartographie marine.

Sections et activités régionales
L'Association canadienne d'hydrographie possède sept (7) sections à travers le Canada. L'administration central se trouve à Ottawa.

Pour plus d'informations, s'adresser au:

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Association canadienne d'hydrographie
C.P. 5378, station F
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