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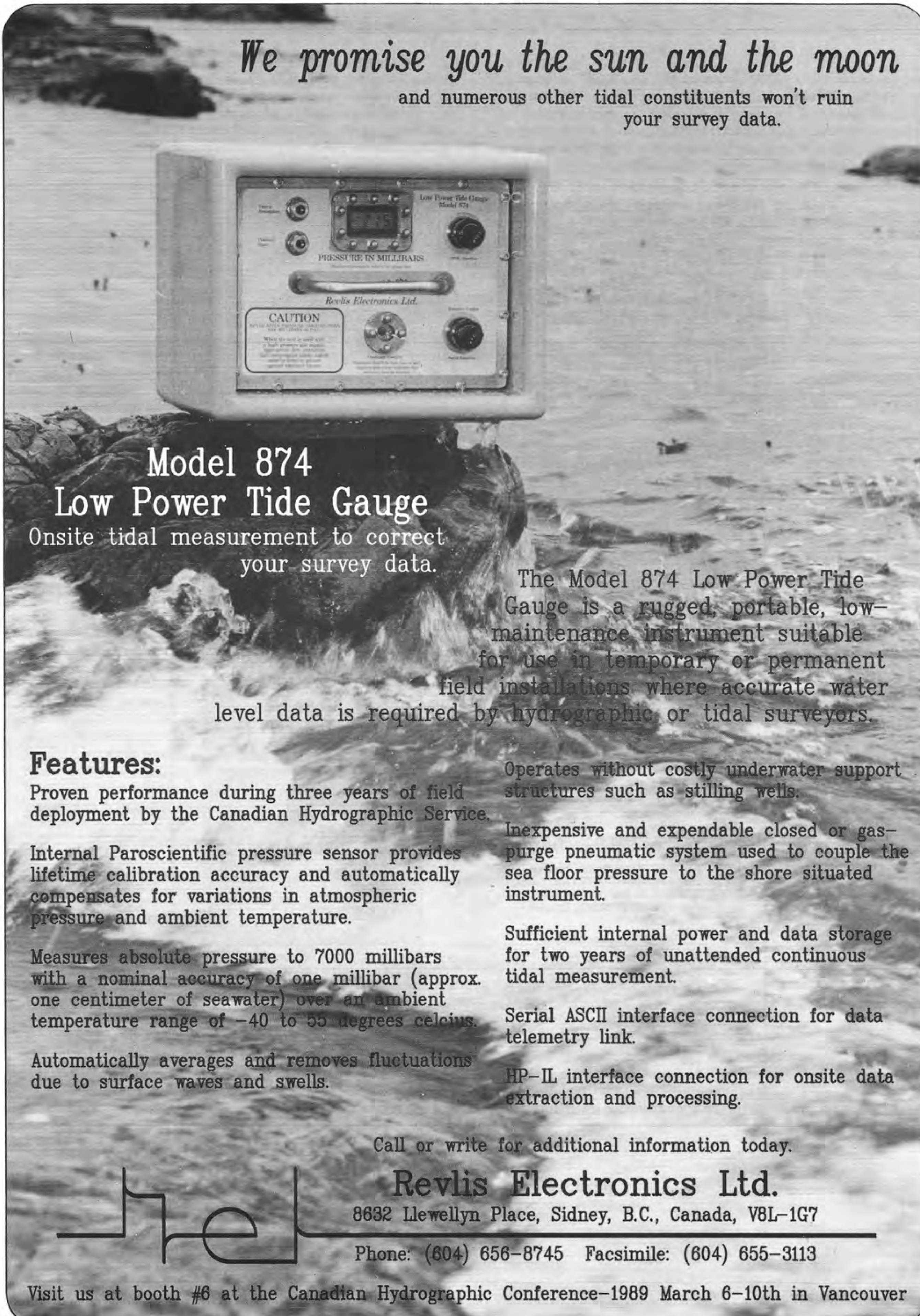
Lighthouse

JOURNAL OF THE CANADIAN HYDROGRAPHIC ASSOCIATION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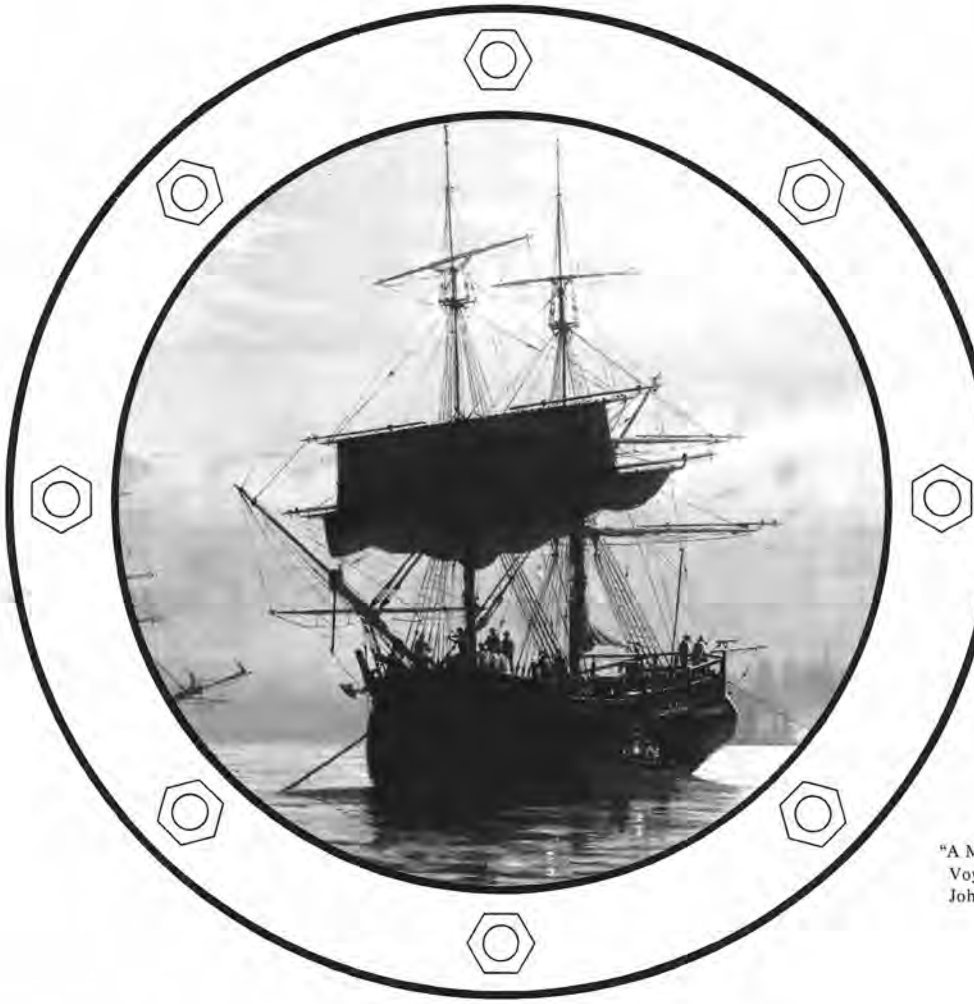

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Consumer and Corporate Affairs Canada | Consommation et Corporations Canada

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THE ISSUANCE OF THESE LETTERS PATENT DOES NOT CONSTITUTE AUTHORITY TO PRACTICE OR TO REGULATE THE PRACTICE OF THE PROFESSION REFERRED TO HEREIN

C A N A D A

LETTERS PATENT

WHEREAS an application has been filed to incorporate a corporation under the name

CANADIAN HYDROGRAPHIC ASSOCIATION
ASSOCIATION CANADIENNE D'HYDROGRAPHIE

THEREFORE the Minister of Consumer and Corporate Affairs by virtue of the powers vested in him by the Canada Corporations Act, constitutes the applicants and such persons as may hereafter become members in the corporation hereby created, a body corporate and politic in accordance with the provisions of the said Act. A copy of the said application is attached hereto and forms part hereof.

Date of Letters Patent - January 22, 1988

GIVEN under the seal of office of the Minister of Consumer and Corporate Affairs.

Frederick H. Sparling

for the Minister of Consumer and Corporate Affairs

RECORDED 26th September, 1988

Film 605 Document 71

David D. Kirchmayer

Deputy Registrar General of Canada

Canada

Message From the National President

Dear member,

I always welcome this opportunity to write to our members because it lets me bring you up to date on the activities of the Canadian Hydrographic Association, and this year we have been very active in interesting ways.

At the National Executive meeting held in Burlington on February 16, 1987, the National President was instructed to proceed with further investigations of the pros and cons of incorporating the CHA, an idea which had already been discussed for some time. As I was the newly-elected National President of the CHA this task fell to me.

My investigations began in July 1987 when a local lawyer was hired to determine the costs and to advise me on the legal requirements and procedures of incorporating federally. The impetus to proceed was provided by three important considerations. The first was to give our executive and officers some legal protection; the second was the need to be incorporated before the Canadian International Development Agency (CIDA) could accept our Association as a manager of CIDA-supported projects; and the third was that no federal grant assistance would be available without our being first incorporated. As we had already committed ourselves to managing CIDA projects I initiated proceedings to have the CHA incorporated.

The Quebec Branch of CHA was already incorporated in the Province of Quebec and it was impossible for the CHA to incorporate nationally without our Branch in Quebec giving up their charter. This they did in January 1988. Our lawyer then began writing the By-laws of our corporation taking as his example our existing constitution and slowly there evolved, over seven versions, a set of By-laws that was acceptable to all our Branches as well as the federal department of Consumer and Corporate Affairs. This process took many months and a great deal of work by all involved.

Several applications were made to Consumer and Corporate Affairs during this period and each application was either recalled by the CHA or refused by the federal department because further changes to the By-laws were required. Finally our application of January 22, 1988 was accepted and our Letters Patent were issued to us on September 26, 1988. It is now framed and hangs in the office of the National President. A copy is printed on the facing page.

Our move to incorporate has taken us down some bumpy roads but it has encouraged national discussion and we have ended up with a job well done. Our lawyer has donated a substantial amount of his own time. His contribution as well as the contribution of the Branch Vice-Presidents and that of the Branch Executives is very much appreciated. The CHA now has a legal identity, some legal protection for its directors, and a set of By-laws which will assist us in moving forward effectively with our increased responsibilities.

It is with great pleasure that I can also announce that the CHA has had three hydrographic training Projects accepted to be sponsored as joint ventures with the Canadian International Development Agency (CIDA).

The first project is a continuation of a project in Jamaica which began as a Canadian Institute of Surveying and Mapping venture in 1983. This continuing plan will be jointly sponsored by CIDA, the CHA and the Jamaican government. T.D.W. McCulloch has been contracted by CHA to manage this three-year project for us and he expects to be taking up residence in Kingston in late November 1988. Mr. McCulloch's terms of reference for this project are "to establish a Hydrographic Surveying and Charting unit within the Jamaican Ministry of Agriculture". The total budget for this Project is $916,000 with CIDA making a very substantial contribution.

The second project is in Malaysia and is also a continuation of a recently concluded CISM joint project with the local government. The purpose of this project is to provide further training in three disciplines: Hydrographic Surveying, Tidal Research, and Marine Cartographic Charting. It is anticipated that with the help of our joint venture Malaysia will have developed its own Hydrographic Training Centre by 1993. This expertise in hydrographic training could then service not only its own national needs but also those of other Asian countries. The total budget for this project is $728,000 with CIDA again making a very substantial contribution.

The third joint venture is entitled "Hydrographic Study Project in Canada for participants from eight developing coastal states". Its purpose is to help develop further professional hydrographic training and ties between CHA and our counterpart associations overseas. This study program will begin with the Hydrographic Conference in Vancouver in March 1989 and will continue with seminars at academic and private sector establishments in British Columbia and Alberta. Once more CHA has requested the assistance of Mr. McCulloch to organize and manage this project.

All of these very worthwhile projects are being sponsored most generously by the Institutional Co-operation and Development Service Division of CIDA. The CHA is Canada's manager of these projects, and I would like to express our gratitude for this assistance. Without the strong financial support of the people of Canada through CIDA it would not be possible for us to bring this sort of help to these developing nations.

In this edition of Lighthouse there is an article by Mr. McCulloch on the subject of these CHA/CIDA-sponsored projects. These ventures are right in line with the Objects of our Association and I hope that they are the first of many such efforts over the coming years.

Barry M. Lusk **National President**

TRAINING OFFICERS REQUIRED
MALAYSIA - 1990 - 1991

Two hydrographic Training Officers will be required - one for a five month period in 1990 and a second officer for a three month period in 1991. The courses to be taught will be modelled on the very successful course run by CISM in 1987 and designed by CHS.

Qualifications

- Many years of experience in all facets of hydrographic surveying.
- Several years experience at the Hydrographer in Charge level.
- Training Officer experience.
- Candidates must have passed the Hydro II level course or its equivalent.
- A degree in Surveying or equivalent would be of advantage to a candidate.
- Candidates must display initiative and ability to lead, liaise and communicate in a non-Canadian environment.
- Membership in CHA.

Costs

All costs related to training officers in Malaysia, including airfares, living allowance and salary, will be provided by the CHA from the CIDA funding allocated to the project.

Summary

Only CHA members who are fully qualified and able to commit their time and energy to the projects should apply. CHA members who are employed by the Government of Canada and who are interested should ascertain whether they can be released temporarily from their duties, before applying for consideration.

The private sector will also be considered, in the light of previous success in going that route.

TRAINING OFFICERS REQUIRED
JAMAICA - 1989 & 1990 - 3 Month Period

Two hydrographic Training Officers will be required for a three month period each to teach special Hydro I type courses in Jamaica. One course is scheduled for 1989 and one the following year. The courses to be taught will be modelled on the successful CHS designed courses.

Qualifications

- Many years of experience in all facets of hydrographic surveying.
- Several years experience at the Hydrographer in Charge level.
- Training Officer experience.
- Candidates must have passed the Hydro II level course or its equivalent.
- A degree in Surveying or equivalent would be of advantage to a candidate.
- Candidates must display initiative and the ability to lead, liaise and communicate in a non-Canadian environment.
- Membership in CHA.

Costs

All costs related to training officers in Jamaica, including airfares, living allowance and salary, will be provided by the CHA from the CIDA funding allocated to the project.

Summary

Only CHA members who are fully qualified and able to commit their time and energy to the projects should apply. CHA members who are employed by the Government of Canada and who are interested should ascertain whether they can be released temporarily from their duties, before applying for consideration.

The private sector will also be considered, in the light of previous success in going that route.

TIDAL EXPERT REQUIRED
MALAYSIA - 1990

A Tidal Expert/Research Scientist will be required to study tidal phenomena in Malaysia for the Directorate of Surveying and Mapping over a five month period, probably in 1990.

Qualifications

- Many years of experience in the tides and tidal currents field.
- Several years experience at a senior level of hydrographic management.
- A requisite degree or its equivalent would be of advantage to a candidate.
- Candidate must display initiative and the ability to lead, liaise and communicate in a non-Canadian environment.
- Membership in CHA.

Costs

All costs related to training officers in Malaysia, including airfares, living allowance and salary, will be provided by the CHA from the CIDA funding allocated to the project.

Summary

Only CHA members who are fully qualified and able to commit their time and energy to the projects should apply. CHA members who are employed by the Government of Canada and who are interested should ascertain whether they can be released temporarily from their duties, before applying for consideration.

The private sector will also be considered, in the light of previous success in going that route.

Please submit your expressions of interest or your request for further details to:

B.M. Lusk
Canadian Hydrographic Association
9860 West Saanich Road
Sidney, B.C.
V8L 4B2
Telephone (604) 356-6373

These offers are made by the Canadian Hydrographic Association.

The Canadian Hydrographic Association and Hydrographic Training in the Third World

by

T.D.W. McCulloch

Foreword

The Canadian Hydrographic Association (CHA) is the professional home of the Canadian hydrographic surveyor and chart maker. A true professional must not only keep abreast of technical developments, he must be prepared to advise and share that expertise with his counterpart in the developing world. Nothing but good can come from such a commitment, for both the profession and the individual who chooses to become involved. The CHA is an active organization prepared to persuade the Canadian International Development Agency (CIDA) to assist with hydrographic and cartographic training in the developing coastal states. Perhaps government agreements can provide other solutions if the combined will to succeed is there. So far that has not happened. The CHA is a proper vehicle to ensure Canadian participation in this worthwhile endeavour.

Historical

The Canadian involvement with providing hydrographic training to developing nations really commenced in 1976 when the Canadian Institute of Surveying (now the Canadian Institute of Surveying and Mapping (CISM)) became a member of the Commonwealth Association of Surveying and Land Economy (CASLE). Inevitably it followed that the CISM members involved with CASLE came into much more direct contact with surveyors from the Third World. As a result of that contact, the CISM in 1978 received funding from CIDA to support the attendance of four surveyors from the Caribbean at the CISM-sponsored Survey Education Colloquium in Quebec.

The following year (1979) CISM received funding from CIDA to support five surveyors from developing nations (Malaysia, Papua New Guinea, Jamaica, Trinidad and Guyana) to attend the very first International Hydrographic Technical Conference (IHTC), which was held in Ottawa. At that conference, the representatives from Jamaica and Malaysia unofficially requested Canadian assistance in establishing and maintaining a hydrographic capability.

This matter was discussed with senior government officials in Canada and in Jamaica and Malaysia. Both developing countries were advised to make an approach through their own governments, thence to Canada. However, after two years of discussions and paper pushing, the proposals were still bogged down in the bureaucracies of all the countries involved.

In 1981, CISM made representations to CIDA which resulted in support for six surveyors from developing coastal states to attend hydrographic training workshops in Canada followed by participation in the International Federation of Surveyors (FIG) Hydrographic Commission technical sessions and workshops at the FIG Congress in Montreauex where hydrography had a very high profile. The success of that project was largely due to the participation of CHA members and, of course, the commitment of the Canadian Hydrographic Service (CHS). It led to another attempt to develop an assistance program through government-to-government channels, but to no avail. It was obvious that while no one was opposed to such a program, in all the countries involved, no one knew which buttons to push for a successful conclusion.

In 1983, CIDA approved a CISM-sponsored and CHS-supported three-year hydrographic training project in Jamaica. The project was administered by CISM, with the Land Surveyors Associations of Jamaica as the Jamaican counterpart. Three Jamaicans received hydrographic training in Canada, and a total of sixteen Jamaican surveyors and surveyors from other Caribbean island states received hydrographic training in Jamaica. The training in Canada was provided by CHS through participation by Jamaicans in the CHS training courses - Hydrography I or Hydrography II. CHS also donated the expertise and time of training officers in Jamaica to ensure the success of the course. Additionally, a demonstration survey was carried out in the approaches to Kingston Harbour by newly-trained personnel under the direction of a CHS Hydrographer-in-Charge, to provide the Government of Jamaica with proof that a small hydrographic competence was being established in Jamaica. Finally, more than $200,000 of hydrographic equipment was transferred to Jamaica to ensure the success of the program. CHA members who contributed greatly to the success of the project (three years) were Peter Richards, Gunther Schuetzenmeier, Jack Wilson, Stu Dunbrack and Bob Covey.

In 1985, CIDA approved a CISM-sponsored program of specialist hydrographic training for Malaysia. Over the term of the project, five Malaysians received training provided by CHS and other Canadian agencies in Delimitations of Maritime Boundaries, Basic Hydrography, and Tides and Tidal Studies. Four Canadian instructors (all CHA members) traveled to Malaysia to provide expertise and advice in a number of specializations.

Gerry Dohler provided advice and information to the Hydrographic Directorate on the establishment and maintenance of a Tides and Tidal Currents unit. Rolly Hamilton provided advice and information to the Hydrographic Directorate on the establishment and maintenance of a Nautical Cartographic Unit. Adam Kerr conducted a number of seminars on Delimitation of Maritime Boundaries. Hans Gray organized, coordinated and taught a Hydrography Course, assisted by Malaysian specialist instructors. In all, eight Malaysian surveyors from the Surveying & Mapping Directorate, the Marine

Department, the Port Authority and the private sector participated in this very successful course.

All of these projects were accomplished without cost to the sponsoring agency - CISM. The time expended in management of the programme was considerable and is listed in the CIDA project documents as a CISM commitment in kind.

Projects Approved for 1988 - 1991 under the Banner of CHA

In 1988, the CHA undertook to sponsor, co-ordinate and manage two CIDA-funded hydrographic training projects, with the possibility of a third in the offing.

Jamaica Project

The Government of Jamaica and other interested groups in Jamaica were impressed by the success of the 1983 to 1985 Hydrographic Training Project. They expressed a strong desire to build on these achievements by developing a permanent Hydrographic Surveying and Charting Unit, with its own organization structure, funding and long term surveying and charting program for Jamaican waters. They committed themselves to such a program providing they could have the support of CHA and CIDA in such an endeavour. Agreement on this project between all interested parties has now been reached and the project should commence no later than December, 1988. The CHS will provide training support in Canada.

The project contains the following elements:

a) A CHA Hydrographic Consultant/Manager will be assigned to the project over a two year period, of which most of the first year will be spent in Jamaica, with at least four inspection visits to be made in the second year. The Consultant will act as the catalyst in the development of the permanent Hydrographic Unit.
b) Suitable electronic equipment will be provided to strengthen the Hydrographic Unit.
c) Training assistance and advice will be provided in both Jamaica and Canada.
d) Training in Jamaica will be aimed at both Jamaican surveyors and those from other Caribbean islands.
e) Technical advice will be provided to other island states in the Caribbean.
f) Contingent on the successful conclusion of the foregoing items, a recommendation for long-term hydrographic vessel requirements will be prepared and adequate funding will be provided to meet that need.

If all goes according to plan, the project should be completed and evaluated by the consultant no later than February, 1991.

Malaysia Project

The success of the 1985 to 1987 "Hydrographic Training for Malaysians" project persuaded the Institution Surveyors Malaysia to request CIDA and CHA to continue the program for 1988 to 1991. This project has now been approved by CIDA and it is anticipated that the project will commence in late October, 1988.

Elements of the project include Basic Hydrographic training in Malaysia, nautical cartographic training in Canada, tides and tidal phenomena studies in Malaysia, Hydrography II training in Canada and Delimitation of Maritime Boundaries studies in Canada. The project should be completed and evaluated by December, 1991. If successful, a recommendation to develop a permanent Hydrographic Training Centre in Malaysia will probably follow.

The project is managed and co-ordinated by a CHA manager.

Participation in Canadian Hydrographic Conference

The Canadian Hydrographic Conference and hydrographic workshops will be held in Vancouver, British Columbia in March of 1989. A plan to have eight surveyors from developing coastal states participate has not yet (September 1988) received final approval. However, there does appear to be some hope that final approval will be received shortly. The project is much smaller than the "Jamaica" and "Malaysia" ventures and will be completed in a month. It would be a great benefit to the participating surveyors and of course would contribute greatly to the success of the conference and workshops. The CIDA name for the project is "Developing Coastal States Hydrographic Study Program". It is aimed primarily at establishing technical exchange links between overseas institutions and the CHA in the furtherance of assisting developing coastal states to meet their international obligations under the UN Law of the Sea and the expansion of marine commerce.

Eight surveyors from eight overseas institutions would be invited to participate in "Discovery 89" and would participate in two weeks of hydrographic workshops to be held in conjunction with the conference. The countries involved would probably be Barbados, Guyana, Trinidad, Jamaica, Solomon Islands, Fiji, Papua New Guinea and Malaysia. However, other countries are under consideration. The project is not designed to impart detailed technology and technique but will be developed to give suitable candidates an intense but broad look at hydrography and its potential impact on overseas institutions.

Summary

Much has been accomplished in the past with the direct assistance of CIDA, CISM, CHS and overseas institutions. All who have contributed so much time and effort to these projects deserve our congratulations and sincere thanks. However, without the dedication of some CHA members very little of a useful nature could have occurred. Now that CHA is a direct actor in the productions outlined in this article, individuals in CHA will no doubt want to take a more active role in future discussions that could lead to greater CHA commitment to technical assistance to the third world. Overseas surveyors can learn much from us, and we in turn will be changed by our experience in working with them.

It is a worthwhile endeavour, which ties in closely with the objectives of the about-to-be-formed FIG/IHO Technical Assistance Coordination Committee.

The History and Problems of Collecting, Storing and Manipulating Hydrographic Data

by

R. Mehlman

Historical Perspective

Any attempt to determine who made the first map or chart would be like attempting to determine who invented the wheel. An ancient clay tablet in existence today bears a map of what is known as Mesopotamia and was fashioned around 3800 B.C. It is quite likely that even before 25 B.C. the Phoenicians of the eastern Mediterranean possessed crudely drawn charts and written sailing directions of a sort.

Until the twentieth century, the method of swinging the lead and observing two coincident horizontal sextant angles was used to obtain and position spot soundings. The density of the soundings was determined by the needs of shipping and the complexity of geology in the area. As the hull of the ship came closer to the bottom, denser soundings were required. While these spot soundings showed the depth of the water at the point indicated, they gave no indication of water depth between soundings.

In the 1930's acoustic sounders were first used by the Canadian Hydrographic Service (CHS) to collect continuous profiles of the ocean's seabeds. However, positioning was still accomplished using coincident horizontal sextant angles or similar means, and information was not available in a lateral direction from the profile line. The spacing of the survey lines was still dependent upon the requirements of shipping in the area.

The 1940's showed the advent of electronic positioning to hydrographic surveying. Soon dependence upon visibility became a diminishing factor as positioning systems became manageable even in the smallest craft.

Today, with the advent of computers, the capabilities of a hydrographic survey are less limited, as hydrographers deal with remote-controlled semi-submersibles, under-ice sounding vehicles, SWATH systems, acoustic sweep systems and airborne sounding systems.

The first charting of Canadian waters was carried out by early French and English explorers. After Canada became a colony of Britain, the British Admiralty took on the responsibility of charting Canadian waters. The Canadian Government did not assume responsibility until 1883 when the Georgian Bay Survey was established. In 1904, when the Admiralty requested that self-governing colonies assume responsibility for their coastal surveys, the Canadian Hydrographic Service was established by Order-in-Council 461.

The British Admiralty continued to maintain responsibility for the surveys of the Labrador and Newfoundland coasts until 1949, when Newfoundland and Labrador joined Confederation. A large number of Canadian charts of the Atlantic Provinces are still Admiralty reproductions and three Admiralty charts of the Newfoundland coast are included in the Atlantic Coast chart catalogue. As modern surveys of the Newfoundland coast are being completed, the Admiralty charts and reproductions are being replaced with up-to-date Canadian charts.

A seasonally-staffed regional office of CHS was opened in Victoria, British Columbia in 1907 and was established on a full-time basis in 1938. The Atlantic Region (now Scotia-Fundy Region) was formed in 1959 in Halifax, Nova Scotia and moved to the Bedford Institute of Oceanography in Dartmouth when it was opened in 1962. The Central Region (now Central and Arctic Region) was formed in Ottawa in 1964 and moved to the Canada Centre for Inland Waters in Burlington, Ontario in 1970. In 1975, a decision was made to decentralize the Chart Production process and to form a fourth hydrographic region based in Quebec City. In 1987, a district office of the Scotia-Fundy Region was established in St. John's, Newfoundland.

The Tidal and Current Metering Program began in 1893. Precise water level gauging of the Great Lakes started in 1912. These two programs were integrated in Ottawa in 1960. All regions now have capabilities for tidal and current measurements. In 1982, the Atlantic Region, CHS, took over the responsibility for the operation and maintenance of the 18 Atlantic Provinces' gauges of the permanent tide gauge network. Inland Waters Directorate of the Department of the Environment operates the gauges in the rest of Canada for CHS.

Task of the CHS

The CHS is primarily concerned with gathering and publishing hydrographic data and marine navigation information for Canada's navigable waters. This information is essential for the safe, orderly and efficient conduct of commercial, recreational and defence shipping. The Service also has the operational responsibility for integrated geophysical/hydrographic surveys of the continental margin and inland seas. Such surveys are essential to obtain a comprehensive description of the extent of the continental land mass and for the control, management and development of mineral and petroleum resources in these areas.

The CHS publishes just over 1,000 nautical charts. Twelve volumes of Sailing Directions, nine Small Craft Guides and six volumes of Tide and Current Tables are also published. In addition, Territorial and Fishing Zone Charts, Natural Resource Maps, and Charts in the General Bathymetry of the Oceans (GEBCO) series are produced.

At the present time approximately 60% of southern waters and 20% of northern waters are surveyed adequately. Due to changing shipping patterns and changing ship drafts, hydrography is an ongoing activity and the survey coverage can only be increased by 2 - 3% annually. Presently, we respond promptly to less than 30% of our requests for surveys.

Data Management

As the amount of data increases, data managers must find improved methods of handling the large volumes encountered. To do this properly, the data must be in a format that is readily accessible.

The first operational deployment of an acoustic sweep in the Atlantic Region was in the Miramichi River area of New Brunswick and lasted three weeks. The system had 18 transducers arrayed on a 30 metre boom, giving 100% bottom coverage. Data were logged at a rate of one depth per transducer every two seconds. This resulted in approximately 10 million measured depths with over 1.5 million depths logged during the three week period. Approximately 26,000 or 2% of the logged depths were portrayed on 11 field sheets at a scale of 1:5,000. This sweep system is now being used on production surveys in Central and Arctic Region.

A new acoustic sweep system which has 33 transducers, is used on board CSS FCG Smith, a 34.8 metre catamaran that operates up to 6 months in the field. As many as 22 million data points are logged during a field season. Data loggers are used on conventional surveys across the country to collect an enormous amount of digital data. This is a staggering amount. How do data managers handle this volume? The answer is a computerized data management system.

Three of the most important aspects of data management are: what to log during day-to-day operations; what to store in the data base; and how to ensure that the data base contains verified and up-to-date information?

Day-to-Day Operations

While it is possible to log all of the measurements made, only 2% of the measurements can be portrayed for a sweep survey, even at a fairly large scale. Therefore, it is necessary to pre-process the data to determine what should be logged. Since the prime purpose of CHS charts is marine navigation and safety, the data are biased to show the shallowest of the soundings collected. On the sweep system, this means that within the data collection window of two seconds, the shallowest sounding is retained as long as consecutive soundings within the time frame confirm that this value is not unreasonable. This method results in the recording of approximately 10% of all measurements.

Data Storage

Data processing procedures in CHS ensure that the data are verified and edited. These data are plotted at the largest presentation scale which is felt to be warranted considering all variables such as positioning accuracy, swell and charting requirements. Overplot soundings are supressed with a bias to the shallower soundings. The verified data are ready to enter into the data base.

But what of the raw data collected in the field? At present the raw data, with any changes that have been made, are archived. These data are not stored on the data base, but are accessible using the proper software on the field processing system. Control of the raw data remains in the hands of the collector.

Data Manipulation

Perhaps the most important aspect of a data base management system is the actual insertion of the data and the retrieval of the data in a usable format. This sounds quite simple but a closer examination of the process shows it to be extremely complex and perhaps the most costly stage of all, both in terms of money and manpower. Hardware is cheaper today than it was ten years ago. But the cost and sophistication of the software has increased drastically. Also, the cost of managing the systems has escalated over the last 15 years. With computer systems changing every day, it is vital that data and storage requirements be properly examined.

A data base system stores data somewhere, remembers where they are, and retrieves them on request. It does not manipulate the data. The CHS system will be regional. All data will be handled within the region of influence, on regional computers rather than from a central location for all regions. The system will be the same in all regions. It will run on the same type of computer, use the same software and be stored in the same format. The process of implementing the data base is a large task. The CHS stores and maintains a vast amount of historical material. As new data are obtained, the outdated data must be superceded. However, the data must be merged to allow valid data from previous documents to appear. As the data are collected over a long period, the process becomes more complex.

Since collected data are never 100% perfect, the data base has to be accessible, to allow errors to be corrected as required. Clearly, this process must be performed in an organized manner by one responsibility centre to prevent havoc. The data must be retrieved in a usable format. Therefore, it is necessary that the data be well labeled within the system, showing what data are available, when they were obtained, when they were last updated and so on. This is extremely important when one considers that the end user will not be a hydrographer.

Summary

Large data sets are necessitating a drastic change in the way data are collected, stored and manipulated. The CHS is starting to implement regional systems for storing and retreiving bathymetric data. There are many points to consider when setting up a data management system that will be required to handle large data sets.

References

Burke, R.G., S. Forbes and C. Stirling, 1986. "The Vertical Acoustic Sweep System, An 'Acoustic Boom' for Hydrographers", Proceedings of CHA Colloquim, Lake Louise, Alberta.

Canadian Hydrographic Service, 1988. "Program Review and Evaluation 1987/88". Dept. of Fisheries and Oceans, Science Sector, Scotia-Fundy Region, Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

Thompson, D.W. 1966. "Men and Meridians, Volume 1". Information Canada, Ottawa, Ontario.

The Field-ing of a Cartographer (or "So That's How It's Done")

by

D. Jackson

Every year hydrographers and cartographers in the Canadian Hydrographic Service exchange assignments in order to gain experience and some insight into how the other half works. Hydrographers compile and draft charts and get to see first-hand how the data they collect are eventually used. Cartographers get to go to the field where they can gain some knowledge of the problems associated with data collection and the reduction and graphic presentation of those data. The mix of hydrographers and cartographers has proven valuable over the years. One such tale follows...

I was followed into the Boss's office by the usual catcalls of "Jackson's in the doghouse ... again!". The conversation that followed was the usual short, businesslike exchange:

Boss: "Have you any plans for the summer?"
Me: "No, no long holidays or anything."
Boss: "How about going on a survey?"
Me: "Sure, where to and how long?"
Boss: "Three months at the north end of Vancouver Island, based at Bull Harbour."
Me: "Sounds good."

End of conversation.

I returned to my desk knowing that Bull Harbour sounded familiar. I went to the reference drawer and pulled out the best scale chart of the area. Yes, there it was, I'd done an overprint on it about a year ago. In Bull Harbour itself I had crossed out the Post Office and Store, and added a life saving station which seemed rather ominous. A check of meteorological tables in Sailing Directions showed that Bull Harbour has experienced measurable snow in August! Well, here was a chance to show those hydrographers that cartographers are not just stay-at-home office types and can, on occasion, count beyond twenty without removing all their clothes. It would also be a good opportunity to test out those behind-the-ear motion-sickness patches, as I do not possess a good pair of sea legs.

So it was with mixed emotions that I learned about a month later that the survey had been changed to Vancouver Harbour. My stomach heaved a sigh of relief, but I was sure that such a cushy survey location would result in the expected comments: "Well on a real survey .....".

Before joining the survey in Vancouver I persuaded the Boss that a day or two spent familiarizing myself with some of the equipment would be useful rather than arriving "cold" in mid-survey. Two days were spent looking at and operating various items of survey equipment, including an afternoon running the ISAH data logging system in a launch in Pat Bay. I realized that most details would be forgotten by the time I went into the field, but some familiarity was gained.

The survey began at the end of April, and by the time I arrived in late May everything was running smoothly. My first few days were spent as an observer, not really trying to learn anything in detail, but endeavouring to understand what was going on.

My first jump on shore was quite memorable. Bruce Lewis carried the batteries and Trisponder, which left me with a theodolite and two sets of legs (the light stuff). It was flat calm and Bruce made an effortless step off the bow. It was low tide and I eyed the green algae-covered rip-rap with some apprehension before choosing a landing site. Unfortunately it was a bad choice. The rock I jumped on shifted under my weight depositing me on the barnacle-encrusted rocks. The hand put out to stop me ruining my good looks received a nasty gash which proceeded to bleed on the equipment which remained stained ever-after. On return to the launch my wound opened up again and large drops of blood splattered on the deck. Glen, the coxswain, was not amused. From that moment on I was always very careful about landing to set up a station. Often Gordie, the other coxswain, would "help" by blowing the klaxon at inappropriate moments and offering shouts of encouragement such as: "Come on, even Carol could jump off there!"

After a day or two of intensive training I became proficient at setting up and operating a range-bearing shore station. Speed and efficiency picked up fairly quickly and I was happily contributing to the survey after only a short training period. It was certainly different from my usual daily routine, setting up office in the fresh air (except by the sulphur wharves), and spending the day guiding the launch along rays, or calling fixes for arcs and spot soundings. I found myself thoroughly enjoying the whole experience. Many curious people stopped to ask what was going on and I did my best to explain between fixes ("No, I'm not taking pictures, it's a theodolite!"). I even got my photograph in the Vancouver Sun.

Days spent on station were intermingled with many assorted duties including revisory survey, measuring wharf heights, coastlining, control and launch repair (handing Gordie the tools he needed). As I had been using a very reliable and easy to use electronic theodolite, the Wild T2 initially seemed quite formidable. However, Bruce was a very patient teacher. At first, he would check my pointing and readings. After some practice I became reasonably proficient and obtained some good splits, but I would not have liked to shoot a long series of angles without more practise. If some hydrographers are shuddering at the thought of a cartographer shooting control, let me say that I did get some very good results albeit much more slowly than somebody with more experience.

My first assignment without a hydrographer in sight (not even through a theodolite), was on a very rainy Sunday. Gordie and I set out in the Wasp and took over 300 lead-line soundings at one of the North Shore marinas. Although reasonably dry in full rain-gear, our hands soon became wet and cold from hauling in the lead-line, and consequently my field notes became rather sodden. On one page I sketched some float revisions. Alex Raymond, our Hydrographer-in-Charge, taped this up on his office wall and took great pleasure in showing all visitors what his tame cartographer was handing in as field notes. After that day I was nicknamed "Captain Leadliner". I guess it could have been worse.

Because there was no spare hydrographer, it wasn't until half way through the survey that I learned how to run the launch side of things. Learning to run ISAH took a day or two, initially just operating the keyboard kept me busy enough. However I soon got the hang of that and started to handle the radio, sounder, keep a look out for traffic and plan my next move. So I felt that I had become a fully-fledged (finned?) hydrographer at last. A day's surveying would now be split in two, half on shore and half in the launch. It gave me quite a thrill to be able to operate so much expensive equipment and to have command of my own launch.... well for half a day at least.

Everybody on the survey was extremely helpful and patient with me. Alex was particularly good in making sure that I was exposed to all aspects of the survey operation. I even spent some time data processing with ISAH which was as close as I got to scaling soundings. Alex also took advantage of having a cartographer on board by asking questions about how to use certain information and what the best field sheet portrayal would be. I think some hydrographers are sometimes guilty of regarding field sheets as a final product without considering the needs of the cartographer. Alex and I spent quite a lot of time talking together and I am glad that he regarded me as somebody to learn from as well as to teach. However, just to make sure that I didn't forget the traditional cartographer's survey role I was put in "charge" of the batteries!

On reflection many small incidents are memorable. Setting up station on the thirty-fifth floor of a Vancouver office tower offered a spectacular view. Perhaps more importantly it allowed most of Coal Harbour to be surveyed from one station in only a couple of days. Another interesting station was on a warehouse roof which involved climbing a radio antenna. Occupying another station, I found myself surrounded by police cars, protestors in Zodiacs trying to achieve martyrdom as human fenders, police boats, camera crews and U.S. warships: I was right in the middle of another Greenpeace protest. Bruce and I played a lot of darts and I usually lost. After one particularly humiliating defeat I consigned my darts to the bottom of Vancouver Harbour. A week or so later I bought a new set. Alex watched my first throw, which totalled seven, with much interest. He then challenged me to a 3 dart high score contest with a one dollar stake. I took careful aim and scored one hundred and forty. Alex handed over his dollar bill without even trying.

I thoroughly enjoyed my summer in the field and certainly learned a great deal that will make me a better cartographer and give me a greater appreciation of the work done by hydrographers. In turn, I hope that they learned a few things from me too. I am very much looking forward to another field assignment in the future.

The very complex nature of both cartography and hydrography makes it desirable to have a core of people who are expert in their chosen discipline. It is equally desirable to have a number of interdisciplinary people who can handle both jobs and can bring them together to a greater extent than at present. With rapidly accelerating technological advances there is no doubt that hydrography and cartography will slowly merge, and the skills necessary for both jobs will be very similar. This makes increased co-operation between the two disciplines necessary to fulfill our role in an ever changing and ever challenging environment.

I would like to thank everyone on the survey for being so friendly and helpful and especially for not throwing me in!

Lighthouse Puzzle Part 1

In the year 2250 the Canadian Hydrographic Service extended operations to other planets. The planet AQUA had to be surveyed. The planet was an earth sized water world with no land masses, no magnetic field and a constant cloud cover. Navigation was entirely by a perfect inertial guidance system. This system always pointed to true north. The origin, for the latitude-longitude earth style chart to be produced, was provided by the drop off space ship.

The "CSS Baffin IX" with her fifty "Dolphin VII's" swiftly finished the survey. Unfortunately, when docking the Dolphin's (still a problem), the inertial guidance system "lost lock", resulting in the ship being totally lost somewhere on a featureless planet. The space ship had no equipment for locating the Baffin IX except visual sighting. They pleaded for some clue as to where on the planet to begin the search.

The Hydrographer in Charge recalled a curious incident during a shoal examination at their last site. The ship had left the shoal buoy and steamed exactly ten kilometres south, then ten kilometres east and finally ten kilometres north. This course had brought them back to the original buoy. The HIC reported this to the space ship, with their obvious location. Where were they?

See **page 47** for solution.

Tests du récepteur LORAN-C Internav 408 pour des application aéroportées

par

P. Bélanger et P. Bellemare

Introduction
Un réseau LORAN-C est un système de positionnement de radionavigation hyperbolique servant à déterminer une position. Il a été mis au point par la marine américaine et adopté par les gouvernements des États-Unis et du Canada comme principale aide à la navigation pour les eaux côtières, les hauturières américaines et canadiennes et les grands lacs.

Le principe de fonctionnement du système LORAN-C en mode régulier d'opération est de déterminer la position d'un observateur en mesurant les différences de temps d'arrivée des impulsions émises par un minimum de trois stations émettrices. Chaque différence de temps d'arrivée (TD) des impulsions provenant d'une paire de stations définit une ligne de position hyperbolique. L'intersection d'un minimum de deux lignes de position hyperbolique détermine la position de l'observateur.

La précision d'une position provenant du système LORAN-C est fonction des principaux éléments suivants: l'erreur produite par le récepteur, les erreurs de propagation des signaux voyageant au-dessus des milieux géophysiques et la géophysiques et la géométrie d'intersection des hyperboles. L'une des tâches du Service hydrographique du Canada consiste à mesurer les erreurs de propagation des signaux afin d'ajuster les lignes de position hyperboliques sur les cartes marines. La méthode utilisée pour déterminer ces corrections consiste, principalement avec l'aide d'un navire hydrographique parcourant les surfaces d'utilisation, à enregistrer les écarts entre la position du système LORAN-C et celle provenant d'un autre système de positionnement plus précis utilisé comme système d'étalonnage. De cette façon, la prise de données est très longue à compléter, ce qui implique un coût élevé des opérations.

En vue de remplir son mandat plus efficacement, le Service hydrographique du Canada supervise un ensemble de recherches pour améliorer ce relevé de calibration en utilisant dans un hélicoptère, un récepteur LORAN-C INTERNAV 408 couplé à un récepteur GPS. Une étude a été effectuée pour déterminer si le récepteur INTERNAV 408 peut être utilisé dans des conditions aéroportées pour calibrer des chaînes LORAN-C au Canada.

Description de l'expérience
Le récepteur LORAN-C INTERNAV 408 est constitué principalement d'un receveur et de deux micro-processeurs. Le premier micro-processeur est utilisé pour effectuer essentiellement la mesure des TD tandis que le deuxième micro-processeur est utilisé pour effectuer le traitement des données et assurer une communication interactive avec l'utilisateur.

Lorsque le récepteur subit des accélérations et/ou des décélérations linéaires où angulaires prononcées, il est incapable de fournir de bonnes positions à l'usager à cause principalement des effets directs sur le processus de la prise de mesures des TD, sur les filtres dynamiques utilisés dans le traitement des données, ainsi que sur les autres composantes des micro-processeurs.

Cependant, dans le cadre de cette expérience et avec la souplesse d'opération qu'offre le mode d'utilisation du récepteur INTERNAV 408, il a été possible d'éliminer l'utilisation des filtres dynamiques du processus de traitement des données. De cette façon, nous pensons que les résultats présentés dans cet article peuvent être associés directement aux effets sur le processus de la prise des mesures des TD ainsi que sur les autres composantes des micro-processeurs.

L'étude avait pour objectifs de déterminer:

1. le comportement du récepteur lorsqu'il était déplacé à une vitesse constante;
2. le temps nécessaire pour que le récepteur redonne une bonne position lorsqu'il est sous l'effet des différentes conditions d'accélérations et/ou de décélérations linéaires où angulaires;
3. les limites de fonctionement et les conditions optimales d'utilisation du récepteur INTERNAV 408.

L'expérience s'est déroulée sur deux routes situées dans les limites de la région de Québec. Une camionnette a été utilisée pour simuler les conditions aéroportées.

Le montage des équipements à l'intérieur du véhicule comprenait:

1. Un récepteur INTERNAV 408 était relié à une horloge au Rubidium HP-5065 A. Elle était synchronisée avec les horloges au césium des stations LORAN-C observsées. Avec ce montage, le récepteur INTERNAV 408 mesurait la différence entre le temps à l'émission et celui à la réception des signaux provenant de chacune des stations LORAN-C observées (mode RHO-RHO).

2. Un récepteur INTERNAV 408 fonctionnait selon son mode régulier d'opération. Il effectuait la mesure du mode TD des signaux provenant des paires de stations.

3. Un micro-ordinateur HP-87 était relié aux deux récepteurs via des modules de communication en série RS-232-C. Le HP-87 interrogeait successivement les récepteurs et assurait le transfert

des données sur des micro-disquettes flexibles. Quant aux antennes des récepteurs, elles étaient fixées sur le toit, à l'arrière de la camionnette (figure 1).

Figure 1

Des repères ont été installés aux abords des sites de l'expérience. La prise de mesure automatisée a été effectuée par un opérateur qui activait le HP-87 à l'instant même où le véhicule passait au niveau des repères. De façon autonome, à l'intérieur des intervalles de temps délimités par les repères, le HP-87 enregistrait les mesures LORAN-C aux intervalles de 2 secondes.

Avec l'aide des horloges internes du HP-87 et en utilisant les modules de communication en série RS-232-C, nous avons mesuré que le temps de communication entre l'envoi d'un message généré par le HP-87 et la réception de la réponse provenant de l'INTERNAV 408 était de 0,28 seconde. De la même façon, nous avons déterminé que les données contenues dans la mémoire tampon du récepteur étaient recyclées à l'intérieur du temps limite de 0,32 seconde. Le logiciel de communication de l'INTERNAV 408 répondait dans un délai constant de temps; il ne prenait aucun retard.

La chaîne LORAN-C disponible sur les sites de l'expérience était la chaîne 9960 avec les stations secondaires CARIBOU et NANTUCKET. L'expérience a été réalisée sur une période de 6 jours au cours du mois de mars 1985; elle se divisait en deux étapes, soit la calibration des repères et les tests de l'expérience.

Au cours des trois premiers jours, une calibration à été effectuée à chacun des repères des sites de l'expérience. Cette étape consistait à enregistrer, sur une période d'observation de 10 minutes, des mesures LORAN-C des modes RHO-RHO et TD. Les tests de l'expérience ont été réalisés pendant les trois autres jours. Ils étaient subdivisés en quatre parties: tests aux vitesses constantes 20, 80 et 120 km/h sur une route droite; tests d'accélération linéaire du type 0-120 km/h et 80-120 km/h; tests de décélération linéaire du type 120-0 km/h et 120-140 km/h; tests sur une route avec une courbe à angle droit.

Résultats

L'erreur de pointé lorsque l'opérateur activait le HP-87 au moment où le véhicule passait au niveau des repères, a été évaluée à l seconde de retard. Tout au long des essais de l'expérience, l'opérateur a toujours activé le HP-87 après qu'il eut passé les repères. Le délai de temps entre l'instant où l'opérateur passait le repère et celui où le récepteur donnait une a été calculé à 1,28 seconde de retard, ce qui correspond à une erreur de mesure de l'ordre de 0,14 µs lorsque le véhicule se déplaçait à la vitesse de 120 km/h. Toutefois, en fonction de la précision qu'il est possible d'obtenir avec le système LORAN-C, nous considérons que cette erreur est négligeable.

La procédure des tests de l'expérience consistait simplement à effectuer la prise des mesures lorsque le véhicule se déplaçait dans le sens aller ainsi que dans le sens retour du parcours. De cette façon, il a été possible d'effectuer une corrélation entre les résultats aux repères donnés.

Au cours des tests d'accélération linéaire, le véhicule simulait les conditions de la façon suivante: près d'un repère désigné, il accélérait subitement pour ensuite se déplacer à la vitesse constante de 120 km/h sur le reste du parcours. Pour les tests de la décélération linéaire, la procédure consistait à immobiliser brusquement le véhicule sur un repère désigné pour ensuite enregistrer des lectures durant une période d'observation de 5 à 10 minutes. L'effet d'accélération et/ou de décélération linéaire sur le récepteur INTERNAV 408 engendrait une variation des écarts entre les lectures et les données de la calibration; ces écarts croissaient (ou décroissaient selon le cas) durant une certaine période de temps pour ensuite décroître (ou croître selon le cas) avant de reprendre l'ordre des écarts mesurés avant l'effet. Ce type de comportement nous indique que le récepteur INTERNAV 408 réagit aux conditions particulières qui lui sont imposées seulement qu'après une certaine période de temps, ce qui implique qu'il accuse toujours un retard par rapport aux conditions qui varient dans le temps.

Nous pensons que les principales causes qui justifient ce retard sont associées directement à l'utilisation de filtres électroniques dans le receveur et le micro-processeur devant effectuer la prise des mesures des TD ainsi que les performances du logiciel utilisé dans ce dernier.

Les figures 2 à 4 représentent les principaux résultats qui découlent de ces tests. Vous remarquerez que le signe des courbes qui représentent les déphasages des mesures par rapport aux données de calibration est directement relié à la direction du déplacement du véhicule (sens aller/retour) au cours des essais. Par example, dans le sens aller du parcours, les données de calibration du mode RHO-RHO de la station SENECA croissaient de repère en repère. Lorsque le véhicule effectuait une accélération dans le sens aller du parcours, à cause du retard contenu dans le récepteur, les mesures du mode RHO-RHO de la station SENECA étaient plus petites que les données de la calibration aux repères, ce qui explique le sens décroissant de la courbe de ces essais. De la même façon, lorsque le véhicule circulait dans le sens retour du parcours, les mesures du mode RHO-RHO de la station SENECA étaient plus grandes que les données de calibration, ce qui explique le sens croissant de la courbe de ces essais.

Les résultats de ces tests sont présentés dans le tableau suivant:

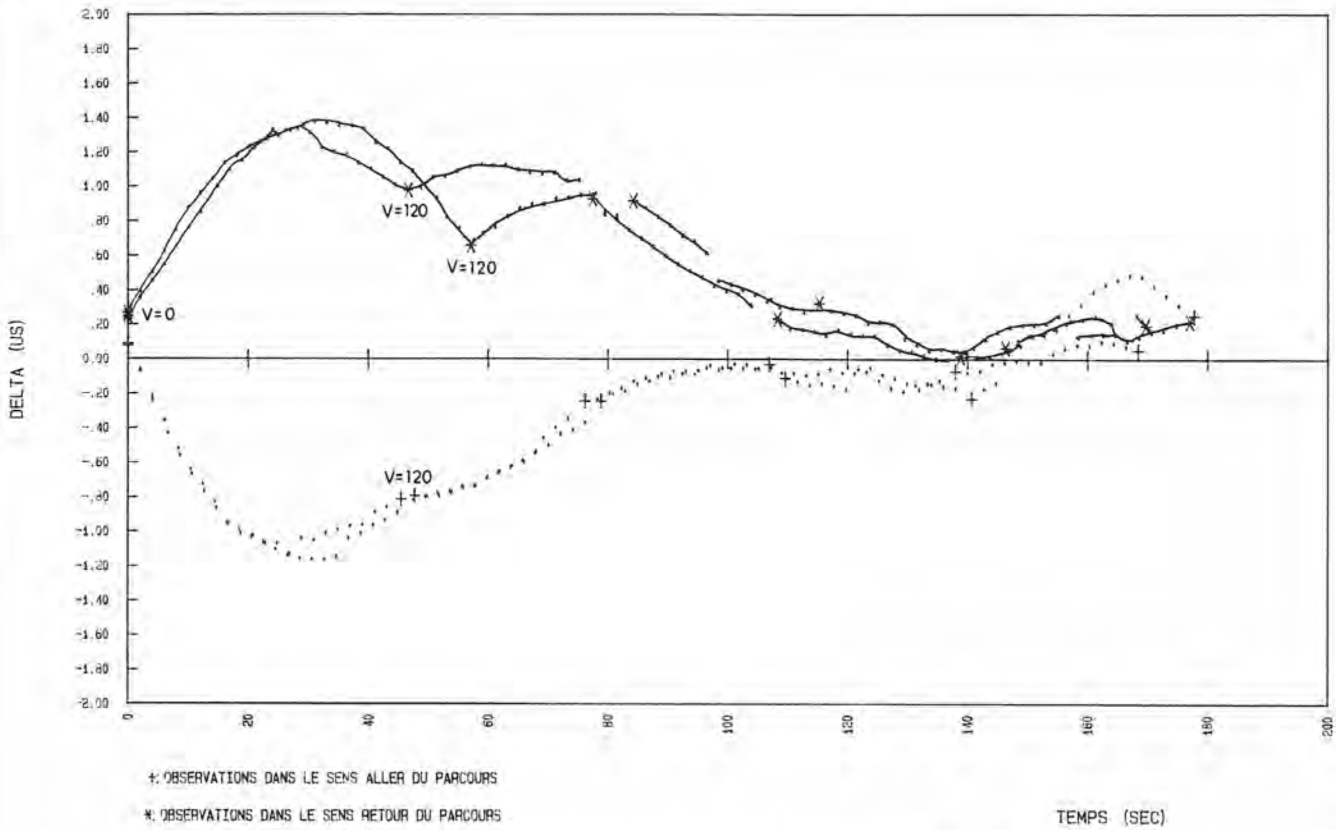

Figure 2: Graphique des tests des accélérations linéaires 0-120 km/h

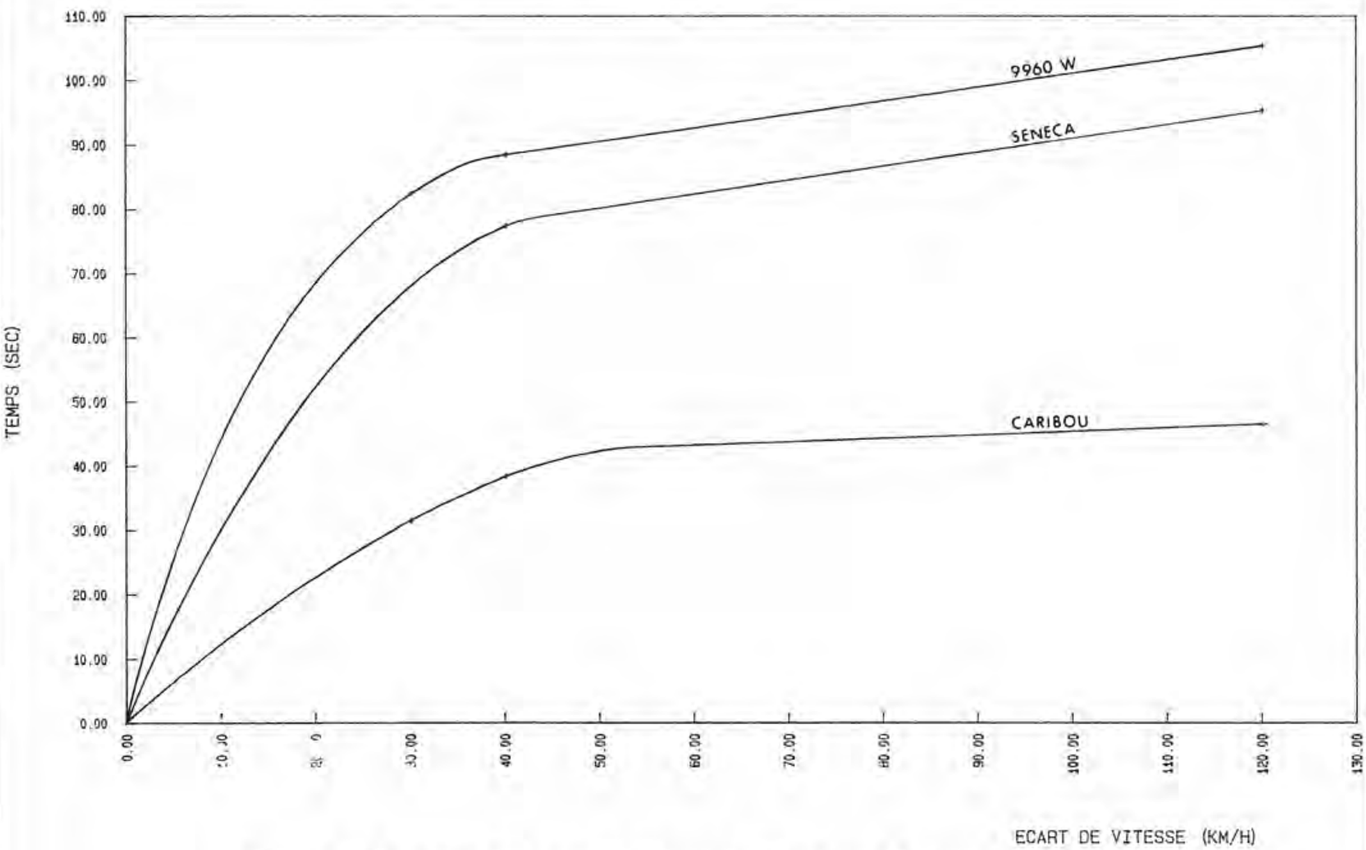

Figure 3: Graphique du temps de résorption des tests d'accélération (sec) en fonction des écarts de vitesses (km/h)

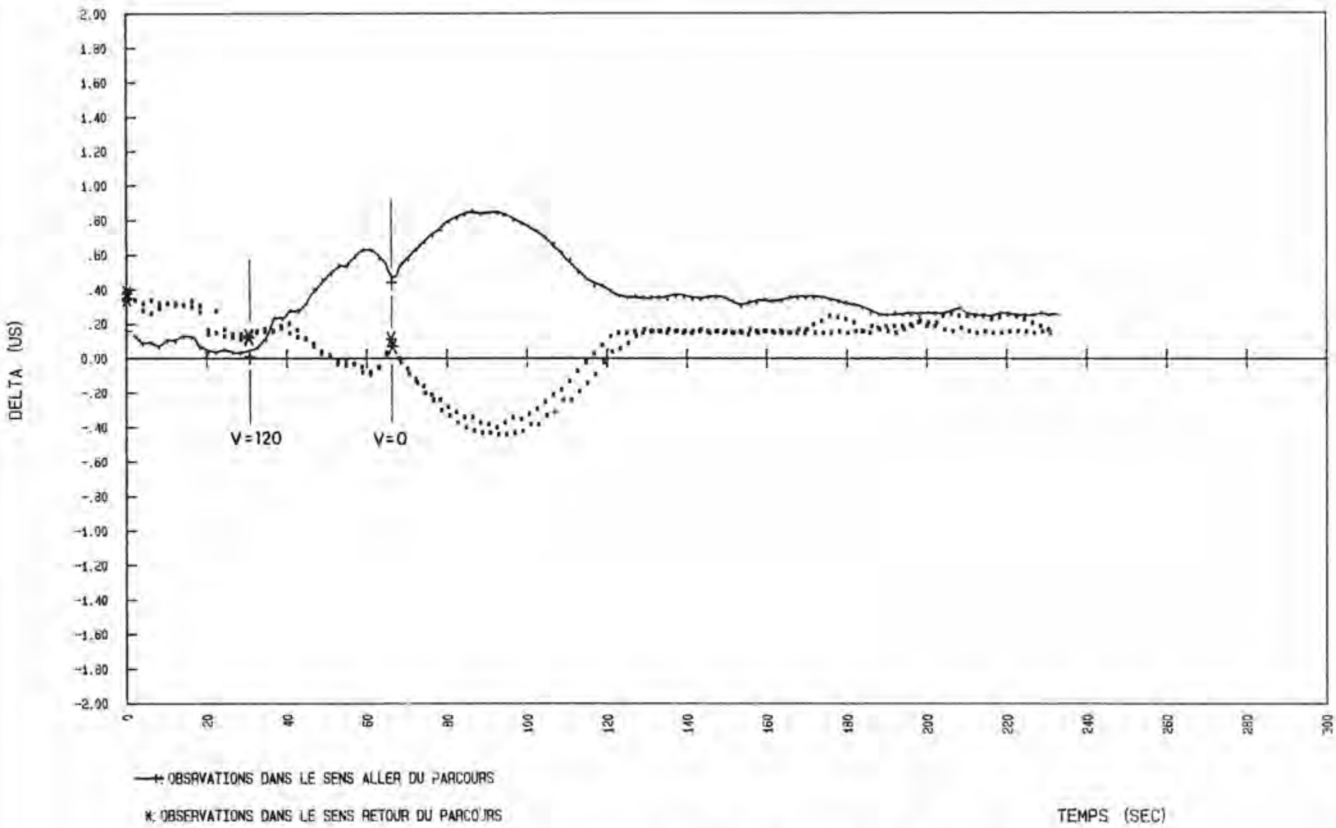

Figure 4: Graphique des tests des décélérations linéaires 120-0 km/h

Tableau des résultats en mode RHO-RHO des tests d'accélération et décélération linéaires.

Type de tests	E min (μs)	T min (sec)	E max (μs)	T max (sec)	T moyen (sec)
Acc. 0-120	± 0,40	42,2	± 2,15	108,5	100
Déc. 120-0	± 0,20	13,5	±0,95	69,8	60

E min: écart minimum mesuré
T min: temps de résorption minimum
E max: écart maximum mesuré
T max: temps de résorption maximum
T moyen: temps de résorption moyen

Un fait intéressant à noter de ces résultats: les écarts minimums mesurés au cours des tests d'accélération et de décélération linéaires ont été obtenus exclusivement des signaux provenant de la station LORAN-C CARIBOU, tandis que pour les écarts maximums, ceux-ci proviennent exclusivement des signaux de la station SENECA.

Lors de la procédure de la calibration, nous avons noté, de repère en repère, que les mesures croissaient (ou décroissaient selon le cas) de l'ordre de 3 μs pour les signaux provenant de la station SENECA, tandis que pour ceux provenant de la station CARIBOU, ils croissaient (ou décroissaient selon le cas) dans l'ordre de 1 μs.

Dans ces circonstances, étant donné que la variance entre les mesures de la station CARIBOU est inférieure à celle de la station SENECA, nous pensons que les ordres des écarts minimums et maximums ainsi que pour ceux des temps de résorption minimums et maximums sont directement fonction de la position du récepteur par rapport aux stations LORAN-C.

De ce fait nous présumons, pour des observations effectuées près de la ligne de base d'une paire de stations, que les ordres des écarts et de temps de résorption seront plus grands que ceux observés dans cette expérience et inversement ils seront plus petits lorsque les observations seront effectuées à une position très éloignée de la ligne de base.

Dans le cadre des tests où le véhicule se déplaçait à une vitesse constante, nous avons mesuré, au niveau des repères, un écart presque constant entre les lectures de INTERNAV 408 et les données de la calibration. D'une façon plus explicite, ce type de comportement pourrait être représenté par une courbe qui oscillerait légèrement autour d'une droite de pente nulle, décalée suivant une certaine constante par rapport aux données de la calibration.

La figure 5 montre la distribution des écarts entre les observations du mode RHO-RHO et les données de calibration des repères des tests effectués à la vitesse constante de 120 km/h. La corrélation entre les mesures des sens aller et retour du parcours nous indiquent que l'écart causé par l'effet du déplacement à cette vitesse est inférieure aux conditions optimales de précision qu'il est possible d'obtenir avec le système LORAN-C.

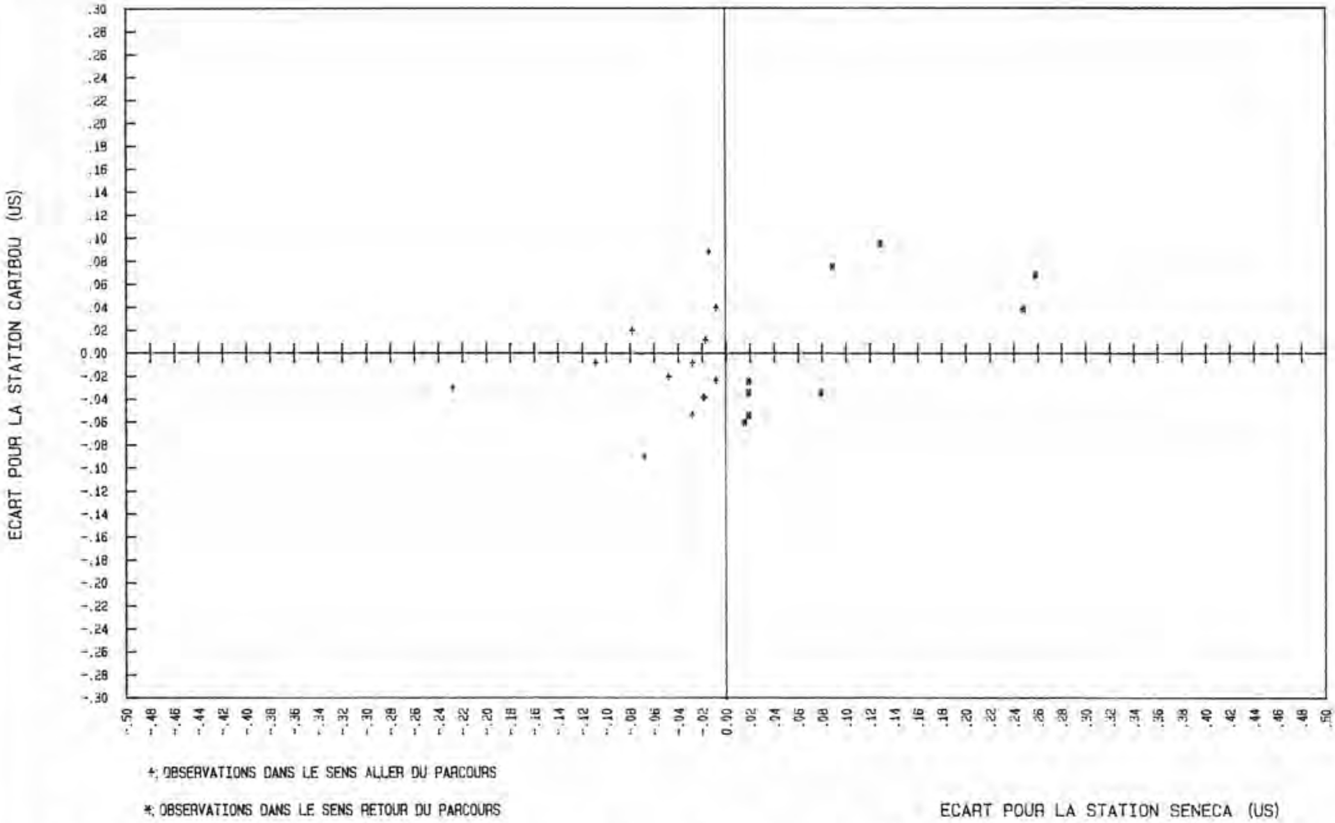

Figure 5: Graphique des écarts entre les observations du mode RHO-RHO et les données de calibration des repères pour les tests à la vitesse constante de 120 km/h

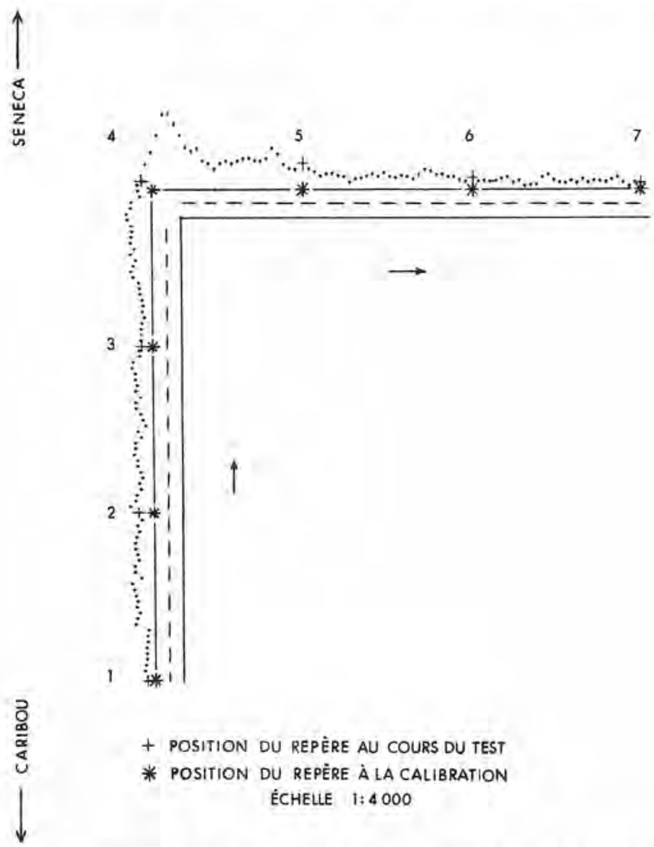

Figure 6: Graphique du test sur la route à angle droit à la vitesse constante de 30 km/h

D'autre part, les distances entre les foyers des distributions et le centre des repères sont inférieures à l'erreur de pointé de l'opérateur et des autres éléments de précision définies dans l'expérience, ce qui implique que nous pensons qu'il n'y a pas de délai constant de retard dans la combinaison du receveur et du micro-processeur pour la prise des mesures des TD. Dans le cas contraire, il est assuré que ce dernier n'est pas significatif par rapport aux conditions optimales de précision qu'il est possible d'obtenir avec le système LORAN-C.

Dans le cadre des tests sur une route avec une courbe à angle droit, nous avons étudié l'effet du parcours angulaire sur le récepteur INTERNAV 408 lorsque le véhicule se déplaçait à une vitesse constante ainsi que la combinaison des accélérations et des décélérations. Au cours des tests où le véhicule se déplaçait à une vitesse constante, nous avons observé, avant de négocier la courbe, un comportement similaire à celui des tests à une vitesse constante sur une route droite. Dans la courbe, le récepteur fournissait les positions d'un véhicule qui se déplaçait sur une route droite, il ignorait complètement la nouvelle trajectoire du véhicule. Une fois la courbe négociée, nous avons observé que le récepteur corrigeait, durant un certain délai de temps, sa nouvelle position (figure 6). Le temps de résorption minimum mesuré lors de ces tests était de 13,7 secondes avec un déphasage minimum de $\pm$ 0,18 µs. Nous avons également observé un déphasage maximum de $\pm$ 0,77 µs, le temps de résorption maximum était de 68,2 secondes. Le temps de résorption moyen était de 60 secondes.

La combinaison des effets d'accélération et décélération linéaire ou angulaire engendre un effet combiné sur l'écart entre les lectures du récepteur et les données de la calibration, ainsi que le temps de résorption. En règle générale, pour déterminer le temps de résorption nécessaire de la combinaison, il faut ajouter 25 secondes au temps de résorption du premier des deux effect qui font l'objet de la combinaison.

Conclusion

Nous considérons que le récepteur LORAN-C INTERNAV 408 peut être utilisé dans un hélicoptère pour effectuer la calibration des chaînes LORAN-C au Canada; toutefois, nous sommes d'avis que le temps de résorption nécessaire pour éliminer les déphasages créés par l'effet d'accélération et/ou de décélération est très grand. En conséquence, si l'on veut optimiser la procédure des opérations lors des applications aéroportées, il sera nécessaire de prendre soin de réduire au minimum ce type de manoeuvre.

Note

Nous remercions vivement Michel Tétu du Département de génie électrique à l'Université Laval, M. R. Eaton de l'Institut océanographique de Bedford d'Halifax et Robert Janes de la compagnie INTERNAV de leur précieuse collaboration tout au long de cette étude.

Bibliographie

Kelly, C. T. , Jr., où inter 1969-70, "Use of LORAN in the RANGE-RANGE Mode", Journal of the Institute of Navigation, vol. 16, no. 4, pp. 390-400

An Efficient Storage Structure for Bathymetric Data

by

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Abstract
For the purpose of channel dredging, it is necessary to obtain a representation of the ocean bottom bathymetry. Because the bottom is not readily visible, it is not possible to make any assumptions regarding its regularity. As a result of this, it is necessary to observe and record the depths over virtually every square metre of surface for which modelling is required. Abstracting the desired information from the large quantities of data collected by surveying is time consuming and expensive. This paper presents an alternative to the storage system currently employed by the Department of Public Works. The rationale for the system design is given, and the result of processing actual data is indicated as a measure of the system's performance.

Introduction
Bathymetric surveys are performed by the Department of Public Works. A mandate of the department is to maintain the waterways in Atlantic Canada. Waterways are underwater trenches or channels which permit passage of ships in areas where it would be otherwise impossible, such as at the entrance to a harbour. They are usually straight, as this simplifies navigation. The size of ship that may pass through a channel is determined by its shallowest depth. In order to make any conclusions regarding navigability, it is therefore necessary to know the bottom depth over the whole channel.

The surface of the bottom of a body of water tends to be somewhat more regular than that of dry land. Sediment deposition and the constant flow of water tend to smooth out many smaller features of relief. As a result, an observed bottom depth may in general be assumed to be representative of a much larger area than it would be on dry land. It is not possible to make any assumptions about the ocean bottom, however, as it cannot be seen. In fact, in performing bathymetric surveys, the practice is rather to observe a minimum of one depth for every four square metres. This practice reduces the possibility of overlooking any possible irregularities in the channel surface but, unfortunately, requires the collection and processing of a large quantity of data.

The bottom depth is measured from a boat on the surface with an acoustic transmitter/receiver device designed specifically for that purpose. This process is referred to as sounding. A survey consists of passing a boat, especially equipped to continually measure and record the bottom depth, over the entire surface area of a channel [5]. The data so collected may be used to determine the size of ship which will pass freely in a channel. They are also used to permit accurate estimates of the amount of dredging work required to modify a channel to allow passage of larger ships.

In order to obtain the required information from the data, plots, cross-sections and volume summaries are produced. Plots of the data, such as in Figure 1, are used to locate the high spots in the channel, thereby indicating the areas likely to require dredging. This is achieved by manual inspection and colouring of the bathymetric plots. Cross sections, such as in Figure 2, are used to illustrate a typical bottom profile in the area suspected of requiring dredging. The volume summaries are required to obtain project cost estimates which are directly related to the quantity of material that must be removed. Production of these constitutes the majority of the work carried out by the processing staff.

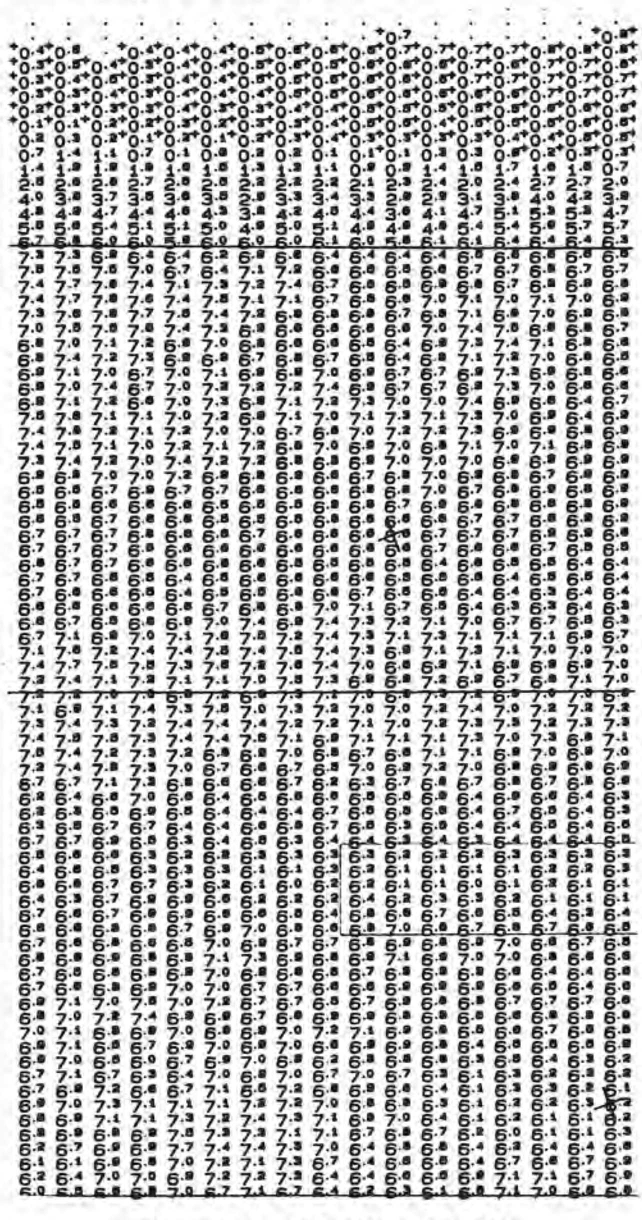

Figure 1: Plot of bathymetric data

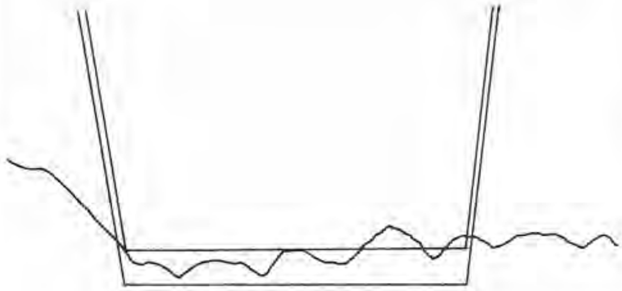

Figure 2: Typical Cross-section

Data Storage: The Alternatives
As mentioned above, large quantities of data are collected during a survey. For example, in one hundred metres of a sixty metre wide channel there will be up to 5,000 depths measured. Each observation has three parts: a depth and two cartesian co-ordinates. Given that each part requires 4 bytes of storage, the resulting total storage requirement for this part of a channel is 60,000 bytes. A simple calculation shows that one kilometre of such a channel will result in well over a megabyte of data. Most channels are over a kilometre in length. The Miramichi river channel is fifty kilometres long, and nowhere less than 80 metres wide. In order to be able to use the data, they must be kept in a manner which will allow efficient storage and quick retrieval.

In designing a storage and retrieval system, primary consideration must be given to the way the data will be accessed. For the purpose of producing plots and cross-sections, access will be by location in the two dimensional mapping space, defined by the pair of co-ordinates. A multi-key addressing system must therefore be used. There are a number of ways to store the data with two index keys. The more common of these structures being: a two-dimensional array, a tree structure such as a quad tree [1,2], and a grid file [3]. These systems will now be briefly described in an effort to show the progression of thought that led to the selection of our approach.

Two Dimensional Arrays
Using an array is probably the simplest approach and is also the one currently being used. A change in one of the array's variables is assigned to represent a change in position along one of the axes of the two dimensions of a plane surface. A variation in the other variable represents movement along the second axis. The value located in a specific matrix position is the depth value associated with that location on the surface.

Applying this to the problem of organizing bottom depths, one dimension of the two dimensional array is aligned with the direction of the centre line of channel. A scale factor relates the subscript values with the distance along the channel. The second dimension is similarly associated with the positions across the channel. A plot of several hundred metres of a channel stored in this fashion is illustrated in Figure 1.

Some features of the system presently employed are as follows. Each observed depth requires no more than three significant digits as it is measured only to decimetre accuracy and never exceed 99.9 metres. The double precision real number format of the HEWLETT PACKARD 9836 processors used by the department allows twelve digits of precision. Therefore it is possible to store up to four observations in one matrix location. The values of the scales associated with each array dimension are designed such that each matrix location represents the minimum observation area of four square metres mentioned earlier. Using this representation, no searching is required to retrieve an item of data by co-ordinates as its location in the array may be determined by a simple mathematical calculation.

There are a number of disadvantages to this approach: 1) The area covered by the array must always be a rectangle; 2) There is only one scale associated with each of the array subscripts, and it must be sufficiently small to permit differentiation in the region of interest, which may be a very small portion of the total area covered; 3) Storage space must be allocated to areas in which there may be no data to record. This is particularly true if the survey area does not happen to be a rectangle; and 4) The amount of storage space required makes use of the data slow and awkward and it is hard to prepare plots and profiles.

Tree Structures
The quad tree [1,2] begins with a square area which is large enough to encompass the entire area of interest. This area represents the root of the quad tree. Associated with this square area there may be a pointer to a record or just some information regarding the area bounded by that square. If there is more information within that square than may be stored by one record, then the square is subdivided into four equal square areas representing the upper left, right and lower left and right quadrants. The four quadrants are systematically identified, by starting in the upper left quadrant and numbering them consecutively in a clockwise direction. The quadrants may themselves be further subdivided into four smaller quadrants. This process may be repeated as many times as is necessary.

The quad tree is a logical choice to organize data for a geometrical retrieval. The speed with which retrieval may be accomplished is, as with most tree structures, of the order log4(n), where n is the number of nodes. Another strength is the ability to determine the nearest neighbours to a point. Nearest neighbour determination is archived in the quad tree structure by a simple lateral traversal. A disadvantage of the quad tree is the additional storage space required for pointers, although there are techniques for minimizing this problem. The quad tree structure, however, may not be the best structure to apply to this problem.

Conceptually, the quad tree involves the repeated division of space into four square areas. (Tree structures may be developed for the two other regular repeatable polygons, such as triangles and sectagons [4].) A difficulty that may be foreseen is that, if we are to achieve compression, we will have to find a way to group the depth data into areas of common depth. It seems unlikely that these areas are going to be square. It would be more realistic to try to work with rectangles, which, although similar to squares, do not require a regularly repeatable decomposition into smaller rectangles. This is especially true if they are to be of variable size. For this reason, we reject the quad tree structure and look for another alternative.

Grid Files

The grid file structure [3] might be another choice for data organization. This technique closely resembles the multidimensional array. It is composed of two parts: a set of scale vectors (one for each key), and a dynamic array. The scale vectors permit a variable division of a space into individual rectangular shapes. The dynamic array stores the information pertinent to each area. This information may be a pointer to a record in on-line storage. The creation of a such dynamic array is not a trivial matter.

Some advantages in the grid file approach are as follows: 1) We now have the ability to define the areas of common depths in a variable scale on both axes of our plane. This allows a more random organization of the information into groups of geographically neighbouring points; and 2) The identification of an area by its range of values on the two axes permits rapid identification of the value associated with a point located within those ranges of values. It is this latter characteristic which makes the grid file approach with or without variable scales a favourite data structure with cartographers.

The main drawback of this technique is that the rectangles can not be of arbitrary sizes as they are defined by ranges of subscript values. Another drawback is the need to store directory entries for every grid cell, whether it contains any data or not.

The Proposed Approach

Overview

Large areas of channel bottom tend to be flat or almost flat. Ideally, we should be able to represent an area of uniform depth by a single record which gives location and boundary of the area, and depth.

These areas may be of various shapes and sizes. Figure 1 shows some such areas in rectangular shapes. Since it is difficult to define and manipulate an arbitrarily shaped area, we should prefer areas of regular shape only.

We propose rectangular shapes as a basis for dividing channel bottom into areas of uniform depths. A rectangle is completely defined by its opposite corner co-ordinates. Thus, one rectangular region (called 'range rectangle' hereafter) in the channel is stored as co-ordinates of 2 opposite corners (4 values), and depth.

Further, we permit rectangles to be of different sizes. This will enable us to achieve more compression of data. We can group neighbouring points of uniform depth into a rectangle of any size.

Let us also make an important conceptual modification in the approach to dividing the geographical area of interest. With both the quad tree and the grid file, we begin with a single node or entry defining the entire area, and then proceed to subdivide that space until we achieve sufficient resolution. What would happen if we reverse the approach by starting out with no areas, and permitting growth in the form of a rectangular grouping of points of common or similar values? This should provide a significant amount of compression, considering the relative smoothness of the channel bottom.

Range Rectangles

Having decided upon using differently sized rectangles to represent the channel bathymetry, the next logical step is to investigate the means of its implementation. We need to formulate efficient procedures for the following tasks:

- i) Initial creation of rectangles: given survey data such as in Figure 1, we need to represent them by the minimum number of rectangles, each enclosing points of the same or nearly the same depth (within a specified tolerance).
- ii) Updating the rectangles data base: when new dredging is performed in selected areas of the channel, the depth in that area changes. These areas are surveyed again, producing survey data of the form in Figure 1. The newly-dredged areas are of more uniform depths and possibly will be of same depth as neighbouring earlier areas. We have to update the rectangle data base to reflect the new depth in certain areas. It is very likely that the dredged area will now need rectangles of different size and location to store the new data more compactly and correctly. We need to formulate an efficient technique for updating the range rectangles data base.
- iii) Retrieve and display depth data.

Data Base Creation

A number of decisions must be made regarding the creation of the data base. We must determine how to accomplish the growth of an individual rectangle as well as how and where to stop its growth. Let us start with the problem of developing an individual rectangle.

A rectangle starts in its smallest size, a single point. This point defines a rectangle with the dimensions equal to the smallest unit of resolution on the two axes. Growth of this rectangle consists of a systematic examination and inclusion of all neighbouring points which are of sufficiently similar depth to be considered the same. The systematic comparison and inclusion of neighbouring points may be achieved by examining values stored in the points in the row-wise and column-wise direction which are immediately adjacent to the starting point. A point is defined as being adjacent to another when the two rectangles (defined by the smallest unit of resolution on both axes) associated with the two points share an edge or vertex. The initial data are stored as a two dimensional array. Thus, for a point at (I,J), we examine depths in row I+1 or I-1, depending upon the direction of growth, and column J+1 or J-1.

The inclusion of all row-adjacent or column-adjacent points would introduce a new set of unexamined adjacent points. Repeated examination and inclusion of these new adjacent points would constitute the growth of a rectangle. The limit to expansion would be reached in one of two ways: 1) when one of all the points in an adjacent row or column was determined to be unacceptable as being of similar value, and 2) the limit of the area of interest is reached. At this time continued expansion may be possible in the other of the two axial directions.

After completing the development of a rectangle, the next question is where to start the next rectangle. Figure 3(a) shows completion of one rectangle in the bottom left corner of an area of interest. If we restrict the growth of rectangles in positive directions, we see that we must start the growth of the next rectangle either at the top (at point A) or to the right (at point B) of the first rectangle.

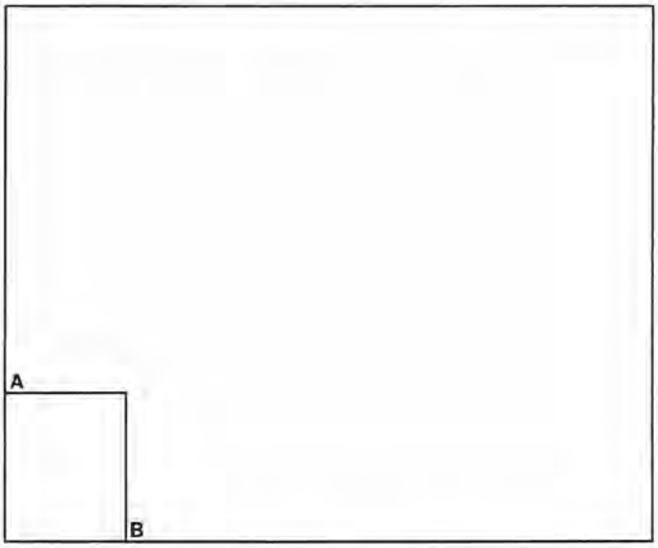

Figure 3a: Formation of one rectangle

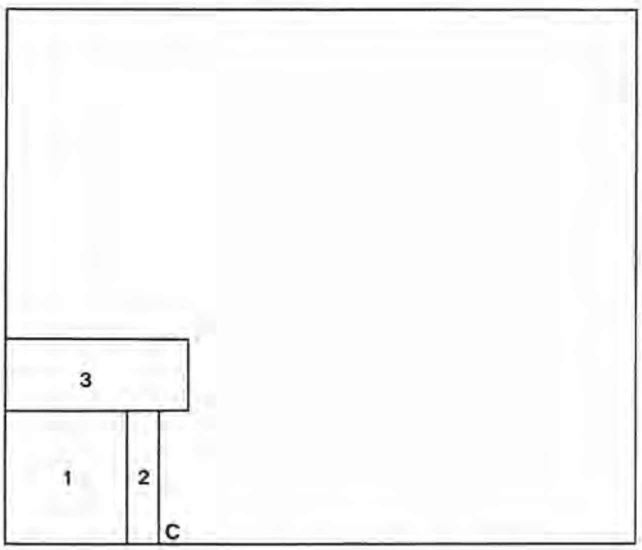

Figure 3b: Ensure rectangles do not overlap

We still need to ensure that the range rectangles do not overlap. Figure 3(b) shows 3 rectangles already completed. If the next rectangle is started at the right-bottom point (C) of 2, we must ensure that it does not grow into 3 vertically.

The operation of examining whether each new row and column to be included in a rectangle is already included in an earlier rectangle proved to be a problem. The initial solution was to inspect each rectangle in the developed list for incidence every time the growth started a new row or column or both. This proved to be too costly in terms of time as the number of rectangles in the list grew. The problem was solved with the help of a second matrix, identical in size and shape to the depth matrix being processed. The matrix was initialized with all zeros, and as an area was added to the list of rectangles, the matrix positions within that area were set to one. Thus, when developing the rectangles, one matrix is examined for depth data and the other is examined for incidence at the same location. If incidence is discovered, then the appropriate restriction may be placed on the growth.

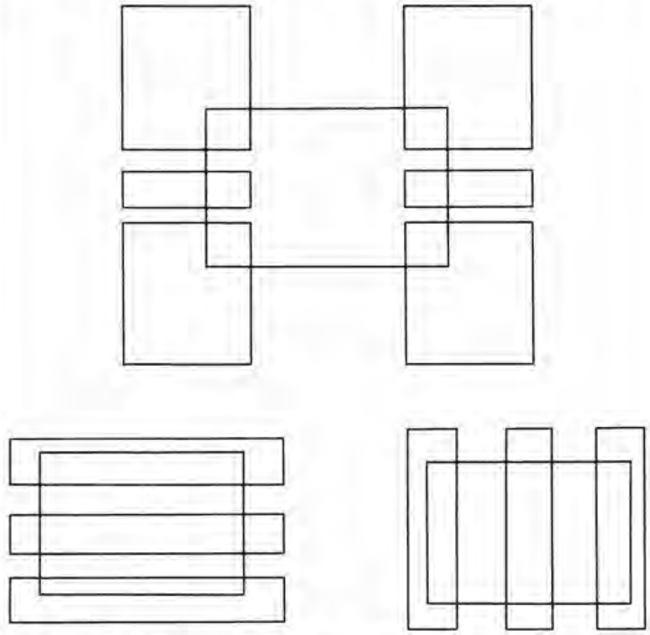

Figure 4: Different ways two rectangles may overlap

We have now considered how to approach the development of an individual rectangle, the three possible causes for the restriction on the growth of a rectangle, and the means by which we continue the development of rectangles until the whole area of interest is covered. Developing a detailed algorithm from this description is now straight-forward.

Tolerance and Averaging

Let us consider the important matter of what depth value to use as the representative depth for an area defined by a rectangle. At first glance one might say that the depth value associated with the first point selected would suffice. All other points included in the area would then have to agree to within some tolerance of that first depth. This might be a suitable solution, but it is not the one chosen here. It was felt that the average of all contributing depths would give more meaningful results, especially for computing volumes for dredging work.

The tolerance, or magnitude of acceptable deviation of a value from the a rectangle's current representative value also requires attention. Examine the profile of a typical channel bottom, as in Fig 2. Given that the side slopes of a channel are usually slightly steeper than that which is supportable by the muddy bottom, the majority of infringements upon the designed channel will occur on the flat area between the bottoms of the sides.

Consider also that the infringements which will be of most concern will occur within a certain range of values above the desired grade. Say, for example, that a waterway was currently considered acceptable as having five metres of draft throughout, and it was the ambition of the department to obtain clearance to six metres. Or, in a six metre channel, there had been sufficient siltation to reduce navigability to vessels of five metres of draft. In these cases, which make up the majority of the work of the Marine Design and Construction Branch of Public Works Canada, interest would be centred upon depths which fall between five and six metres. Depths outside this window, being of less significance, are given only a passing glance.

If we apply these observations to the problem of establishing optimum tolerances when developing the rectangles, we can see that it is possible to have a variable set of tolerances. When the two values being compared for compatibility range above or below the depth of prime concern, a higher tolerance is permissible, and therefore, better compression may be achieved. However, if either the current rectangle's depth or that of the point under consideration falls inside that prime range, then a lower tolerance must be used. Thus, tolerances can be made a function of depth.

Updating the Data Base

If a channel survey indicates that there are areas of encroachment upon the desired depth, excavation of those areas will be arranged. When dredging is completed, the affected areas will be resurveyed. The result of this second survey should show a relatively flat surface (due to fresh dredging) at depth below the desired clearance. At this point the initial survey along with the final survey of the newly-dredged area represents the channel's bathymetric relief. Any potential user will be required to use two charts (corresponding to the old and new surveys) when reviewing the data for an area. This situation would exist until the time when the entire area is surveyed. This may be months or years. For convenience, therefore, it is useful to consider merging the two survey results. Merging the two surveys will involve meshing of rectangles where the rectangles representing the most recent survey will take precedence. This may have an added advantage. Remember that the areas being dredged are represented in the pre-dredging data as a number of rectangles in the lower tolerance region. In the post-dredge data the same general area should tend to be represented by a smaller number of rectangles, as it will be composed of data in a higher tolerance region. Thus, as a result of the smoothing effect of the dredging activity, there will be a certain amount of reduction in the total number of rectangles in the list.

Updating the developed list of rectangles involves meshing that list with the rectangles developed to represent the newly-dredged areas. Initially, all the areas in the new rectangles are also covered by the rectangles in the original data. This overlap must be eliminated by removing or modifying all rectangles in the old list which are either partially or completely within areas represented by the new rectangles. We must start by converting the data from the after-dredging survey into a rectangle list. This list is then superimposed upon that of the pre-dredge survey. All areas from the original survey that appear in the new data are modified or eliminated until no same area is represented by two rectangles. This merged list represents the post-dredge bathymetric information for the channel.

The modification of overlapping rectangles mentioned above, while not technically difficult, requires a significant amount of code. This is due to the fact that there are fourteen distinct ways (although some are quite similar) in which two rectangles may overlap. These are demonstrated for the reader in Figure 4. As can be seen, an individual overlap situation may result in the creation of one to four new smaller rectangles. The problem of identifying an overlap situation was handled by comparing the relative position of the four vertices of a rectangle from the pre-dredge rectangle list to those of all areas in the new rectangle list.

A brief description of the algorithm for implementing the update process is given below.

The first range rectangle from the old list is selected and the new list is scanned for incidence with it. If an incident rectangle is discovered, the old one is marked for deletion and modifications are made to it so that the incidence no longer occurs. The modified rectangles are placed in a temporary list and the next entry in the old list is selected. This next rectangle is inspected for incidence in the same manner as the previous one, and the process is repeated until all entries in the old list have been examined. All marked rectangles in the old list are removed and the array is compressed. The new rectangles in the temporary list are added to the old list and the process of inspection and modification is repeated, starting with the first new entry in the old list and ending when all new entries have been examined. The process of examining, modifying, compressing and adding new entries to the old list is repeated until there are no new entries to place into the new list.

The Software

The initial model for the software was developed on the university's PRIME computer in PL/C, which was chosen for its structural features. Initially the test data used was generated with the help of a trigonometric sine function. Upon completion of satisfactory tests, some real data were required for testing. It was discovered that there was no physical medium common to the Public Works computers and the University's computer system. The system used by Public Works is an older model of the Hewlett Packard 200 series micro computers, which is not IBM or MS/DOS compatible. The software was then converted to HPL, a derivative of BASIC, the language used on the Hewlett Packards.

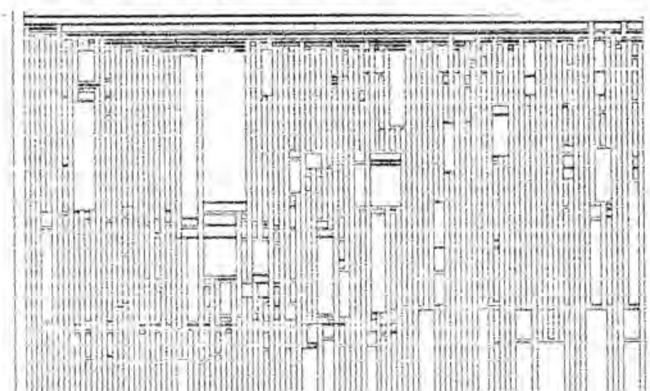

Figure 5: Range rectangle for data in figure 1

To test the system design, data from a project currently in progress were selected. The matrix representation of the pre-dredge data is given in Figure 1. It may be seen by inspection that the bottom in the area of the channel varies from six to seven metres. The desired clearance for this section of the waterway is 6.1 metres. The data consist of 30,000 depth measurements. Since each point needs 12 bytes of storage, the total storage required in the older system is 360,000 bytes.

Figure 5 illustrates the range rectangle representation of the same section of waterway. There were 1,247 rectangles required to represent the area. Given that four bytes are required to store each co-ordinate on an axis, and allowing eight bytes for the depth and any related information, each range rectangle requires 16 bytes of storage. Thus the total storage requirement is 19,952 bytes. We have achieved a compression in excess of 90 percent. This compression has a hidden bonus associated with it. It now becomes possible to work with the data in an interactive fashion. The time required to process the information for graphic screen presentation is short enough that the process of examining the data for encroachments may be accomplished in a matter of minutes on a colour monitor. This activity had been previously achieved by the laborious process of plotting the data on paper and manually colouring areas of different depth.

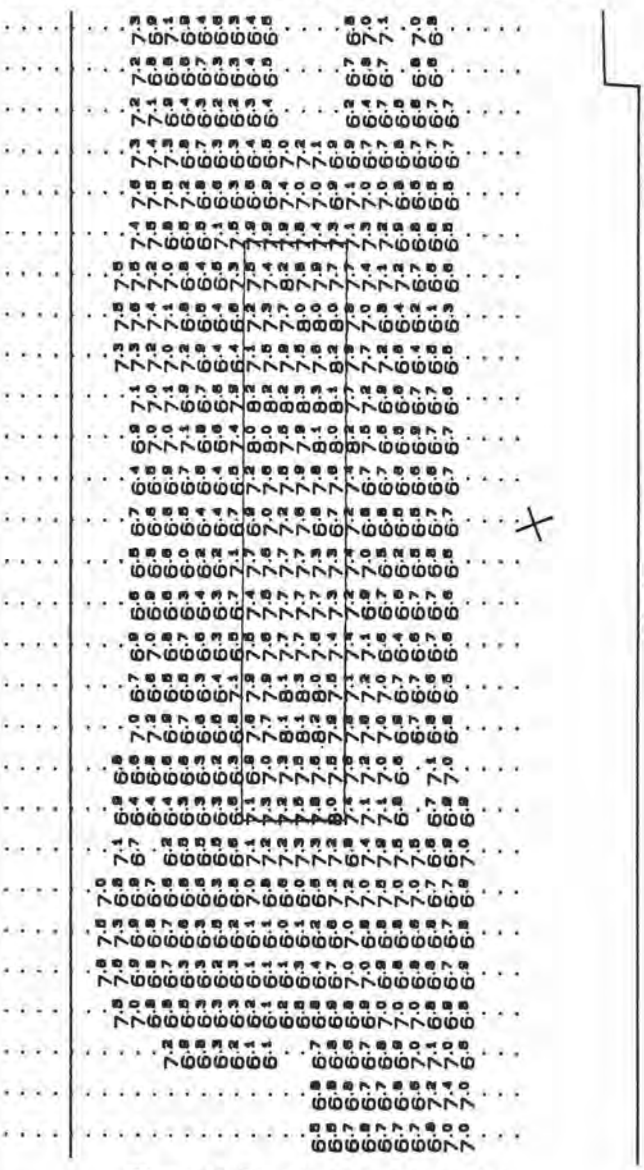

Figure 6: Post-dredge survey data

Figure 6 shows the post-dredge survey data for a section of the same area. This data were first converted into range rectangles and then used to update the initial range rectangle (Figure 5) data base. Figure 7 shows the updated rectangles.

Figure 7: Updated range rectangles

Both the creation and the update programs required thirty minutes of execution time for the 30,000 point matrix on the Hewlett Packard 9836 machines.

Conclusions

It is possible to reduce the storage requirements and enhance the effective use of large quantities of data. A variation of the grid file technique based upon anticipated characteristics of the data was selected. An algorithm for converting the existing format of data into the new format was designed and implemented as well as an algorithm for updating the new format.

The results of tests performed on real data showed that the new approach did achieve a substantial compression of storage requirements. The results were demonstrated to the engineers using the data and their immediate observation was that this would be a very useful tool during the planning stage of a dredging project. The storage and retrieval technique introduced and developed in this paper proved to be a worthwhile alternative to the one presently in use.

References

1. Abel, 'Some Elementary Operations on Linear Quadtrees for Geographic Information Systems', The Computer Journal, 28(1), p. 73, 1985.

2. Finkel, R. A. and Bently, J. L., 'Quad Trees: A Data Structure for Retrieval on Composite Keys', Acta Informatica, 4, pp. 1-9, 1974.

3. Nievergelt, H. and Hinterberger, H., 'The Grid File: An Adaptable, Symmetric Multikey File Structure', ACM Tran. on Database Systems, 9(1), 1981.

4. Samet H., 'The Quadtree and Related Data Structures', Computing Surveys, 16(2), 1984.

5. Wilson, T. and R. Belyea, 'The Application of Electronic Sweep Systems for Dredging Quality Control', Canadian Hydrographic Conference, Burlington, Ontario 1987.

Self-Tracking Range/Bearing Positioning Systems - An Evaluation

by

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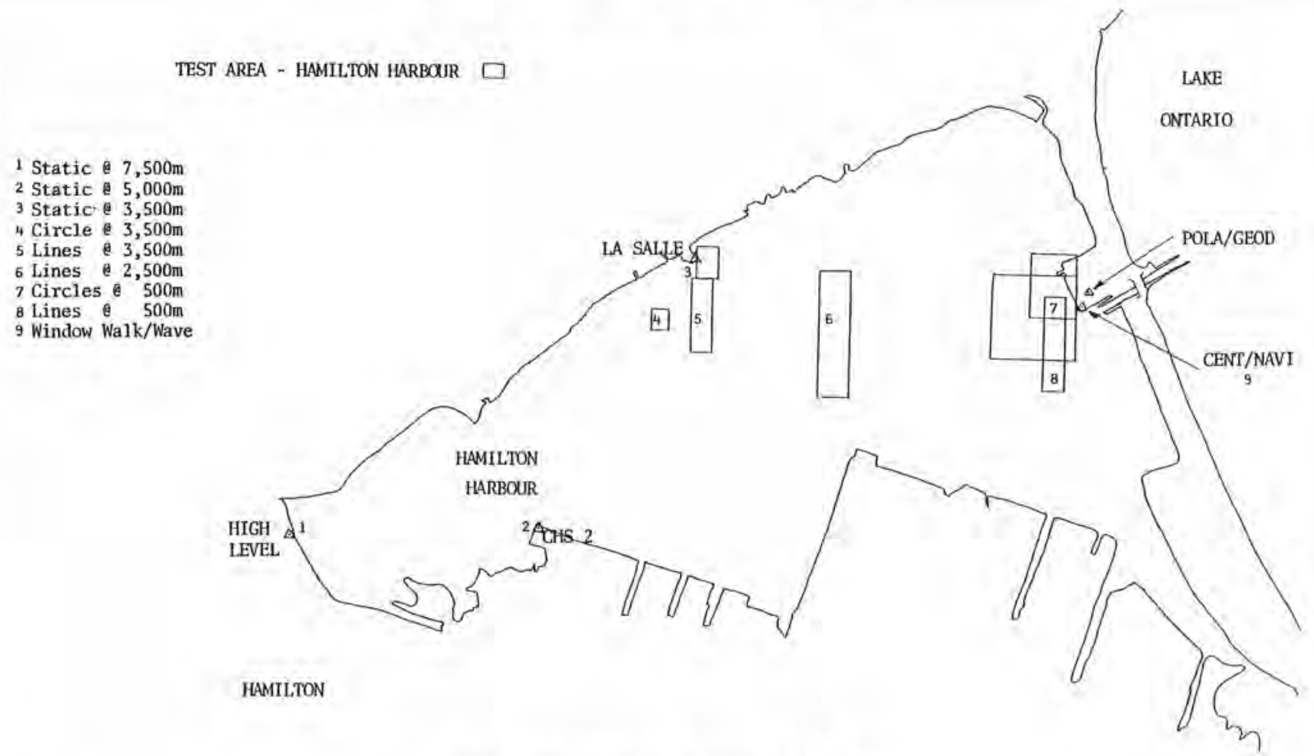


Figure 1: Hamilton Harbour test area

Introduction

The Canadian Hydrographic Service (CHS), Central and Arctic Region recently conducted an evaluation of 3 self-tracking range/bearing systems: the Krupp-Atlas Polarfix, the Navitronic Navitrack 1000, and the Geodimeter IMS Autotracker. Each of these systems positions a survey launch by emitting a laser beam from a shore station towards a set of reflecting prisms on the launch. The elapsed time between the initiation of the beam and the receipt of the reflected signal is used to compute the distance to the launch. The bearing is computed, at the shore station, clockwise from the reference object (RO) to the laser orientation. Once the system obtains a valid reflection from the launch, the laser continues to track the launch as it moves. Although each system is limited to line of sight, they will all continue to track if the signal is lost for brief periods of time. In addition, the Polarfix and Navitrack have the capability to search for the prisms and resume tracking once they are found.

The tests were conducted at the Canada Centre for Inland Waters (CCIW) at Burlington, Ontario, Canada during the last two weeks of October and the first week of November, 1987. Since it was not possible to log data from all three systems simultaneously, the Navitrack and Autotracker were evaluated independently against the Polarfix. The Navitrack/ Polarfix tests were conducted on October 28th and 29th and the Autotracker/Polarfix tests on November 4th and 5th. The weather during the tests was considered acceptable for normal survey operations.

This paper describes the results of these tests and has been used as the justification for the acquisition of one of the three systems.

Survey Area

The tests were conducted in and around Hamilton Harbour (figure 1). The positioning systems were set up at two horizontal control stations (CENT and NAVI) located on the west dock face at CCIW for most of the tests. The remaining tests used horizontal control located on the roof of CCIW at stations POLA and GEOD. The RO for the dynamic tests was located at station La SALLE. Stations HIGH LEVEL, CHS2, and La SALLE were used for the static distance measurements. The following table lists the control used during the evaluation:

Station	Northing	Easting	Instrument Elevation
CENT	4794267.89	597193.24	4.2
NAVI	4794271.69	597190.66	4.2
POLA	4794450.34	597261.05	35.7
GEOD	4794454.89	597257.90	35.7
HIGH LEVEL	4792117.43	590039.40	32.4
CHS 2	4792111.99	592367.16	4.5
La SALLE	4794592.53	593716.48	4.6

Method

Introduction

The tests were designed to evaluate the systems in both the static and dynamic modes. The static tests consisted of distance measurements to known control points throughout the study area. These points were located at distances of approximately 3500m, 5500m, and 7000m from the positioning systems.

Photo 1: Polarfix and the Autotracker at stations CENT and NAVI respectively

The dynamic tests included the tracking of the sweep vessel, CSL Penguin, along predetermined routes in Hamilton Harbour and the positioning of prisms that were carried by hand along walking courses on land. The Polarfix was used for navigation in the launch trials and the prisms were located on the cabin approximately 3m above the water. While underway, the coxswain was instructed to steer all lines in a constant manner. The CSL Penguin is shown in Photo 2.

The following sets of prisms were used during the trials:

1) 12 Krupp-Atlas prisms in two horizontal rows
2) 27 Geodimeter prisms set in three horizontal rows
3) 3 and 10 Wild Leitz prisms

During the launch tests, the Polarfix and the Navitrack used the Krupp-Atlas prisms while the Autotracker used its own prisms. For the static tests, all systems used the Wild Leitz prisms.

Specific Tests:

1. Circular courses approximately 50m in diameter were laid out at two locations approximately 500m and 3500m from the shore stations. This course was designed to test how well the systems performed on curved survey lines and on turns in the ends of regular survey lines. The course was marked by three buoys which the coxswain used as a guide. 5 circuits of each course were completed.

2. The second test consisted of running a line among the sailboats moored at the La Salle Park Marina and back and forth in front of the RO. The objective of this test was to determine if the systems would lock onto the sailboat masts and/or the RO.

3. The third test involved running lines along the CCIW ship berth to see if the systems would experience interference from larger ships and the breakwall. Numerous trailers and lamp posts on the wharf edge also served as potential signal reflectors.

Photo 2: CSL Penguin

4. For the fourth test, a series of five parallel straight lines approximately 1000m in length were run at two distances from the shore stations. The first series were run at 500m and the second series at 3500m for the Polarfix/Autotracker test and at 2500m for the Polarfix/Navitrack test (figure 1). In all cases, Polarfix was used to navigate the launch.

5. Since the sun is the strongest infrared source in the area, a test was conducted to see if the laser receiver would lock onto the shimmer of the sun on the water. To avoid damage to the equipment, there was no attempt to deliberately point the laser receiver directly at the sun. This test was run at 9:30 am when the sun was low on the horizon.

6. For the sixth test, a set of three prisms was carried in front of the wall of a building to see whether the systems would lock on to reflections from the wall or the windows. The prisms were carried parallel to the wall for a distance of approximately 30m and then back to the starting point. The prisms were 2.5m off the ground.

7. The seventh test was primarily a test of absolute accuracy. At station HIGH LEVEL, ten reflector prisms were set up over the horizontal control station at an approximate distance of 7000m from the positioning systems and data were logged for a period of one minute. The number of prisms was then progressively reduced, one at a time over one minute intervals, and observations collected for each new set of prisms. The total set of prisms was then set up again and moved toward the laser systems by a distance of 1 m. As a check on system stability and range, the ten prisms were then carried by hand 30m away from the control point along a fence line. Data were collected for 20 seconds at the end of the line,

then the prisms were returned to HIGH LEVEL along the same path and data recorded over the survey point for another minute. These tests were repeated at 2 other control points, CHS 2 and La SALLE, located at distances of approximately 5500m and 3500m respectively from the positioning systems. At these sites, only 3 prisms were used for both the static and walking tests and the edge of the wharf was used for the walking course.

Photo 3: Polarfix and Navitrack at stations POLA and GEOD respectively

8. To test the effect of waves on a rocking boat, a set of three prisms was rocked back and forth in a two metre arc covering a 90 degree sector.

9. In order to test the vertical tracking ability of the systems, the systems were set up over control points on the roof of CCIW and tracked the launch as it steamed toward CCIW, then along the breakwall, and continuing northwestward. The vertical angle ranged from 1.3 degrees at the start of this track to a maximum of 13 degrees when the launch was closest to the positioning system. The track led the launch behind three heating plant chimneys and provided another opportunity to assess the ability of the systems to track through obstructions.

Statistical Analysis

The problem in making a good and valid analysis of positioning data is that it is difficult to have a standard to compare the systems against. This is particularly true for kinematic (i.e. moving) systems. Since hydrography in general demands a high level of positioning accuracy, it is difficult to set up a more accurate standard for comparison. The solution is to characterize the errors as systematic bias or random noise. In general, it is possible to establish the bias level through a series of static tests in an environment similar to that of its intended use; a baseline measurement over water, for example. It is then possible to establish the bias since very precise static range or angle measurements can be conducted with standard land survey equipment.

Determining the variance under kinematic conditions is different because the equipment being tested is the most precise available and therefore cannot be easily compared to other positioning systems. Starting with the assumption that the systems are unbiased (as they have just been tested for this in static measurements), the systems' variance under kinematic conditions must be determined. The first assumption is that the launch followed a straight line (or arc) for at least short intervals. This is a good assumption given that the tests were held under fair conditions with an experienced helmsman at the wheel. Random deviations from a fitted path are an indication of a systems' variability. To detect these deviations, polynomials are fitted to portions of the lines for each system and the standard error of the residuals is computed. An analysis of the residuals (i.e. the differences between the observed positions and the "fitted" positions) clearly identifies large deviations such as range spikes and inherent jitter in the systems.

For the static tests, the distances from the measured point were calculated and a frequency distribution generated. The mean error and standard deviation for each test were used to compare the systems.

A polynomial was fitted to smaller data sets for the dynamic tests. The straight lines were fitted with a first order polynomial and the arcs with a fourth order polynomial (each system fitted to its own data). The standard error of the residuals for each of the tests was used as the comparison criterion.

The mean error and standard deviation of all the tests for each system were also computed.

Results

General

The results of the tests are presented as plots of the data that were collected during each test, as statistical analyses of the data for portions of each test and as direct field observations.

Each plot contains the following header information:

1) start-stop times of the data;
2) the scale;
3) the total number of data points within the selected time frame;
4) the number of data points plotted;
5) the number of data points ignored.

This refers to data points the processing software rejected because:

a) The ranges were below the minimum values for each system (Polarfix < 50m, Navitrack and Autotracker < 20m).
b) There were not enough laser returns from the prism ring for the Polarfix. (The teleface outputs a value from 0 (min) to 9 (max). Krupp-Atlas representatives said not to use data with values less than 9.)
c) The Polarfix system had a dynamic tracking filter which produced readings whenever requested even though the laser may not be taking a reading at that very moment. (This filter can produce readings up to 10 seconds old, perhaps due to a transmit pause or loss of lock. The age is output with the data, and Krupp-Atlas representatives said not to use any data older than 0.6 seconds.) and

6) the number of data points that plotted out of the northing-easting limits at plot scale. On figure 6, the Autotracker heads off the paper several times.

Autotracker/Polarfix Evaluation

Figures 2 to 5 are plots of the positions obtained during the circle tests (test 1) of the Autotracker/Polarfix at 500m and 3500m respectively. Visual inspection of these figures indicates that both systems are comparable in performance with one noteworthy exception. The Autotracker gives a large number of erroneous readings at the 3500m range (figure 4). The standard error of the residuals is given in Table 1a.

During the attempts to have the positioning systems lock on to other reflecting surfaces (tests 2, 3, 5 and 6), the Autotracker did not lock on to the reflecting objects whereas the Polarfix locked on to the RO in test 2 and to the wall/windows in test 6. However, the Autotracker was manually set to wide beam during test 6. Although the wide beam setting improves the tracking ability of the Autotracker, it seriously reduces the range of the system and requires operator intervention, both of which are unacceptable to survey operations. The offset in the location of the two plots in figure 15 is a result of the shore stations being intentionally offset to avoid a line of sight obstruction.

Figures 6 to 8 are plots of the lines and the corners between lines at 500m and 3500m from the systems (test 4). These plots show that the Polarfix performed better than the Autotracker on the straight line tests. However, the Autotracker did seem to track better on the corners than the Polarfix (note the saw tooth track in figure 6). Once again, the standard error of the residuals given in Table 1a. indicate that the Polarfix provided a better fit than the Autotracker data.

Two tests of system accuracy were conducted at distances of 3500m and 7000m (test 7). At 7000m, the number of prisms used was progressively reduced from 10 to 8 to 6. Examination of figures 11 (3500m) and figures 12 to 14 (7000m) and of the standard deviations of the data sets (Table 1b) clearly shows that the Polarfix exhibits less scatter and is more accurate. In addition, when the prisms were reduced to 6, the Autotracker lost lock and required operator intervention in order to continue the test. At La SALLE and HIGH LEVEL, sets of 3 and 10 prisms, respectively, were carried by hand and the resulting plots are shown in figures 9 and 10. From these plots, it appears that the Autotracker again provided more erroneous data and this observation is supported by the statistical analysis of the data in Table 1b.

The rocking boat simulations (test 8) were conducted at a distance of approximately 150m. The Autotracker was unable to maintain lock during this test. The Polarfix lost lock once, but only momentarily.

During Test 9, the Polarfix tracked the launch through the change in vertical angle and through the obstructions; but the Autotracker lost lock when the launch passed behind the chimneys and stopped tracking after approximately 8 seconds. On the second pass, the operator reset the Autotracker to wide beam in order to maintain lock. But operating the system on wide beam reduces the range of the system and is undesirable under normal survey operations.

In addition, the Autotracker gives no indication of "quality" or "confidence" in its data. For example in figure 12, 580 of the valid data points are plotted in one spot! The system continues to output its last valid range and bearing without any indication that it had in fact lost lock of the target.

Navitrack/Polarfix Evaluation

Figures 16 to 19 contain plots of the results of the circle tests (test 1) of the Navitrack/Polarfix comparison. Although both systems performed well during these tests, the Navitrack traces are smoother, possess fewer gaps in the data and portray the launch's course more realistically (see horizontal shifts in position of Polarfix track on figure 19). The standard error of the residuals for segments of these lines is also lower for the Navitrack system.

Both the Polarfix and Navitrack performed well in tests 2, 3, 5 and 6 although the Polarfix had more gaps in the data on test 6 (figure 30).

The results for test 4 were similar to test 1 (figures 20 to 23). Figures 21 and 23 offer another illustration of the poorer performance of Polarfix on turns. Again, standard error estimates are lower for the Navitrack system in this test (Table 2a).

During the walk tests (test 7), the Navitrack appears to exhibit less scatter in the data at the 5000m distance (figure 24) although it does have more missing data. This figure again illustrates the horizontal shifts in position that have appeared in other Polarfix tests. At 7000m (figure 25), the performance of the two systems is similar.

For the static section of test 7 (figures 26 to 30), the Navitrack generally outperforms the Polarfix. With the exception of the 5000m test, it is more accurate and has a lower standard deviation (Table 2b). A close examination of these figures reveals a banded appearance to the data which we have interpreted as the angular resolution of the systems. The width of these bands at 7000m is 25cm for the Polarfix and 10cm for the Navitrack.

The rocking boat simulations (test 8) resulted in good performance from both systems with the Polarfix losing lock only once.

The Polarfix and Navitrack performed well in the vertical angle tests (test 9). Both systems were able to track the launch and had no difficulty with the obstructions on this test.

Summary

The evaluations described in this paper were carried out in two stages. In the first stage the Krupp-Atlas Polarfix and the Geodimeter Autotracker were simultaneously put through a series of nine tests. Similarly, the Krupp-Atlas Polarfix and the Navitronic Navitrack were compared. The results of these tests were plotted and analysed statistically.

The analysis of the test results indicates that the Autotracker does not meet CHS requirements because of its range limitations, its poor performance in tracking the launch as it passes behind obstructions and the requirement for operator intervention. In addition, the Autotracker is not equipped with search algorithms in the event of signal loss.

The Polarfix and Navitrack do meet the requirements of CHS. Both systems have methods of searching for the prisms if the signal is lost which worked successfully during the tests.

Table 1a: Dynamic Tests - Mean of Standard Error of Residuals

Autotracker/Polarfix

Test	Autotracker	Polarfix
Line 1 @500	0.819	1.567
Line 1 @500	88.698	3.162
Line 2 @500	3.701	3.044
Line 3 @500	3.518	2.625
Line 4 @500	15.166	1.707
Corner @500	2.132	3.637
Circle @500	3.254	3.867
Line 1 @3500	1.379	1.413
Line 2 @3500	0.786	1.428
Line 4 @3500	1.567	1.707
Circle @3500	9.677	8.835
Corner @3500	4.944	4.721
Walk out @3500	6.605	2.936
Walk back @3500	7.760	2.669
Walk out @7000	12.178	1.302
Walk back @7000	16.240	1.217

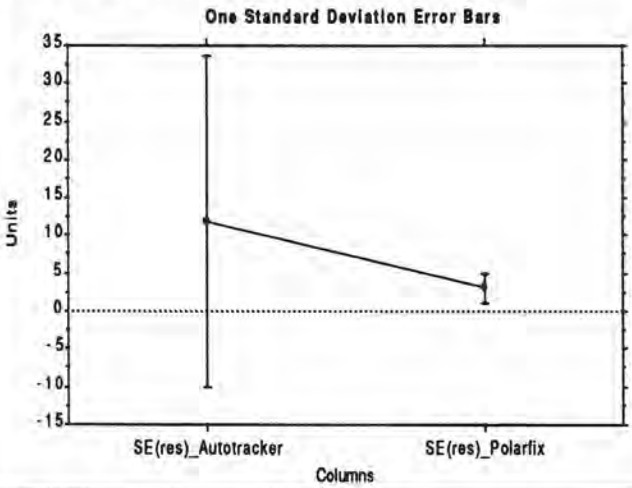


Table 2a: Dynamic Tests - Mean of Standard Error of Residuals

Navitrack/Polarfix

Test	Navitrack	Polarfix
Line 1 @500	0.819	1.567
Line 2 @500	0.655	0.904
Line 3 @500	0.744	1.014
Line 4 @500	0.598	0.985
Line 5 @500	0.970	1.602
Circle @500	0.475	1.163
Line 1 @2500	0.629	1.241
Line 2 @2500	0.602	0.649
Corner 1 @500	1.227	3.649
Corner 2 @500	0.773	4.888
Corner @2500	1.075	4.559
Circle @3500	2.862	5.269
Walk out @5000	2.410	5.057
Walk back @5000	2.792	2.740
Walk out @7000	1.602	0.779
Walk back @7000	1.449	0.787

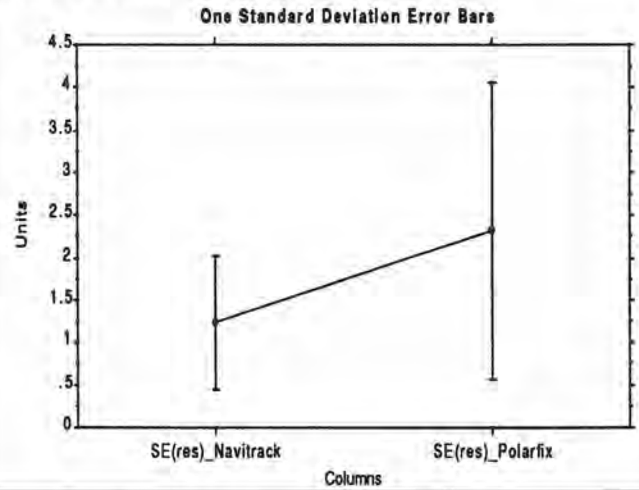


Table 1b: Static Tests - Mean of errors (metres)

Autotracker/Polarfix

Test	Autotracker		Polarfix	
	Mean Err	Std Dev	Mean Err	Std Dev
Static @3500	1.549	0.222	1.001	0.169
Static 6 @7000	1.707	0.633	1.336	0.319
Static 8 @7000	1.807	1.035	1.300	0.188
Static 10 @7000	0.977	0.677	1.282	0.220

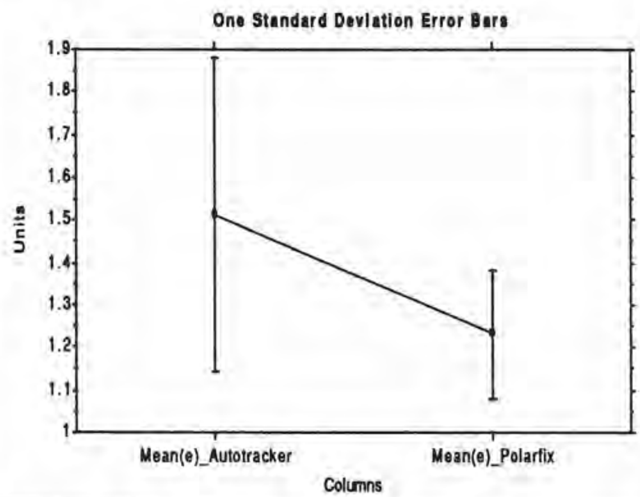
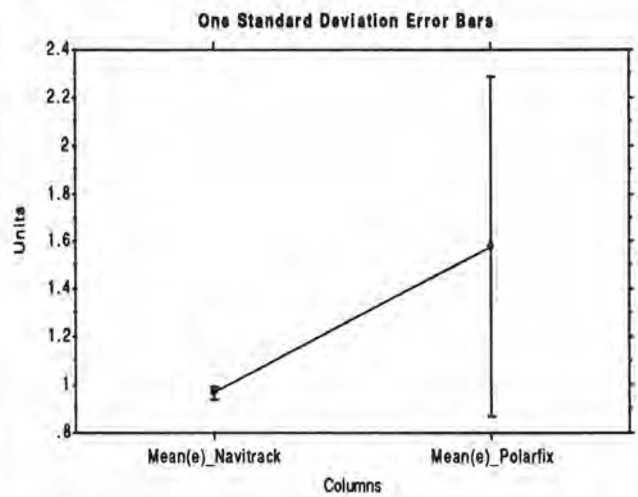


Table 2b: Static Tests - Mean of errors (metres)

Navitrack/Polarfix

Test	Navitrack		Polarfix	
	Mean Err	Std Dev	Mean Err	Std Dev
Static @5000	0.933	0.189	0.507	0.090
Static 6 @7000	0.997	0.217	1.943	0.247
Static 8 @7000	0.971	0.174	1.952	0.254
Static 10 @7000	0.978	0.138	1.898	0.260



During this evaluation, the Navitrack was more stable in tracking the launch (particularly on turns), had better angular resolution, and was more accurate in static distance measurements than the Polarfix.

Acknowledgements
The three systems which were evaluated were operated by company representatives. Their assistance was invaluable and we wish to express our sincere thanks to all involved. Krupp-Atlas Elektronik GMBH was represented by Mr. Manfred Gerlach, Chief Development Engineer, Survey Department; Mr. Ed Blayer, Manager, Engineering Services, Krupp-Atlas U.S.; and Harold D. Tolton, V.P. Marketing, Surnav Corporation. Navitronic As. was represented by Mr. Gerald G. Ryals, Director, Operations from Navitronic U.S.; and Mr. Pat Brassard, Sales Manager, Bytown Marine Ltd. Geodimeter of Canada Ltd. sent their National Sales Manager, Robert T. Ragsdale to operate their equipment for the tests.

Appendix 1: Detailed System Descriptions

__Geodimeter IMS Autotracker__
- 1 Autotracker: 1 laser instrument unit, 1 joystick control, 1 telemetry link transmitter (5m coax cable, 1 quarter wave antenna)
- 1 display/control unit.
- 1 Honda generator.
- 1 step-up transformer(110 to 220 volt).
- 1 instrument cable.
- 1 tribrach.
- 1 Wild tripod.
- 2 transport cases (instrument/control unit).
- 1 tool kit.
- 1 operators manual.
- 1 telemetry link receiver (5m coax cable, 1 quarter wave antenna).
- 1 prism assembly (3 holders, 27 prisms).

Photo 4: Geodimeter IMS Autotracker

__Navitronic Navitrack 1000__
- 1 polar positioning laser
- 1 polar positioning command unit
- 1 positioning transceiver: 1 12-volt power supply, 1 CPU board, 1 radio modem, 1 UHF radio, 1 antenna, 1 battery (with charger)
- 1 carrying case for transceiver
- 1 aluminum tripod
- 1 Hyflex 1000: 1 Z80 main CPU, 1 HP-IB/RS-232C system I/O, 1 DC power module 24 v DC, 1 range/bearing display unit, 1 radio modem, 1 UHF radio
- 1 omni directional antenna
- 1 antenna cable, 10 m

Photo 5: Navitronic Navitrack 1000

__Krupp-Atlas Polarfix__
- 1 laser sensing head
- 1 control unit: 1 antenna, 1 battery, 1 external battery cable
- 1 connecting cable 2.5 m
- 2 transport cases (sensing head/control unit)
- 1 tribrach
- 1 Wild tripod
- 1 teleface unit: 1 antenna, 1 antenna/teleface cable 15 m, 1 power supply 24 volt, 1 power supply cable 2.5 m, 1 data transfer cable 5 m
- 1 prism ring assembly

Photo 6: Krupp-Atlas Polarfix

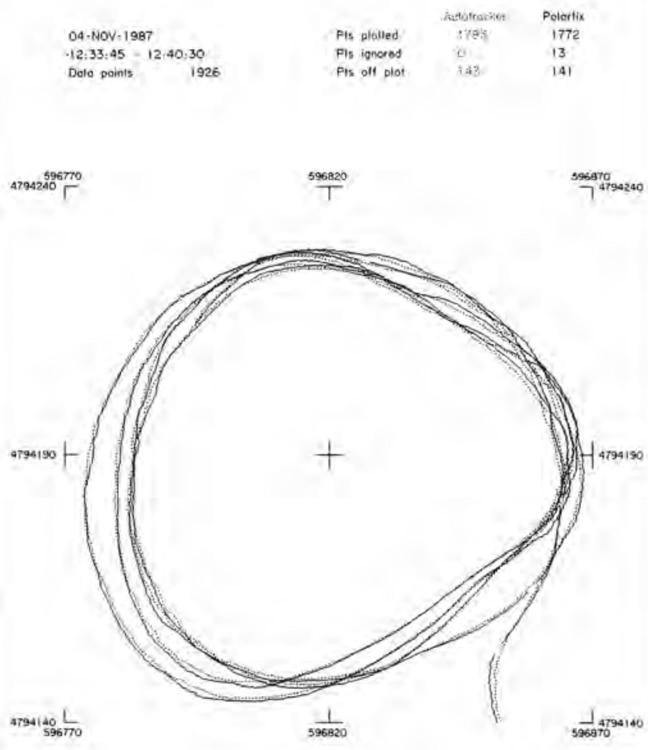


Figure 2: Circles @ 500 m

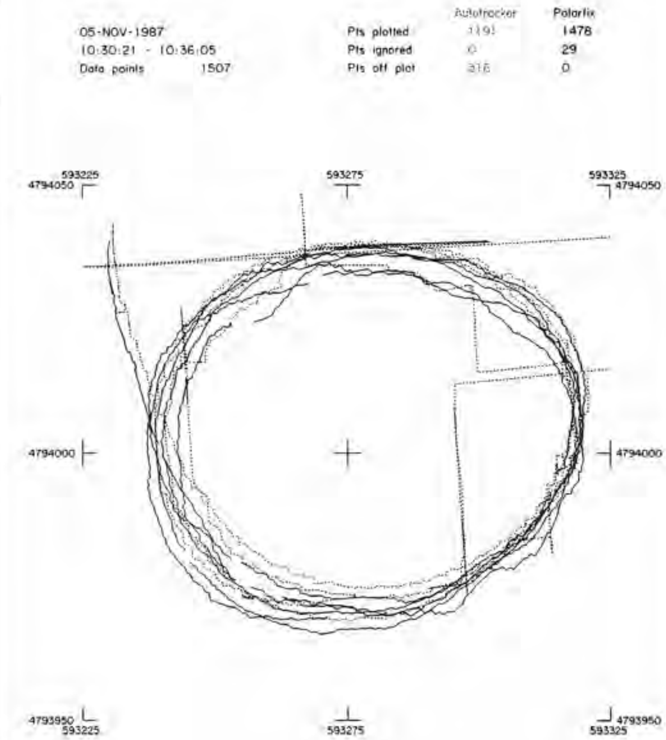


Figure 4: Circles @ 3500 m

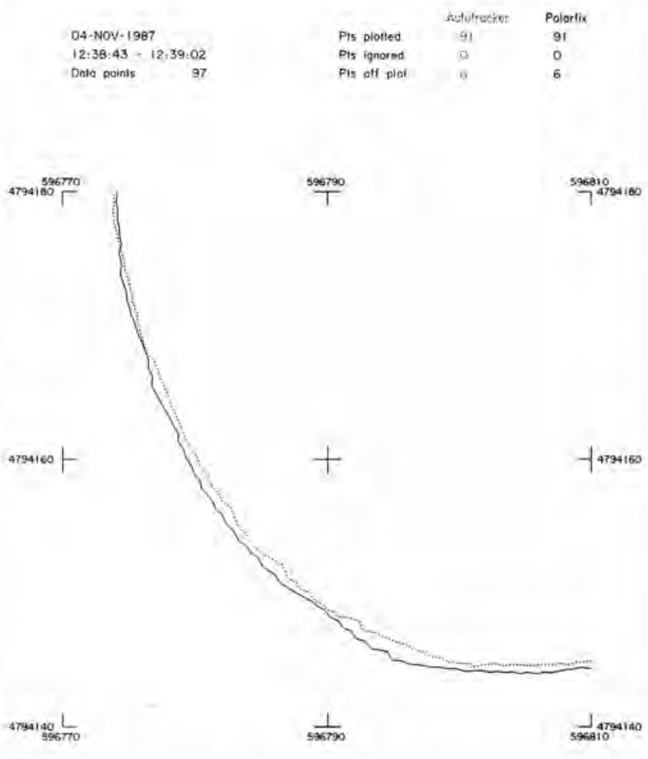


Figure 3: Line of Circle @ 500 m

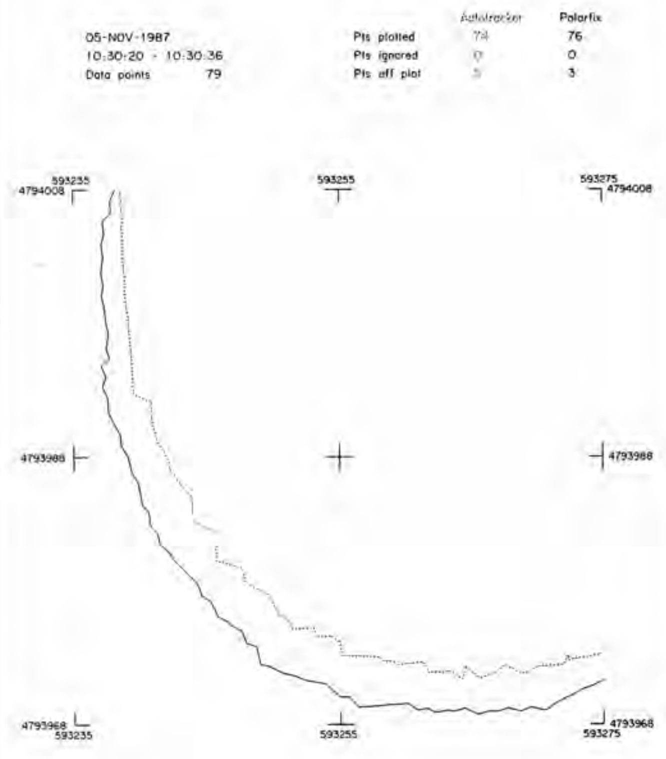


Figure 5: Line of Circle @ 3500 m

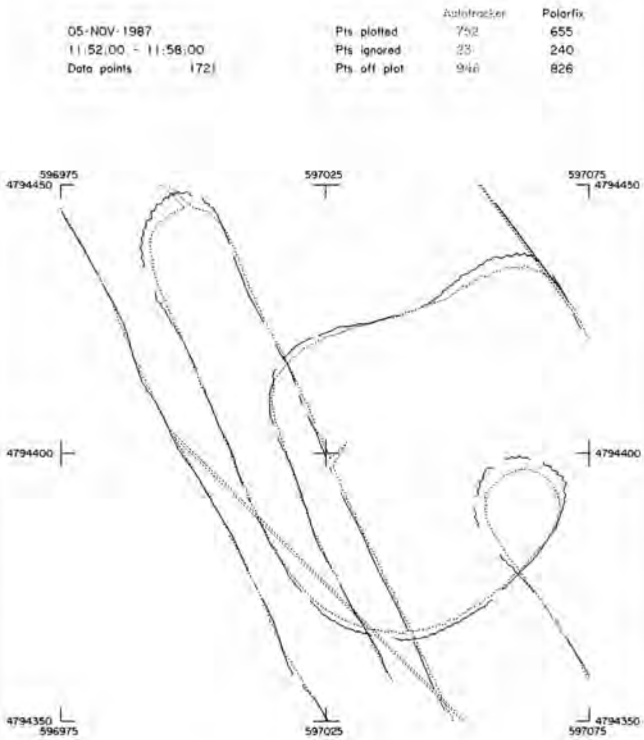


Figure 6: Corners and Lines @ 500 m

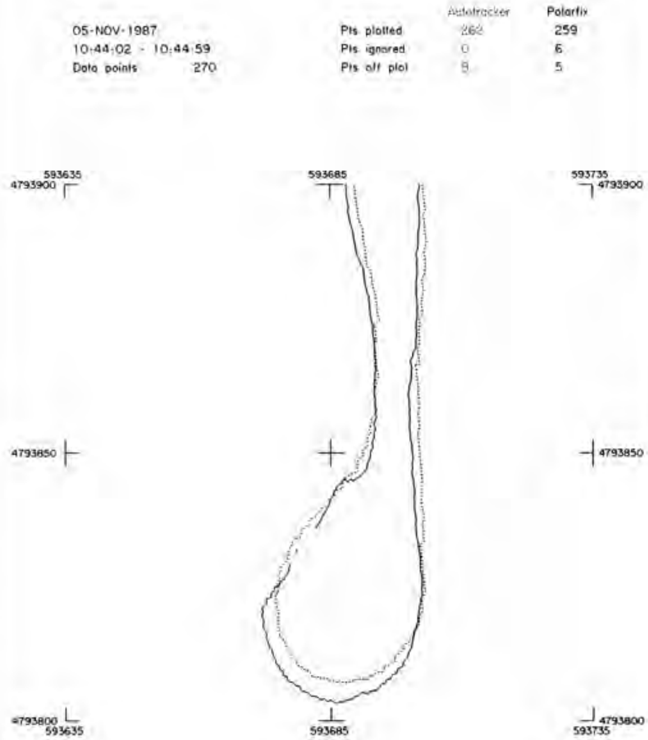


Figure 8: Corners @ 3500 m

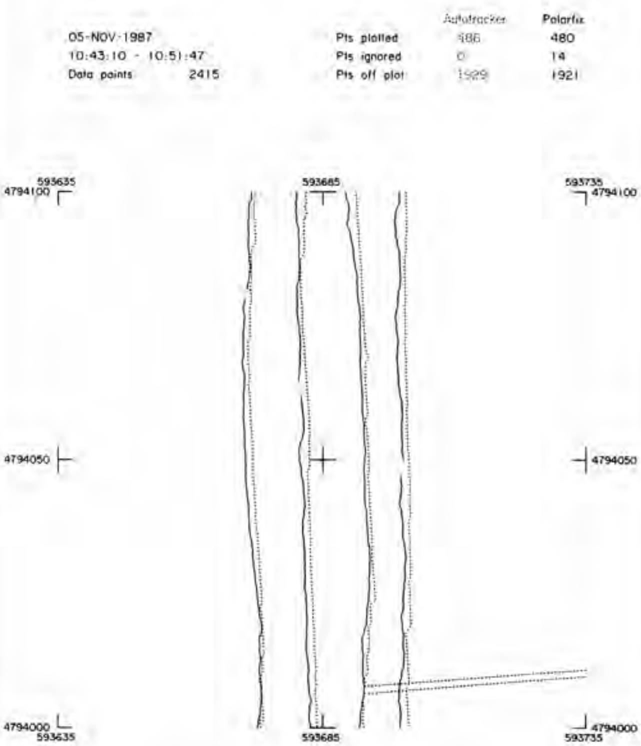


Figure 7: Lines @ 3500 m

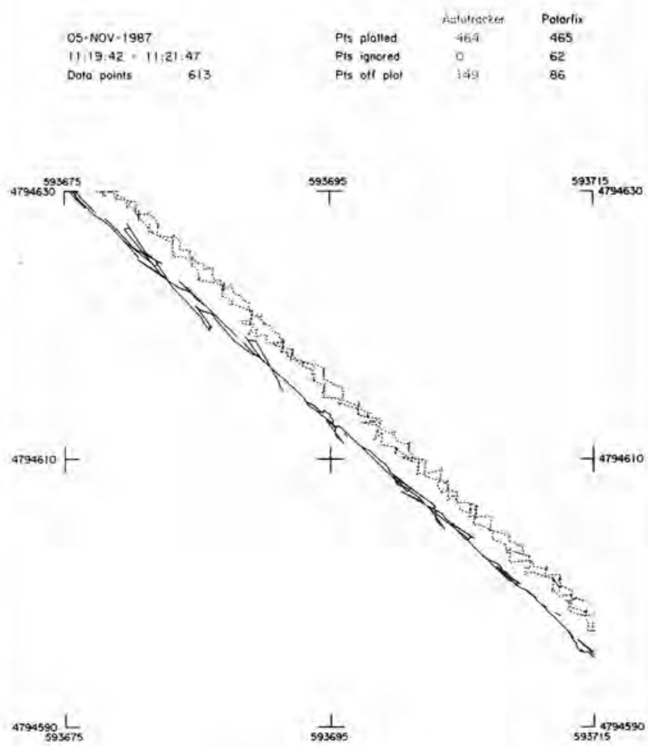


Figure 9: Walk @ 3500 m

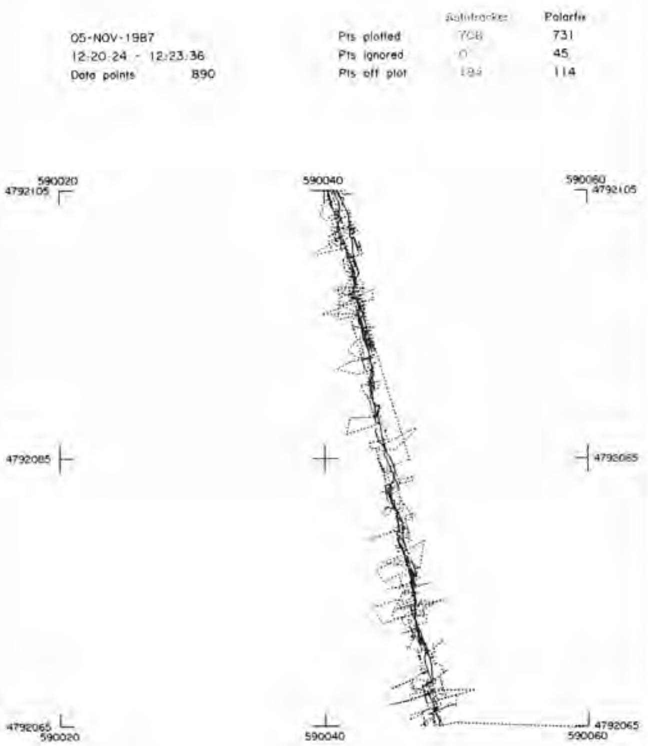


Figure 10: Walk @ 7000 m

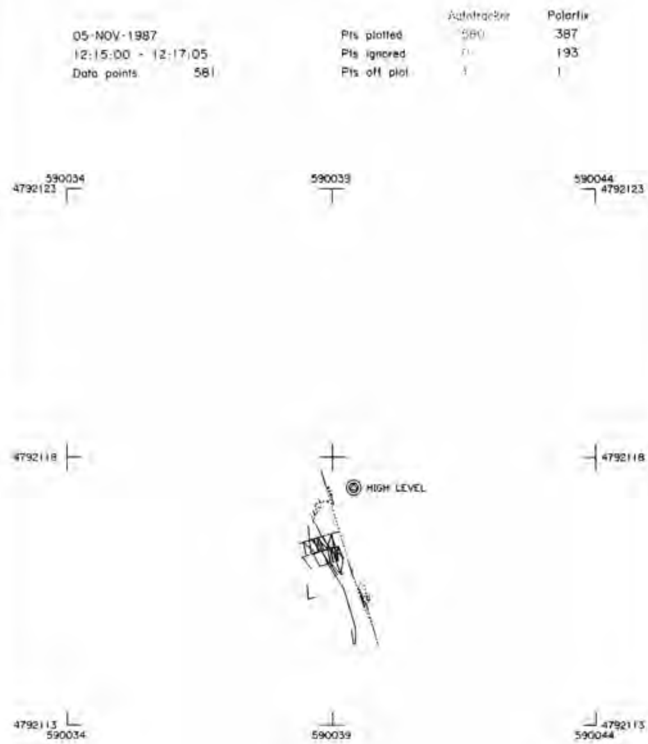


Figure 12: Static 6 Prisms @ 7000 m

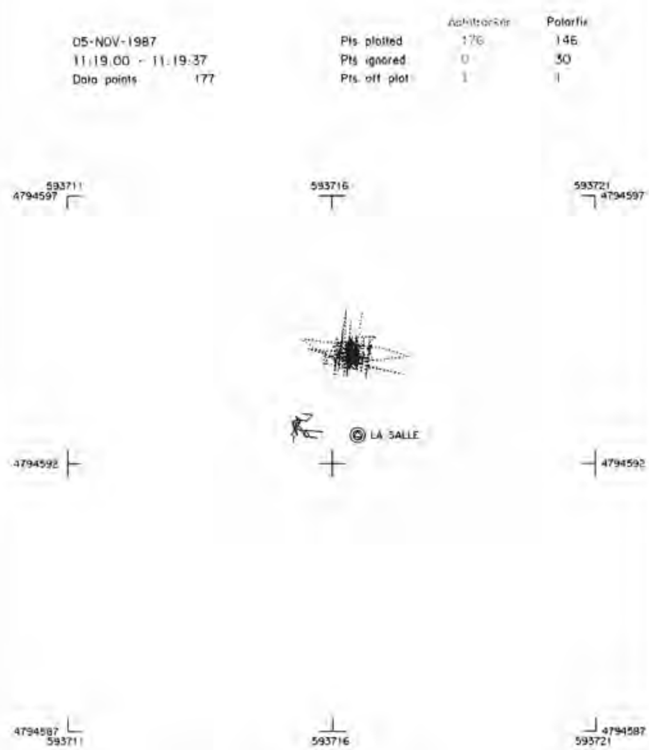


Figure 11: Static @ 3500 m

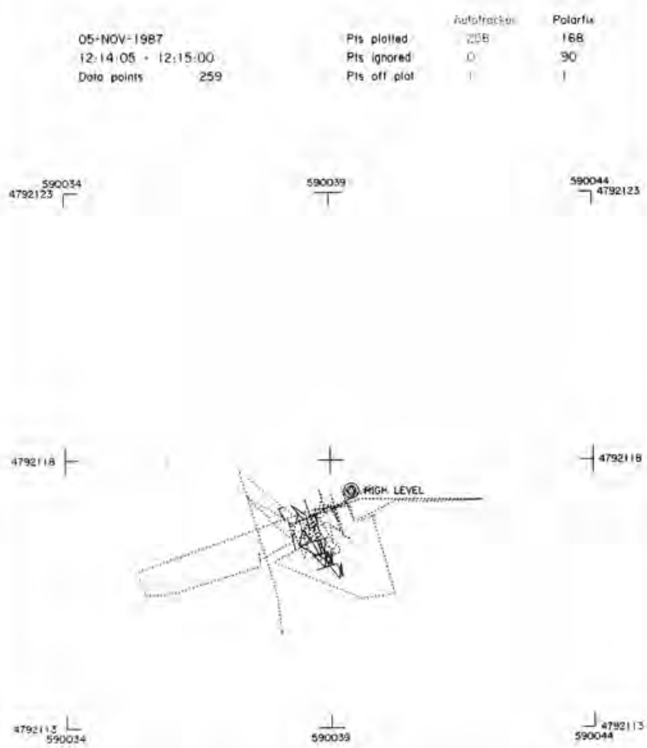


Figure 13: Static 8 Prisms @ 7000 m

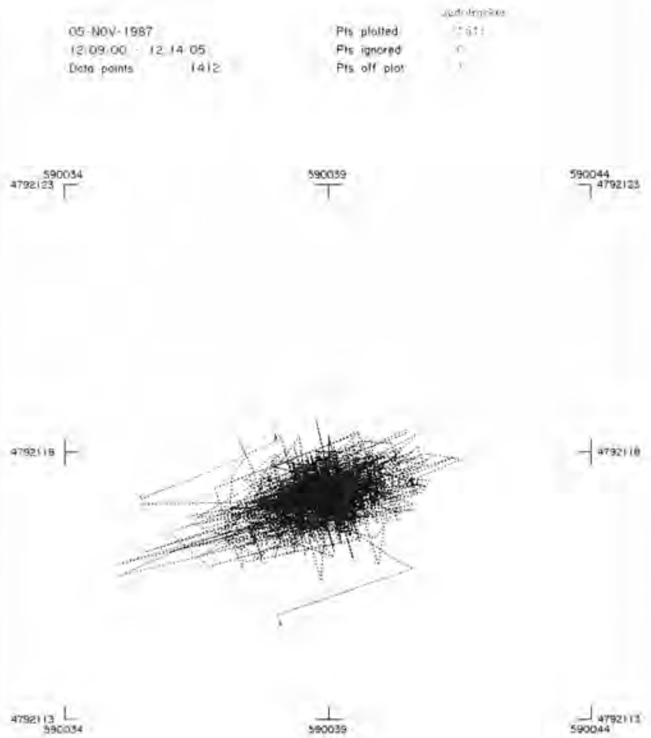


Figure 14a: Static 10 Prisms @ 7000 m

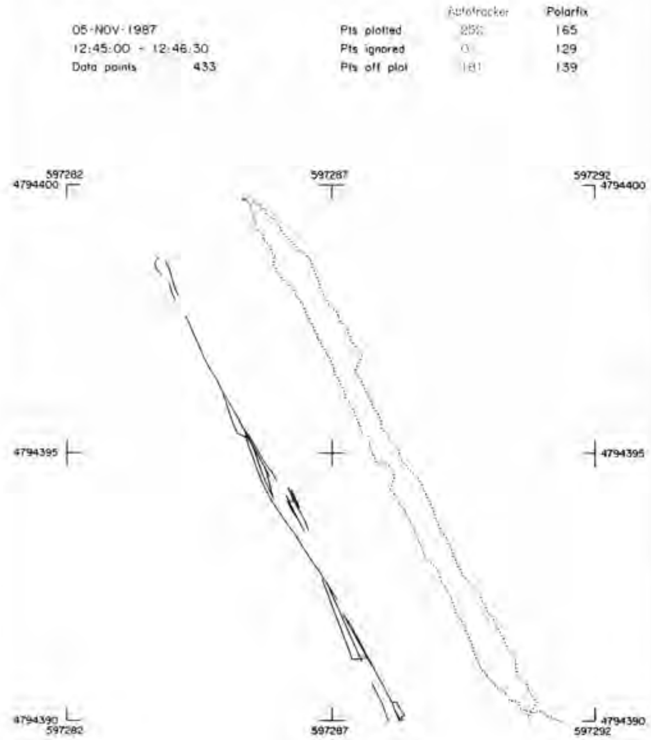


Figure 15: Window Walk @ 150 m

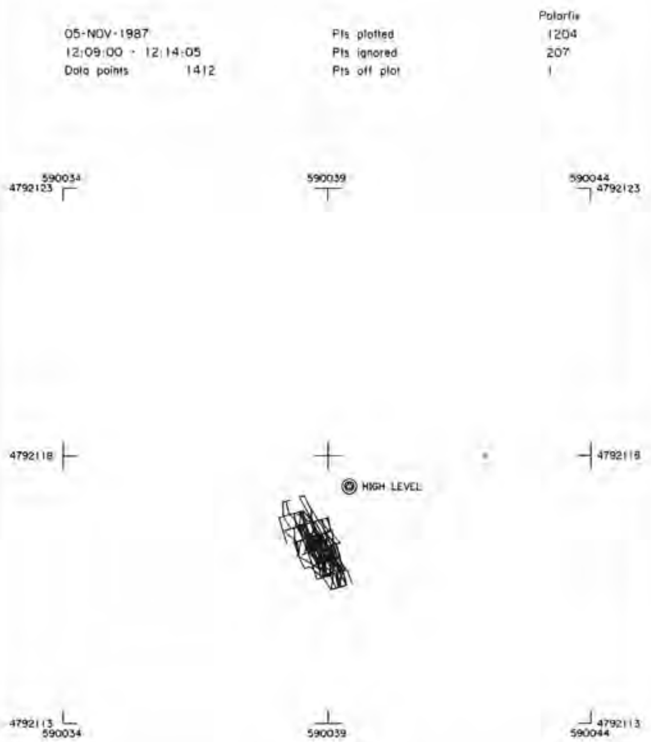


Figure 14b: Static 10 Prisms @ 7000 m

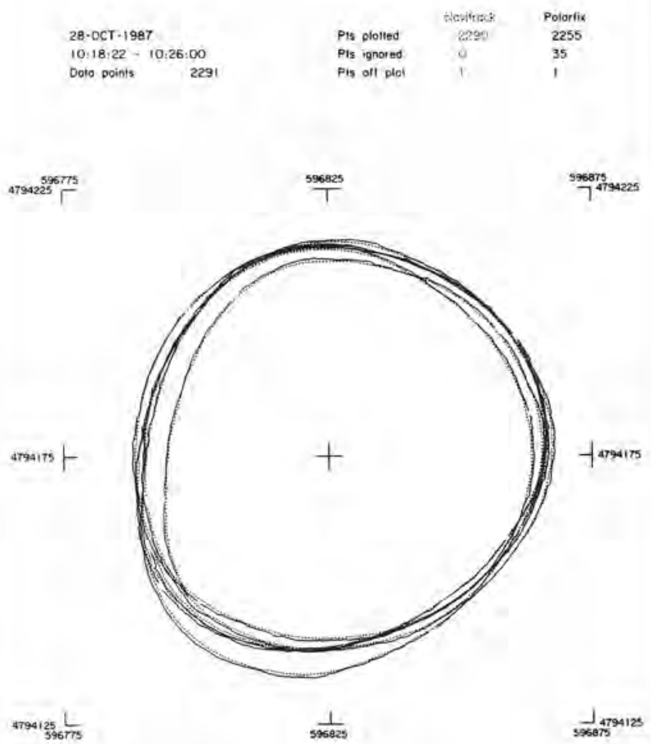


Figure 16: Circles @ 500 m

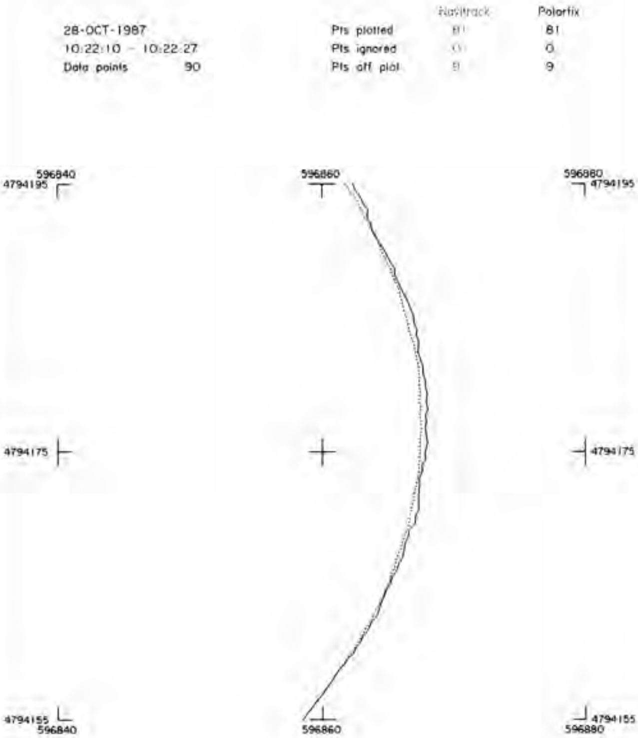


Figure 17: Line of Circle @ 500 m

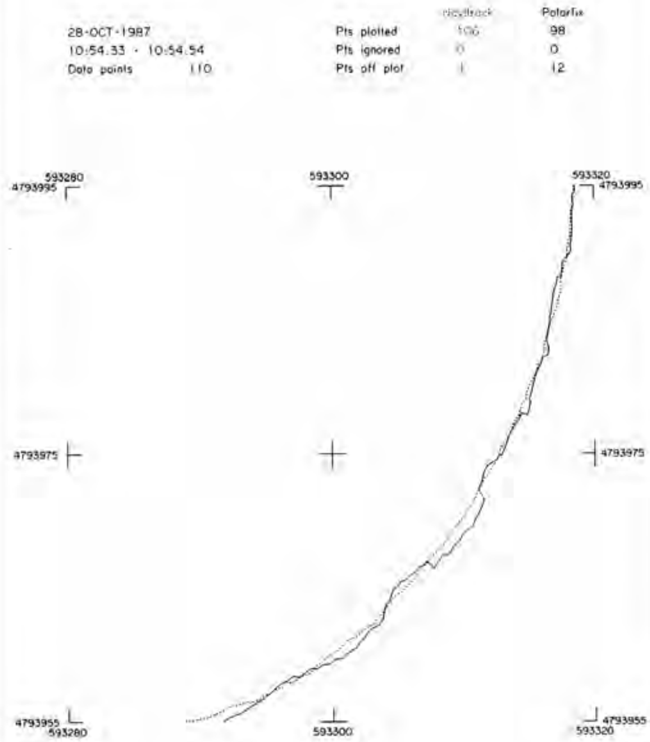


Figure 19: Line of Circle @ 3500 m

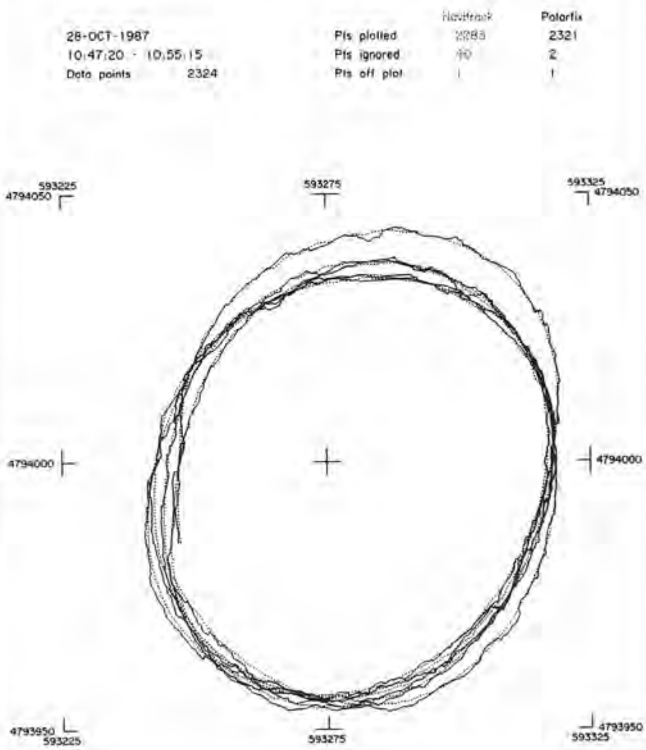


Figure 18: Circles @ 3500 m

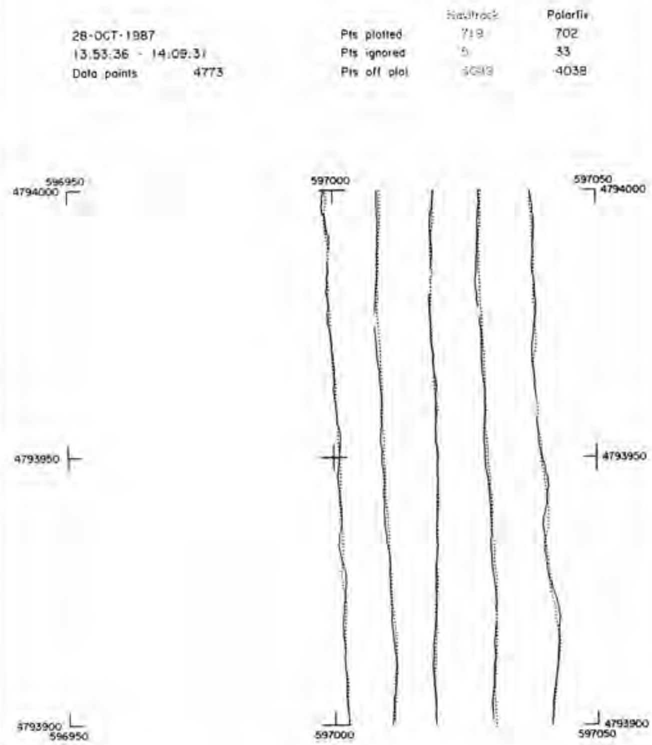


Figure 20: Lines @ 500 m

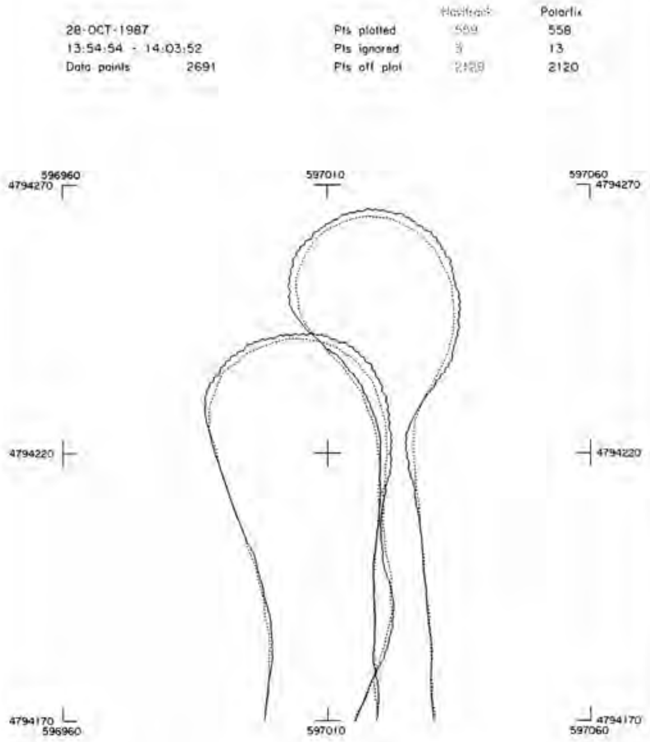


Figure 21: Corners @ 500 m

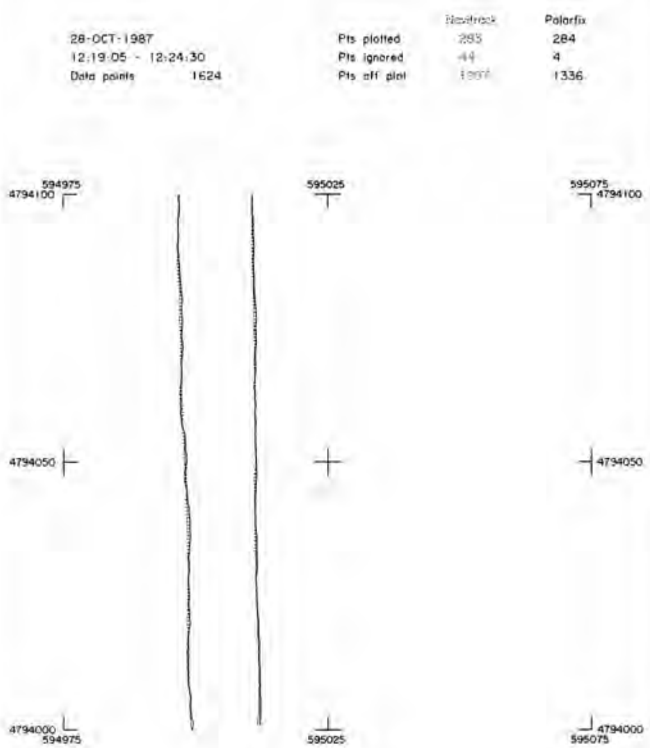


Figure 22: Lines @ 2500 m

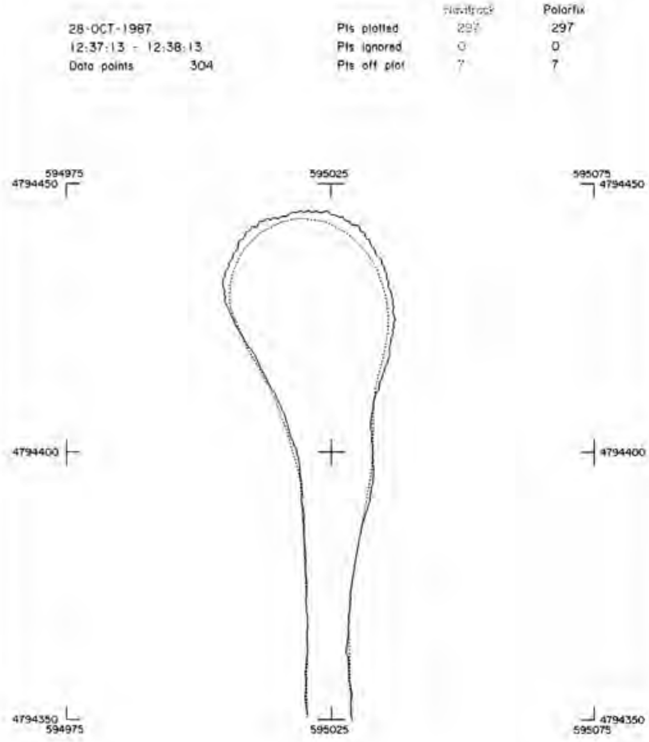


Figure 23: Corners @ 2500 m

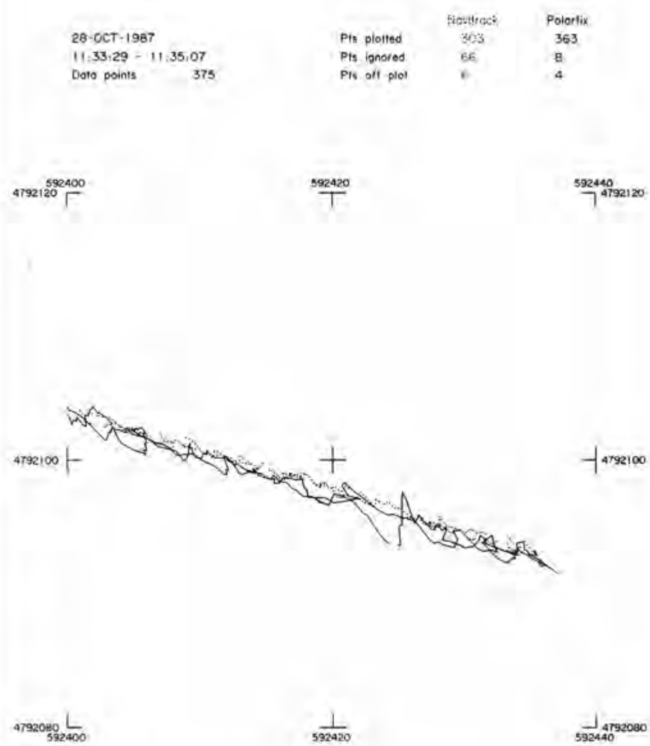


Figure 24: Walk @ 5000 m

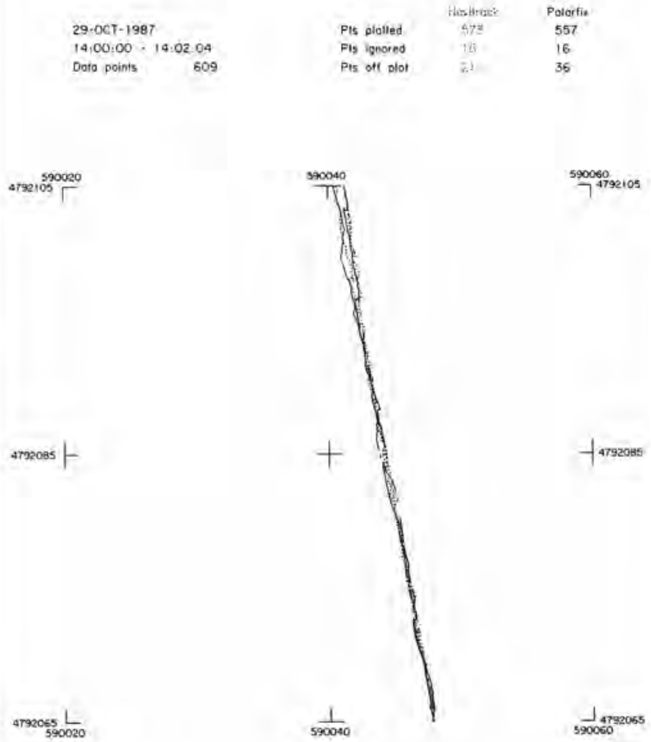


Figure 25: Walk @ 7000 m

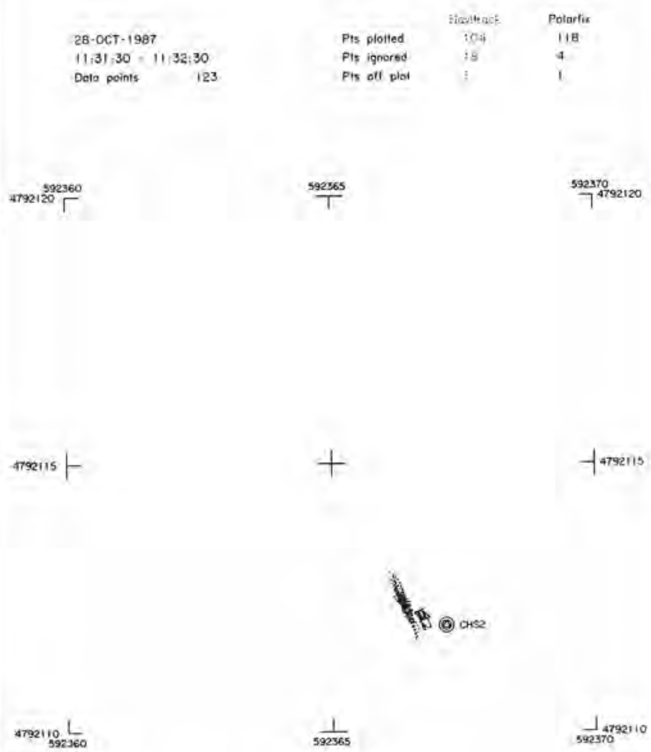


Figure 26: Static @ 5000 m

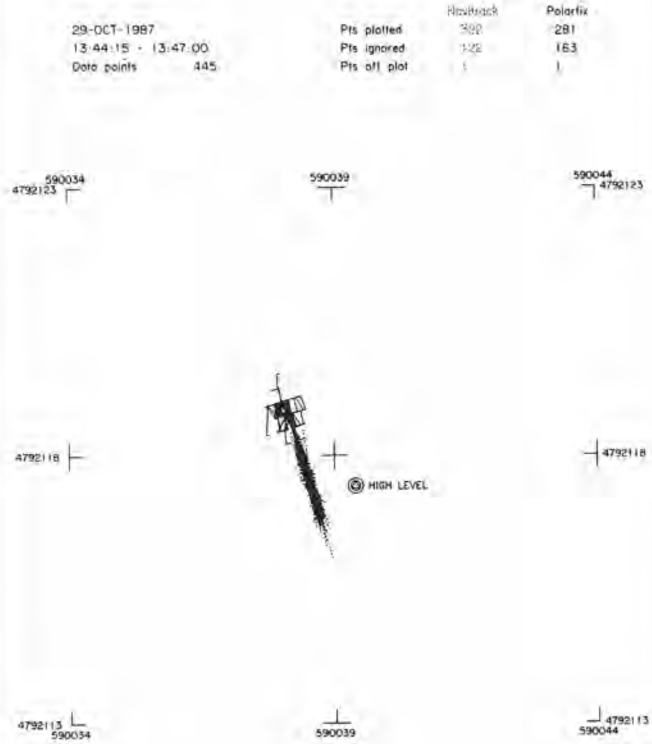


Figure 27: Static 6 Prisms @ 7000 m

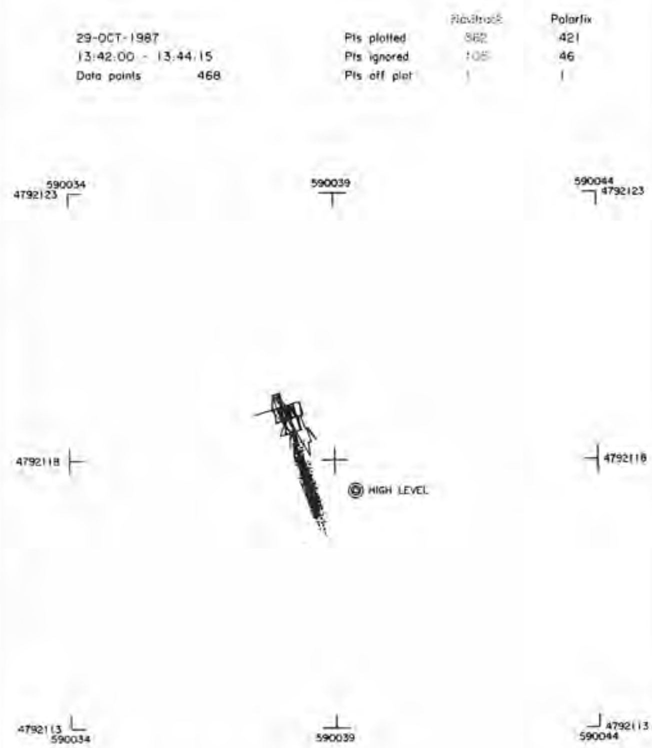


Figure 28: Static 8 Prisms @ 7000 m

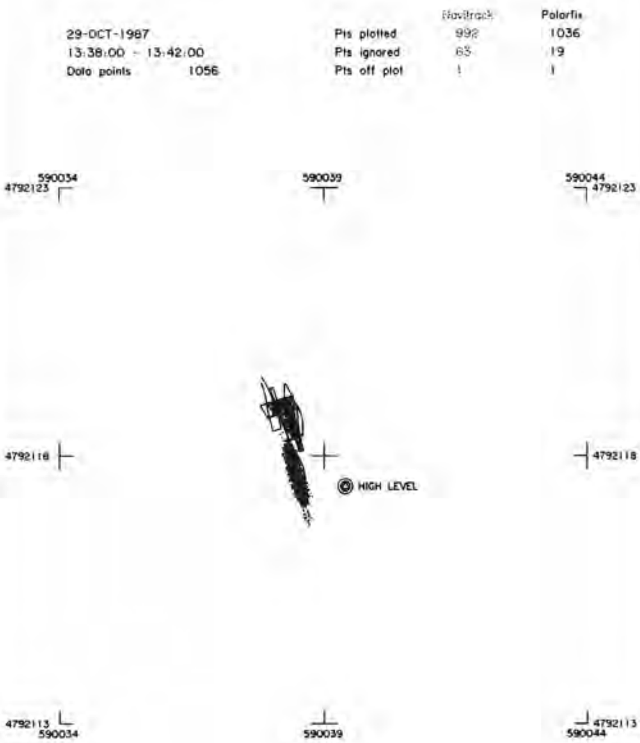


Figure 29: Static 10 Prisms @ 7000 m

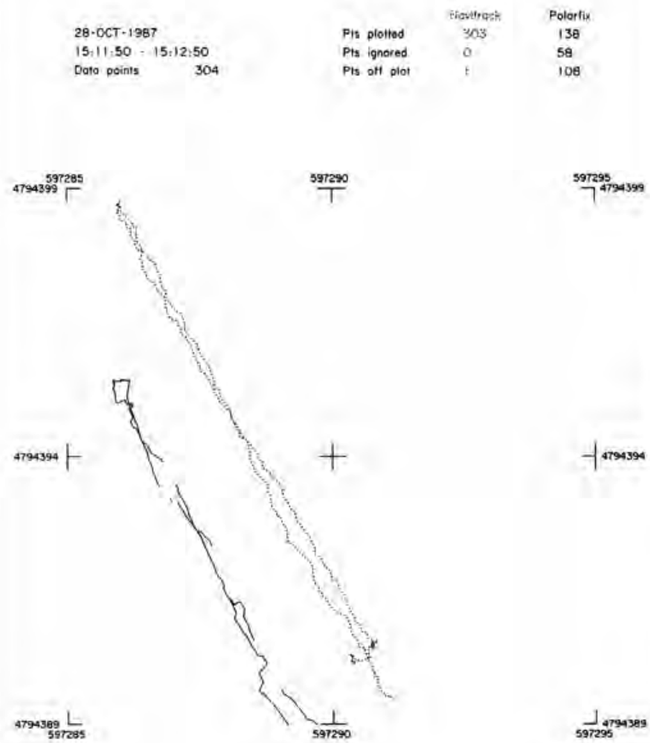


Figure 30: Window Walk @ 150 m

The LORAN-C says we're in Trinidad

The Canada-France Border Dispute

by

R. Karczuga

The G. E. Wade Essay Award was established by Central Branch of CHA in 1987 in memory of the late Gerry Wade who was a very active and respected member of Central Branch, and who was the National President of CHA in 1977. After some 37 years of service (26 with CHS) Gerry took "early" retirement in 1977 to established the Hydrographic Surveying Program at Humber College, himself teaching courses in the program. He was also instrumental in helping establish the similar program at Erindale College of the University of Toronto. Gerry was very interested in encouraging his students and so we felt it fitting to establish an annual award in his memory to encourage good writing skills in students enrolled in hydrographic and cartographic courses. Winning entries are submitted to the editor of Lighthouse for possible publication and will also receive cash prizes of $50.00 or $100.00 at the judges' discretion.

Entries must be received in Central Branch by 29 May each year and can be on any aspect of hydrography or cartography. Many college and university course assignments are eligible. The prospect of a $50 or $100 cash prize will make such assignments more interesting and worthwhile to students, and publication in our journal will encourage students to refer to such journals in their subsequent research.

Five entries were received in this first year of the G.E. Wade Essay Award, and the judges awarded Honourable Mention to Ryk Karczuga for his Overview of Microfix 100C and Mini-Ranger Positioning Systems, a report submitted as part of a course in Hydrographic Survey Technology at Humber College of Applied Arts and Technology. This report is some 70 pages in length and as it was written from the point of view of the user it makes an outstanding supplement to the manufacturers' literature. The judges also awarded the First Prize of $100.00 to Ryk Karczuga for his essay on the recent fishing dispute between Canada and France. This essay: The Canada-France Border Dispute - St. Pierre and Miquelon was submitted by him as an assignment on Maritime Law and is now published here with his consent. We have made no effort to judge the opinions or conclusions expressed by the author of this paper, and the opinions expressed are not necessarily the opinions of the editor of Lighthouse or of the Canadian Hydrographic Association.

It may seem strange that Canada and France have an ongoing border dispute. The two countries are separated by the huge expanse of the Atlantic Ocean. Yet, the dispute has become very heated over the years, with complex economic and political issues to be resolved. Whether a solution which is agreeable to all parties can be reached depends on the cooperation of all parties concerned. There are more than two interested parties who may agree or disagree, depending on the issue.

The dispute is centered around the small islands of St. Pierre and Miquelon, located approximately 27 kilometres south and west of the Burin Peninsula, Newfoundland. The French claim sovereignty to this small chain of islands, and demand all rights granted to a state under international law. This, of course, includes the rights granted under the "United Nations Convention on the Law of the Sea" which allow a coastal state to claim a 12 nautical mile territorial sea and 200 nautical mile exclusive economic zone (EEZ). The 200 nautical mile limit is the issue of the dispute, since the EEZ gives the coastal state all rights over marine exploitation, of which fishing is the most important in this area.

Prior to 1977, the 12 nautical mile limit was generally recognized as the 'official' extent of a coastal state's jurisdiction over the adjacent waters. However, nations realized that great amounts of wealth could be exploited from the sea, and one of the provisions of the "United Nations Convention on the Law of the Sea" gives the coastal state rights over waters extending 200 nautical miles from baselines used to establish the territorial sea limit. These rights include control over marine life and mineral resources, with provisions being made to prevent over-exploitation such as over-fishing which may cause extinction or poor quality stock. The provisions also allow other states to exploit an EEZ, as long as permission is granted, regulations are adhered to and quotas are met.

In 1977, Canada declared a 200 mile EEZ which honoured the territorial limit of St. Pierre and Miquelon. In 1978, France declared a 200 mile EEZ around the islands of St. Pierre and Miquelon. Because of the proximity of St. Pierre and Miquelon to Canada, the two EEZs overlapped. The area of dispute is the approximate size of Nova Scotia, and has abundant fish stock. Most of the dispute is focussed on fishing rights.

Since the declaration of the EEZs by both Canada and France, incidents have occurred which have kept tension between the two countries quite high at the diplomatic level. A third party may be needed to resolve the dispute, as was the case in the Canada-U.S. Gulf of Maine dispute.

The disagreement has created friction between four parties: the Government of Canada; the Government of France; the fishermen of St. Pierre-Miquelon; and, the fishermen of Newfoundland. It is the fishermen of the area who have suffered the most, since their livelihood is dependent on the fish they catch. Since 1977, both Canada and France have harassed the other's fishing boats in the area each claims as its own.

When the Canadian Government claimed its EEZ in 1977, a quota on allowable fish catches was introduced: 6400 tons in the disputed area. To a certain degree, this quota was imposed when the French Government declared its right to a 200 mile EEZ around the islands of St. Pierre-Miquelon. The two countries suspended all drilling operations in the disputed zone until an agreement could be reached. The fishing quota imposed by the Canadian Government was used to get the French Government to seriously negotiate, so that an amicable solution could be attained.

During the years from 1977 to 1984, French trawlers fished in the area, and obeyed the quota restrictions as outlined by the Canadian Government. There were a few isolated incidents which led to diplomatic notes being exchanged by the two countries. For example, a French Naval tug stopped and inspected two Canadian boats in 1981 and, in 1982, the Canadian Government started inspecting and detaining French trawlers by strictly enforcing inspection regulations.

Some French trawlers were taken into custody, with large bonds being paid before the ships were permitted to leave. Both Canada and France used these harassment techniques to induce the other into negotiating a resolution of the boundary dispute.

In 1984, the French trawlers started to blatantly over-fish the area where quota restrictions were in force and, in some cases, catches four times the allowable maximum were being taken by the French fishing vessels. This not only disturbed the Canadian Government and Canadian fishermen, but also the fishermen of St. Pierre-Miquelon, for it was their waters, as well, that were being over-fished. There was not much the Canadian Government could do, except watch and monitor the chronic over-fishing by the French trawlers.

The only recourse left for the Canadian Government was to send the dispute to international court, as negotiations with France were at a stalemate. Over-fishing was depleting local catches and seriously threatening the economy of the area. However, before France would permit arbitration by a third party, they insisted that Canada increase the fish quota between the years of 1988 and 1991.

In February of 1987, the Canadian Government agreed to this proposal, on condition that the dispute be taken to third party arbitration on the international level. This action was opposed by the Atlantic Provinces, who claimed that the Federal Government was 'selling them out'. The resultant furor caused the Federal Government to back down on its promise to allow larger quotas in return for third party arbitration. In fact, Prime Minister Mulroney wrote an apologetic letter to one of his own cabinet ministers, then Transport Minister John Crosbie, a native Newfoundlander, who had criticized the government's proposal. In the letter Prime Minister Mulroney said, "Canadian interests, not relations with France, are the paramount consideration".

In March of 1987, the Canadian Government closed all Canadian ports to French trawlers. This was done for two reasons: to appease the Atlantic Provinces; and to put diplomatic pressure on the French and thus force a resolution to the dispute by means of international arbitration. Meanwhile, the fishermen of St. Pierre-Miquelon were demanding larger quotas for themselves, and friction between the Canadian Government and St. Pierre-Miquelon also increased. In June of 1987, then French President Mitterand, when visiting Quebec, stated adamantly that no further negotiations between Canada and France would be possible until Canada opened its ports to French trawlers.

By October of 1987, no progress in negotiations had been made, and Canada cancelled all fishing rights to French trawlers for the subsequent year. Tension is still high between the two countries. A French fishing vessel, with officials from the Government of France on board, is currently taunting the Canadian Government by disobeying the restriction. The crisis is reaching a point where diplomatic relations between the two countries may become seriously strained, with repercussions being felt, not only in the fishing industry, but in other economic unions between the two countries. For example, Canada is currently shopping for nuclear submarines. France produces one of the submarines in which the Canadian Government has shown interest. The territorial dispute, as it exists now, may affect a large international deal such as this.

The dispute must be settled soon. Current tension and years of stalemate must be resolved by an unbiased third party of international esteem. What would a third party decide as being a fair compromise for all parties concerned?

By the provisions of the Law of the Sea, every coastal state is entitled to control waters within its EEZ. The provisions also state that all exploitation of the seas should be of such a nature as to preserve and replenish marine life, allowing mankind to harvest the seas indefinitely. The provisions of the Law of the Sea also give due regard to informal boundaries that exist due to historical convention, and it is this provision of the Law of the Sea that may ultimately decide the fate of the dispute.

Canada, is following guidelines outlined by the Law of the Sea, to reach an amicable solution to the dispute. The French Government has made no effort to reciprocate the actions. Although the dispute is very complex, and both countries can gain or lose large portions of quality fishing grounds, one solution is reasonable for all parties concerned. The disputed area should be given to Canada so that Canada can claim the area under the jurisdiction of its EEZ, but a provision should be made to give the fishermen of St. Pierre-Miquelon the right to fish the areas, as if it were their own EEZ. Any fish not harvested by the fishermen of Canada and St. Pierre-Miquelon could then be harvested by France. A fish quota system would have to be worked out, so that the economies of the Atlantic Provinces and St. Pierre-Miquelon would not suffer. Also, preservation of fish species should be a consideration in the quota system.

The historical aspect of the area, in terms of the Law of the Sea, will be an important factor if the dispute ever goes to international court. The Canadian Government used this aspect of the Law of the Sea during the International Court hearings regarding the dispute surrounding the Gulf of Maine. Many insiders consider that the final ruling was based on this historical aspect, and that Canada did well in terms of the final ruling.

Another solution may be to form a governing body, made up of all parties concerned, to rule the area. Representatives from Canada, France, the Atlantic Provinces, St. Pierre-Miquelon and some internationally appointed neutral party, would then oversee the disputed area, ensuring that exploitation would not become rampant, and that all parties concerned would benefit as decreed by any agreements or treaties.

Whether some solution will finally be reached is still to be seen. International negotiations of this kind can last for several years, and any agreements must be upheld by all signing parties. The Law of the Sea is still in its infancy, and it is cases like this that will eventually shape the future and outcome of similar disputes. All nations must make a genuine effort to negotiate fairly, so that all may share in the wealth of the sea.

News From Industry

Klein Associates

Klein Associates have recently introduced the new Klein Digital Sonar System 590, an advanced new high-resolution side scan sonar system with simultaneous dual frequency scanning. It uses the Simultaneous Dual Frequency 100/500 kHz towfish and records the four sonar channels (both frequencies on both sides) on plasticized thermal paper with a resolution of 8 dots per linear millimetre (203 dots per inch), giving a density of 64 dots per sq. mm. The system uses the Model 595 Transceiver Graphic Recorder which features operator-friendly but fool-proof controls that won't let an unwary operator impair the performance of the equipment.

Klein Model 595 Digital Sonar Recorder

The new Klein Model 595 Recorder can also simultaneously operate a 3.5 kHz Sub-Bottom Profiler and output all five channels to a magnetic tape recorder, though only four channels can be displayed. The recorder interfaces with existing Klein cables and towfish, making it easier to update present systems. Klein reports that this new system has been selected by the Royal Australian Navy for use in mine location in its Craft-of-Opportunity Program after two weeks of field trials with four similar systems.

Klein also announce the completion of a contract for 16 of their MK 24 Underwater Ordnance Locators for the US Navy. This was after tests where the MK 24 side scan sonar investigated a field of dummy mines.

Klein's Full Ocean Depth Side Scan Sonar was used recently to locate the wreckage of a South African jumbo jet 747 which disappeared in the Indian Ocean off Mauritius. The search was carried out by Steadfast Oceaneering, a subsidiary of Oceaneering International. The wreckage was found after some 13 hours of searching with the dual frequency SSS in depths of 14,600 feet in an area of rough sea bottom.

Surnav Corporation

Surnav tell us of three new GPS products from Trimble Navigation. The 4000SL Surveyor is a lightweight backpackable GPS system offering pre-programming and internal data logging. The 4000SLD Surveyor is a dual frequency version of it featuring up to 5 satellites on each channel for static work or 10 channels for kinematic surveying. The GPS Pathfinder is a rugged navigation and position-logging system offering 3 to 5 metre accuracy and internal RAM data recording up to 448K.

Navitronic

Navitronic of Denmark tell us of their new portable hydrographic echo sounder Navisound-10 for use in depths up to 300m. The Navisound-10 is a low-cost lightweight unit for use in even the smallest vessels and features digital output as well as the analog record. It has standard output for connection to a computer or a data logging system, and 200 kHz or 50 kHz transducers can be used.

Navisound-10

Krupp Atlas Elektronik

Krupp Atlas Elektronik report that two of their Polarfix laser range-azimuth positioning systems have been ordered by the US National Ocean Service of NOAA, Norfolk, Virginia for high precision survey work in East Coast, Gulf of Mexico and Great Lakes regions. The Polarfix system operates from a single shore-based tracking and control unit with a set of target prisms on a survey launch and can be operated unattended using remote computer control. The systems ordered by NOS are to be used in conjunction with a series of five survey launches, and are being interfaced with hydrographic data acquisition systems.

Krupp Atlas Elektronik have also perfected the Fansweep Swath Sounding System. This uses beam-forming techniques to allow 100% coverage of the bottom from a single transducer assembly. No longer do you need a boom system of transducers to get full swath coverage of the bottom! The Atlas Fansweep system is a multibeam echo sounder for use in depths of 100m or more and employs a fan with a choice of up to 52 beams. It scans the bottom within a sector of up to 128 degrees, thus covering a swath width of 4 times water depth. The transducer of this Fansweep system can be mounted in-hull or over-the-side from a vessel-of-opportunity and as well as on on-board colour display the data can be integrated with positioning systems and can be post processed.

Technical Survey Services Ltd
TSS announce that their 320 Heave Compensator has been selected by Ross Laboratories Inc of Seattle, USA, for use in their SWATH echo sounder system. Ross ordered the 320 after lab tests and sea trials of several types of heave compensators. The SWATH system incorporates several echo sounder transducers mounted on booms on either side of a survey vessel, and the TSS 320 makes real-time corrections for heave, roll and pitch for each transducer. The result is an accurately compensated band of soundings providing clear bathymetric charts.

TSS 320 Motion Compensator

The TSS 320 has also been purchased by the Port of London Authority for surveys in the Thames Estuary. With the 320 they can continue survey work in rougher sea conditions and this has been so successful that they have ordered a TSS 320 for another of their survey vessels.

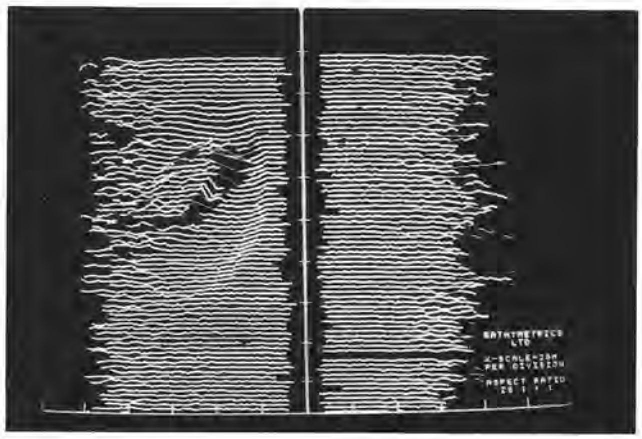
The Royal New Zealand Navy has also ordered four of the TSS 320 Heave Compensators (complete with the optional pitch and roll sensors) for use in their survey vessels.

Andrews Hydrographics Ltd
Andrews Hydrographics have produced an editing and post-processing package for hydrographic surveys. The software is written machine-independent so it can be used on most personal computers such as IBM, DEC and Amstrad as well as offshore survey computer systems such as Hewlett Packard. The program can handle thousands of soundings and navigation data and can produce fair sheets, dredge volumes and 3D contours. It is interactive, allowing clean up of data by recalculations or editing parameters, and other functions include tidal corrections, overplot removal and an ASCII plot file. Coastlines can be added either from a keyboard or from a digitizing program, and the software also allows data collected to be transferred to more powerful in-house computers for post-processing.

Qubit
Qubit's Mine Surveillance System (QMSM) is based on portable systems available commercially so that it can be easily installed on craft-of-opportunity. The QMSM includes high resolution side scan sonar, the TRAC IVB integrated navigation positioning system, and the QASAR sonar analysis and reduction system.[photo available]

The complete system provides real-time targeting and analysis to help the operator study his targets, pinpoint their positions using the touch-sensitive screen, and make comparisons with other targets. All this with high-resolution logging and a range of digital sonar enhancement techniques. The operator can later fast-scan the record to edit earlier interpretations, and he can plot a complete overview or isolate specific track lines or groups of targets. Recent trials have shown position relocation and repeatability of better than 5 metres.

Qubit also report that their Qubit TRACIVB integrated navigation system has been used by Bathymetrics with their Bathyscan swath sounder to process the positions of soundings. The Bathyscan swath sounder has been used on surveys of platform sites, sand waves and rock outcrops on the west coast of Scotland and also on a trench in Chesapeake Bay. Results can be portrayed on a 2 metre matrix - an interesting wreck, for instance - but generally a 5 m matrix is used.



Bathyscan Swath Sounder record

Wide swath sounding produces a much greater density than regular sounding and thus eliminates missed shoals as well as giving a means of quality control. And the surveyor can typically record depths over a 200 metre strip of the seabed in a single pass.

Simrad Subsea
Simrad Subsea is introducing a new low-cost portable Hydroacoustic Positioning System. The rugged HPR 300P is designed for applications such as ROV or tow-fish and is

compatible with existing HPR transponder channels. The Simrad HPR 300 is based on the super-short baseline technology used in the HPR 309 system and only one onboard portable transducer is needed for positioning. The transducer is omnidirectional with automatic roll and pitch compensation and is designed for over-the-side as well as in-hull mounting. All functions are controlled by a joy-stick from a standard colour monitor.

Simrad HPR 300

MARIN (Maritime Research Institute Netherlands)
Here's one for our mariners. Marin report that the Rotterdam Municipal Harbour Board is introducing simulator training to give ship-handling experience in a tricky part of a ship canal. It simulates ship handling in a variety of wind conditions and uses a ship's bridge simulator.

They mention that such simulated experience may well become increasingly important in training job skills. Sounds great. But does this system also simulate the distressing effects of a splitting headache, a touch of flu, sleepless nights, long hours of 2-minute fog horn blasts, and a sudden blinding rainstorm?

Appointments
Trevor Illingworth is now Sales Manager with Technical Survey Services Ltd. of England. Qualified as a Master Mariner, he has recently been Project Sales Manager with Unitor Ships Service and has experience both as Marine Surveyor and in Technical Sales. His responsibilities now include worldwide sales of the TSS geophysical and hydrographic survey equipment product lines.

John Hammer has moved to Qubit, manufacturers of integrated navigation survey systems, in their recently-opened North American office in Rockville, Maryland. Formerly with the US Defence Mapping Agency, Mr. Hammer has some 23 years experience in hydrography, oceanography and mapping.

Karl Kieninger has accepted an appointment as Manager for Marine Systems of the US Division of Krupp Atlas Elektronik at Clark, New Jersey. Formerly Chief of the Hydrographic Survey Branch of NOS at Norfolk, Virginia, his responsibilities now include marketing of Krupp Atlas hydrographic survey systems throughout North America.

Dr. Vincent B. Robinson has recently been appointed as Director of the Institute for Land Information Management (ILIM). This is a new unit at at the Erindale Campus of the University of Toronto, and Dr. Robinson will have overall responsibility for all ILIM issues: scientific, technical, social, economic and legal. Institute activities include research in land information management as well as development, training programs and consultative services to clients.

Dr. Gerard Lachapelle has accepted a professorship with the Department of Surveying Engineering at the University of Calgary. His responsibilities include hydrographic and offshore surveying and other aspects of geodesy, and he will continue his research on positioning and navigation systems. Dr. Lachapelle joins a strong team already active within the department, and the hydrographic and offshore surveying program is being re-designed and enhanced to ensure that it meets FIG IHO criteria on Standards of Competency for Hydrographic Surveyors.

General
The International Association of Geodesy has established a Special Study Group on GPS Kinematic Positioning Methods and Applications. The President of this SSG is CHA member Dr. G. Lachapelle, and several other members of the group are also CHA members.

The Canadian Association of Aerial Surveyors (CAAS) has changed its name to Geomatics Industry Association of Canada (GIAC). Since 1961 CAAS has represented firms offering aerial photography and mapping, and with services now covering the entire geomatics field the name change became very appropriate. Member firms now employ computer graphics, satellite positioning and imaging systems as well as offering land surveying, geodesy, hydrographic and GIS services.

The Sherbrooke Institute of Cartography has changed its name to the Canada Centre for Geomatics to better reflect its activities. The CCG will establish and maintain the National Topographic Data Base to facilitate map production and revision, and this will also satisfy the requirements of the new GIS used for land and environment management.

Sustaining Members

Several firms in Canada have expressed interest in having closer links with the CHA because of their close involvement with hydrography and its technological developments, and because the CHA is the only professional association of hydrographic people in Canada. In 1987 the CHA defined a new form of membership to allow such firms to become more closely involved with the activities of CHA and to maintain closer contact with users of their products. Through our journal Lighthouse these Sustaining Members would also be able to reach a world-wide audience of people involved with hydrographic and cartographic work. This new class of membership is the Sustaining Member.

The benefits of Sustaining Membership include:

- a special Sustaining Member certificate suitable for framing,
- three copies of each issue of Lighthouse,
- copies of the local Branch news letters,
- invitation to participate in CHA seminars,
- an annual listing in Lighthouse,
- an annual 250-word description in Lighthouse and
- discounted advertising rates in Lighthouse.

The Annual Dues for Sustaining Membership in the CHA has been set at $150.00 (Canadian).

The names and addresses of each sustaining member are listed below. In each issue of Lighthouse we will bring you information on some of our sustaining members. This time we have information on Bytown Marine Limited, Institut Maritime du Quebec and SURNAV Corporation.

Aanderaa Instruments Ltd, 560 Alpha Street, Victoria, British Columbia, V8Z 1B2 (contact Gail Gabel)

Bytown Marine Limited, 140 Morrison Drive, P.O. Box 11397, Station H, Ottawa, Ontario K2H 7V1, Telephone: (613) 820-6910, Fax: (613) 726-0266, Telex: 053-4117 (contact Patrick Brassard)

Bytowm Marine Limited is an Ottawa-based company and the Canadian representatives for several international manufacturers of marine electronics, radio communications and water resource monitoring products, including Magnavox, Navitronics, Sercel, Sutron, Cubic Communications and HyGain.

Satellite Navigators, Satellite Communications (INMARSAT) Systems, Hydrographic Sweep Survey Systems and UHF Radio Location Systems supplied by the company's Marine Systems Division are in extensive use throughout Canada with the Canadian Hydrographic Service, Canadian Navy, Canadian Coast Guard and Public Works Canada

The Communications Division specializes in the supply of commercial, industrial and military antenna systems and a full range of HF, VHF and UHF Surveillance Receivers. As a leading supplier to the Canadian Department of National Defence the Communications Division has delivered HF surveillance receivers to the Canadian Navy and HF Tactical Log Periodic antennas to the Canadian Army, including two trailer mounted systems, the firstyof their kind to be deployed in Canada.

The Environment Systems Division specializes in the provision of a wide range of water resource and environmental monitoring systems, ranging from complete Direct Readout Ground Stations and Data Management Software packages used for the collection and processing of remote data received via the GOES satellite system, to Remote Terminal Units, Water Level Monitoring Stations and Weather Imagery Systems, all of which are in use by various Government agencies throughout Canada.

Technical support services to each division are co-ordinated from Ottawa where the company maintains a fully equipped electronics workshop and a comprehensive inventory of spare parts and components. In addition to providing installation, training and field engineering support services the company has recently expanded their engineering capability to include the design and manufacture of prototype electronic equipment.

Corporation des Pilotes du Bas St. Laurent, 340 Dalhousie, CP 38 Stn. B, Québec, P.Q., G1K 7A1 (contact Jean-Yves Roy)

GENEQ, 7078 Rue Jarry Est, Anjou,P.Q. , H1J 1H5 (contact Maurice Parisé)

Institut Maritime du Quebec, 53 St-Germain Ouest, Rimouski, P.Q., G5L 4B4, Telephone: (418) 724-2822, Fax: (418) 724-0606, Telex: 051-8-6510 (contact Claude Jean)

A sustaining member of Section du Quebec, l'Institut Maritime du Quebec is now offering various courses at its Rimouski location. These courses include coverage of navigation, meteorology, seamanship and marine emergency duties and are offered in both English and French.

L'Institut Maritime also offers full length winter courses covering the Standards of Competency set by the International Hydrographic Organization, and these include subjects such as nautical science, marine surveys, terrestial surveys and environment science.

Quester Tangent Corporation, 9865 West Saanich Road, Sidney, British Columbia, V8L 3S3 (contact John Watt)

SURNAV Corporation, 1000-38 Antares Drive, Nepean, Ontario, K2E 7V2, Telephone: (613) 723-1830, Fax: (613) 723-0786 (contact Harold Tolton)

SURNAV Corporation is an Ottawa based company supplying technologically advanced navigation/survey systems, bathymetric systems and tidal and water quality sensors to the Canadian survey marketplace. Present clients include federal and provincial government agencies, oil and gas exploration, dredging, aerial application and aircraft manufacturing companies.

SURNAV represents various international manufacturers including: Del Norte Technology Inc. (microwave and UHF trisponder systems); Trimble Navigation Inc. (GPS geodetic and navigation receivers); TAU Corporation (GPS data presentation software); Krupp Atlas Elektronik (laser positioning and precision bathymetric systems); Comstar Inc. (navigation data processors); and Ocean Data Equipment Corp. (tidal and water quality sensors and bathymetric products).

In addition to new equipment sales, rentals and rent-to-purchase agreements, SURNAV provides an extensive inventory of GPS, microwave and UHF positioning and bathymetric equipment for term rental. All equipment sold or rented is technically supported throughout and after warranty by a fully-equipped maintenance facility. Training and installation support is also provided.

SURNAV maintains close lines of communications to its principals, ensuring that the changing needs of the Canadian surveyor are embodied in the evolutionary process of technology development.

Terra Surveys Ltd, 1962 Mills Road, Sidney, British Columbia, V8L 3S1 (contact Rick Quinn)

Solution to Lighthouse Puzzle

From page 47

Draw a circle of exactly ten kilometres in circumference about the south pole. From any point on this circle proceed exactly ten kilometres north and drop a buoy. From this buoy it is possible to sail ten kilometres south then ten kilometres east and finally ten kilometres north (along the same track taken south) arriving back at the original buoy.


QUESTER TANGENT
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SIDNEY, B.C., CANADA V8L 3S1
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TELEX: 049-7307
QUESTER TANGENT
ISAH
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ATLANTIC BRANCH

Atlantic Branch now has 75 paid-up members, and with mixed feelings hopes soon to see several of their members regroup to form a new Branch of the CHA in Newfoundland. Atlantic Branch has produced three news letters this year, and another will be out before Christmas. These news letters really help to keep the members in touch with each other, and with their members scattered over the Atlantic Provinces the news letter is much appreciated.

Congratulations to Cathy Schipilow who delivered a bouncing baby boy (John David) on July 9. [Another prospective new CHA member in a few years!] Our congratulations also to Steve and Ann Forbes who are expecting sometime in March of next year. John Cunningham still plans to get married in November - unless, of course, he has to go into the field. On a down note, Bruce Anderson left CHS at the end of September when his term expired. Best of luck, Bruce, in the future! Our new Regional Director of Hydrography is Paul Bellemare. One of his first acts was to join the Atlantic Branch of CHA. Welcome to our Region, Paul, and welcome to the Branch!

Bowlarama: Atlantic Branch sponsored CHA Bowlarama III in late April. This bowling party was a great success with some thirty odd people - some odder than others - and a good time was had by all. Special mention was made of the preliminary warm-up in a local pub.

CSS ACADIA: Many Branch members also took part in the 75th Anniversary celabrations for CSS Acadia at the Maritime Museum of the Atlantic this past summer. Festivities began with a birthday party on May 8, then continued on July 8 which was the anniversary of her arrival in Canada.

Summer Beach Party: Atlantic Branch also sponsored a mid summer Beach Party on a secluded beach on MacNabs Island. Hot dogs and buns were supplied but members and friends supplied their own liquid refreshments. Soft drinks only, you understand. The evening was almost rained out, but the survivors had a ball!

Seminars: The fall and winter seminar series is now under way, and it is hoped that these functions will continue once a month and will mostly be evening events with invited speakers. Holding these seminars in the evening allows more members from private industry to take part and also allows more leisurely discussions with the speakers, and some social time later for members to get better acquainted.

The Atlantic Branch annual general meeting is scheduled for December, and the new Branch Executive will no doubt continue the good work done by the 1988 Executive. Atlantic Branch now has some 33 members from private industry and these members are taking an increasingly important role in the activities of the CHA and the interesting program of Branch events.

SECTION DU QUEBEC

Le conseil d'administration de la Section du Québec a accueilli un nouvel administrateur, Marc Journault qui remplace Denis Hains président régional sortant démissionnaire.

Plusieurs réunions du conseil d'administration ont eu lieu depuis le printemps dernier, les points suivants furent soulevés: production de matériel promotionnel (vidéo, kiosque), planification d'activités, élaboration d'un plan de financement, organisation du concours pour le choix d'un logo national et préparation de projets subventionnés.

Les soirées-conférences organisées par la Section du Québec ont suscité beaucoup l'intérêt. Le 13 avril à Rimouski, Jean Regniers professeur à l'Institut maritime du Québec a traité du système de navigation par inertie. En juin dernier à Québec, sous le thème les nouvelles méthodes hydrographiques, Patrick Hally du S.H.C. a entretenu l'auditoire de sondage au laser et de balayage acoustique. Et toujours à Québec en septembre, Yvan Bédard professeur à l'Université Laval a donné une conférence sur la gestion d'informations spatiales numériques.

Deux autre activités ont eu lieu récemment, une conférence sur les risques catastrophiques donnée par monsieur Mohamed El-Sabh et dans le cadre de la Semaine des sciences Normand Doucet a traité du système de navigation LORAN-C.

La Section du Québec parraine une fois de plus des programmes de création d'emplois. Cet été, le projet Difi 88 a permis l'embauche de deux étudiants: Jean Marc Bélanger et David Lepage. Le vidéo réalisé, dans le cadre de ce projet, constitue un document de promotion et de vulgarisation des plus intéressants. D'une durée de près de dix minutes, on y véhicule de l'information sur l'hydrographie et sur l'Association.

Un autre projet employant trois personnes; une agente de communication, une agente d'administration et un graphiste se poursuit jusqu'en décembre 1988. Un kiosque de promotion sur l'A.C.H est en voie de réalisation. Les employés travaillent également à l'élaboration d'un plan de financement et à la mise en place d'une structure permettant l'organisation d'un colloque.

La Section du Québec soumettra prochainement deux autres projets à des organismes fédéraux. Ceux-ci seront axés principalement sur l'organisation d'événementd d'envergure et sur l'analyse des possibilités des gestion de programmes d'échange et de formation.

La Section du Québec compte actuellement 88 membres dont trois sont membres de soutien, le département de navigation de l'Institut maritime du Québec, la Corporation des pilotes du Bas Saint-Laurent et l'entreprise GENEQ.

L'assemblée générale annuelle de la Section du Québec est prévue pour le 3 décembre prochain. En plus de la présentation officielle du vidéo et du kiosque, le programme comportera une conférence sur les naufrages.

Nous désirons mentionner que les documents de référence suivants sont disponibles au bureau de la Section du Québec: le vidéo des conférences du colloque "L'hydrographie dimension essentielle aux sciences de la mer" et le compte rendu de ces mêmes conférences.

OTTAWA BRANCH

There has been a change in the Branch executive. Kathy Young resigned from the executive when she left the Department of Fisheries and Oceans to accept a position in the private sector; we are grateful for her participation in Branch activities over the past few years. Clay Fulford volunteered to fill the vacancy and is now the Chairman of the Tour Committee.

Ottawa Branch has added a number of new members to our ranks: Dave Monahan, Colin Bromfield, Paul Holroyd, Keith McCooeye and Ralph Renaud (all from the CHS); Jim Bradford from DND; and Don Mitchell who works for the Marine Environmental Data Service (MEDS) in Ottawa. This brings the number of members to 66.

Thanks to the efforts of Marilyn Van Dusen, the Branch has held a number of seminars since April. Thirty-five people attended a luncheon seminar in May, where Hank Jones, of the Marine Environmental Data Service, presented a paper entitled "DATA RICH - INFORMATION POOR". In June Tom Irvine (Transport Canada) presented a video of the passage of a ship through the Arctic to resupply Eureka. Also in June, Dr. Ron Wilson (MEDS) presented a seminar on the Ocean Ranger Disaster. Dr. Wilson was a member of the Ocean Ranger inquiry.

Clay Fulford organized a highly successful visit to a Canadian Hydrographic Service field survey party in Cornwall and a tour of the St. Lawrence Seaway vessel control centre in Massena, New York. Ken Hipkin, the hydrographer in charge of the St. Lawrence River survey, prepared an excellent demonstration of the equipment and procedures in use in the field.

Ottawa Branch will be participating in the Canadian Institute of Surveying and Mapping's (CISM) campaign for public awareness at Algonquin College on Nov. 17, 1988. Our CHA booth will feature an impressive banner lent to us by Québec Branch.

The Branch Christmas Luncheon will be held December 15, at Alexander's on the Island Restaurant. All members and friends are welcaome to attend.

Congatulations to Paul and Shelly Holroyd who were married in March, and to Colin and Patsy Bromfield who were married in May.

The Branch was saddened by the death of Murray Watkins in April, 1988. Murray had been a member of the Cartographic Development Division of the CHS since he joined the CHS in 1969. With his mathematical and programming skills Murray made significant contributions to the fields of hydrography and cartography.

A number of our members have been on the road. Neil Anderson, Mike Casey, Ross Douglas, Tim Evangelatos and P.K. Mukherjee attended the US Hydrographic Conference in Baltimore, April 1988. Neil and P.K. were members of the panel of experts at the Electronic Chart Workshop held right after the conference; Dick MacDougall also participated in this workshop.

Ross Douglas spent two weeks in Australia, where he attended the Five Nations Conference on Defence Mapping and Charting. Bob Hinchley of McElhanney Ltd. spent the summer surveying in Madagascar. Dave Gray attended the March 1988 Royal Institute of Navigation Conference, 'Radionav 2000 - A European Dimension', which was held in London, England. Dave also visited the Hydrographic Department in Taunton. In June Dave was in Copenhagen, Denmark to represent Canada in discussions regarding the Canada - Greenland boundary.

Dick MacDougall attended the American Congress of Surveying and Mapping / American Society of Photogrammetry and Remote Sensing Conference in St. Louis, Missouri in March. Dave Monahan attended the meetings of the GEBCO (General Bathymetric Chart of the Oceans) Guiding Committee, in Wormley, U.K. Harold Tolton, Surnav Corporation, was part of a strong contingent from Canada at the Brighton (U.K.) Oceanology Show. Harold also attended the Hamburg Ship and Machinery Show in September. GPS was a very important element of the show - there was a whole day devoted to papers on GPS and many European companies were there to exhibit their GPS hardware.

Ross Douglas attended the Canadian Institute of Surveying and Mapping (CISM) Annual Meeting in Winnipeg in May, 1988. Mike Casey took off his skates off this summer just long enough to complete the 330 km Rideau Lakes Cycling Tour. Mike Casey also attended the Institute of Navigation Conference the Seminar on Artificial Intelligence in Navigation Systems, both held in Colorado Springs, September 1988. Bill Gould has published a comprehensive "HOW-TO" book on boardsailing entitled "Boardsailing: Do it Standing Up".

Brian Tait left the Department of Fisheries and Oceans in May to join the Ministry of State for Science and Technology as the Manager, Annual Framework Paper.

Two members of Ottawa Branch retired in the spring of 1988; Ernie Robichaud, Chief of Sail Directions (CHS) retired after 35 years service with CHS and Gunther Mayerlen of the CHS Geodesy and Tides Unit retired after more than twenty years service.

Neil Anderson addressed the Commercial Opportunities in Coastal and ocean Information Workshop, Dartmouth, September, 1988. John O'Shea participated in the celebrations in Halifax marking the 75th anniversary of the entry of the CSS ACADIA into the CHS fleet.

The prize for the Best Technical Article in Lighthouse in 1987 was won by Ottawa Branch member Don Vachon for his article "Electrostatic Plotting: POD (Print On Demand) and Related Projects".

CENTRAL BRANCH

Central Branch now has 77 paid-up members: 43 with CHS in Burlington and 34 with private industry etc. In order to help all our members keep in touch we have continued with our regular Branch news letter, using it as a vehicle to bring minutes of meetings and other news items to members. This news letter is also mailed to all International Members of CHA to bring them up to date news of CHA activities between editions of Lighthouse.

We take this opportunity to welcome our nomadic members (most of our Branch) back from their summer excursions. Now we can pick up our family and social life where it left off back in April.

We have added three new members since our last Lighthouse report: Scott Holladay, Senior Research Geophysicist with Aerodat of Mississauga; Ken McMillan, President of McQuest Marine Research & Development, Burlington; and Andrew Leyzack, student in the hydrographic surveying program at Humber College. Welcome aboard! We hope to see you at all our Branch events and to introduce you to your fellow members. Your first beer is on us!

Summer barbecue: Our mid summer Branch Barbecue this year was hosted by Jo Anne and Bruce Richards and was a very enjoyable occasion. About 25 or so (we forgot to count...) members, spouses etc were there enjoying the sun and shade in a fine country setting. Jo Anne did a great job of co-ordinating the salads and desserts and we all ate far too much. Our thanks to Dan McKenzie and the local Film Club for sponsoring some of the refreshments. Thanks, Dan! And roll on next summer!

H2O Bonspiel: The 18th Annual H2O Bonspiel is coming! This event is scheduled for Sunday 12 February 1988 at the Grimsby Curling Club, and all members and friends are welcome. This is a very popular annual event, but spaces are limited to 64 so get your application in soon.

This Bonspiel is sponsored by several generous firms and individuals, so there are prizes for everyone and yet the price has been kept very reasonable. Sponsors are warmly invited to bring their own teams, and Norman Wade have recently been "fielding" a very fine team. If you or your company would like to help sponsor this event please write to Boyd Thorson who is the co-ordinator this year.

Seminars: Our Central Branch Seminar Series continues, with guest speakers invited to speak to our group either at a luncheon in a local restaurant or as part of an evening business meeting.

G.E. Wade Essay Award: This annual award was established in 1987, and five entries were received for this first year's award. The competition is open to students enrolled in hydrographic or cartographic courses, and is designed to encourage good writing skills in students.

This year's winner of a $100.00 First Prize is Ryk Karczuga for his essay on the recent fishing dispute between France and Canada. This essay was submitted by him as an assignment on Marine Law in his Hydrographic Survey course at Humber College, Rexdale, Ontario, and is now published in this edition of Lighthouse. Ryk Karczuga was also awarded Honourable Mention for his 70 page report: "Overview of Microfix 100C and Mini-Ranger Positioning Systems". Being written from the point of view of the user, this report would make an excellent handbook for field personnel.

Entries are now being accepted for next year's award, so when you are submitting assignments for your hydrographic or cartographic courses think about sending us a copy. That assignment may win you $50.00 or $100.00!

International Members: This form of membership in the CHA is available to those who are not resident in Canada but would like to keep in touch with hydrography by being members of CHA. The annual membership dues for International Members remain at $30.00 (Canadian) for 1989.

Since our last report several International Members have joined us: Luis Alphonso de la Rocha, dredge surveyor with Antigua Masonry Products in Antigua; K.T. Cheang, Senior Hydrographic Surveyor with Shell Petroleum in Brunei; Luis Leal de Faria, head of Survey Division, Hydrographic Institute, Portugal; Adam J. Kerr, director of the International Hydrographic Bureau, Monaco; and Charles David Meador, with the US National Oceanographic Office, Miami.

Our by-laws specify that the International Membership be administered as directed by the National President, and he has arranged that this part of our organization will be handled by Central Branch.

In addition to receiving Lighthouse, International Members also receive the Central Branch NewsLetter to keep them in touch with CHA activities and concerns. This news letter gives news of fellow members and some discussion of matters of interest as well as minutes of Central Branch meetings and news from other Branches. Input from all CHA members and other Branches is very welcome so drop us a line.

CAPTAIN VANCOUVER BRANCH

The Captain Vancouver Branch of the CHA is now entering its third year of operation. The membership has grown to fifty and the energetic support of many has kept our branch interesting and vital. The branch continues to meet its objectives by holding regular technical meetings for our members.

This year will be especially busy as the branch puts its plans in place to host the 1989 Hydrographic Conference. The Vancouver Trade and Convention Centre will provide an excellent international venue for the "Voyage of Discovery". We hope all members will set sail for Vancouver in March 1989.

The Captain Vancouver Branch continues to work with the Pacific Branch of the CHA and has also established a good relationship with the U.S. Hydrographic Society (Seattle Branch). We are looking forward to further co-operation with these groups this season.

At our last regular meeting we were presented with an excellent overview of the complexity of surveying and monitoring the Fraser River System.

After a busy summer schedule, the branch's next regular meeting will be held in November. Topics will include the North Sea Project and Hydro '88. The branch also warmly welcomes an international guest to share his views on these topics and hydrography, in general.

PACIFIC BRANCH

The JOHN P. TULLY under Tony Mortimer successfully surveyed a large portion of the Queen Charlotte Sound before the ship was relinquished to Arctic Surveys.

Once again intrepid surveyors under the able leadership of Barry Lusk ventured into the Beaufort Sea and the land of the midnight sun. With few exceptions, this group of hearty explorers sallies forth periodically with neither fear nor shame nor trembling hand on pay day to show the flag and exert our sovereignty in Canada's great outback.

George Eaton and his team on the Barge Pender successfully surveyed the Queen Charlotte Strait area using the ISAH collection system and CARIS software to produce final field sheets. There was a total of 2004 shoal exams in this complex area.

People events this summer made news. Congratulations to Harvey Pfluger on his daughter Allison. Bruce Lewis and Alex Raymond on successfully completing all their CLS exams. Graham Whincup and Gerry Kidson on passing Carto II. Dennis Sinnott and Neil Sutherland on their promotions. Very best wishes and congratulations to Carol Nowak and Ken Halcro on their engagement.

The first annual Canadian Hydrographic Association H2O bonspiel was held on March 27, 1988 at Glen Meadows. Twelve of the best teams ever to play at the Glen Meadows Curling Club provided numerous spectators with a brand of curling seldom witnessed in this part of the country. After six continuous hours of gut-wrenching action, the Dick Herlinveaux team, which included John and Sharon Larken and Barbara Kerr, were declared champions. For comic relief a curling team from Terra Surveys, consisting of Jim and Judy Vosburgh, along with Rick Quinn left few of the spectators disappointed with their performance towards a last place finish. Following the curling action all 48 participants enjoyed a superb smorgasboard dinner. After the dinner, prizes were distributed and the Vosburgh trio had the last laugh on everybody by collecting the best prizes - including a power sander and a pair of binoculars. A very big vote of thanks to George Schlagintweit for putting together a curling event which someday may rival the Canadian Brier.

Stan Huggett Retires: William Stanford Huggett retired from the Canadian Hydrographic Service on May 30, 1988, ending a career that spanned 35 years. Stan joined the Canadian Hydrographic Service as a junior hydrographer on May 30, 1953. Prior to that, he had served as an officer cadet on merchant ships from 1942 to 1946, and then with various steamship companies as third mate, second mate and chief officer. He received his Masters Foreign Going certificate in August 1952.

During his career Stan has made many noteworthy accomplishments. In 1958 he was placed in charge of CHS involvement with the blowing up of Ripple Rock in Seymour Narrows. In this capacity he advised on the best time for the blast (on Easter Monday during a strong ebb tide), planned current and wave surveys, and carried out the post explosion hydrographic surveys. In 1960 he became involved in discussions with the naval architects regarding a replacement for the PARRY. This new vessel is the CSS PARIZEAU, which was commissioned in 1967. Stan Huggett was its first hydrographer-in-charge and for several years used the vessel extensively for tide and current surveys in the Strait of Georgia. The data collected during this period provided much of the information needed for a numerical model developed by Dr. Pat Crean. This model ultimately led to the very successful Current Atlas of Juan de Fuca Strait and the Strait of Georgia.

Over the years Stan had a very enjoyable and productive association with the PARIZEAU, carrying out hydrographic and oceanographic surveys in the western Arctic and on the British Columbia coast, in addition to cruises to Japan and the equatorial Pacific.

From drift pole and mast and boom measurements of currents in narrow passes, to Ekman and CMDR in situ current meters (recording with ball bearings and punch paper tape respectively), to the workhorse Aanderaa current meters, and finally today's surface drifters and vector averaging current meters, Stan has installed and recovered more than anyone else in Canada. He has published 19 volumes of data reports on the British Columbia Coast alone. More than a few oceanographers have benefitted from Stan's knowledge and experience over the years.

Stan's most recent projects have been to determine the current patterns in Hecate Strait, Dixon Entrance, and off the west coast of Vancouver Island. During this time he was also actively involved in the planning and designing of the CSS WM. J. STEWART replacement, the CSS JOHN P. TULLY, which was commissioned in 1985. It is unfortunate that Stan never had the opportunity to conduct a survey with the CSS JOHN P. TULLY before he retired.

Stan Huggett was honoured at a dinner and dance held at the Glen Meadows Golf Club on June 10. To help him adjust to retirement, his friends presented him with a set of golf clubs and a golf bag. There was time for only one or two rounds with the new clubs before Stan and Phyllis left for a vacation in England and the Mediterranean. Stan will be greatly missed by all of us in the Canadian Hydrographic Service and by his many friends and colleagues in the oceanographic community.

Jack Curtis Retires: Jack Curtis was given a fine sendoff when 62 friends honoured him and his wife , Doris, at a lunch at Glen Meadiws on August 19. Tony O'Connor presented a certificate from the Government of Canada for 32 years service in the Navy, Air Force and the Department. Joe Van Eyk presented a heavy-duty mountain bike from Jack's many friends at the Institute, and Dave Paton presented a bottle of the finest Glenlivet on behalf of the PSAC. We hope Jack will be careful with the combination.

Coming Events

Fourth International Symposium on Okhotsk Sea & Sea Ice
The Fourth International Symposium on Okhotsk Sea & Sea Ice will be held 5-7 February 1989 at Hokkaido, Japan. The scientific program is organized by the Okhotsk Sea & Cold Ocean Research Association, based at the Sea Ice Research Laboratory, Hokkaido University. For more information contact Dr. Masaaki Aota, Sea Ice Research Laboratory, Hokkaido University, 094, Japan

Canadian Hydrographic Conference Discovery 89
Captain Vancouver Branch of CHA will be hosting the 1989 Canadian Hydrographic Conference at the Pan Pacific Hotel and the new Convention Centre in Vancouver, 6-10 March 1989. The theme of this conference is "Discovery 89", and a fine program of technical papers, social events and manufacturers' exhibits has been prepared. A special workshop will be devoted to the Electronic Chart, and survey ships from several nations will be on show. For more information contact Canadian Hydrographic Conference '89, 8911 - 152 Street, Surrey, British Columbia, Canada, V3R 4E5

Marine Technology Society Intervention '89
Marine Technology Society announces Intervention '89 which will be held in San Diego, March 13-15 1989. This gathering of underwater technology and technologists will explore in depth the technical advances in this special field and will feature state-of-the-art exhibits and a program of as many as 50 timely papers. For more information contact Marine Technology Society, PO Box 261149, San Diego, California, USA, 92126

Canadian Institute of Surveying and Mapping
The annual conference of the Canadian Institute of Surveying and Mapping will be held 6-9 June, 1989 at Halifax. There will be a vigorous hydrographic session (6 papers), and our spies tell us that the social program is just as magnificent as the one at Winnipeg in '88! For more information contact CISM 1989, Convention Chairman, PO Box 5378, Station F, Ottawa, Ontario, Canada, K2C 3J1

FIG XIX Congress
The Fédération Internationale des Géomètres are holding the FIG XIX Congress at Helsinki, Finland, 10-19 June 1990. The conference theme will be "The Challenge of the Information Society for Surveyors", and the FIG Commission IV (hydrography) is a particularly active part of the Congress.

Vancouver Conference
Simon Fraser University, will host the Vancouver Conference in Vancouver April 17-19, 1992. This conference on exploration and discovery will be part of the commemoration of Captain Vancouver's arrival on the Pacific Coast in 1792, and will present coverage of new research on all aspects of exploration and discovery, particularly relating to the North Pacific. Those interested in participating should send summaries of 100 to 200 words, along with a brief vitae to The Director, Vancouver Conference, Department of History, Simon Frazer University, Burnaby, British Columbia, Canada, V5A 1S6

Lighthouse Puzzle Part 2

From page 8

The space ship, of course, checked the north pole. The CSS Baffin was not there! This wrinkled a few brows until the mate on the survey ship asked why everyone assumed it had to be the north pole. There was after all another place on every planet where such an event could occur. The space ship proceeded to the second location and found the CSS Baffin. Where were they?

See **page 41** for solution.

November 1988

Lighthouse

Journal of the Canadian Hydrographic Association

LIGHTHOUSE originally began as an internal newsletter of the Canadian Hydrographers' Association (CHA) in the winter of 1969. It was conceived as a means of stimulating discussion between the branches of CHA. Over the years, **LIGHTHOUSE** has become Canada's national hydrographic journal. It still remains faithful to the original goal of providing a mix of technical, historical and social information of interest to hydrographers and cartographers. But its circulation has expanded to include over 1,000 individuals, companies and hydrographic organizations in Canada and around the world!

1988 Rate Card Information

POSITIONING

The acceptance and positioning of advertising material is under the sole jurisdiction of the publisher. However, requests for a specified position will be considered if the position premium of $25 has been included in the insertion order.

MECHANICAL REQUIREMENTS

Advertising material must be supplied by the closing dates as camera-ready copy or film negatives (Colour ads must be film negatives). Copy preparation, including colour, bleed and photos will be charged at the printer's cost plus 10%. Proofs should be furnished with all ads.

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

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Publication Trim Size: 8 1/2" x 11 1/2" (Width x Length)
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CLOSING DATES

LIGHTHOUSE is published twice yearly in April and November. The closing dates are March 15th and October 15th respectively.

PRINTING

Offset screened at 133 lines per inch.

RATES (All rates are quoted in Canadian Funds)

	B & W	Colour	
		Spot*	Four
Outside Back Cover	NA	NA	950
Inside Cover	250	300	750
Body, Full Page	225	275	600
Half Page	150	200	600
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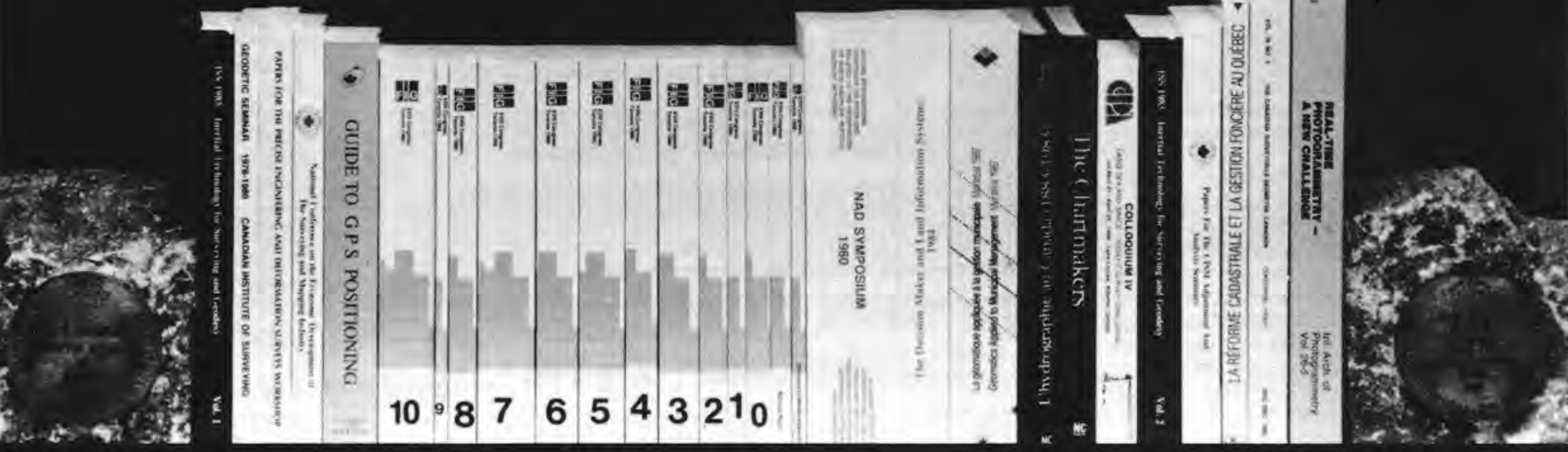

- **FIG Congress 1986**

Proceedings Part I — The presented papers for the Toronto FIG Congress were preprinted in 9 volumes (one for each of the 9 technical commissions of FIG). **$60.00/52.00**

Proceedings Part II — This 2-volume set contains volume 0, the official report of the Congress including the keynote addresses and Resolutions and, in Volume 10 (575 pages) some 45 papers that were received too late for publication in volumes 1 to 9. **$20.00/16.00**

- **Geomatics Applied to Municipal Management**

The 49 preprinted papers from the 1987 International Symposium on Geomatics are published in a single 650-page volume. The Symposium dealt with the basic concepts, the technologies and the development and implementation of Municipal Management Information systems with emphasis on working systems in various countries around the world. **$45.00/36.00**

- **Economic Development Conference Proceedings**

The papers presented at the December 1986 National Conference on the Economic Development of the Surveying and Mapping Industry, an edited summary of the discussions and the full text of the final conference resolutions are reproduced here in a 268 page volume. **$45.00/36.00**

- **Real-Time Photogrammetry — A New Challenge**

The preprinted papers of the 1986 Symposium of ISPRS Commission V in Ottawa cover all the various fields of non-topographic photogrammetry identified in Commission V. The 69 papers are published in a single volume of 544 pages and include papers dealing with low altitude aerial photogrammetry, unconventional technologies in close-range photogrammetry, close-range photogrammetry in industry and applied science, biostereometrics, digital and real-time close-range photogrammetry and architectural photogrammetry. **$45.00/36.00**

- **Guide to GPS Positioning**

This is a self-contained manual on the Global Positioning System for practising surveyors, field hydrographers, engineers, geophysicists, geologist, geographers, oceanographers, space scientists and professionals in information management, transportation, forestry and agriculture. The guide includes explanations of concepts, orbits signal structures, measurements, biases and errors, solutions, static and moving platforms, differential data links, survey design, receivers, etc. The guide contains 600 pages and 200 figures. **$35.00**

OTHER PUBLICATIONS AVAILABLE

Collected Papers of Geodetic Seminars (1978-1980)	$15.00/12.00
*Compass to Satellite (History of Surveying in Canada 1882-1982)	$20.00/16.00
Geodesy II (Adjustment and Analysis Seminars, 1983)	$27.00/22.00
Inertial Technology for Surveying and Geodesy (1985)	$45.00/36.00
Land, Sea and Space — Today's Surveying Challenge (CPA/CHA Colloquium IV 1986)	$40.00/32.00
La réforme cadastrale et la gestion foncière au Québec (1985)	$40.00/32.00
L'Hydrographie au Canada (1883-1983)	$40.00/32.00
NAD Symposium 1980 (2nd Symposium on North American Vertical Networks)	$18.00/15.00
Precise Engineering and Deformation Surveys (Workshops, 1985)	$20.00/16.00
The Chartmakers (History of Nautical Surveying in Canada to 1983)	$40.00/32.00
The Decision Maker and Land Information Systems (FIG Commission III, 1984)	$35.00/28.00

*Compass to Satellite was a regular issue of *The Canadian Surveyor* Vol. 36, No. 4. All paid up members at that time will have received a copy.

Postage and packaging charges are: $3.00 per publication for Canadian destinations — $5.00 per publication for all other countries

NOTE: The first price mentioned is the price for non-member the second price is for members

Make cheques payable to: CISM, PO Box 5378, Station F, Ottawa, Ontario K2C 3J1 Canada

CHALLENGE FOR THE 1990s

GIS

GEOGRAPHIC INFORMATION SYSTEMS

Users ▾ Applications ▾ Issues ▾ Data Dissemination ▾ Roles of Government, Industry and Academe ▾ Research ▾ Technology ▾ Methodology ▾ Education

NATIONAL CONFERENCE

In Search of Solutions

GIS is a rapidly developing field lying at the intersection of cartography, computing, geography, photogrammetry, remote sensing, statistics and surveying. As we are becoming aware, GIS will have a profound effect upon society. Yet this burgeoning field is not without its problems.

The number of GIS installations is growing. However, the wide range of software and hardware used has often evolved with little regard to standards. Furthermore, the development of a GIS in isolation may be a duplication of effort and misuse of valuable resources. The full potential of GIS technologies will not be realized until certain common problems are resolved, standards are developed, and management requirements are more fully understood.

This conference provides a forum to search for and share solutions to our common challenges of implementation, development and maintenance of a GIS. It will focus on users, applications and management. Topics under discussion include the roles of government, industry and universities; standards; data dissemination; systems development; and technologies, methodologies and research; as well as legal, educational and training considerations.

The Program

Morning plenary sessions and afternoon parallel sessions are supported by an exhibit of leading GIS and data suppliers, an industrial forum, data base demonstrations and technical tours.

Conference registrants may also attend optional introductory and advanced seminars. On February 27, the day preceding, registrants are invited to a state-of-the-art overview. The day after the conference, March 3, participants are invited to attend an advanced seminar on GIS issues.

Be part of the solution. Contact the Conference Director for further details.

February 28 to March 2, 1989

45°25'N Latitude, 75°42'W Longitude

Westin Hotel — Ottawa, Canada

Who Should Attend

Challenge for the 1990s is of interest to managers, users and applications specialists, whose professions increasingly depend on spatially referenced data. The conference will be attended by representatives from federal, provincial and municipal governments, industry, and educational institutions, representing the various fields of agriculture, civil engineering, climatology, forestry, geology, land registration, marine and land environment, municipal planning and management, natural sciences, surveying and transportation.

Registration

- Fee prior to January 16, 1989: CAN$125.00
- After January 16, 1989: CAN$150.00
- Students: CAN$50.00
- Optional seminars: T.B.A.

Conference Director
GIS National Conference 89
Canada Centre for Mapping
615 Booth Street
Ottawa, Ontario
Canada K1A 0E9

FAX: (613) 992-4961

Sponsors

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In cooperation with:

- **American Congress on Surveying and Mapping**
- **American Society for Photogrammetry and Remote Sensing**
- **Urban & Regional Information Systems Association**
- **Association of American Geographers**

DÉFI DES ANNÉES 90

SIG

SYSTÈMES D'INFORMATION GÉOGRAPHIQUE

Utilisateurs ▾ Applications ▾ Questions ▾ Diffusion de données ▾ Rôle des gouvernements, de l'industrie et des universités ▾ Technologie ▾ Méthodologie

CONFÉRENCE NATIONALE

du 28 février au 2 mars 1989

45°25'N latitude, 75°42' O longitude

Hôtel Westin — Ottawa, Canada

À la recherche de solutions

LES SIG se trouvent au carrefour de la cartographie, de l'informatique, de la géographie, de la photogrammétrie, de la télédétection, de la statistique et des levés. Nous prenons conscience chaque jour davantage de l'effet considérable que les SIG exerceront sur la société. Toutefois, ce domaine florissant, en pleine expansion, n'est pas sans connaître certains problèmes.

Il existe un nombre croissant d'installations faisant usage de SIG. Cependant, la vaste gamme de machines et de logiciels utilisés ont souvent été mis au point sans qu'on ne tienne vraiment compte des normes établies. De plus, l'élaboration de SIG dans l'isolement peut mener à la répétition d'efforts antérieurs et à une mauvaise utilisation de ressources précieuses. Il faudra résoudre certains problèmes, fixer des normes et mieux comprendre les besoins de gestion avant de voir les technologies relatives aux SIG atteindre leur plein potentiel.

Cette conférence se veut une occasion propice à la recherche et à l'échange de solutions applicables aux problèmes de mise en oeuvre, d'expansion et d'entretien des SIG. Les utilisateurs, les applications et la gestion seront les grands thèmes de la rencontre.

Le programme

Des sessions plénières auront lieu en matinée et seront suivies de sessions parallèles en après-midi. Le programme comprend également une exposition regroupant des fournisseurs reconnus de SIG et de données, des discussions entre des représentants de l'industrie, des démonstrations de bases de données et des visites techniques.

Les participants pourront assister à des ateliers libres de différents niveaux. Le 27 février, soit la veille de l'ouverture de la conférence, les participants seront conviés à un tour d'horizon de l'état actuel de la technique. Après la conférence, soit le 3 mars, un atelier de niveau supérieur traitera de questions relatives aux SIG.

Relevez le défi! Vous pouvez obtenir de plus amples renseignements en vous adressant au directeur de la conférence.

Les participants

La conférence "Défi des années 90" intéressera les gestionnaires, les utilisateurs et les spécialistes de l'application des SIG qui, dans l'exercice de leurs fonctions, doivent utiliser de plus en plus de données à référence spatiale. La conférence réunira des représentants des gouvernements canadien, provinciaux et municipaux, de l'industrie et des établissements d'enseignement.

Inscription

Les frais d'inscription sont :

- avant le 16 janvier 1989 125 $CAN
- après le 16 janvier 1989 150 $CAN
- pour les étudiants 50 $CAN
- Les frais des ateliers libres seront annoncés à une date ultérieure.

Directeur de la conférence
Conférence nationale de 1989 sur les SIG
Centre canadien de cartographie
615, rue Booth
Ottawa (Ontario) Canada K1A 0E9

FAX: (613) 992-4961

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- **American Society for Photogrammetry and Remote Sensing**
- **Urban & Regional Information Systems Association**
- **Association of American Geographers**

The Canadian Hydrographic Association

What Is The CHA?

The Canadian Hydrographic Association (CHA) is a non-profit, professional group of about 500 members with the objectives of advancing the development of hydrography, cartography and associated activities in Canada, furthering the knowledge and professional development of its members, and enhancing and demonstrating the public needs for hydrography.

The CHA is the only national hydrographic organization. It embraces the sub-disciplines of hydrographic surveying, marine cartography, marine geodesy, offshore exploration and tidal and current studies. The CHA is formally affiliated with the Canadian Institute of Surveying and Mapping.

What Will The CHA Do For You?

The CHA will advance your knowledge of hydrography and cartography and associated disciplines and keep you informed of the latest developments in these disciplines. It enables you to develop and maintain contacts with others involved with hydrography, both nationally and internationally. These benefits are provided through the publication of Lighthouse, through the sponsorship of seminars, colloquiums, training programs, national conferences and through branch and national meetings.

Lighthouse

Lighthouse, the journal of the Canadian Hydrographic Association, 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 gleaned from national and international academia, industry and government. Present circulation of the publication is approximately 800.

Membership

Membership is open to all hydrographers, those working in associated disciplines, and those interested in hydrography and cartography. Types of membership are: Member, Sustaining member, International member and Honorary/Life member.

Branch Activities

The CHA has seven branches located in Dartmouth, Nova Scotia; Sainte-Flavie, Québec; Burlington, Ontario; Ottawa, Ontario; Calgary, Alberta; Vancouver, British Columbia and Sidney, British Columbia. National headquarters is located in Ottawa.

Further information is available from:
National President
Canadian Hydrographic Association
P.O. Box 5378, Station F
Ottawa, Ontario
Canada K2C 3J1

l'Association canadienne d'hydrographie

Ce qu'est l'ACH

L'Association canadienne d'hydrographie (ACH) est un organisme sans but lucratif réunissant un groupe professionel de plus de 500 membres ayant des objectifs communs, comme faire progresser le développement de l'hydrographie, de la cartographie et de leurs sphères d'activités au Canada, permettre les échanges d'idées et le développement professionel de ses membres, et rehausser et démontrer l'importance de l'hydrographie auprès du public.

Au Canada, l'Association est la seule organisation hydrographique qui embrasse les disciplines suivantes levé hydrographique, cartographie marine, géodésie marine, exploration extra-côtière et étude des marées et courants. L'ACH est affiliée à l'Association canadienne des sciences géodésiques et cartographiques.

Ce qu'elle peut faire pour vous

L'ACH vous offre des avantages tels que parfaire vos connaissances de l'hydrographie, de la cartographie et des disciplines connexes, tout en vous tenant au courant des nouvelles techniques et des derniers développements réalisés dans ces domaines. Elle aide a 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 et par la tenue de séminaires, de colloques, de programmes de formation et d'assemblées régionales et nationales.

Lighthouse

Lighthouse, la revue de l'Association canadienne d'hydrographie, 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 800 copies.

Comment devenir membre

Le statut de membre est offert aux hydrographes et à tout ceux oeuvrant et ayant un intérêt dans les disciplines associées de l'hydrographie et la cartographie. Les catégories de membres sont: membre, membre de soutien, membre international et membre honoraire.

Sections et activités

L'ACH possède sept sections localisées dans Dartmouth, Nouvelle-Écosse; Sainte - Flavie, Québec; Ottawa, Ontario; Burlington, Ontario; Calgary, Alberta; Vancouver, Colombie-Britannique et Sidney, Colombie-Britannique. L'administration centrale se trouve à Ottawa.

Pour plus d'informations, s'adresser au:
Président national
Association canadienne d'hydrographie
C.P. 5378, station F
Ottawa, Ontario
Canada K2C 3J1

Application for Membership/Formule d'adhésion

I hereby make application for membership in the Canadian Hydrographic Association
Je désire devenir membre de l'Association canadienne d'hydrographie en tant que

☐ member / membre ☐ sustaining member / membre de soutien ☐ international member / membre international

and if accepted, agree to abide by the constitution and by-laws of the association
et si ma demande est acceptée, je m'engage à respecter la constitution ett les règlements de cette association

Name/Nom
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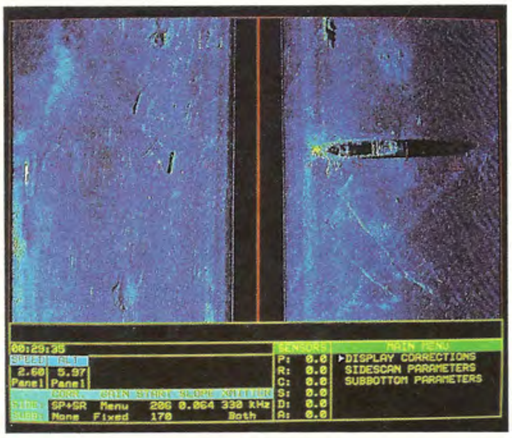

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