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Lighthouse

JOURNAL OF THE CANADIAN HYDROGRAPHERS' ASSOCIATION

Edition No. 26, November 1982

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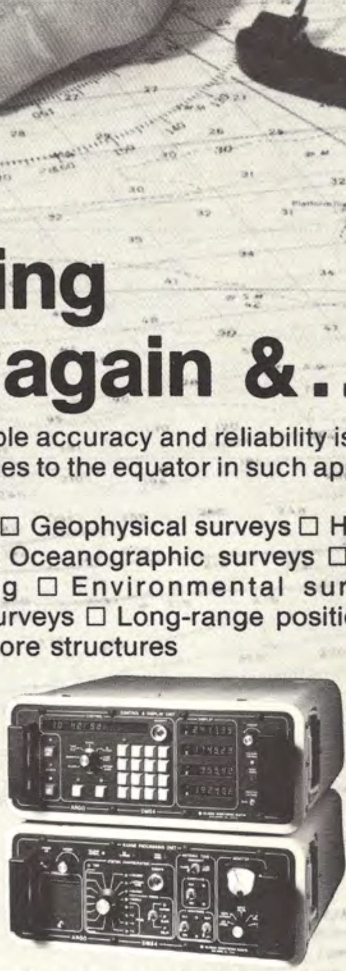

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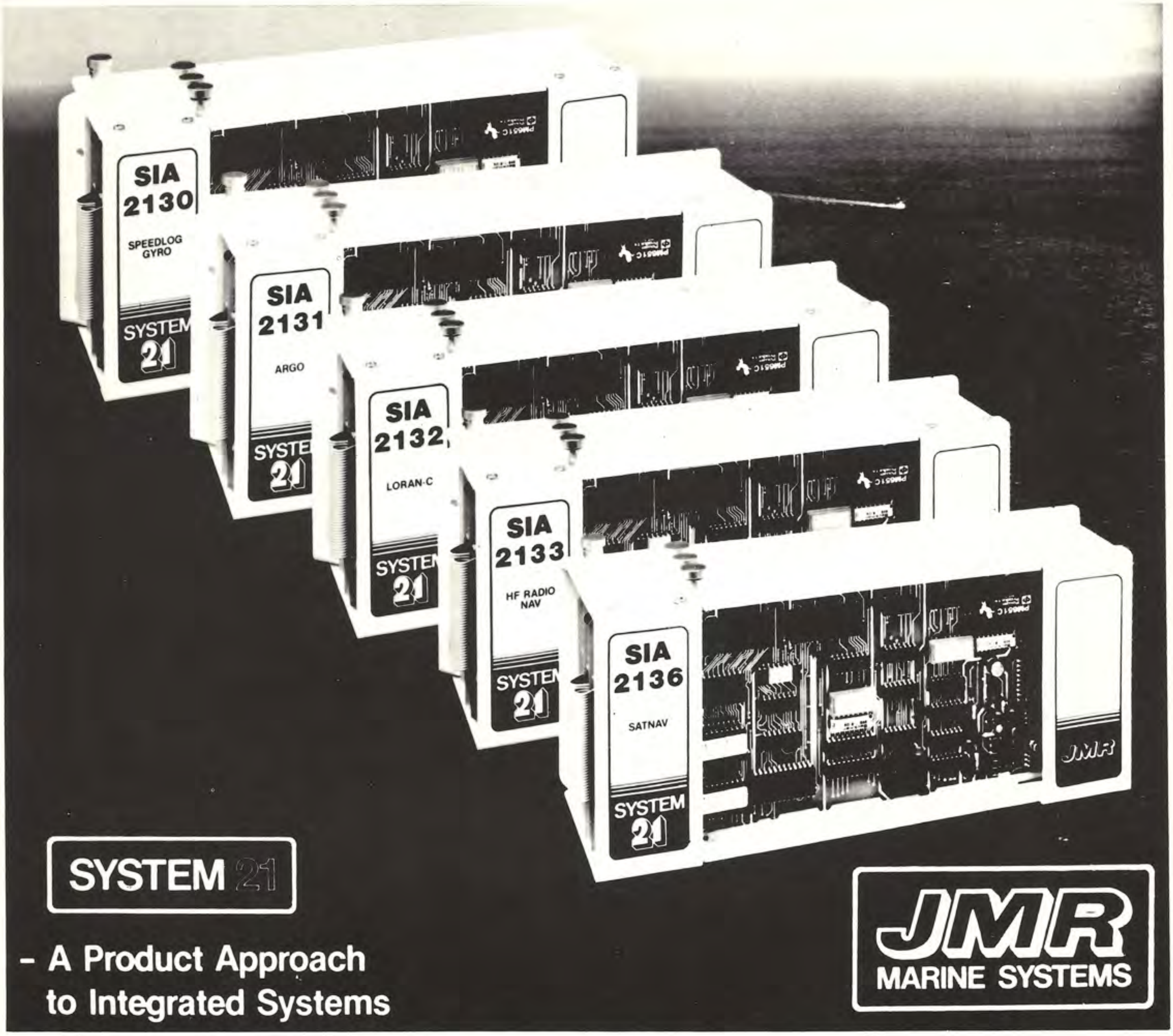

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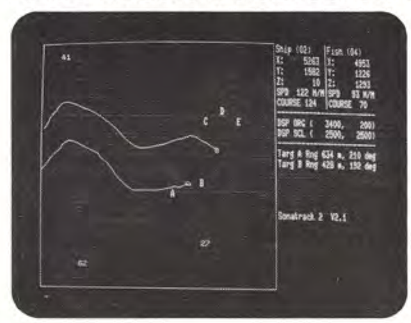

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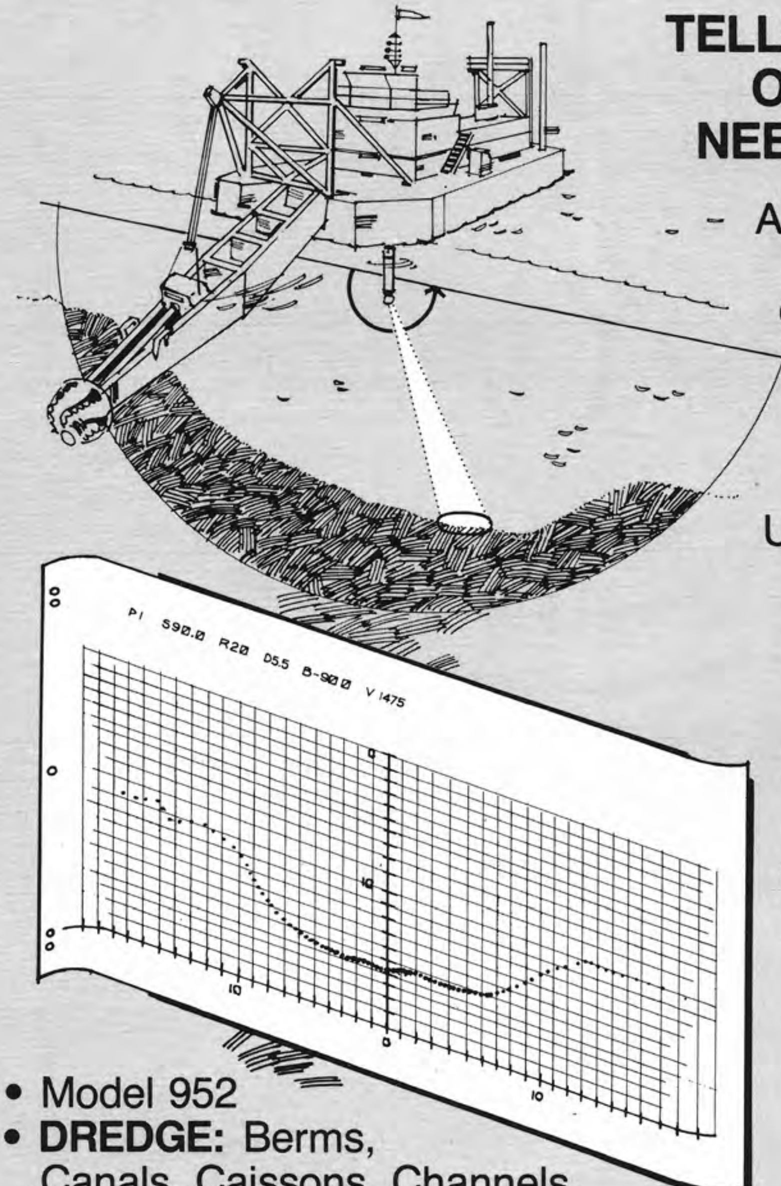

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The Canadian Hydrographic Service Courses in Marine Cartography

By
H. Furuya

Canadian Hydrographic Service, Headquarters

The Cartography courses of the Canadian Hydrographic Service (CHS) are concerned with the construction and maintenance of nautical charts. Cartography I teaches new cartographic employees the basics of how to compile, draw and revise the charts. Cartography II provides greater in-depth and more theoretical knowledge about the nautical chart cartographic processes and also provides knowledge about directly and indirectly associated subjects.

The cartographic processes in the production of the Canadian navigational charts have been, for several decades, identified by two main functions, compilation and drafting. The compilation function is concerned with the manipulation of field data. This normally involves the reduction of the field data in graphical form to the scale of the chart to be constructed and then carrying out the compilation functions of assembly, adjustment and generalization so that the representation of the sea floor and the depths available are clearly and simply portrayed to meet the mariners navigational requirements. The drafting function is devoted to the final negative drawing of the features to the specifications prescribed as well as to effect some generalization such as smoothing of line features. It is also concerned with the colour separation processes; all of which affects the quality of the printed charts.

Prior to 1953, the hydrographers were out on surveys from May to the end of October, but during the winter months they compiled charts as one of their main tasks. The compilation drawing was then given to the chart drafting office where the fair drawing of the chart was carried out. The hydrographers reviewed the fair drawing before it went to camera for the negatives required for colour separation.

This system became inefficient as surveys and the number of charts under production and revision increased. The hydrographers were not in the office from May to November, hence, the production of charts being compiled and incomplete in April would be delayed by over six months. Furthermore, the hydrographers were not present in many cases when the fair drawings were completed and ready for review. These factors contributed to the changeover whereby the draftspersons gradually undertook the compilation of charts. This established the two main groups in the construction of charts; compilers and draftspersons.

The cartographic staff recruited in the fifties was mainly from drafting courses of short duration established for specific needs. The type of recruit changed slowly so that in the sixties, more of the recruits were from technical schools, and in the seventies, from technological colleges where the recruits had taken and sucessfully completed the Cartography program offered. More recently, some university geography graduates have been employed. However, none of these schools, colleges or universities teach "How to Compile a Chart" nor to instruct on standards, specifications and drafting processes requisite to the production of navigational charts.

The training of the new cartographic employees in the compilation and drawing of charts was through "on-the-job" training and it took about two years before the new employee could contribute to production. Training on-the-job was not the most efficient method because supervisors were faced with production schedules and new employees did not enhance production but rather detracted from it. The first year and perhaps the second year of employment were devoted to learning, frequently through a repetitive process, until the job was of acceptable quality. Furthermore, the supervisor did not and, in many cases could not, devote adequate time to train the new employee effectively.

The need for formalized training was recognized and in the early 60's some classroom type training in drafting was conducted, however, the immediate production demands always took precedence. Finally, in 1975 steps were initiated to establish a basic marine cartography course and in the summer of 1977, the first course was held. This course gave instructions only in the compilation processes in the construction of nautical charts. In the spring of 1978, the first full course covering both the compilation and drafting processes was implemented. The duration of the course was sixty days; approximately forty days were devoted to compilation-revision and twenty days to drafting-reproduction. In the fall of 1978, the second full course was held, and from 1979 one course each year.

The Cartography I course provides instructions on the basics of how to construct without any complications a standard nautical chart from field and other sources data, and how to revise or maintain such charts. It is expected that the trainees after completing Cartography I, will continue to learn the variety of more complex, irregular type of compilations, and to improve their drafting skills on the job in their own production offices. Cartography I does not teach new employees to be an expert at any particular aspect of the job, in fact, the duration of the course permits only a minimum of practice time to enhance their skills. Tests and exercises when practical, and final examinations are given. In addition, each trainee has to undertake and submit practical compilation and drafting projects both of which are marked and are included in the final results.

The Cartography II course was implemented for the first time last fall. It's duration was four and a half weeks. The course is intended for the cartographic employees of the CHS who have taken and successfully completed the CHS Cartography I course and who have progressed to the DD 4 level, that is the top working classification. The course provides more of the principles and theoretical background to some of the cartographic processes and greater indepth details relating to complex data and generalization. In addition, knowledge is provided about subjects that are directly and indirectly concerned with the nautical charting. The successful completion of the Cartography II course is a requirement stipulated in the "Marine Cartographer Development Program" in order to advance beyond the DD 4 level.

Efforts were made to obtain instructors and lecturers with the requisite specialized knowledge; consequently twenty-five different instructors/lecturers contributed to the course. The trainees on the courses are encouraged to voice their views and the practices of their regional offices during seminar type discussions.

The course is intense, however, the examinations were intentionally limited in the first course. In future courses, tests and assignment exercises will be included where practical and the results should form a percentage of the final marks in order to aid the trainee in passing the course.

The objective of the instructors in both Cartography I and II courses is to assist the trainees to learn and comprehend the subjects taught and to pass the course, without sacrificing the course standards and level of complexity of examinations.

The 1982 syllabus for the Cartography I course and the Cartography II course are included.

Canadian Hydrographic Service Cartography I Course

Objective
To provide instruction to cartographic employees in the basics of how to construct and revise marine charts.

Employees who have taken and passed the course should have gained sufficient knowledge to be productively employed, and with on-the-job practice and supervision gradually undertake more varied and complex tasks.

Purpose
The basic marine cartography training is provided in order to aid in determining whether a new cartographic recruit should be retained, based on taking and passing the course. The training also advances the productive capabilities of the new cartographic employees and establishes a standard basic qualifying factor for the Cartography II course.

Cartography I Course Syllabus

INTRODUCTION TO MARINE CARTOGRAPHY
— definition of chart edition categories
— styles of chart presentation, i.e. traditional-style and contour-style; rectangular and strip formats
— physical description of charts, papers used for printing, borders, graticules, notes, numbering system
— general description of the cartographic content of charts
— differences between topographic maps and nautical charts
— description of chart types (general, coastal, harbour etc.)
— brief explanation of the purpose of charts
— general overview of the compilation and drafting procedures in the production of New Charts

MARINE CHART TERMINOLOGY
— definition of general and specific terminology used in marine cartography and associated fields
— explanation of abbreviations and acronyms

SYMBOLOGY
— explanation of the symbols and abbreviations used on nautical charts
— the application of symbology to charts
— drafting specifications for symbols and abbreviations

PLANNING OF NEW CHARTS
— reasons for producing New Charts
— brief description of the purpose and preparation of chart schemes
— explanation of neatline sizes, scales, layouts, map projections used for New Charts
— preparation and approval of chart formats and specifications

REPROGRAPHICS
— description of various materials and their uses
— brief review of earlier techniques and materials and their effect on present-day chart production
— brief description of lithography and the requirements for plating
— use of E.M.R. colour guide
— the printing process and problems requiring the cartographer's attention.

PEN AND INK DRAWING
— use, care and maintenance of equipment
— description of various inks and materials
— drawing on various materials
— drawing various freehand symbols

HAND LETTERING
— hand lettering both Roman italic and upright Egyptian
— development and appreciation of shape and spacing

HYDROGRAPHIC SURVEYS
— outline of the various phases involved in hydrographic surveys
— brief description of horizontal control and types of control points
— types of position fixing systems used in hydrographic surveying
— general description of types of surveys e.g. offshore, harbour, reconnaissance, track, revisory etc
— submission of field data (field sheets, field reports etc.)

MAP PROJECTIONS
- the shape of the Earth and distortions arising from projecting the spheroid onto a flat surface
- various projections used by C.H.S. past and present and their properties and recognizable traits

PROJECTION COMPUTATIONS
- computation of plotting values for polyconic, Mercator and U.T.M. projections
- computation for plotting geographic positions on the polyconic and Mercator projections
- determination of neatline sizes
- verification of natural scales
- calculation of graphic scales

TIDES AND WATER LEVELS
- general explanation of tides and their effect on navigation
- variation in water levels of non-tidal waters
- vertical datum systems for tidal and non-tidal waters
- establishment of chart datum and the requirement to relate datums of source data to chart datum
- description and purpose of bench marks and gauges
- purpose of hydrographs and tidal data boxes shown on charts
- purpose of tide tables and water levels publications

CHART PRODUCTION SOURCE DATA
- examination of C.H.S. field sheets as sources of depth information
- explanation of the Navigable Waters Protection Act
- source data from Department of Public Works
- source data from Energy, Mines and Resources
- Mareps and Hydrographic Notes
- source data from other government agencies, private companies, foreign hydrographic offices etc
- assessment and correlation of source data, problems encountered and how these are resolved

SCALE REDUCTION OF SOURCE DATA
- methods and equipment, which to use and limitations of each
- compensation for change of projection from source data to chart
- procedures for extra-large reductions
- calculation and drawing of photo reduction scales

PREPARATION OF COMPILATION MOSAICS
- description and purpose of the Harris Registration System
- registration and duplication of the projection base plot for compilation purposes
- examination of source data suitable for mosaicking
- demonstration of the method of preparing compilation mosaics
- examination of typical problems encountered, how to recognize and resolve them; identification of problems which must be brought forward for consultation
- dealing with overlapping surveys and overlays to field sheets.

COMPILATION DRAWING
- purpose of the compilation drawing
- method and procedure of preparation
- description of the data to be shown on compilation drawings and the data deliberately not included
- requirements for neatness, accuracy and consistency

SOUNDING SELECTION AND DEPTH CONTOURS
- purpose of sounding selections
- factors affecting the selection of soundings
- critical, significant and representative soundings
- the role of contours in traditional-style and contour-style sounding selections
- conventions, procedures and techniques in the preparation of traditional-style sounding selections
- conventions, procedures and techniques in the preparation of contour-style sounding selections; the importance of linear interpolation
- development of metric depth contours from non-metric sources
- use of broken contours
- effect of contours on the selection of soundings
- generalization and smoothing of depth contours
- role of contour identifiers in the contour-style presentation
- selection of drying heights and rock symbols
- identification of bottom quality types and their significance on charts; guidelines for their selection

VERTICAL DATUM ADJUSTMENTS
- procedure for requesting vertical datum comparisons of source data and charts
- application of vertical datum adjustments to sources and the effect on soundings, contours, rock symbols, drying features, islets and elevation values

GENERALIZATION OF SOURCE DATA
- brief explanation of the factors causing the requirement to generalize
- objectives in generalizing various types of charted data
- methods of generalizing point, line, area and alphanumeric data
- limits of generalization and the role of symbology

COMPILATION OF OTHER DATA
- topography for charts; what and how much to show
- preparation of chart titles and specialized notes
- bar scales and speed scales
- presentation of magnetic information; use of compass roses and isogonic lines
- preparation of Source Classification Diagrams and other special diagrams

AERIAL PHOTOGRAPHY
- brief explanation of the basic properties of aerial photographs and their use in the chart construction process
- use of stereoscopes and stereo models

NOMENCLATURE
- role of the Canadian Permanent Committee on Geographical Names
- submission of C.H.S. field data for consideration
- operations of the C.H.S. nomenclature units; procedure for requesting nomenclature for New Charts and New Editions
- selection of nomenclature and explanation of the C.H.S Policy with respect to geographic names in bilingual form

AIDS TO NAVIGATION
- types and purpose of aids to navigation and a general explanation of the Canadian system
- operation of the C.H.S. aids to navigation units and their liaison with Ministry of Transport
- procedure for requesting aids to be shown on New Charts, New Editions and Reprints; examination and explanation of typical "aids copies"
- purpose and preparation of cable copies, wreck copies, traffic separation copies

NOTICES TO MARINERS
- purpose of Notices to Mariners
- permanent, temporary, preliminary and annual notices
- written notices and chart amendment patches
- notices to shipping
- authorities for notices; the role of C.H.S., Ministry of Transport, Department of National Defense, other agencies and foreign authorities

— preparation, printing and distribution of the weekly Notices to Mariners publication; analysis of information contained
— chart correction procedures and corrections to related publications

CHART AMENDMENT PATCHES
— types and purpose of chart amendment patches
— explanation of printing requirements and procedures
— description and demonstration of preparation procedures

PREPARATION OF A CHART CONSTRUCTION HISTORY
— preparation of a sources-used and action-taken listing
— purpose and preparation of "Notes to File"
— chart construction material to be retained

REVISION COMPILATION
— purpose and use of chart maintenance copies and record cards
— assessment of incoming source data for action on existing charts
— typical problems encountered with incoming source data, how they are resolved or noted for future action

PREPARATION OF NEW EDITIONS AND REPRINTS
— reasons for reprinting existing charts and the factors affecting the choice of reprinting category
— prepartion of and approval procedures for New Edition and Reprint specifications
— enumeration and explanation of the revisions which are permitted on Reprints
— review of current uncharted data for possible notice or chart amendment patch action before preparation of Reprints
— review and update of the maintenance copy as a New Edition drafting guide
— preparation of information requests for New Editions:
(a) standard requests for aids to navigation, nomenclature, tides and water levels update etc.
(b) special requests for specific data such as a field examination or directed to an outside agency for information pertinent to the chart being revised

COMPUTER-ASSISTED CARTOGRAPHY
— introduction to the system, its history and current state
— use of the digitizing system
— processing digital data using various established programs
— editing through GOMADS
— data processing using various established programs
— preparation and processing of chart reproduction material through the automated drawing system

NEGATIVE ENGRAVING
— use, care and maintenance of negative engraving equipment
— description and purpose of materials and techniques
— engraving exercises to develop required "touch" and eye-hand co-ordination

ALPHANUMERIC OVERLAYS
— description and technique of methods of preparation
— standards and techniques of type placement
— conversion of positives to negatives; negative retouching and spotting
— colour separation of information; combination of alphanumeric information with line negatives of same colour for printing
— standards and techniques for labelling lattice negatives
— methods and procedures for amending negatives with negative stripping film

COLOUR TINT NEGATIVES
— procedures for producing colour tint negatives by both the S.G. positive method and the scribe-etch method
— description of the use of screens

REVISION DRAFTING
— description of methods, techniques and materials including negative stripping, retouching and the use of scribe-etch intermediates
— assessment of existing reproduction material to determine the methods to be used for revisions

VERIFICATION AND QUALITY CONTROL
— the role of "peer checking" and the supervisor's review during the chart construction process
— identification and description of the various verification stages during the compilation and drafting of New Charts, New Editions and Reprints
— procedures for making amendments and resolving conflicts of opinion after the various stages of verification
— explanation of the colour proofing procedure and approval for printing
— role of Quality Control at Headquarters

PRINTING, RELEASE AND DISTRIBUTION
— preparation of plating and printing instructions
— description of plating and printing processes
— explanation of the release procedure
— description of the chart distribution system

Canadian Hydrographic Service Cartography II Course

Objective:
The objectives of the Cartography II course are: to provide more theoretical principles and background to the cartographic processes involved in the construction and maintenance of nautical charts; to give greater in-depth details and techniques of certain processes in chart construction; to provide more knowledge about related subjects that directly effect the cartographic processes; and to present subjects that maybe only of peripheral interest.

PURPOSE
The purpose of the Cartography II course is to enhance the technical knowledge and competence of the cartographers so that they may more effectively fulfill supervisory or specialist roles. The successful completion of the course is one of the requirements in order to qualify for positions beyond the top working level.

Canadian Hydrographic Service Cartography II 1982

September 28 to October 28

Subjects	SYLLABUS Periods
1. Planning and Priorities	3
2. Elementary Principles of Navigation and use of charts	6
3. Hydrography	25
4. Field sheets	6
5. Tides, Currents & Water Levels (Advanced)	6
6. Aerial Photos	7
7. Assessment of Complex Data	24
8. Cartographic Communication	18
9. Generalization	18
10. Automated Cartography	8
11. Related Subjects	5
12. Peripheral Subjects	18
	144
Study Periods	14
Final Examinations	8
Commencement & Critique	6
Total	172

or approximately 4½ weeks

1. **PLANNING AND PRIORITIES** 3 Periods
   - — planning — survey and charts
   - — priorities — surveys and charts
   - — a detailed study and analysis of the factors that are considered in the preparation of chart schemes and individual chart formats including the specification sheets

2. **ELEMENTARY PRINCIPLES OF NAVIGATION AND UTILIZATION OF CHARTS** 6 Periods
   - — an examination of how mariners and others use charts with special emphasis on the aspects of charts that are important to mariners.

3. **HYDROGRAPHY** 25 Periods
   - — planning of survey operations
   - — basics of control requirements
     - a) Geodesy — Basic Principles
     - b) Projections — Principles
     - c) Types of control and accuracies
   - — soundings
     - a) datums
     - b) positioning
     - c) measurement of depths and recording shoal exams
     - d) point to point, air photo, track, and spot sounding
   - — automated acquisition systems
   - — processing, including tidal reduction of depths and automated processing systems

4. **Field Sheets** 6 Periods
   - a) Presentation of data, contouring
   - b) Checking, verifying

5. **TIDES, CURRENTS AND WATER LEVELS (Advanced)** 6 Periods
   - — vertical datums, both current and obsolete and the procedure for converting data (datum)
   - — reference from one to another
   - — description and explanation of measurement techniques and instruments used
   - — purpose and interpretation of co-tidal charts

6. **AERIAL PHOTOS** 7 Periods
   - — photogrammetry — principles
   - — limitation of photos and plots
   - — use of photos in surveys
   - — use of photos in chart production

7. **ASSESSMENT OF COMPLEX DATA** 24 Periods
   - — assessment procedures for more complex data such as overlapping surveys, revisory surveys, engineering drawings, field reports, etc
   - — identification of items requiring additional information before actioning or items to be brought forward for consultation before actioning
   - — discussion of various limits of authority in making decisions on the utilization of various types of source data, formulation of recommended courses of action
   - — types of queries and requests for information including preparation for revisory surveys
   - — procedure for preparing queries, various forms of queries, e.g. formal, informal, verbal, documented, etc
   - — researching process for query presentation, amount of background information concerning the problem that should be presented
   - — horizontal datum adjustment
   - — vertical datum adjustment

8. **TOPICS CONCERNING GENERALIZATION AND PERCEPTION MAINLY RELATING TO CARTOGRAPHIC COMMUNICATION TECHNIQUES FOR MAPS.** 18 periods

   Introduction:

   Ideas concerning maps, map design and map perception
   - — Map Making and Cartographic Design; defining general classes of maps and general approaches to perceptually based map design
   - — Generalization in Cartography: discussion of nature of generalization in maps, scale dependent and function dependent and forms
   - — Map symbols: perceptual dimensions of map symbols which convey coded information
   - — Area Symbols: perceptual attributes of color and texture that relate to their use as area symbols

Integration of Geometric and Perceptual considerations
- Two Point Perspective Drawing
- Deformation In Maps and Drawings: analysis of scale change in map projections and two point perspective drawings
- Cognitive Behaviourism: a discussion of the implications of the spherosity of the earth and some perceptual dimensions of the earth which can be used in mapping
- Cartographic Communication and Chart Design: A discussion of how various perceptual principles could be applied to the design of nautical charts

Interpolation Models used in the generation of contours.

9. **GENERALIZATION** 18 Periods
- principles
- interrelations and guidelines; selections, smoothing, symbolizing, exaggeration, minimizing, scale relationship, saliency and importance of details
- detailed examination of the methodology and symbology involved in the generalization of more complex source data
- generalization and its relationship to the ratio between source scales and charting scales

10. **AUTOMATED CATOGRAPHY** 8 Periods
- state of the art, in automated cartography in the CHS to date, and automated processes actually implemented to replace manual processes.
- The use of automated processes and traditional manual processes as an effective combination in the construction of marine charts

11. **OTHER RELATED SUBJECTS** 5 Periods
- Standing Orders — processes
- Printing Charts — Specifications
  - What to look out for, especially
  - contract printing
- N/M — Principles

12. **PERIPHERAL SUBJECTS** 18 Periods

.1 — oceanography
.2 — geophysics
.3 — geology
.4 — sailing directions
.5 — IHO
.6 — legal liabilities, limits and international concerns
.7 — GEBCO and Geoscience Mapping

- description of the sources, techniques, methods and procedures, etc., employed in the preparation of the Natural Resources Series, GEBCO sheets and other specialized charts
- problems concerning various source data
- geomorphology and contouring

COMMENCEMENT AND CRITIQUE	6 Periods
Study Periods	14 Periods
Final Exams	8 Periods

TOTAL PERIODS = 172
= 4½ wks.

JULY 1982

An Upwelling Gyre off the West Coast of Vancouver Island

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INTRODUCTION

We recently completed a 3 year study of the physical and biological oceanography over the continental shelf off the west coast of southern Vancouver Island (Figure 1), where a highly productive planktonic ecosystem is driven throughout the summer by an upwelling gyre that is controlled by the shape of the coastline and by local bathymetry. This paper summarizes results published in more detail in Freeland and Denman (1982), Mackas and Sefton (1982), and Denman et al. (1981).

The study region is exposed to the eastern Pacific Ocean and is affected by forcing from the Strait of Juan de Fuca. The outflow from that Strait is predominantly in the upper 100m of the water column and is the upper layer of a classical positive estuarine circulation pattern, driven ultimately by the fresh water of the Fraser River. This outflowing water, which has a salinity contrast with the deep layers of only about 1.5°/oo by the time it reaches the shelf, turns northwards along the coast to form a Vancouver Island coastal current. The coastal current is, presumably, fed by buoyancy sources (fresh water outflow from rivers and inlets), and appears to be a permanent feature of the local oceanography but has a large seasonal variation.

The continental shelf in the region is dissected by a deep submarine canyon, the Juan de Fuca Canyon. However, a second canyon which we nicknamed the "Spur Canyon" (see Figure 1) appears to play a very substantial rôle in determining the local physical and biological oceanography. Stucchi (1982) has found that changes in the density structure that we have attributed to an interaction with this canyon in turn have a very substantial impact on the deep water masses in a nearby fjord, Alberni Inlet (shown at the top centre of Figure 1).

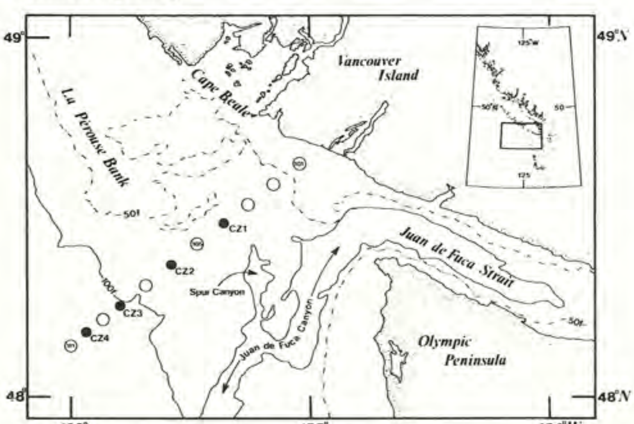

Figure 1: The study region showing the main hydrographic sampling line. Solid circles indicate current meter moorings (from Freeland and Denman, 1982).

DISSOLVED OXYGEN AND DENSITY

The large seasonal variation in water properties in the study area is illustrated best by a time series of dissolved oxygen concentration at a single location (station 105) on a continental shelf, shown in Figure 2. The data show an abrupt event that occurs each spring

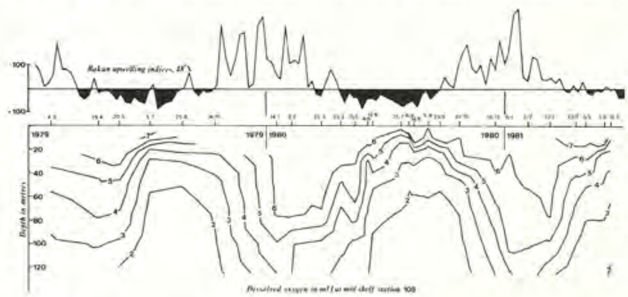

Figure 2: Time series of dissolved oxygen concentration at station 105. Dated ticks represent sampling dates and the top trace shows winds calculated from surface atmospheric pressure maps at 48° N, 125° W. Shaded sections are upwelling-favourable southward blowing winds (from Freeland and Denman, 1982).

and delivers dense, low-oxygen water onto the continental shelf in June of each year. The annual cycles of density and oxygen are very large and represent a single upwelling event each year that lasts for typically 4 months (unlike more "episodic" upwelling regions, c.f. Oregon).

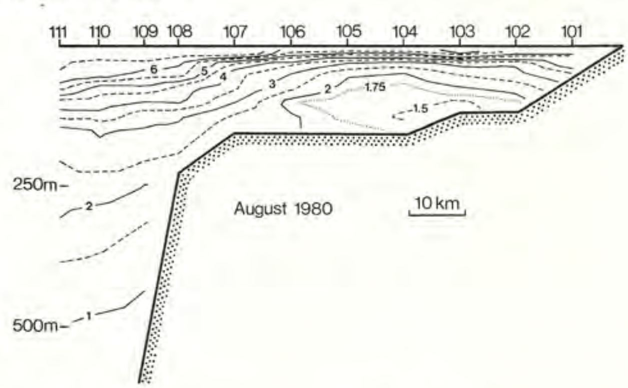

Figure 3: Dissolved oxygen concentrations along the station line shown in Figure 1, for August 6, 1980 (from Freeland and Denman, 1982).

Figure 3 shows a vertical section of dissolved oxygen concentration through the anomaly and distinctly shows the pool of low oxygen water on the continental shelf. Figures 4 and 5 show hori-

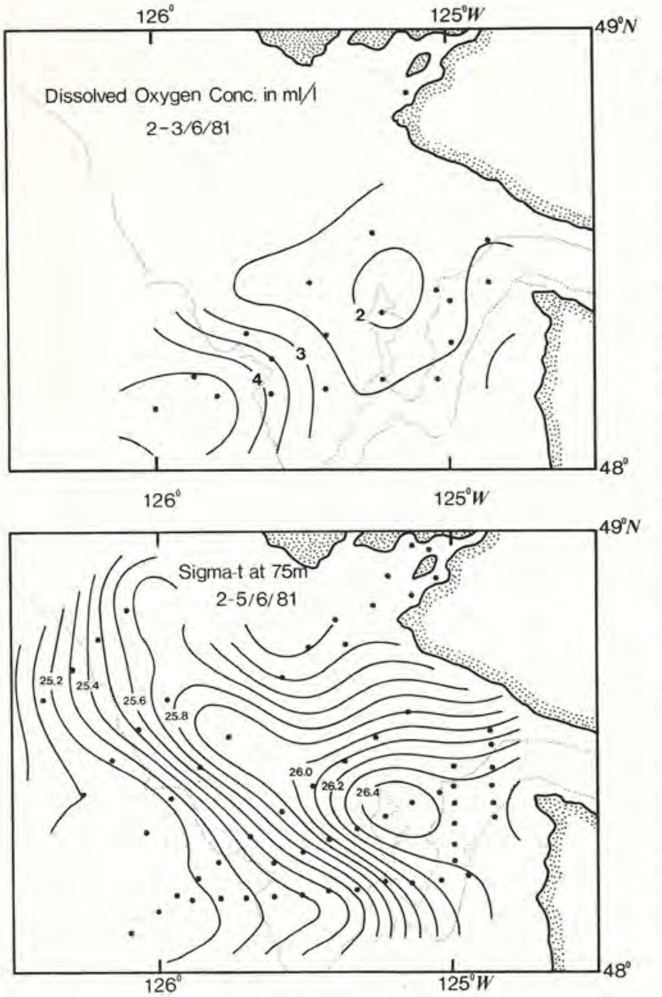

Figure 4: Objective maps of dissolved oxygen concentration and sigma-t (density anomaly) at 75m for 2-3 June, 1981. Station locations are solid dots and the dotted line represents the 183m (100fm) contour (from Freeland and Denman, 1982).

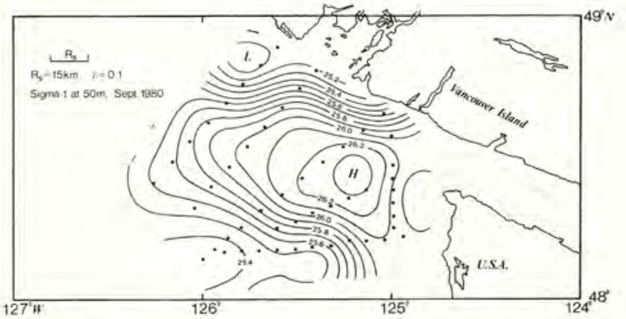

Figure 5: The same for sigma-t, September 23, 1980 (from Freeland and Denman, 1982).

zontal sections of water properties from cruises in two different years contoured to exhibit the horizontal extent of the low-oxygen anomaly. On the diagrams the 180m depth contour has been marked lightly; it should be noted that the oxygen and density contours always close around the northern terminus of the Spur Canyon. Other properties have been mapped and the same pattern appears regularly. We conclude that the head of the Spur Canyon is a major local source of dense low oxygen water that is also particularly rich in nutrients. The source water appears to have properties similar to those of the poleward flowing California Undercurrent.

VELOCITY STRUCTURE

As mentioned in the introduction, the outflow from the Strait of Juan de Fuca drives a coastal current. Current meters located inshore show a weak seasonal cycle, as might be expected from the nature of the current. At the shelf edge, however, we observe a strong northward flow at all depths in the winter. In the spring of each year the shelf edge currents reverse producing what Huyer et al. (1979) call the "spring transition". After the spring transition a barotropic eddy forms on the southern Vancouver Island shelf. At first sight it would appear that the lateral shear (northward flow inshore, southward at the shelf edge) would be sufficient to spin up such an eddy. However, suppose that at time t=0 we initiate narrow currents V_o and $-V_o$ at opposite sides of a continental shelf of width 2L. By scaling, the time taken to spin up the central region is $T \sim L^2/A$, where A is the horizontal eddy diffusion coefficient. Taking $L \sim 30$ km, and $A \sim 10^5 cm^2/sec$ (Okubo, 1971) we find $T \sim 3$ years. Even if A approaches oceanic values of say $5 \times 10^6 cm^2/sec$ T is still much too long. The flow out of Juan de Fuca Strait is, however, strongly sheared (see Huggett et al. (1976) for example) and must be advecting cyclonic vorticity onto the shelf. It seems likely that the shelf edge current will also advect cyclonic vorticity from the north and so there then seems little difficulty in getting vorticity to the centre of the shelf. The spin-up time for an eddy is then governed by an advective time scale, $T \sim L/U$. For $L \sim 30$ km, and $U \sim 5$ cm s^{-1}, we find $T \sim 1$ week for the eddy spin-up upon spring transition. The internal Rossby radius on the shelf is about 15 km; the Spur Canyon is therefore relatively narrow, having width of typically 5 km. We suggest that to 1st order the eddy is not influenced by the canyon because of this scale disparity. The location over the canyon then is not a result of bathymetry, but rather of vorticity constraints ultimately caused by shoreline features such as Juan de Fuca Strait. The centre of the eddy is however located over the head of the Spur Canyon, and their interaction (shown pictorially in Figure 6) results in the observed upwelled water reaching the centre of the shelf, apparently in the following way.

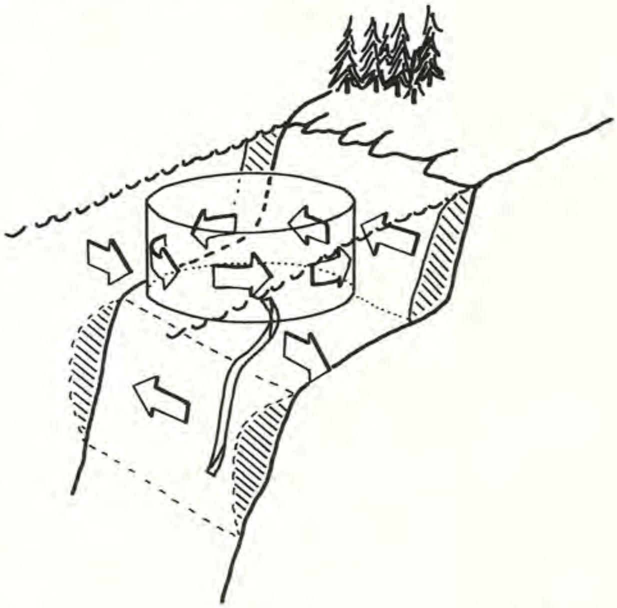

Figure 6: A schematic picture of the gyre located over the head of the submarine canyon.

A parcel of water in mid water column is in approximate geostrophic balance in the eddy, so a radial *inward* pressure gradient balances the Coriolis force produced by the azimuthal (cross canyon) component of velocity. As we descend in the water column the pressure gradient remains continuous, but as we pass into the canyon the azimuthal velocity must drop to zero. Hence, water inside the canyon is unbalanced geostrophically but sees an inward pressure gradient. This, we believe, drives the upwelling. Can this mechanism supply water from a sufficiently great depth?

Let us suppose that the inward geostrophic pressure gradient associated with the eddy does work on water parcels as they move along the canyon system from the shelf edge to the centre of the eddy. That work should balance the work needed to raise a parcel of dense water from an arbitrary depth H to the depth of the continental shelf, 150 m. We are thus looking for the depth H from which water can be raised to the shelf level ariving with zero kinetic energy. Hydrographic data result in a value of H~450m, so it is possible energetically to raise water by this means from large depths on the continental slope up the canyon to the centre of the continental shelf.

This energetics argument is interesting but not compelling. The process is strongly non-linear since the water advected from large depths up the canyon will tend to produce an outward baroclinic pressure gradient that will tend to limit the flow. However, this baroclinic gradient will make a steady state possible and in that sense will tend to simplify the problem. A more detailed theoretical analysis is carried out in Freeland and Denman (1982) which gives a transit time for water to travel up the Spur Canyon of 1-3 months, comparable with observed times for the low oxygen water to appear on the continental shelf after the spring transition.

BIOLOGICAL IMPLICATIONS

The flux of nutrient-rich waters up onto the shelf results in high photosynthetic productivity by phytoplankton throughout the summer period (Denman et al., 1981), and resulting high standing stocks of phytoplankton in the area. In some colour images from satellites, the eddy is outlined by a pattern in the blue/green colour ratio, representative of near surface phytoplankton concentrations, although we have not seen a surface manifestation of the eddy in temperature or other physical variables.

A direct effect of the eddy on zooplankton distributions is not easy to establish, but Mackas and Sefton (1982) have shown that the patterns of both phytoplankton and zooplankton community composition (i.e. groupings of stations with similar species dominance ratios) reflect the presence of the eddy and its related current structure. In Figure 7, stations with the same symbol are those with very similar species collections. In both zooplankton and phytoplankton, stations characterized by "offshore" species (circles) were also found at midshelf suggesting the presence there of offshore water. The southward flowing outer shelf currents were probably responsible for the compositional patch (squares) that showed up on the outer shelf, and species from Juan de Fuca Strait were found at inner and midshelf locations (solid triangles).

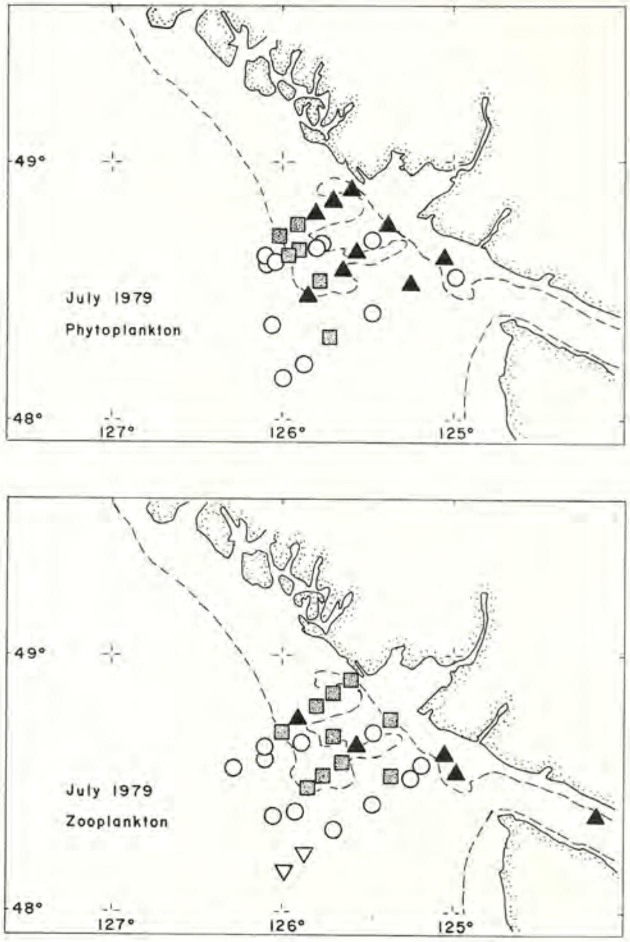

Figure 7: Distributional map of phytoplankton and zooplankton for July 1979. Stations with the same symbol had statistically similar species compositions (from Mackas and Sefton, 1982).

FUTURE WORK

In the near future, we plan to study current flows and mixing patterns in the canyon system jointly with Americans scientists (since it crosses the international boundary) in order to test our models more rigorously.

REFERENCES

Denman, K.L., D.L. Mackas, H.J. Freeland, M. Austin and S. Hill, 1981, Persistent upwelling and mesoscale zones of high productivity off the west coast of Vancouver Island, pp. 514-521, In: *Coastal Upwelling*, F.A. Richards (ed.), American Geophysical Union, Washington, D.C.

Freeland, H.J. and K.L. Denman, 1982, A topographically controlled upwelling centre off southern Vancouver Island, *J. Mar Res., 40*(4).

Huggett, W.S., J.F. Bath and A. Douglas, 1976, Data record of current observations, Volume XV, Juan de Fuca Strait 1973, Institute of Ocean Sciences, Sydney, B.C., Canada.

Huyer, A., E.J.C. Sobey and R.L. Smith, 1979. The spring transition in currents over the continental shelf. *J. Geophys. Res., 84*(C11), 6995-7011.

Mackas, D.M. and H.A. Sefton, 1982, Plankton species assemblages off southern Vancouver Island: Geographic pattern and temporal variability. *J. Mar. Res., 40*(4).

Okubo, A., 1971, Oceanic diffusion diagrams, *Deep-Sea Res., 18*(8), 789-802

Stucchi, D.J., 1982, Shelf-fjord exhange on the west coast of Vancouver Island. Proceedings of the Coastal Oceanography Workshop, Os, Norway, June 6-11, 1982.

Meteorology and Oceanography in the Falkland Islands Region

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Abstract

The climate and general oceanography of the Falkland Islands region are reviewed. Descriptions of the pack ice distribution, tidal regime and sea state are also included.

1. **Geography**

The Falkland Islands are located approximately at 52° S and 60° W (Figure 1) in the southern part of the Atlantic Ocean. There are two main islands, referred to as East Falkland and West Falkland Islands (Figure 2) and some 340 small islands. The total area of this island group is about 12,960 km^2. The East and West Falkland Islands are separated by the Falkland Strait which has an average width of about 40 km.

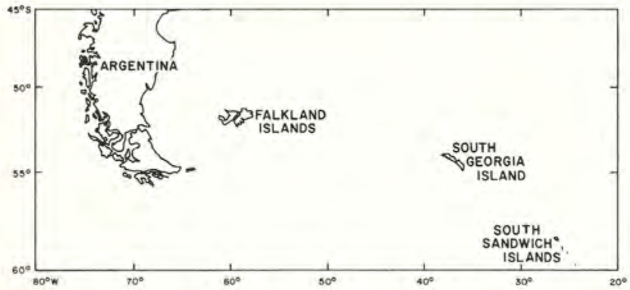

Figure 1: Location of the Falkland Islands.

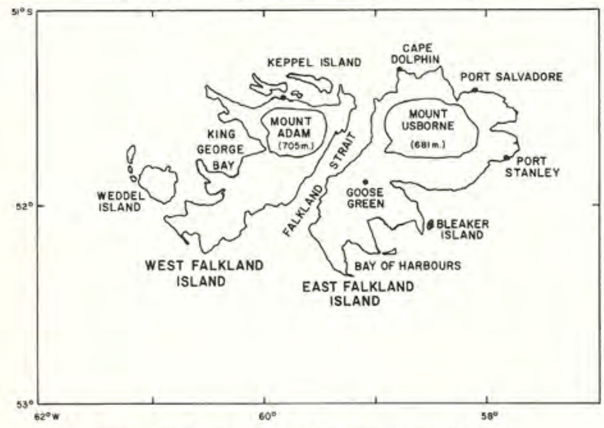

Figure 2: Geography of the Falkland Islands.

The islands are indented with several fjords. There is a mountain chain on East Falkland. The peak of this is referred to as Mount Usborne and has an altitude of about 681 m. There is a mountain chain on West Falkland also. The peak of this is referred to as Mount Adam and has an altitude of about 705 m. Except for isolated mounts most of the land is only about 3 m above sea level.

2. **Climate**

Since the Falkland Islands lie close to the continent of South America, we can gain some insight of the climate in the Falklands area by considering the climate of South America. South America extends from about 10° N to 55° S, for a distance of about 7,245 km. In South America, the variation in climate and weather with latitude and with season is not as pronounced as in North America. The difference is mainly due to the tapering of the land mass toward the South Pole (Haurwitz and Austin, 1944).

There are several reasons for the mildness of climate in South America. Since most area of South America lies in the tropics, it is basically a warm climate continent. In the southern latitudes the width of South America is smaller and there is water on three sides.

The seasonal variation of climate is not pronounced for the following reasons. Unlike North America and Eurasia, South America is rarely affected by extremely cold polar continental air masses in winter. Summer heating is not very pronounced south of 40° S.

The average surface air temperature in January (summer in the southern hemisphere) is about 10° C and the average July (winter) temperature is about 3° C in the Falklands area (Schwerdtfeger, 1976). The average annual precipitation is about 300 cm. The precipitation occurs during about 200 days per year (persistent drizzle type as opposed to the heavy thunder-storm type precipitation) more or less evenly through the year with a slight maximum in summer. It is cloudy about 70 percent of the time in the year. Fog occurs frequently but thunderstorms are rare.

The Falkland Islands area is generally traversed by the maritime polar airmass (mp) in summer and the mpku (maritime polar colder than underlying surface, unstable aloft) type airmass in winter.

Tropical cyclones do not occur in the South Atlantic Ocean. Major extra-tropical cyclones occur and the Falkland Islands region is traversed by these cyclones throughout the year. During winter they travel more or less from west to east whereas in summer they travel from WNW to ESE.

3. **Oceanography**

Average surface water temperatures in the Falkland Islands region are about 8° C in February and about 5° C in August. The surface circulation can be expected in terms of the following current systems (Haurwitz and Austin, 1944): (1) the warm, southward moving Brazil current along the east coast of South America, (2) at about 55° S, the southern hemisphere is completely surrounded by the westward drift current (Figure 3), and (3) the Falkland Current can be considered as a branch of this.

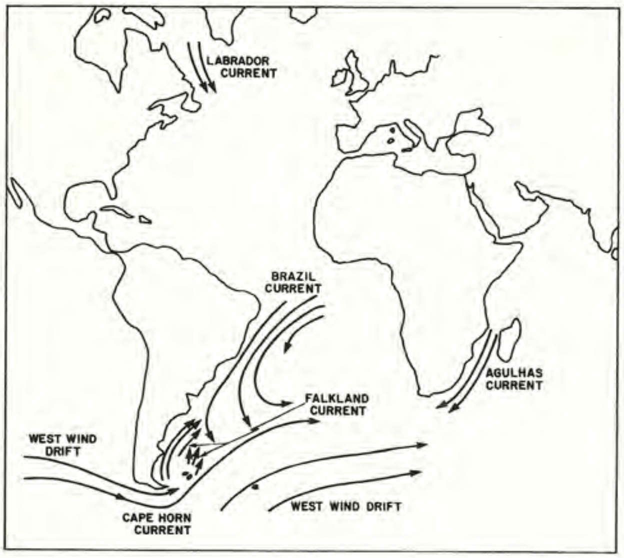

Figure 3: The ocean currents mentioned in this study.

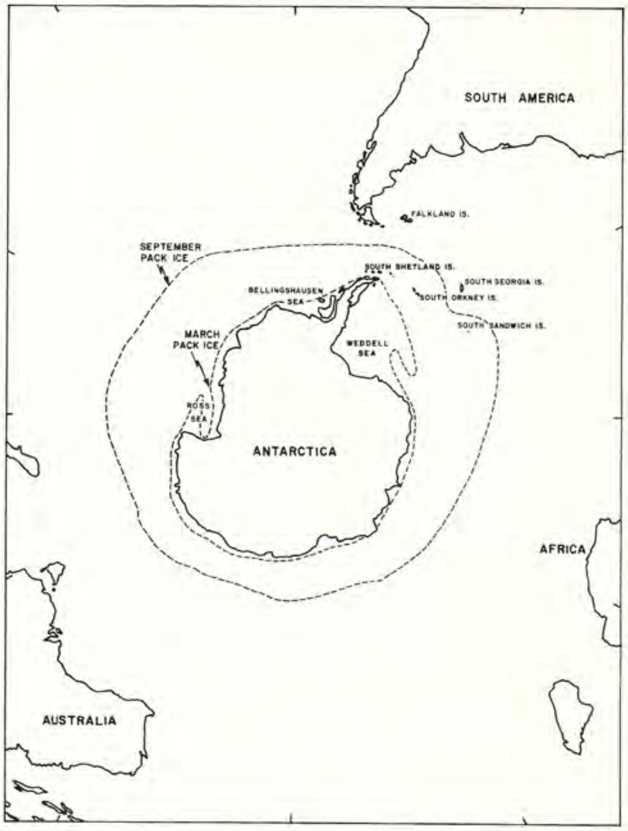

Figure 4: Limits of pack ice distribution in March and September.

Next we will discuss the movement of the Antarctic pack ice. The Antarctic pack ice experiences a much greater variation than Arctic pack ice. Antarctic ice pack occupies minimum area (about 2.6×10^6 km^2) in March and maximum area (about 18.8×10^6 km^2) in September (Figure 4). For comparison we can state that the Arctic pack ice minimum (in summer) is about 5.2×10^6 km^2 and the maximum is less than 11.8×10^6 km^2.

Almost 85% of the Antarctic pack ice melts each year; hence pack ice in the following year is predominantly of the (Anon, 1978) first year replacement ice which attains on the average a thickness of 1.5 m. The Antarctic ice pack can move quite fast, sometimes by as much as 65 $km \cdot day^{-1}$. The multi-year ice in the Ross, Bellinghausen and Weddel Seas can trap ships.

As can be seen from Figure 4, the Antarctic ice pack does not approach the Falkland Islands nor the South Georgia Island. However, the South Sandwich Islands, the South Orkney Islands and the South Shetland Islands are encircled by the ice pack in September.

4. **Tides**

Table 1 lists the amplitudes and phases of the following tidal constituents at various stations in the Falklands area: M_2 (principal lunar semi-diurnal, period 12.42 hours), S_2 (principal solar semi-diurnal, period 12.00 hours), K_1 (lunisolar diurnal, period 23.94 hours), 0_1 (principal lunar diurnal, period 25.82 hours). For comparison, data at stations on the South Georgia Island are also included (Anon, 1979).

The form number F listed in Table 1 is defined as (Defant, 1961)

$$F = \frac{K_1\ 0_1}{M_2 + S_2} \qquad (1)$$

Only the amplitudes of the tidal constituents are considered in equation (1). The following classification of tides is generally made based on F.

$F < 0.25$: semi-diurnal (S)
$0.25 < F < 1.5$: Mixed, mainly semi-diurnal (MS)
$1.5 < F < 3$: Mixed, mainly diurnal (MD)
$F > 3$: Diurnal (D)

As can be seen from Table 1, at all the stations (except Speedwell Island) the tide is either semi-diurnal or mainly semi-diurnal. The existence of predominantly diurnal tide at Speedwell Island can be attributed to local topography which appears to suppress the semi-diurnal tide and amplify the diurnal tide. This presents an interesting feature and needs a separate study.

For the M_2 tidal constituent, there is an amphidromic point (where the range of the tide is zero) south of the Falklands. For the S_2 constituent also there is an amphidromic point, but it is located just south of the tip of the South American continent (Accad and Pekeris, 1978).

5. **Storm surges and tsunamis**

We mentioned earlier that there are no tropical cyclones in the South Atlantic Ocean. However, extra-tropical cyclones traverse South America and Falklands and sometimes they recurve. Storm surges up to 3 m amplitude could occur, though not frequently. Storm surges with amplitudes less than one meter are quite common.

Tsunamis also could occur in the Falkland Islands region, although not much literature exists on this topic. Figure 5 shows the epicenters of tsunami-genic earthquakes during the period 1883 to 1976. It can be seen that several earthquakes have occurred close to South Georgia Island and these could have caused tsunamis in the Falkland Islands region.

Figure 5 also shows major volcanic eruptions during the period 1510 to 1980. It can be seen that there are no volcanic eruptions close to the Falklands and the possibility of tsunamis due to volcanic explosions is small or negligible.

Table 1 Information on the tides in the Falkland Islands area.

Station	Location	Latitude (South)	Longitude (West)	M_2		S_2		K_1		O_1		F	Classification
				Amp (cm)	Phase (deg)	Amp (cm)	Phase (deg)	Amp (cm)	Phase (deg)	Amp (cm)	Phase (deg)		
Bay of Harbours	East Falkland	52° 15'	59° 19'	16	166	7	192	9	65	11	34	0.87	MS
Bleaker Island	East Falkland	52° 12'	58° 51'	31	135	12	174	7	58	11	10	0.42	MS
Lively Settlement	East Falkland	52° 00'	58° 28'	34	153	14	183	8	67	12	4	0.42	MS
Goose Green	East Falkland	51° 50'	58° 58'	36	151	14	181	7	36	11	1	0.36	MS
Stanley	East Falkland	51° 42'	57° 52'	45	158	15	183	13	37	15	6	0.47	MS
Port Louis	East Falkland	51° 33'	58° 09'	47	157	15	192	11	35	14	7	0.40	MS
Port Salvador entrance	East Falkland	51° 25'	58° 19'	60	191	19	225	20	73	18	11	0.48	MS
Ajax Bay	Falkland Sound	51° 34'	59° 05'	64	219	20	234	16	97	16	28	0.38	MS
Northwest Island	Falkland Sound	51° 35'	59° 10'	63	216	18	244	15	105	17	33	0.40	MS
Swan Island	Falkland Sound	51° 47'	59° 35'	43	229	10	287	12	100	14	24	0.49	MS
Great Island	Falkland Sound	51° 58'	59° 42'	35	259	13	285	14	79	17	46	0.65	MS
Speedwell Island	Falkland Sound	52° 12'	59° 41'	2	124	0	?	11	36	14	358	12.5	D
Chatres	West Falkland	51° 43'	60° 05'	101	278	23	327	8	112	15	32	0.19	S
West Point Island	West Falkland	51° 21'	60° 41'	92	253	30	292	13	113	14	25	0.22	S
Port Egmont	West Falkland	51° 21'	60° 03'	82	233	30	270	20	117	17	23	0.33	MS
Keppel Sound	West Falkland	51° 20'	59° 55'	85	227	23	264	16	105	15	22	0.29	MS
Golding Island	West Falkland	51° 23'	51° 26'	65	256	14	298	15	124	15	45	0.38	MS
Moltke Harbour	South Georgia Island	54° 31'	36° 01'	23	227	12	248	5	59	10	27	0.43	MS
King Edward Cove	South Georgia Island	54° 17'	36° 30'	24	216	12	236	5	27	10	24	0.42	MS
Leith Harbour	So. Georgia Is.	54° 08'	36° 41'	28	205	12	233	4	70	9	36	0.33	MS
Elsehul	So. Georgia Is.	54° 01'	37° 57'	27	211	14	257	3	58	9	40	0.29	MS

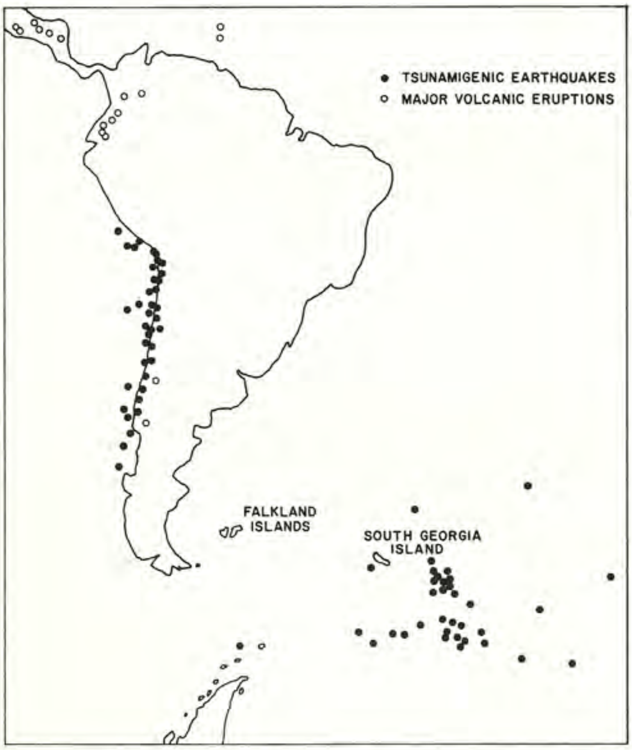

Figure 5: Tsunami-genic earthquakes and major volcanic eruptions in South America and South Atlantic ocean.

6. **Sea state**

The South Atlantic Ocean area from about 40° S to the Antarctic Circle (60° S) has one of the strongest sustained winds on the globe. Persistent winds up to 41 km•hr^{-1} occur frequently. Because of the persistent winds, wind waves up to 3 m amplitude are a persistent feature in the waters surrounding the Falklands. During stormy weather, wind waves with amplitudes as large as 14 m have occurred.

Actually the situation could even be worse if the so-called giant waves could occur here. The giant (episodic, freak, killer, abnormal) waves were first noticed in the 1960's in the Mozambique Channel area (between the east coast of South Africa and the Malagasy Republic). During the closure of the Suez Canal, the ships from Asia to Europe and the Americas had to go through the Mozambique Channel (Mallory, 1974) and several ships foundered due to giant waves. Under ideal conditions these giant waves could attain amplitudes as large as 40 m.

Although tsunamis and storm surges could also attain amplitudes of several metres, they occur during a longer duration (tsunamis occur during several minutes to a few hours, and storm surges occur during several hours and sometimes even up to one or two days). On the other hand the giant wave occurs during a few seconds and this makes it even more dangerous than tsunamis and storm surges and particularly difficult to predict. Another difference is that, whereas tsunamis and storm surges attain significant amplitudes only near the coast, giant waves can have great amplitudes even in deep water.

Giant waves can occur when ocean swell meets ocean currents traveling in the opposite direction. The swell extracts energy from the opposing current and gets amplified. The ocean swell in the South Atlantic and Indian Oceans travels from southwest to northeast. Off the east coast of South Africa (Figure 3) the swell is opposed by the Agulhas Current and giant waves occur here. Another example of a location where giant waves could occur is off the Labrador Coast of Canada where the south flowing Labrador Current meets the swell. Near the Falklands, significant giant waves cannot develop because the ocean swell and the Falkland Current are in the same direction (Figure 3).

Acknowledgements

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References

Accad, Y. and C. L. Pekeris (1978) Solution of the tidal equations for the M_2 and S_2 tides in the world from a knowledge of the tidal potential alone, Phil. Trans. of the Royal Soc. London, Ser. A, Vol. 290, 235-266.

Anon (1978) Polar region atlas, published by the Central Intelligence Agency, Washington, D.C., 66 pages.

Anon (1979) Admiralty tide tables 1980, Vol. 2, published by the Hydrographer of the Navy, U.K., 405 pages.

Defant, A. (1961) Physical oceanography, Vol. 2, Pergamon Press, New York, 598 pages.

Haurwitz, B. and J. M. Austin (1944) Climatology, McGraw-Hill Inc., New York, 410 pages.

Mallory, J. K. (1974) Abnormal waves on the south east coast of South Africa, Int. Hydrographic Review, Vol. 51, 99-129.

Schwerdtfeger, W. (1976) Introduction, Chapter 1 in "Climates of Central and South America", world survey of climatology, Vol. 12, Elsevier Publishing Company, Amsterdam, 1-71.

Un Survol Historique De l'Hydrographie Au Canada Français

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RÉSUMÉ

La colonisation du Canada est liée à l'histoire maritime, plus particulièrement celle racontant l'exploration du coeur du continent en pénétrant la voie d'eau majestueuse qu'est le Saint-Laurent. Cet exposé relate l'histoire de sa décourverte des premiers temps qu'elle fut apercue sur les côtes maritimes de l'Atlantique jusqu'aux levées modernes de l'actuel Service hydrographique en passant par les étapes de l'exploration du Passage du nord-ouest, de la Baie d'Hudson, et des Grands Lacs. Cette communication localise cet historique au "Canada français" surtout pour définir géographiquement les limites globales de cette exploration et souligner l'importance des découvreurs français dans notre histoire.

ABSTRACT

The colonization of Canada is tied to Maritime history, particularly exploration of the heart of the continent via penetration of that majestic waterway — the St. Lawrence River. This paper recalls the River's history from the time of its first sighting from Maritime coasts to the modern surveys of it by the hydrographic service; along the way, we touch on the exploration for the Northwest Passage, and of Hudson Bay, and the Great Lakes. The historical account focuses on French Canada in order to define the geographic extent of their exploration efforts and to underscore the importance of French discoveries in our history.

INTRODUCTION

L'Hydrographie a joué un rôle capital dans la décourverte et l'exploration des premiers temps de notre pays. Après avoir maîtrisé l'art de la navigation en haute mer par maintes traversées, les européens découvrirent dans leur recherche pour la route aux épices et autres raretés de l'Orient qu'un obstacle de taille leur barrait la route — "le nouveau monde". La recherche de ce passage qui leur permettrait de franchir cette barrière terrestre donna lieu à une série d'explorations à travers ce qui est aujourd'hui le Canada. Eurent alors lieu les recherches du passage par le Saint-Laurent, du passage du Nord-Ouest et du Nord-Est, affirmant la nécessité des connaissances de l'hydrographie pour naviguer dans ces eaux. Plus tard, quand il fut évident que l'obstacle était infranchissable, et que c'était en fait un continent permettant la colonisation, la voie d'eau du majestueux Saint-Laurent, route privilégiée de l'entrée au coeur du continent vit naître la nécessité de cartes hydrographiques de plus en plus justes et fiables, permettant une navigation guerrière et commerciale sécuritaire. Cet exposé retrace l'histoire de ces explorateurs/hydrographes/cartographes qui ont maîtrisé les dangers de l'inconnu pour permettre à ce qui apparut comme un obstacle de devenir un pays.

LE REGIME FRANCAIS — JACQUES CARTIER

Bien que n'ayant pas été rendue publique ou connue de façon universelle en ce temps-là, l'existence des côtes de l'actuelle Terre-Neuve était familière aux pêcheurs portugais et français. Les premiers voyages des Cabot (1497) et Verrazano (1525) font vaguement état d'un "nouveau pays qui n'a jamais été vu par personne". Ce n'est qu'en mai 1534 que Jacques Cartier envoyé par le Roi de France, François 1er, avec la mission de découvrir un passage, atteint Terre-Neuve. A la suite d'une exploration qui lui permet de noter avec une considérable précision les détails qui seront utiles aux navigateurs et aux pêcheurs futurs, et qui le menèrent du détroit de Belle-Isle au Labrador (qu'il décrit comme inhospitalier et dangereux, sans bonnes terres), jusqu'aux Iles-de-la-Madeleine et à l'Ile du Prince Edouard, à la Baie des Chaleurs (qu'il prend pour un passage), à l'Ile d'Anticosti où il s'aperçoit qu'une route existe entre l'Ile et la Côte Nord, mais où courants et vents sont si forts qu'ils l'empêchent d'aller plus loin, il décida de rentrer en France ou il arrive au début de septembre.

En 1535, un second voyage est entrepris dans le but de poursuivre l'exploration de ces terres. Il atteint le point où il a rebroussé chemin auparavant. En août, après avoir passé quelques jours à explorer la rive Nord du Saint-Laurent et avoir appris par des indiens que "la rivière rétrécissait au fur et à mesure qu'on la remontait, que l'eau devenait douce et que personne n'avait atteint sa source", Cartier commence à explorer le fleuve. Il atteint l'Ile d'Orléans, remonte la rivière St-Charles où est situé le village Indien de Stadacona. Poursuivant plus vers l'avant sa remontée du Fleuve, il arrive à Hochelaga où il se heurte aux rapides de Lachine, infranchissables, qui le font rebrousser chemin jusqu'à la Rivière St-Charles où il passe l'hiver.

Au printemps de 1536, il repart pour la France en passant par le détroit de Cabot.

Cartier effectua un troisième voyage en 1541 qui n'apporta que peu de découvertes nouvelles, ce qui termina son travail.

Il avait effectué une tâche de grande valeur. Les résultats de ses voyages augmentèrent la richesse des renseignements contenus dans les cartes du temps qui définissaient le continent et le Saint-Laurent. Arrêté par les rapides de Lachine après s'être aperçu que les rives du fleuve se refermaient sur lui dans son exploration du passage vers l'ouest, il avait quand même rapporté que de riches terres basses, propre à la colonisation, existaient le long du St-Laurent. Il rapporta aussi des notes et des renseignements utiles aux futurs explorateurs.

CHAMPLAIN

Entre les voyages de Cartier et l'arrivée du Sieur de Champlain en Nouvelle-France, les côtes de l'est commencerent à se dessiner sur les cartes européennes ainsi que Terre-Neuve et le Saint-Laurent.

Les Français établirent des installations permanentes dans les Maritimes. Ils venaient de plus en plus le long de ces côtes.

Né en 1567, Samuel de Champlain effectua un premier voyage d'exploration dans le golfe et le fleuve Saint-Laurent en 1603. Il y explora et cartographia le Saguenay entre autres. L'année suivante, il reçut pour mission d'explorer la côte de l'Atlantique, ce qu'il fit, découvrant la côte de la Nouvelle-Ecosse, la rivière Ste-Croix, la

Baie de Fundy (dont il releva le fait qu'elle donnait lieu à d'extraordinaires marées), la rivière St-Jean et ses chutes réversibles ainsi que le Bassin protégé connu de nos jours sous le nom d'Annapolis.

En 1608, de retour dans le Saint-Laurent, il fonda la ville de Québec dans un rétrécissement du fleuve.

De 1608 à 1635 à titre de lieutenant-gouverneur de la colonie, Champlain s'acquittait de ses tâches et s'en afranchissait dès qu'il le pouvait afin d'explorer toujours plus loin cette terre nouvelle.

Reconnu comme le père des arpenteurs géomètres au Canada, plus arpenteur et géographe que navigateur et hydrographe, Champlain fut néanmoins un explorateur des cours d'eau de la Nouvelle-France. On lui doit la cartographie des eaux de l'Atlantique jusqu'à la Baie Georgienne en passant par la rivière des Outaouais, la rivière Richelieu, les lacs Champlain et Ontario.

Les méthodes utilisées pour les levés marins à cette époque consistaient surtout en des déterminations de latitude à l'aide de l'astrolabe, et de descriptions des voies d'eaux, côtes etc. reportées sur des plans sommaires. Les mises en plan se faisaient surtout à partir de la position quotidienne de l'explorateur précisée par ses notes de terrain.

De par la variété des tâches qu'il a accomplies, de son insatiable curiosité et de son apport de travail énorme qu'il a réalisé en cartographie entre autres, Champlain est considéré comme le père de la Nouvelle-France. Ses cartes, bien qu'imprécises par rapport aux normes plus strictes établies plus tard, ont mis sur pied la base des connaissances topographiques de la nouvelle colonie.

LES PASSAGES NORD-EST ET NORD-OUEST

Pendant tout ce temps, une pépinière de navigateurs continuèrent d'explorer les passages vers les Indes en passant par le Nord.

En 1576, Frobisher, natif d'Angleterre, mis les voiles sur le nouveau monde. Il atteint la baie qui porte son nom et explora ainsi lors de deux voyages subséquents les premières voies d'accès aux eaux de l'Arctique canadien.

De 1583 à 1587, John Davis, sur les traces de Frobisher, pousse plus loin l'exploration, "décrivant et positionnant: îles, rochers et havres pour les besoins précis de la navigation, avec les lignes et les échelles qui conviennent", mais sans succès dans son but de découverte d'un passage vers l'ouest.

En 1607, Henry Hudson navigua à partir de la Tamise pour un voyage "de découverte d'un passage par le Nord jusqu'à la Chine". Après plusieurs voyages et nombre de découvertes telles que la Baie qui porte son nom, le pasage n'était toujours pas trouvé. Il trouva la mort abandonné par ses hommes qui s'étaient mutinés.

En 1616, Bylot et son pilote Baffin naviguèrent à leur tour ces eaux nordiques à la recherche du passage pour en arriver à la conclusion qu'il y avait de moins en moins d'espoir de trouver cette voie.

En 1631, Thomas James, explorant la baie d'Hudson et la Baie qui porte son nom, mit fin à cette étape de la recherche du fameux passage. Il était devenu des plus improbable qu'une telle voie existât. On se consacra dès lors sur l'exploration des territoires bordant la Baie d'Hudson, royaume de la traite des fourrures.

Champlain, bien que son nom soit lié à la découverte de deux des grands lacs, ne fut pas le premier blanc à les contempler. Un jeune du nom d'Etienne Brulé y fut envoyé en 1611 et y rapporta des données permettant de dresser les cartes de Champlain.

Jean Nicolet fut aussi envoyé en mission par le Sieur de Champlain en 1634 pour trouver un passage dans les mers du Sud où sous le nom plus connu du temps la "mer de l'ouest", imprécision due à la connaissance non définie des cinq Grands Lacs.

A la mort de Champlain en 1635, les pères Jésuites entrent en jeu dans l'exploration des eaux de la Nouvelle-France. Les pères Brébeuf, Chaumonot, Marquette, pour n'en nommer que quelques-uns, poussent plus loin l'exploration des Grands Lacs.

Plus près de Québec en 1646, Jean Bourdon aidé par le père Jogues, entreprend de faire un levé de la Rivière Richelieu muni d'un compas et d'un quadrant, dans une expédition remplie de dangers en territoire iroquois.

Peu après que Louis XIV, Roi de France, eut assumé le contrôle royal de la colonie en 1663, un programme fut institué dans le but de produire des capitaines et des pilotes en Nouvelle-France. Ce programme avait deux buts: l'enseignement de l'hydrographie pour produire des arpenteurs capables de faire des cartes précises et l'entrainement de capitaines et de pilotes capables de faire naviguer d'une façon sécuritaire les navires dans les eaux du Saint-Laurent.

L'instruction fut donnée à Québec par les laics jusqu'en 1706, années pendant lesquelles se succéderent Martin Boutet, Jean-Baptiste-Louis Franquelin, Louis Jolliet et Jean Deshayes. Les pères Jésuites donnèrent l'instruction en hydrographie entre les appointements de ces hommes et furent appelés plusieurs fois à devenir officiellement professeurs de navigation et de pilotage.

De plus, en 1681, le ministre Français de la marine, Colbert, décrit que les pilotes de rivière et les capitaines sont tenus de reporter les sondages et autres données hydrographiques dans la Nouvelle-France.

En 1685, Sieur J. B. L. Franquelin devient le premier "Hydrographe du Roi" basé dans la colonie. C'est ainsi que se dessine la prise en main rationnelle de la chose hydrographique et cartographique dans la colonie.

Franquelin qui étudia en France avant de venir en Nouvelle-France, se révéla plus cartographe que pédagogue et insista si fort pour être démis de ses fonctions d'enseignant qu'il fut renvoyé en France comme cartographe du Roi. On doit à Franquelin nombre de cartes du Nouveau Monde, de la Nouvelle-France et entre autres une carte du fleuve Saint-Laurent basée sur les observations de Louis Jolliet. A cette époque, les cartes de cette région du monde se faisaient presque exclusivement par des Français, l'Angleterre se bornant en majeure partie à la baie d'Hudson et ses environs.

En 1695, Louis Jolliet, grâce à ses nombreux voyages et à ses cartes dressées à partir d'observations personnelles ou de mémoires, obtint enfin le poste qu'il convoitait depuis 1685. Après la mort subite de Jolliet en 1700, Jean Deshayes est nommé comme Hydrographe Royal à Québec en 1702.

JEAN DESHAYES

Jean Deshayes fut trés actif dans la communauté scientifique française où il avait été appointé "Ingénieur de Sa Majesté en hydrographie", avant de venir en Nouvelle-France en 1685 dans un voyage ayant pour but de faire des observations astronomiques et de dresser la carte hydrographique du Saint-Laurent.

En 1685, Deshayes effectue un voyage de reconnaissance jusqu'au lac Ontario en compagnie du Gouverneur Denonville. Sa santé chancelante fait douter de la réussite de sa mission. Durant l'hiver de 1685-1686, il prépare son levé du Saint-Laurent en établissant une ligne de base mesurée sur la glace d'un bord à l'autre du fleuve à Québec. Il dessine et oriente les lignes de rivage de la rive nord et de la rive sud près de Québec. A partir du mois de mai, sa triangulation est étendue jusqu'à Sept-Iles à l'aide de 300 triangles sur 350 milles. La triangulation rendue impossible pour relier la péninsule de Gaspé à la côte Nord, il estime la distance par la vitesse de son embarcation corrigée de la dérive pour relier les deux rives du Saint-laurent en passant par l'Ile d'Anticosti. Son levé incomplété à l'automne de 1686, il retourne en France projetant de revenir l'année suivante, mais ceci ne se matérialisera pas. Ce n'est qu'en 1702, lors de son appointement comme hydrographe du Roi que la Nouvelle-France le vit de nouveau.

Les instruments et les méthodes utilisés par Deshayes ainsi que la précision et le souci des détails qu'il mit dans ses relevés firent que sa carte, lorsqu'elle fut publiée, fut un modèle de son temps. En fait Deshayes était plus scientifique et cartographe que marin ou navigateur. Outre la triangulation qui fournit une bonne base à sa carte, la détermination du rivage qu'il orienta à la boussole et qu'il vérifia en mesurant au pas en plusieurs endroits (dont l'Ile d'Orléans); les sondages et examens des hauts fond (dangers pour la navigation) reprenant les sondages de ses matelots en qui il n'avait pas confiance parce qu'ils inventaient des profondeurs; il prenait aussi beaucoups de notes et de croquis fournissant des multitude de détails comme les aides à la navigation, les variations du compas, les marées (des renseignements indispensables pour les marins).

Jean Deshayes mourut à Québec en 1706. Sa carte, qui fut la base de la navigation sur le Saint-Laurent jusqu'à la fin du régime Français, reste un standard et un des plus beaux exemples de cartographie marine de cette époque. Cette carte servit même de base à la première carte anglaise du Saint-Laurent en 1757 quand Thomas Jeffreys publia la sienne. Jean Deshayes, qui n'avait que peu retravaillé en hydrographie après son retour en 1702 comme hydrographe du Roi, laissa aux pères Jésuites la tâche de pourvoir à l'enseignement de l'hydrographie à Québec après sa mort, ce dont ils s'acquittèrent jusqu'à la fin du régime français en 1759.

Parmi ces pères on retient les noms de François le Brun, Charles Messîger, Joseph Deslandes, et Joseph-Pierre Bonnêcamps venus de France dans le but précis d'enseigner l'hydrographie.

Il devenait évident que la colonie dans son développement avait de plus en plus besoin de navigateurs, d'ingénieurs, de cartographes et d'hydrographes. L'établissement hydrographique français ou "Dépôt des cartes, plans et journaux" fondé en 1720 indiqua l'importance d'entreprendre des levés et de publier des cartes pour la navigation sécuritaire des navires de la Marine et du commerce dans la colonie. Durant la décade qui suivit, d'ambitieux plans de levés des eaux du Saint-Laurent furent élaborés mais qui ne menèrent qu'à bien peu de réalisations concrètes et qui étaient destinés à aider le développement des pêcheries et du commerce des fourrures.

Sieur de Voutron, commandant du navire l'Afriquain, fit un rapide levé du Saint-Laurent de l'Ile d'Orléans à Kamouraska en 1714. Il proposa un plan détaillé de levés du fleuve qui fut approuvé par le Duc d'Orléans mais qui n'eut que peu de suite étant donné le manque de ressources et de navires.

En 1723, un autre officier naval, Henri-François Desharbiers, Marquis de l'Etanduère, plaça des bouées sur le Fleuve et soumit un long rapport sur l'état de la navigation. Deux ans plus tard, les conditions s'étaient tant détériorées qu'il recommanda qu'un programme complet de levé soit implanté.

Le poste de Capitaine du port de Québec, qui était aux mains de marchands, fut donné en 1727 à Richard Testu de la Richardière suite aux recommandations de l'Etanduère. Il avait les responsabilités additionnelles de la navigation dans le Saint-Laurent. Commençant en 1730 et durant plus de 10 ans, Testu de la Richardière effectua à l'aide de l'Etanduère les levés les plus détaillés du Saint-Laurent jamais effectués. Tous les ans, un ou deux pilotes des navires de guerre étaient laissés à Québec pour acquérir de plus grandes connaissances du fleuve, travailler durant l'hiver sur les cartes, et assister la Richardière l'été sur les levés.

La Richardière effectua, durant toutes ces années jusqu'à sa mort en 1741, des levés du détroit de Belle-Isle, des Iles du golfe du Saint-Laurent, de la Baie des Chaleurs, et du détroit de Canso. Il fut l'instigateur de la pose de bouées et d'aides à la navigation (alignement). A la suite de la disparition de la Richardière, le programme si bien amorcé ne fut pas repris tout de suite faute d'un remplaçant valable. Ce n'est qu'en 1751 que Gabriel Pellegrin ancien assistant de La Richardière et officier de port en second prend sa place à la suite de trois infructueux candidats.

En 1755-1756, il construisit deux cartes de la longueur totale du St-Laurent et soumit une longue critique sur des cartes récemment imprimées par Nicolas Bellin, les premières depuis celles de Deshayes.

Durant les trois années suivantes, il continua à travailler pour la marine, travaillant avec Montcalm et Bougainville. Jalousé par certain de ses supérieurs pour son titre de Capitaine de Brûlot récemment acquis, et malgré sa grande connaissance du Saint-Laurent, il fut ignoré lors de conseils de guerre portant sur la défense de Québec alors que les anglais avaient déjà pénétré dans le fleuve.

Un de ses derniers efforts fut de déplacer les aides à la navigation existantes pour diriger l'ennemi vers des eaux dangereuses, dans les derniers moments du régime français au Canada.

LE REGIME ANGLAIS

Durant les années qui précédèrent la capitulation de la Nouvelle-France, les arpenteurs/hydrographes anglais commencèrent à dresser des cartes du golfe et du fleuve Saint-Laurent en vue de la conquête.

A Halifax ces préparatifs de cartographie réunissaient trois hommes qui eurent tous trois une grande place dans l'hydrographie des eaux de ce qui allait devenir le Bas Canada, ce sont Samuel Holland, Des Barres et James Cook.

Des Barres rédigea des cartes à grande échelle du Havre et de Québec, à partir de documents et de plans obtenus d'officiers français. Elles servirent lors du siège de Québec aux Anglais pour qui ces eaux étaient peu connues.

Après la capitulation, Samuel Holland, devenu arpenteur général du Bas Canada, dirige plusieurs arpentages vitaux et inventaires des ressources du pays nouvellement conquis.

Les commandants de la marine royale britannique s'aperçurent que l'hydrographie de l'ex-Nouvelle-France était insuffisante pour assurer la sécurité de la navigation. Une demande pressante de cartes est faite à partir des levés existants mais surtout à partir de levés nouveaux à effectuer.

James Cook fut l'un des plus prolifiques hydrographes à relever le défi posé. Il passa nombre d'années à faire des levés d'une grande exactitude avec une grande science professionnelle, dans le fleuve, le golfe du Saint-Laurent, Terre-Neuve et les côtes Atlantiques, jusqu'en 1768.

Durant le siècle qui suivit, l'amirauté Britannique continua d'être l'instigatrice des levés hydrographiques dans le fleuve et le golfe du Saint-Laurent. On peut retenir plusieurs noms tels que Owen, Bayfield, Collins, Boulton avant que la conduite de ces levés ne revienne au Service Hydrographique du Canada.

Le plus connu pour son énorme travail est sans doute l'amiral Bayfield qui est à l'origine de plus de 100 cartes couvrant les Grands Lacs, le fleuve et le golfe du Saint-Laurent. Levés avec la plus grande précision possible du temps (1837-1853) son travail resta un exemple pour les hydrographes qui lui ont succédé ainsi que bien sûr un guide fiable pour les nombreux navires qui naviguèrent dans ces eaux dangereuses.

Après la confédération, en 1883 plus précisément, le Service Hydrographique du Canada fut créé. Il fut chargé du levé des eaux des Grands Lacs. Cette responsabilité s'accrut au cours des ans en prenant en charge peu à peu, la responsabilité totale de toutes les eaux de son territoire à la suite de l'amirauté Britannique.

BIBLIOGRAPIE

1) Pritchard, J. S. Pr.; "Early French Hydrographic surveys in the Saint Lawrence River". (International hydrographic review, Monaco LVI (1), janvier (1979).

2) Leclaire, Alphonse; "Historical, legendary and topographical guide along the Saint Lawrence" (the trades publishing Co., Montreal) (1906).

3) Baker, J. N. L., "A history of geographical discovery and exploration (George G. Harrap & Co. Ltd., London) Harrap's new geographical series (1931).

4) McKenzie, Ruth, "L'amiral Bayfield, Pionnier de l'hydrographie marine" Environnement Canada, Fish. Mar. Serv. Misc. Spec. Pub. # 32 (1976).

5) Stewart, Alexander M. "French Pioneers in North America" Part 1-3 New-York State Archeological Association (1976)

6) Dawson L. S., "Memoirs of Hydrography" Cornmarket Press Ltd London (1895) (Reimpression (1969)).

7) Thomson Don W., "L'homme et les Méridiens", vol 1-2-3 Information Canada (Ottawa) 1966, 1973, 1969.

8) Anthiaume Abbe A. "Evolution et enseignement de la Science nautique en France et principalement chez les Normands". Paris, Ed. Ernest Dumond (1920).

9) "River St Lawrence from Montreal to Strait of Belle Isle" (L. et Ed. Variées) (31 cartes).

10) Fraser, R. J. "Marine charts of the St Lawrence Route" The Canadian surveyor (January 1929).

Experiences With A Smart Digitizer

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For some time now, one of the stumbling blocks to digital depth acquisition has been the depth digitizer. Unreliable digital data cause many processing headaches and probably do more to deter the cause of automation than any other single factor. A new generation of hardware, using microprocessor technology to improve the reliablity of digital depth acquisition, has recently come on the market. In the fall of 1981, the Hydrographic Development Section, Central Region, Canadian Hydrographic Service, decided to try to use the so called "smart" digitizer in an attempt to improve our data logging and processing programs for field surveys. After a careful study of digitizers commercially available, our choice was narrowed down to a unit manufactured by Raytheon Ocean Systems; they were not only microprocessor based (to help reduce bad data) but also they were not too expensive.

Two survey parties were to be fully automated in 1982. Southern Lake Huron, and the St. Lawrence River. The section obtained six Raytheon SSD100 digitizers so that each survey could operate two sounding launches, and have a back-up unit. Once the digitizers were received, bench testing revealed several flaws in the units. Work began to correct these shortcomings.

Since the aim of our surveying is to log data in view of producing a navigational chart, it is imperative that the data we log be accurate. The worst problem we ran into with the SSD100 concerns its internal timer "clock". The digitizer computes a depth value by counting the clock pulses between the time it receives a transmit pulse and and echo pulse from the sounder transceiver. The timer clock in the SSD100 was found to drift over a period of time, which resulted in erroneous values of depth being calculated. The digitizers were modified by adding a crystal controlled timer clock. [see figure #1] Crystal controlled oscillators are very accurate, and have very little drift. A small circuit board was assembled, containing a crystal, oscillator chip, and several divider chips. A crystal frequency was selected to provide a nominal clock output frequency of 8 KHz. to produce correct depth values at a sound propagation velocity of 1463 m/sec. in the water column. All survey sounding done in Central Region is done in metric units, so there was no need for different output frequencies to support feet or fathoms operation, that are available on the off-the-shelf SSD100. The feet and fathom selector switches were bypassed.

The Raytheon digitizers were to be used with the NAVBOX, a data acquisition system designed in Central Region. The NAVBOX, a microprocesor based system, generates a 1 microsecond pulse at predetermined times to cause a fix mark on the echo sounder graph. This pulse is, however, much too short to be visible on the chart. Since the digitizer is connected between the NAVBOX and the echo sounder, it is the logical place for this pulse to be lengthened appropriately. A one chip flip-flop was added to the digitizer to accomplish this function. [see figure #1] The circuit works as follows: when the NAVBOX requests a fix mark, the chip waits for the next transmit pulse, which stops the marking. This creates an ideal fix mark, one solid line the entire length of the graph.

The St. Lawrence survey used Ross 801 portable echo sounders while the Lake Huron survey used Atlas DESO 10 sounders. Cables were made up using appropriate connectors, to interface the various pieces of equipment. When the sounders were tried, the verify and fix marking did not operate properly.

It turned out that different sounders have different input marking signal characteristics. To accomodate the various echo sounders being used with the SSD100, the fix marking circuit was modified. When these modifications were done, the complete systems were tried aboard the launches in Hamilton Harbour. All equipment worked properly and the surveys departed for the field.

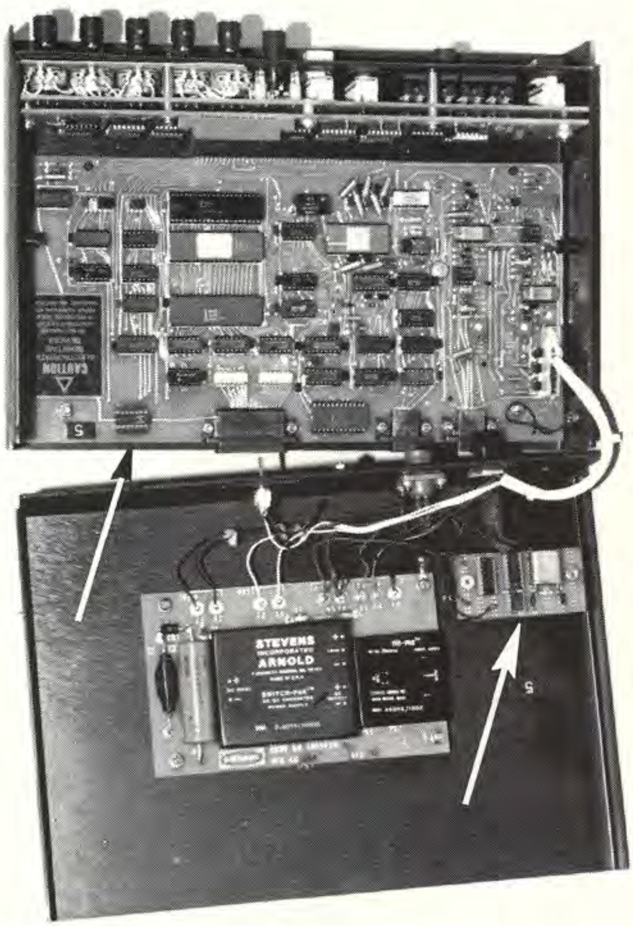


FIGURE 1: Arrows Indicate Added Components

Later in the summer, problems arose on the Lake Huron survey. Because the Atlas DESO 10 did not perform well in depths over 100 metres in our high speed, planing hull launches, ROSS 200A FINE LINE sounders, which operate at a lower frequency and transmit more power, were selected to replace the Atlas. The ROSS transceiver unit required a few modifications to interface properly to the SSD100.

However, problems still persisted. When the weather was anything other than flat calm, air trapped beneath the hull would cause an occasional loss of echo. The tracking gate in the SSD100 requires three consecutive echoes within the gate window to validate the bottom position. If the sounder misses one echo, even though the next two may be digitized correctly, there will not be output to the data acquisition system. At survey sounding speeds, in rough weather and in these particular launches, too much data was being lost: as much as 34 seconds of zero depths could be recorded in a minute, even though the sounder was acquiring depths; we normally log a depth per second. To solve this problem, we contacted Raytheon; they rapidly modified the digitizer program and sent us new EPROMS (silicon chips which contain the computer program in the digitizer.) The new program outputs to the NAVBOX any depth value which falls within the gate.

The "smarts" in this digitizer lie in the microcomputer and its program, which control digitizing and tracking of the bottom. The digitizer gate validates echoes on a timing basis. Based on previous echoes, the digitizer opens an expected time gate for the next echo. To accomodate varying bottom topography, the operator can select from front panel switches, narrow, medium or wide gate widths; these correspond to 2, 4, and 8 metres respectively. The gate prevents signals from being considered bottom echoes if they do not fall within the expected time slot; if a return falls outside the gate, the digitizer enters search mode. If four consecutive echoes are lost, the display begins to flash and the gate is widened to 32 metres. If four sucessive return echoes fit within the new gate, gate width returns to the selected size and the gate is centered on the last good echo. If no echo is found, bottom search occurs from the depth reverberation setting to the next transmit pulse. At our request, Raytheon have given us the necessary program changes to alter these gate parameters.

There are several other switches and adjustment knobs on the front panel (some would say there are too many.) [see figure #2] A tide/draft control permits the digitizer to be corrected for launch draft, tidal correction, if known, or other fixed offsets in depth value. A reverb blank control sets a minimum depth above which the digitizer will not operate; this prevents transducer ringing from generating false echoes. A shallow water alarm control can be set to provide audible warning in decreasing water depths; the audible alarm in the SSD100 was removed because we already have one on the NAVBOX which duplicates this function. The "VS" button displays sound velocity; in our case this is fixed at 1463 m/sec.; the sound speed adjust knob has no effect due to the crystal controlled oscillator modification. The manual switch and control enable the user to position the gate where the bottom is seen to be on the chart recorder; when entering operate mode, the manual gate position is used as starting point to search for the echo. The threshold control is the most important one on the digitizer. It operates in the opposite way to a sensitivity or gain control: turn it counterclockwise to increase digitizer sensitivity. This control has proven to be very delicate to adjust; it is difficult to adjust the knob so the digitizer will always lock on to the bottom (after a reverse maneuvre for instance.)

Sounder and digitizer accuracy are verified twice daily with a bar check in Central Region; fixed errors were removed from digitized values with the tide/draft control. Errors progressive with depth were noted and compensated for in post-processing of the data; this is necessary due to the fixed velocity of sound of the crystal controlled oscillator.

Several problems remain to be solved: in areas infested with weeds, the digitizer will lock on to the earliest returns: the tops of the weeds. The human eye can discern on the graph where the real bottom lies, but the digitizer can not. If the previously mentioned threshold control is not precisely set up, the digitizer will not reacquire bottom lock correctly. This is a typical scenario: a launch is approaching the end of a survey line near shore. At the end of line fix, the coxswain stops the boat rapidly by engaging in reverse; air beneath the hull causes loss of bottom echo. The digitizer gate opens up, and the digitizer locks on to noise, usually around 100 metres deep. The hydrographer has to reset the digitizer into manual mode, then back to operate, to lock it on to the proper bottom.

Except for these few remaining annoyances, the now modified digitizers worked very well. None of the four units in use failed, so neither spare was used. Raytheon and other companies sell more sophisticated and more expensive digitizers; we wanted to keep costs down. The SSD100 costs less than $4000 and with appropriate modifications, which are now well documented, further units are easy to change. These inexpensive units have worked very well for us, so far, and are built to continue to do so. Their flexibility enables them to be easily connected to almost any echo sounder, and their performance is well worth the effort needed to make a few minor modifications.

Figure 2

The Hydrographic Commission of FIG 1980-1982

This latest report on the Hydrographic Commission of FIG covers the period 1980 to 1982. It is a follow-up to articles published by "Lighthouse" in 1978 and in early 1980 on the same subject.

To briefly recap events prior to the period 1980-82, Canada had hosted the very successful 1979 International Hydrographic Technical Conference and preparations had been made for a meeting of the Commission delegates in Edinburgh, July 1980, to discuss implementation of the final plans for the Montreux Congress, the various Working Group meetings, and meetings between the Chairman and the Commission Secretary.

Officers of the Commission for the 1978-81 period were T. D. W. McCulloch, Canada, Chairman, M. Nagatani, Japan, Vice Chairman and Rear Admiral R. Munson, USA, Executive Secretary. The meeting in Edinburgh was attended by:

T. D. W. McCulloch, Canada, Chairman
M. Nagatani, Japan, Vice Chairman
Rear Admiral S. Ritchie, IHO
Rear Admiral D. Haslam, United Kingdom
B. Ayinde, Nigeria
M. Bolton, Canada

Prior to the Montreux Congress, the Hydrographic Commission of FIG and the Canadian Government hosted a Hydrographic Workshop in Canada, attended by six participants from five developing countries. The project aimed at exposing the participants (most of whom have little competence in hydrographic surveying, but were picked because of their professional background in land surveying and positions of influence within their respective countries) to the problems and opportunities posed by the Commission theme for Switzerland — "Hydrography and the Challenge of Exclusive Economic Zones for developed and developing nations". The workshop in Canada was followed by attendance at the FIG Montreux Congress held in August 1981.

The first session (401) of the Hydrographic Commission 4 commenced at 0900 on the 12th of August 1981, with more than 100 persons in attendance. The Chairman of the Commission opened the session by briefly outlining the history of the Commission, its successes and its continuing goals. He noted the Commission theme "Hydrography and the Challenge of EEZs for developed and developing nations" and the fact that Rear Admiral Ritchie of the IHO had been the founding father of the Commission and that his keynote address to follow, "The New Challenge Facing the World's Hydrographers" was most timely and would set the tone of the Commission's deliberations.

Rear Admiral Ritchie's presentation was up to his usual high standard and sparked considerable discussion. One of the items which received a fair amount of attention was his suggestion that the next FIG (IHTC) technical conference be held in a developing country.

Ingenieur-General Bourgoin of France followed with a fine presentation on "Oceanology and the EEZ — The Role of the Hydrographic Surveyor"'. He stressed the necessity to have a global planning mechanism in place to exploit oceanic resources without unduly disturbing the natural environment — and how hydrographers can help solve such problems. A number of questions were raised and answered.

Rear Admiral Munson, USA, Executive Secretary of the Commission, presented Commander Dyde's (Antigua) paper on the "Development of a Regional Hydrographic Surveying Organization". Although Admiral Munson was not entirely familiar with the area of the West Indies under discussion or of the underlying problems, he presented the paper with such aplomb that it received much attention and comment. It was noted that although there were a number of people in the audience from the West Indies, unfortunately none were from the vicinity of Antigua.

Session 402 opened later the same morning of the 12th August with Dr. Nagatani of Japan, Vice Chairman of Commission 4 in the Chair. The first paper of the session on "The Role of the Indian Hydrographic Training Facility for Developing Nations" was presented by Captain Goh of Malaysia in the absence of the author, Rear Admiral Fraser of India. The presentation led to some discussion particularly from representatives from the developing nations.

G. Haskins of the U.K. followed with a well illustrated and fascinating look into the future entitled "Exploration into Deeper Waters". The presentation was well received and led to some discussion on limits of accuracy and the tendency to push systems beyond their design specifications. This paper was moved from Session 408, as the original scheduled paper by Collins of the USA, "A Private Sector Surveying Operation in the East Central Red Sea" was unable to be presented.

The final paper of the session was the Ingham, UK paper on FIG/-IHO International Advisory Board Report on Standards of Competence for Hydrographic Surveyors which was presented by Lt. Cdr. Don Ret'd, Netherlands. Cdr. Don brought us up-to-date on Advisory Board deliberations and decisions while emphasizing that the paper represents the author's perceptions as a FIG appointed member of the Advisory Board and is complementary to the Second Edition (June 1981) of the IHO/FIG Standards of Competence for Hydrographic Surveyors published by the IHO and approved by the Chairman of the FIG/IHO Advisory Board, Rear Admiral Kapoor of the IHO and the members of the Board. Some discussion took place.

Session 403 commenced at 1600 hours on the 12th, under the chairmanship of Rear Admiral Munson, USA, substituting for Rear Admiral Fraser of India. The three Commission 4 Working Groups presented outstanding reports on:

- 414a — Data Acquisition and Processing Systems — presented by Chairman, R. Bryant, Canada
- 414b — Standard Test Procedures for Precise Positioning Systems — presented by Chairman, A. Cooper, IHO
- 415 — Detection of Underwater Anomalies — presented by Chairman Bourgoin of France.

The calibre of these published reports is such that they will be excellent texts for hydrographic surveyors' reference in future years.

Session 404 commenced a.m. on the 14th August and was a joint session with Commissions 2, 5 and 6. Professor Allan, UK, Vice Chairman of Commission 2 chaired the session. The first Commission 4 speaker was Professor Hamilton of Canada, presenting a paper by Professor Wells, also of Canada, entitled "Mathematics and Computing Syllabus for Hydrographers in Canada". The paper was well received with a number of questions asked. The second Commission 4 speaker was Ingenieur-General Robertou of France, who presented his paper on "The Instruction of Specialist Engineers in Hydrographic Surveys in the Marine Environment at ENSTA". It also was well received and brought a number of questions.

A number of papers from other Commissions had been withdrawn from the session leaving a UK paper from Commission 2, entitled "Towards and Efficient Syllabus in Mathematics and Computing for the Land Surveyor", a paper by Professor Zlantanov of Bulgaria on "Computing Syllabus for EDM" and a similar paper by Professor Hallerman of Germany.

Session 405 was chaired by J. Roberts, UK Commission 4 delegate and commenced at 1600 hours on the 14th August. There were four absolutely fine papers to be presented.

"Recent Technological Developments in Arctic Hydrography" by R. Douglas, Canada was a suitable opener with emphasis on the degree of sophistication required to successfully survey in a very hostile environmment. It brought forth considerable discussion.

"Influence of Echo-Sounding Methods Upon Sea-Floor Representation" by Charlot of France was a thought-provoking paper for all hydrographic surveyors present. The pros and cons of the philosophy expressed in the paper appeared evenly distributed among participants in the audience.

"Aerial Hydrography Laser Bathymetry and Air Photo Interpretation Techniques for Obtaining Inshore Hydrography" by S. MacPhee of Canada was a well prepared and well presented paper, which did not hesitate to record failure as well as success. The audience responded in the same lively manner.

"Remote Sensing Hydrographic Techniques in the Coral Sea" by Youngs, Papua New Guinea was a brilliant illustration of an almost completely undeveloped country faced with a huge uncharted EEZ, no national hydrographic service, but with Landsat information that could be used to at least supply reconnaissance charts for an interim period. There were inevitably warnings from several surveyors about the dangers of mariners placing undue reliance upon reconnaissance charts, but also several experienced voices who maintained that any information was better than none at all. Probably this was the highlight paper of the Commission 4 input into the Congress.

Session 406 was chaired by J. Riemersma of the Netherlands and commenced at 0900 on the 15th August. The first paper was "Port and Harbour Surveys in the Dynamic Sea Floor Environment of Guyana" presented by R. Choo Shee Nam, Guyana.

The paper was well received with some discussion relating to the peculiar properties of "sling mud". The second paper was "Siltation Volume Computations for the Port Hedland Harbour and Approach Channel" by Cooke, Australia. This paper dealt with the silting of the harbour entrance and approach and the related problems faced by hydrographic surveyors. The paper was well received. The session ended with an enlightened paper on "The Tidal Survey of the UK" presented by Lt. Cdr. Glen, UK. The paper sparked considerable discussion.

Session 407 commenced at 1400 on the 15th August and was chaired by S. MacPhee, Canada. It was a joint session with five papers originally planned — two from Commission 4 and three from Commission 5. Two of the Commission 5 papers were not presented, leaving the line-up as follows:

"The Evolution of a High Frequency Seabed Acoustic System and its Application to Underwater Engineering" by Punch, UK was presented by J. Roberts, UK. This paper was of first class calibre, recording the changing application of underwater acoustics, particularly in the offshore hydrocarbon industry. The resulting discussion among participants, both industrial and governmental was most stimulating.

The second paper "Integrated Navigation and Position Systems for Offshore Petroleum Exploration on Canada's East Coast" by D. Thomson, Canada, dealt with the three goals that can be achieved through system integration — relaibility, accuracy and consistency, another excellent paper which raised considerable interest.

The final paper, although slotted in Commission 5, was right on target for Commission 4 participants — "Inertial Applications in Offshore Exploration" by A. Hittel of Canada. The paper discussed the integration of the Inertial System with radio positioning and doppler satellite, thereby yielding a dynamic position of greater reliabilty then its component parts. The interesting discussion which followed was only limited by the time available.

Session 408, Commission 4's last session of the Congress, commenced at 1600 on August 17th and was chaired by B. Ayinde of Nigeria. Several changes were made to the planned schedule. The Haskins paper had been rescheduled in 402, the Renard paper could not be presented due to the absence of the author, and the Fraser of India paper was again presented, as the author had finally arrived at the Congress. "The Role of the Indian Hydrographic Training Facility for Developing Naitons" was further explored, leading to discussion, particularly from representatives from the developing nations. The Saxena, USA, paper on "Hydrographic Surveys of the 1980's" was presented by Rear Admiral Munson, USA. The paper was well received in the main, but the author came in for some strong comments regarding his statement "that one of the major causes for groundings was due to poor bathymetric data". The Chairman of Commission 4 undertook to record the matter and make arrangements to discuss the matter with the author. (Subsequently Rear Admiral Munson has advised the Chairman that National Ocean Survey, USA, will be taking up the question directly with Dr. Saxena. The final paper was "Potential Uses of Chart Data in Digital Form" by G. Murt, U.K., a good presentation looking into the future uses of digital data-bases and the perceived requirement for "personalized charts". With considerable discussion ensuing it was a suitable end to a fine set of paper presentations at the Commission 4 session of FIG Congress XVII.

The remainder of the session was taken up with discussion on the six resolutions considered by the Commission Executive — outgoing and incoming — Messrs. McCulloch, Nagatani, Munson, Riemersma and Goh. The first resolution 410 dealt with the establishment of new Working Group 416 to produce a catalogue covering Integrated survey systems, Positioning systems, Depth determining systems and other auxiliary systems and equipment, the Hydrographic Society to be approached concerning its publication. The structure of the new Working Group would be based upon former WG414a (now defunct) membership and increased as required. The resolution passed unanimously, thanks to the hard work behind the scenes of the drafters.

Resolution 402 discontinued WG414b as its work was not completed as WG416 would delegate a large part of the work to WG414b. The IHB was requested to publish a trials programme. The resolution passed unanimously without discussion.

Resolution 403 resolved that WG415 continue until it prepares a chapter on 'remote sensing' and issues a new report. The resolution passed unanimously without discussion. Resolution 403 resolved that there was an urgent need for definition of a "Surveying

Service" and that the attention of the International Telecommunications Union and all National Administrators be called to attend to this urgent matter. The resolution passed unanimously after some discussion.

Resolution 405 reflected the opinion of a broad body of participants that a second International Hydrographic Technical Conference would advance the objectives of Commission 4. It called upon the UK to consider hosting such a conference in 1984. The resolution caused considerable discussion, as both Nigeria and Jamaica had submitted qualified written invitations to the Commission to host a similar event in their countries. These submissions were sparked in part by the suggestion in Rear Admiral Ritchie's keynote address that the next IHTC be held in a developing country, modest in concept and aimed specifically at developing coastal states wrestling with their new EEZ responsibilities. After considerable discussion the resolution was adopted requesting the UK explore ways and means of internationally funding the attendance of surveyors from developing countries and to investigate the feasibility of expanding the 1984 Hydrographic Symposium into an IHTC and to report their findings to the officers of Commission 4 within six months. If the UK offer is invalid, the officers of the Commission would approach Nigeria and Jamaica for further discussions. The resolution passed.

Resolution 406 was a resolution dealing with requirements for encouragement of developing nations in seeking advice on the setting up of hydrographic surveying capability. It raised heated debate in its original form which would have made Commission 4 a focal point for channeling requests to other bodies such as IHO and UN. Obviously, developing countries wanted some body, any body, to do more than has transpired to the present. In the interests of peace and harmony, the resolution was altered to reflect the concerns and sensitivities of the IHO.

The Chairman thanked the officers of the Commission, the Session Chairmen, the Working Groups, and the many participants for a successful Congress, and wished Dr. Nagatani, Mr. Riemersma and Captain Goh his support and best wishes in their period of office 1982-1984.

During the Congress, an average of 94 persons attended each session of Commission 4. Participants came from 41 different countries, the IHO and the UN. The Commission was ably supported by H. Schoeniech our Swiss Congress Liaison Officer.

All six resolutions were ratified by the Permanent Committee and General Assembly of FIG meeting on the 18th August, 1981.

In January 1982, M. Nagatani of Japan took over as Chairman of the Hydrographic Commission of FIG. With the next FIG Congress to be held in Bulgaria in June 1983, he has his work cut out for him in planning and implementing the Hydrographic Commission programme. To assist in the development of the programme, the immediate past chairman of the Commission met with M. Nagatani and Captain Goh, Malaysia, Secretary of the Commission, in March 1982. Further meetings of the Commission took place at the Netherlands, FIG Permanent Committee meeting in June 1982. Present were:

M. Nagatani, Japan, Chairman
J. Riemersma, Netherlands, Vice Chairman
B. Ayinde, Nigeria
M. Bolton, Canada
T. D. W. McCulloch, Canada, Immediate Past Chairman

The theme of the Bulgaria Hydrographic Commission Sessions was adopted, "Modern Techniques and International Cooperation in Hydrographic Surveying".

The following schedule will be followed:—

DATE	SESSION	AUTHOR	NATION	TITLE
21 June 1983 401 Chairman: M. Nagatani, Japan				
1100-1230	401.1	Nagatani	Japan	Opening Remarks
	401.2		IHO	Keynote Address
	401.3	Joint Team	Japan Indonesia Malaysia Singapore	Cooperative Survey for Production of Common Datum Charts in the Straits of Malacca and Singapore
	401.4	Richards Perrin	USA	Hydrographic Exchange Program — US with Canada and Great Britain.
	401.5	Saito	Japan	The New Ocean Terminal Project in Federal Republic of Nigeria.
22 June 1983 402 Chairman: J. Riemersma, Netherlands				
1100-1230	402.1			The FIG/IHO Advisory Board on Standards of Competence for Hydrographic Surveyors.
	402.2	Bourgoin	France	Report on WG 415 (Detection of Underwater Anomalies).
	402.3	Millen	UK	Report on WG 416 (Production of a Catalogue of Commercially Available Hydrographic Equipment and Systems).
24 June 1983 403 Chairman: G. Douglas, Canada				
	Joint Session 2, 4, 5 and 6			
0900-1045	203.1			
	403.1	Uchino	Japan	Group Training Courses in Hydrographic Services by the Government of Japan.
	505.1			
	604.1	Brooling	Sweden	Moving the Surveyor into Outer Space.

DATE	SESSION	AUTHOR	NATION	TITLE
24 June 1983 404 Chairman: S. C. Goh, Malaysia				
1400-1545	404.1	Wright	U.K.	The Role of the Consulting Hydrographic Surveyors
	404.2	Gromwell Wade	USA	U.S. Navy Contracted International Hydrographic Surveying by the Private Sector.
	404.3	Williams Gray	Canada	A Contract Hydrographic Survey of Lake Manitoba, Canada.
	404.4	Colvin	U.K.	Sea Trials of an Advanced Sector Scanning Hydrographic Sonar Providing High Speed Wide-Swathe Hazard Detection and On-line Profile and Contour Charts.
24 June 1983 405 Chairman: B. Ayinde, Nigeria				
1600-1730	405.1	Douglas	Canada	The Map/Chart — A Canadian Approach to Recreational and Environmental Charting.
	405.2	Bonnot	France	Le Leves Photobathymetriques et les Restituteurs Analytiques.
	405.3	Schleider	Germany	Die Synoptischen Vermessungen der Deutschen Kustengewasser der Nordsee.
	405.4	Andree	Germany	Realisierung Eines Intergrierten Landund Seevermessungs-systems.
25 June 1983 406 Chairman: J. Roberts, U.K.				
1100-1230	406.1	Sugiura	Japan	Photogrametric Investigation on the Upheaval of Water in the Strait, Hayatomo Seto.
	406.2	Le Gouic	France	L'Imagerie du Fond avec Divers Types de Sondeurs.
	406.3	Korhonen	Finland	Processing of Digital Hydrographic Data in the Finnish Board of Navigation.
	406.4	Andrews	U.K.	Heave Compensation — An Overview of the Practical Problems and Possible Solution.
27 June 1983 407 Chairman: T. McCulloch, Canada				
1100-1230	407.1	Grant	Canada	An Integrated Inshore and Offshore Navigation System.
	407.2	Lachapelle	Canada	Impact of NAVSTAR/GPS on Land and Offshore Positioning.
	407.3	Souquiere	France	L'Exploitation Hydrographique des Photographies Aeriennes Prises a Partir d'un Aeronef Localise par Procede Radioelectrique.
	407.4	Kelly	U.K.	Survey Operations for Magnus Oilfield Development 1981-82.

It is hoped that the Bulgarian Congress will be as successful a Hydrographic Commission venture as the Swiss one. Commission highlights to look to in the future — the publishing of new WG 415 (Detection of Underwater Anomalies) which will include a chapter on "Remote Sensing" — a new edition of the FIG/IHO Standards of Competence for Hydrographic Surveyors, and probably most important of all, the decision taken by the Hydrographic Society in collaboration with the Royal Institution of Chartered Surveyors and the FIG Hydrographic Commission to expand the Hydrographic Society 1984 Symposium (September 3-7, Plymouth) into a Second International Hydrographic Technical Conference. The Conference will be devoted to spreading expertize and knowledge, and illuminating the need for hydrography, with particular accent on the problems of developing maritime nations and on the exploration and exploitation of Exclusive Economic Zones.

See you all there in 1984!

T. D. W. McCulloch — November 10, 82

Captain Owen of the African Survey 1774-1857

by
E. H. Burrows

In this well researched book, Dr. E. H. Burrows F.R.G.S. has written a very informative and human biography on William FitzWilliam Owen, one of the more distinguished hydrographers ever to serve the Royal Navy. In the first two chapters, the author traces the ancestry of Captain Owen, explains how the Owens acquired Campobello Island in Passamaquoddy Bay and the months that Captain Owen's father spent on Campobello Island establishing a settlement. The elder Owen died a bachelor in 1778 when his son was four.

William FitzWilliam Owen went to sea with a friend of his fathers at age four, spent two years on ships and then eight years at various schools. He returned to sea at age fourteen as a midshipman. It appears that he commenced his formal career as a hydrographic surveyor at age 30 in 1804. In the period 1804-1813, he sailed and carried out surveys in the East Indies and the Indian Ocean returning to England as a Captain.

In 1815 he sailed for Canada to take over the Great Lakes Survey operating out of Kingston and having as assistants such notable surveyors as Bayfield, Vidal and Becher. The Great Lakes Survey was virtually abandoned in 1817 and Owen returned to England, and was placed on half-pay early in 1818.

Captain Owen was recalled to active duty in 1821 to commence a survey of the Coast of Africa. During the next four years his African party surveyed 20,000 miles of coast and produced 300 charts. On his return to England, his ships were paid off and the African survey officially ended. Captain Owen however returned once more to Africa several years later to assist in the establishment of a colony for freed slaves on the Island of Fernando Po. Before returning to England in 1831, after an absence of four years, he had established the colony and rounded the Horn coming as far west as Lima. On his return he was retired, and he and his dutiful wife and two daughters settled in London.

In 1835, ownership of Campobello Island passed on to Captain Owen and in the same year he, his wife and family settled there. While living at Campobello he was elected to the Parliament of N.B. and became active in local affairs.

In 1842, he was once again appointed by the Admiralty to conduct surveys in the Bay of Fundy and adjacent coasts of New Brunswick and Nova Scotia. COLUMBIA, a paddle steamer was sent across the Atlantic to serve as the survey ship and over the next five years many surveys were carried out. Captain Owen was made a Rear Admiral in 1847 and at age 80 a Vice Admiral in 1854 — he died in 1857.

The chapters in this book dealing with Captain Owen's surveys in Canada should be of much interest to Canadian hydrographers, cartographers and historians. In many ways the book brings home to the reader the importance of Admiralty surveys to the commerce of Canada and the dependence on the Admiralty surveyors that existed well beyond the death of Captain (Admiral) Owen.

S. B. MacPhee

Captain Owen of the African Survey 1774-1857
by Dr. E. H. Burrows, Published by A.A. Balkema
P.O. Box 1675, N. 3000, BR Rotterdam, Netherlands
1978, 248 pages — ISBN 90 6191 934X

Huntsman Award

On October 27th the A. G. Huntsman Award was presented to Professor Christopher J. R. Garrett at the Bedford Institute of Oceanography. The award has been established to recognize excellence of research in and outstanding contribution to the marine sciences. This award is presented annually and is directed towards excellence in some particular area of marinie science. Professor Garrett, who is at present at Dalhousie University, is interested in physical oceanography but particularly he is recognized for his work in the theory of ocean mixing and for his fundamental work on the field of internal wave dynamics. Although this may be a rather far cry from hydrography some of his work has been directed at the study of low frequency signals in tidal records and he has carried out some of this work in conjunction with the Tidal Section of the Hydrographic Service at the Bedford Institute.

In accepting his award Professor Garrett very modestly claimed that he was only one of a group of physical oceanographers who developed their ideas jointly. Following the award he presented some of his ideas on diffusive processes in the oceans in an elegant and straightforward manner in the lecture which traditionally follows the award.

Small Craft Piloting and Coastal Navigation

by A. E. Saunders

This is a textbook on coastal navigation designed to take the reader from the novice road-map reader stage to the semi-professional skills of a confident boater with as little pain as possible. The author is himself a boater of many years' experience and decided to write this book after several years of teaching Power Squadron courses so as to fill the gap between the once-over-lightly pamphlets and the deep dry-as-dust textbook levels of instruction that were available to the novice boater.

The book is well laid out and takes the reader by the hand to introduce him in turn to the Rules of the Road, buoys, charts and the compass before delving into actual navigation examples and position plotting. Position fixing and position lines are beautifully handled and these sections would make good required reading for newer hydrographers, and good revision reading for the rest of us, while the "practice cruises" are good demonstrations of how to use the various methods of visual positioning.

The author is to be commended for having the illustrations of the New Canadian Buoyage System on the end papers of the book, but unfortunately the detailed discussion chapter on buoyage covers the older, lateral system with only a few words at the end to acquaint the reader with the new system.

The book is an excellent course in small boat navigation and would make a really good text for any navigation class. The lone student using it for individual study, however, would have some head-scratching moments due to the several misprints, minor errors and the occasional outright mistake. Errors such as referring to 285° as being "magnetic west" (page 30) and calling distance travelled "speed travelled" should surely have been removed at an early re-writing stage. And any hydrographer who doesn't notice the errors in figure 5 and on page 282 is invited to apply for work elsewhere!

In reading through this work I was struck by two things: the book is well thought out, well written and fills a long felt need, but it was not, alas, well proof read. The book is eminently readable being written in an easy-to-read manner avoiding the pedantic scholarly style so dear to many text-book authors, but there are enough minor errors to trip up a student. When these inaccuracies (I found about 35 in the first 200 pages) are cleared up for the Second Edition, however, this book will certainly be worthy of a place on the bookshelf of every boat owning family. It is written at just the right level and may well become a standard text on the subject.

J. H. Weller

Small Craft Piloting and Coastal Navigation
by A. E. Saunders, Published by
Van Nostrand Reinhold Publishers
1410 Birchmount Road
Scarborough, Ontario M1P 2E7
Canada.

Recent Developments in Side Scan Sonar Techniques

by
W. G. A. Russell — Cargill (Ed.)

This collection of papers includes articles by B. W. Flemming, M. Klein, and P. N. Denbigh. It is a book that should find a space on every hydrographer's bookcase. Not only does it provide an historical review of the development of sonar and side scan, but it brings the reader up-to-date on the theoretical developments that are being carried out. In particular, it discusses the development by Denbigh of a side scan sonar that can provide quantitative information which, as every hydrographer knows, is the ultimate goal in side scan development, for which we have waited many years.

The collection of papers not only includes the enthusiastically supported ideas of several researchers but also the sober facts of error sources and explains many of the limitations of sonar in terms easily understandable to the working hydrographer. The problems of providing intelligible displays of the data are well covered, and a variety of solutions are provided though the majority of these tend to stress large scale plans and not the typical scales of perhaps 1:100,000 that are used for navigation charts.

This modestly published book will be available to hydrographic training establishments and to those institutions teaching marine geology.

A. J. Kerr

Recent Developments in Side Scan Sonar Techniques
Edited by W. G. A. Russell-Cargill
Central Acoustics Laboratory
University of Cape Town
South Africa

Navstar and Hydrography

When you think about the problems we have with positioning for hydrography, many of them arise from the way signals propagate over the earth's surface and through the lower atmosphere. Range holes in Mini-ranger, skywave at night in Hi-Fix, land path phase lag errors in Loran-C are all examples.

The neat solution is not to transmit through that troublesome earth/atmosphere interface at all, but instead to look straight down from overhead, from satellites. There is negligible signal attenuation in the ionisphere, and the propagation velocity can be determined by comparing simultaneous measurements on two separate frequencies.

Transit Satnav was the first step in this direction of course, but though it was a fantastic advance in navigation, the long interval between fixes meant that it could never be a stand-alone positioning method for hydrographic surveys.

For the last three years, a test flight of six satellites of the next Satnav, the "Navstar Global Positioning System", (NAVSTAR G.P.S.), has been airborne. As with Transit, Navstar is consistently surpassing its design goals, and this time it is clearly a hydrographer's tool; it is capable of 20 m accuracy, continuously, wherever four satellites are in sight. And from 1987, when the full constellation of 18 satellites is deployed, there will be four in sight 24 hours a day. However, there is one snag: Navstar is a military system, and will be degraded to 500 m accuracy for the Standard Position Service available to civil users (as opposed to the Precise Positioning Service used by the U.S. Military). But although the method of degrading the accuracy has not been specified, indications are that by putting a monitor receiver on a known position onshore and broadcasting the positioning bias observed there to sounding vessels in the vicinity, we will be able to recover full accuracy within a limited radius. This is differential operation.

It will obviously pay us to find out ahead of 1987 as much as we can about the performance of Navstar, and about the effectiveness of differential operation and what its range limits are. Sheltech Canada, always an innovative survey company, have owned a Navstar receiver for 18 months now, and a year ago we joined with them and the Department of Surveying Engineering at the University of New Brunswick, where Dave Wells is working, in a programme to develop a seagoing Navstar system, evaluate its performance, and experiment in differential operation. Sheltech provide the receiver, develop software, and analyse the results; UNB do more general system analysis and develop algorithms to optimize performance; we provide test set-ups for evaluation at sea.

The first data-gathering test was made on HUDSON in November, 1981. By the second cruise in May, 1982 we were able to navigate HUDSON by Navstar in real time with 50 m accuracy judged by Loran-C. In November, 1982 Navstar will be out on MAXWELLfor accuracy testing against Mini-ranger position. And if all goes according to plan we will start on differential testing in 1983.

Would you like to be able to forget about maintaining transponder batteries, calibrating Hi-Fix, struggling with Rho-rho Loran-C? Hang on. It is too early yet to know, but maybe, just maybe, you will be able to do that ten years from now.

R. M. Eaton

Canadian Fishermen's Charts

The "Kingfisher" Charts, produced by the British Whitefish Authority for some years now, are not strictly charts in our sense of the word. They are diagrams showing seabed features that the fisherman needs to know about, referred to the common grid used by all fishermen — not lat., long., but Decca, in Europe, and Loran on this side of the Atlantic. The most important features on the "Kingfishers" are the hang-ups, rock piles, wrecks, etc. that other fishermen have lost their gear on. Other points of interest are well-heads and pipelines, seabed topography (fish like submarine crags and steep slopes), and the nature of the seabed.

In a study done for Fisheries and Oceans in 1980 Nordco Ltd., of St. John's Newfoundland, interviewed a hundred "highliner" fishermen in Nova Scotia and Newfoundland, and concluded that a Canadian "Kingfisher" series was feasible. But it is easy enough to say "yes" to a questionnaire when nothing depends on it. The verification of Nordco's conclusion depends on whether fishermen will in fact give information on hang-ups when asked for it, and on whether they will then buy the charts showing all hang-ups collected at $30 each. The actual production of the charts would be less of a problem, as it would simply be an economy version of standard chart production.

This October the Department of Fisheries and Oceans gave Nordco a contract for a Pilot Project consisting of three 1:250,000 "Canadian Fishermen's Charts", one 1:100,000 chart, and two "Inshore Plotting Sheets". (The latter are intended for recording the positions of nets and traps and do not show hang-ups.) The Pilot Project charts will be of Nova Scotia and Newfoundland, the intention being to extend coverage if the first charts go over well. In order that Nordco can concentrate on the unexplored factors of collecting hang-up data and then marketing the charts, the Canadian Hydrographic Service is helping their chart production by providing borders, Loran-C lattices, bathymetry (from the Natural Resource Series contoured charts) and advice on cartographic techniques.

The pilot series will be on sale from February, 1983, and by next June we should have a good feel for how the Canadian Fishermen's Charts are going over.

R.M.E.

Symposium — The Display on Maps and Charts of Data Collected by New Methods of Ocean Survey

This Symposium was held at the National Environment Research Council Headquarters at Swindon, U.K. October 4-6, 1982. The Symposium was organized by Ron Linton of the Experimental Cartography Unit on behalf of the Commission on Marine Cartography of the International Cartographic Association. The objective of the meeting was to examine cartographic methods of representing oceanographic (and hydrographic) data that has been collected by some of the new instruments such as sonar systems, including side-scan and data that has been remotely sensed, typically by satellite.

The meeting was attended by 25 to 30 individuals from a broad background in both the marine sciences and cartography. There was a strong interest in sonar systems, and many of the informal discussions involved various types and applications of sonar. Interesting developments in side-scan sonar are apparently taking place in South Africa, the U. K. (University of Bath), the U.S.A., and Canada with great interest in the development of quantitative systems using inferometric principles to measure beam angle. At the output end, discussions centered around mosaicing processes and techniques for discriminating between depth change and changes in bottom reflectivity. It was reported that in the U. K. the Sector Scanning Sonar besides being usefully deployed as a search tool on HMS BULLDOG is now being used as a mapping instrument by a commercial company which has used it for mapping areas of the English Channel. In the mapping role the transducer is trained perpendicularly to the ship's course. The digital information collected on a frequency of 270 khz is of high resolution and is manipulated to produce grey-scale plots of the bathymetry.

There was considerable discussion on the use of colour displays for which it was noted that they provide a far greater dynamic range than the grey scales. The use of colour was brought out at the symposium in demonstrations of the IS^2 Image Processing System. During this session it was shown how data from the Nimbus 7 satellite could be manipulated to enhance patterns relating to the distribution of phytoplankton. It was also demonstrated how SEASAT data could be manipulated to detect wave direction and length.

At the less exotic end of the spectrum, the need for detailed coloured maps of morphology, geology, and other parameters was discussed with some conclusion being reached that there was a need for simple one parameter monotonic 'quickie' maps in view of the large production costs and limited number of users of multi-coloured maps of ocean parameters. In the working groups one of the questions asked was whether there was a need for a library of side-scan records, rather analagous to an air photo library. Finally and perhaps the most important issue for hydrographers to consider, there was a universal support for the need to expedite the development of a common format for the archiving and exchange of digital bathymetric data.

This symposium forms and element of one of the two tasks set by the Commission on Marine Cartography to be completed by the International Cartographic Conference at Perth, Australia in 1984. The second task is a review of techniques to mapping the Exclusive Economic Zone, and a study is at present underway on that topic.

A.J.K.

Robotics in Hydrography

This is a subject which hopefully you will hear more about in the future, but this will serve as a first note. Two major contracts are underway at present with International Submarine Engineering Ltd. of Port Moody, B.C. to produce two prototype robot vehicles for the Canadian Hydrographic Service. These vehicles are called ARCS (Autonomous Remotely Controlled Submersible) and DOLPHIN (Deep Ocean Logging Profiler and Hydrographic Instrumentration and Navigation). Although seemingly similar, the purpose and engineering considerations are quite different. ARCS is to be deployed through a hole in the Arctic Sea ice on a 5 mile by 5 mile search and survey pattern. It will be positioned by an Oceano acoustic positioning system and will be controlled and pass data on demand through an acoustic link. Anticipated problems include the transmission of signals between the ice which may be alternately reflected between the irregular bottom of the ice and the sea floor. ARCS at present offers one the few prospects for obtaining continuous bathymetric profiles or side-scan imagery in polar regions that are inaccessible to ice-strengthened survey vessels.

DOLPHIN is a remotely controlled version of the parallel sounding side launch but unlike the manned launch is planned to be propelled about 15 feet beneath the surface to avoid the worst of the wave action. The vessel will be powered by a diesel engine, and a snorkel will extend to the surface. The snorkel will also support an antenna, and control of the robot will be by radio link which is also planned as the medium for data transmission. Anticipated problems of this vehicle are envisaged more in the hydrodynamics of propelling it at ship speeds (12 knots) and for it to remain stable than in the data link, although that also will probably not be without difficulty.

The prototype of DOLPHIN is planned for trials early in 1983 with ARCS to follow a year later.

A.J.K.

LEAVING HOME

by Peter Duffy

The Nova Scotian, Halifax Herald Ltd.

There was no time for Lorraine Landry to be nostalgic. The day had come for her to leave Green Island and there was much to do if she and her belongings were to be ready for the helicopter that would be landing in a few hours.

There were still some boxes which had to be packed, and a bed to dismantle, and a final dusting to be done to make ready for the new keeper.

The small, dark-haired woman with the soft brown eyes and even softer Acadian accent busied herself around the house that had been her home for so long.

Born just a few miles away in Petit-de-Grat on Isle Madame, Mrs. Landry had been brought to the tiny island by her parents when she was two years old. Her father had been the Green Island light keeper and she had lived happily there for 49 years, the last 30 of them with her husband Conrad who had also been the light keeper.

Conrad died last April and so, after a lifetime of having back-bone-jarring fog horns and the steady pulse of the light for neighbors, the time had come for her to bid farewell to her island home.

For most people, the prospect of spending their lives on a tiny outcrop of rock, even one within sight of land, is unthinkable. What would you do? How would you pass the time? Mrs. Landry can only smile and shrug, because time never seemed to hang heavy for her on her island. "I was always quite busy," she remembers. "I'd do a little knitting, some reading, we had the television, and in the summer our folks would come out to join us."

She and her husband had a son and two daughters, and raising them was a full-time job in itself, she admits. Mrs. Landry educated the three youngsters to Grade 8 level by correspondence courses before enrolling them in the high school in Arichat.

So many memories for such a small island. She straightened over her dismantled bed and cocked an ear to the west. Yes, it was the coast guard helicopter slapping its way steadily towards the island, coming to take her to her new home in Petit-de-Grat and bringing the new lighthouse keeper to take up his station.

Mrs. Landry squinted into the late August sky and could make out the helicopter with the large net dangling underneath containing her replacement's furniture. She smiled in anticipation of the new-comer's arrival. He was a young man in his late 20s and not too long married. She knew him very well indeed.

He was her son. (and a hydrographer in the Atlantic Region until last year)

Comparisons Between Acoustic and Active and Passive Optical Depth Measuring Systems

By

David Monahan

Canadian Hydrographic Service, Headquarters

M. J. Casey and R. J. MacDougall

Central Region

ABSTRACT

This paper summarizes the results of a study to find cheaper, faster methods of surveying shallow water. The data from the 1980 aerial hydrography mission on the Bruce Peninsula of Lake Huron were evaluated by direct comparison with a conventional hydrographic survey of a portion of this area. The evaluation results are discussed and the paper terminates with the presentation of the options considered for future devlopment and their importance as defined by the Canadian Hydrographic Service senior management.

INTRODUCTION

The initial factors for carrying out hydrographic development in Canada are quite simple. Canada is an enormous country; much of the area to be surveyed is afflicted by ice and/or bad weather for large portions of the year multiplying the magnitude of the problem. Secondly, launches and ships are extremely slow; they are even slower when operating in shallow and therefore dangerous waters. Finally echo sounders measure only a profile, leaving vast areas unmeasured. All development projects are ultimately tied to one of these factors and when a project is proposed which is potentially both fast and measures over areas, that project is so intrinsically appealing that it must be pursued. The Aerial Hydrography Program in its many guises has such appeal. Here we evaluate some results of this program.

The Canadian Aerial Hydrography System was assembled in 1979 by P.A. Lapp Limited under an Unsolicited Proposal to Supply and Services Canada. The system consists of an aerial survey camera (Wild RC-10) and a profiling laser bathymeter hard-mounted to an Inertial Navigation System (Litton LTN 51), all mounted in a Canada Centre for Remote Sensing (CCRS) DC-3 aircraft. An airborne data acquisition system recorded aircraft position and attitude from the inertial navigation system (INS) and other sensors to coincide with each camera exposure and laser firing. The inherent drift in the inertial system was limited by periodic photogrammetric resection fixes and a post mission Track Recovery Software (TRS) used to generate "refined" positions.

The system was flown in the Thousand Islands area of the St. Lawrence River in 1979. Detailed system description and the results of an evaluation performed by the contractor have been treated in several papers (1, 2, 3). The system was flown again in 1980 obtaining color aerial photography and laser bathymeter profiles over a 50 kilometre stretch of Lake Huron coastline. The final product of this system is a shoreline plot containing photogrammetric spot depths and laser bathymeter depths.

The photography collected in 1980 was also used to generate rectified mosaics on which Garry Hunter and Associates interpreted shallow water contours using airphoto interpretation techniques. Original plans to merge the spot depths from the photogrammetric and laser sources as "ground truthing" for the air photo interpretation process fell through due to work schedules.

A conventional hydrographic survey of a portion of the 1980 survey area was carried out early in 1981. This survey was undertaken at double the scale of the aerial plots to provide an abundance of data for comparison purposes. The results of the photogrammetric, laser and airphoto interpretation approaches were compared to the conventional survey. We recognize that this experimental design is not ideal in that the systems should have been tested under various conditions, that is over several different acoustic surveys. Time and expense did not permit such testing. Nevertheless, the results from this single test were most revealing and indicated the aspects of aerial sensing that were worthy of further development and testing.

Photo Lidar System

The data for photogrammetric depth measurement and the Lidar depths were obtained simultaneously from the Canada Centre for Remote Sensing DC-3 aircraft. At the time that the equipment was assembled, it was thought that photogrammetry would be the main survey tool, and that it would be possible to measure spot depths and draw contours from the photographs. Lidar was conceived as being a supplementary device which would be used to help orient photographs by providing some reference depths; it could possibly be used to give depth profiles in water too deep for the photogrammetric measurements. As a consequence, the problem of positioning the aircraft became one of orienting the photographs in which pitch, roll and yaw were measured in addition to latitude, longitude and altitude. High accuracies were regarded as necessary for these measurements and a great deal of hardware and software processing time when into determining the six parameters. (The methods or orienting photographs from ground points do not work over water).

Photogrammetry

The first disapppointment with the photogrammetry was the impossibility of contouring the stereo models. Four different operators were used and they were hard pressed to measure spot depths, let alone contour the data. The hope for complete aerial coverage was not achievable. What was possible was the measurement of a number of spot depths, but coverage of the survey area was not complete. Depths were only obtainable in water less than 6 metres and within that depth range, only 24% of the area yielded measured depths. It proved impossible to measure depth in the remaining 76% of water less than 6 metres or in water deeper than 6 metres. This incomplete sporadic coverage was the second major disappointment.

We then turned to examining the accuracy of the depths that did appear on the photogrammetric field sheet by comparing them to the conventional field sheet. Each depth on the photogrammetric plot was compared to the corresponding conventionally obtained depth. Samples were examined from models set by resection and by the track recovery software (TRS) to determine if there was any significant difference in the distribution of depth differences. The depth differences for these samples are shown in Table 1. Recalling that water depths in all cases are less than six metres, the differences appear unacceptably large and spread over too wide a range.

a)	**SAMPLE SIZE 946**	WHOLE FIELD SHEET	
	49%	differ from Field Sheet by	0 — 0.5 m
	22%	differ from Field Sheet by	0.6 — 1.0 m
	24%	differ from Field Sheet by	1.1 — 2.0 m
	4%	differ from Field Sheet by	2.1 — 3.0 m
	1%	differ from Field Sheet by	3.1 m
b)	**SAMPLE SIZE 107**	TRS MODELS	
	36%	differ from Field Sheet by	0 — 0.5 m
	31%	differ from Field Sheet by	0.6 — 1.0 m
	27%	differ from Field Sheet by	1.1 — 2.0 m
	6%	differ from Field Sheet by	2.1 — 3.0 m
c)	**SAMPLE SIZE 147**	RESECTION MODELS	
	44%	differ from Field Sheet by	0 — 0.5 m
	33%	differ from Field Sheet by	0.6 — 1.0 m
	23%	differ from Field Sheet by	2.1 — 3.0 m

Table 1. Comparison of photogrammetrically derived depths with conventional field sheet. a) All soundings compared. b) Only those soundings positioned by the Track Recovery Software are compared. c) Soundings positioned by resection are compared.

The comparison of depths obtained from resection and TRS set models was carried a step farther and the mean depth difference caluclated as a percentage of the mean depth. This exercise was conducted over varying ranges of depths and the results tabulated in Table 2. It was noted that the majority of observations were deeper than the depths on the conventional field sheet. The prime contractor was made aware of these differences, a third sample area was measured using a different operator and these results evaluated. The majority of the photogrammetric depths were now shallower than those of the conventional plot. This exercise would appear to confirm the fact that the system is indeed operator dependent. This new sample was evaluated in the same manner as the earlier and the results presented in Table 3.

SAMPLE SIZE 169		
61%	differ from Field Sheet by	0 — 0.25 m
31%	differ from Field Sheet by	0.6 — 1.0 m
7%	differ from Field Sheet by	1.1 — 2.0 m
1%	differ from Field Sheet by	2.1 m

Depth Range	% of Sample	Mean Depth	Mean Difference	% Mean Diff. / Mean Depth
≤1 m	9%	.81 ± .20 m	.19 ± .54 m	23%
1.1-2 m	51%	1.60 ±.28 m	-.29 ±.40 m	18%
2.1-3 m	37%	2.46 ±.25 m	-.44 ± .54 m	18%
≥3.1 m	3%	3.7 ± .44 m	-1.16 ± .94 m	31%

TABLE 3. Differences between conventional field sheet and photogrammetric field sheet. These depths were reported after the differences shown in Table 2 were pointed out to the contractor.

A general examination of the photogrammetric plot revealed that 87% of the depths fell inside the two metre contour. Of the 13% of the depths contained in water deeper than two metres only 36% agreed with the conventionally obtained depths within +0.5 metres. Other important deficiencies evident on the photogrammetric plot were:

— Shoal areas that were not indicated as such
— absence of critical shallow soundings
— shoreline did not represent high water line
— the depths are discrete spot measurement.

SAMPLE	DEPTH RANGE	% OF SAMPLE	MEAN DEPTH	MEAN DIFFERENCE	% MEAN DIFFERENCE / MEAN DEPTH
TRS SAMPLE SIZE 107	≤1 m	34%	0.53 ± 0.33 m	0.89 ± 0.50 m	168%
	1.1 - 2.0 m	40%	1.57 ± 0.64 m	0.82 ± 0.89 m	52%
	2.1 - 3.0 m	23%	2.41 ± 0.22 m	0.72 ± 0.70 m	30%
	≥3.1 m	3%	3.23 ± 0.06 m	0.07 ± 0.46 m	2%
	≤2.0 m	75%	1.11 ± 0.60 m	0.84 ± 0.72 m	76%
RESECTION SAMPLE SIZE 147	≤1.0 m	28%	0.63 ± 0.32 m	0.60 ± 0.53 m	95%
	1.1 - 2.0 m	41%	1.54 ± 0.29 m	0.63 ± 0.51 m	41%
	2.1 - 3.0 m	31%	2.40 ± 0.22 m	0.70 ± 0.45 m	29%
	≤2.0 m	69%	1.18 ± 0.54 m	0.59 ± 0.53 m	50%

TABLE 2 : Depth differences where the mean difference is expressed as a percentage of mean depth.

The first three items can be improved upon by altering or adding to the processing techniques but the fact that these plots do not represent 100% bottom coverage will remain. It is virtually impossible to contour sub-surface features due to the lack of bottom contrast.

Lidar Analysis

A sample of approximately 400 lidar soundings was available in the Bruce test area. The lidar depths were well distributed in time, space and depth enabling a comprehensive analysis of the lidar errors as a function of both sonor-related and depth-related effects.

Fig. 1

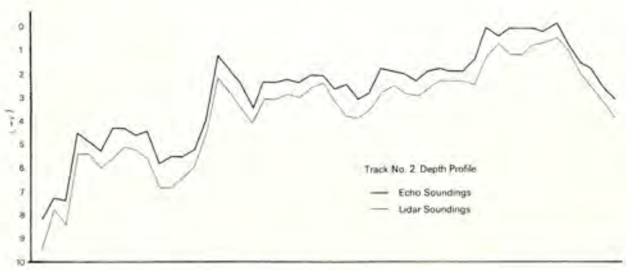


Figure 1 shows both acoustic and lidar profiles of a portion of one of the flight lines. Note the very high degree of profile correlation. Clearly both instruments are sensing the same bottom. A higher degree of correlation might be possible if the pulse profile was compared to the acoustic profile. The data available for analysis included only every sixth lidar pulse. Note also that the depth bias (the lidar reading is always deep) is near constant. This depth bias is caused by scattering within the water column. This phenomenon is currently the subject of a research project with Moniteq Inc. of Toronto.

Fig. 2

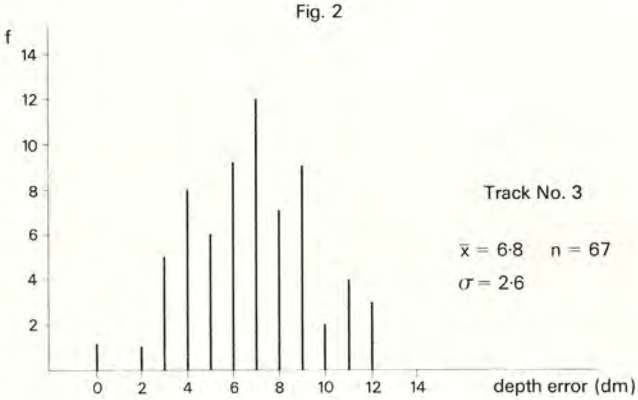


Figure 2 is a histogram of the depth difference distribution along Track #3. Pooling all sample depth differences together results in an estimated standard deviation of 28 centimetres for the lidar errors. This pooling together however assumes that the depth error is the same regardless of its position in space, time or depth. If this assumption is false it will inflate the standard deviation estimate.

Figure 3 and 4 show the depth bias and standard deviation estimates analyzed on a track by track basis. The intervals are 2 confidence regions. The homogeneity assumption appears to be suspect. Figure 5 shows the depth difference analyzed on a depth by depth basis. The samples were sorted by depth and grouped into 1 metre depth cells. The data suggests that the depth bias is near constant until about 6 metres wherein it begins to increase exponentially. In order to reduce this bias effect and get an unbiased estimate of the lidar error, the following empirical depth bias model was formulated:

$$Y = A + B \exp (Cd - E)$$

Where Y is the depth bias in decimetres
d is the depth
and A, B, C, E are unknown parameters.

The model parameters can be related to physical phenomena since it is known that the signal strength of the lidar pulse diminishes exponentially with depth.

Fig. 3

Fig. 4

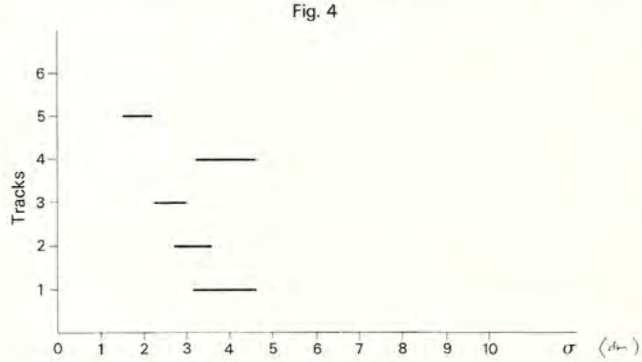
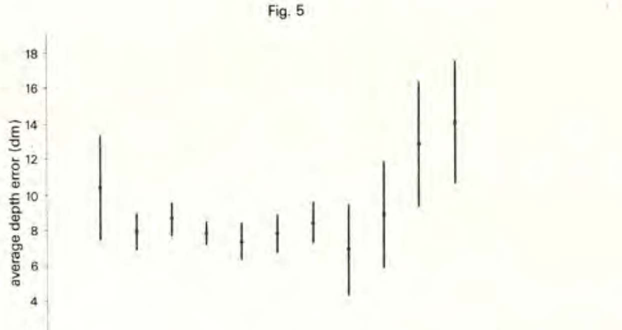
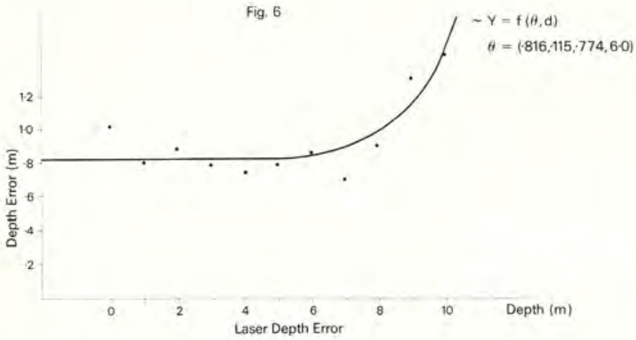


Fig. 5



The sample was randomly divided into two subsamples called the model calibration group and the model validation group. The first group was used to generate least squares estimates of the values of A, B, C and E. See Figure 6. The calibrated model was then used to correct the depths in the validation group, that is compute and subtract the bias from the depth. These corrected depths were then compared to the acoustical soundings. The results of applying this simple technique were impressive. Average depth bias was reduced to zero and estimated standard deviation of the lidar error reduced to 23 centimetres. A more sophisticated depth bias analysis which does not require any acoustic depth calibration is being



developed by Moniteq. It examines the lidar return pulse and extracts water quality parameters which contribute to pulse stretching. We can expect an improvement of the 23 centimetres resolution once this technique is in production. Planned improvements to the laser hardware and better bottom detection software will contribute to further depth resolution.

Photo Interpretation

The photo interpretation contract results were also compared over the same area. Photo interpretation differs from photogrammetry in that contours are drawn based more on an intrepretation of the image in the photograph than on measurement. For our tests we first of all compared the coordinates of 81 targeted horizontal control stations to the corresponding ground coordinates of these stations. The results of this test are shown as Table 4 in which the

PHOTO INTERPRETATION

SAMPLE	ΔN	ΔE
81 Control Stations	-1.06 ± 4.05 m	1.33 ± 5.24 m

TABLE 4

difference in northings and the difference in eastings for the 81 controlled stations are shown to be acceptably small. This indicates that the photo mosaic was quite well controlled. Second, the contours drawn by the photo interpretation process were compared to those of the field sheet and statistics showing the worst case of disagreement are shown in Table 5. From this plus an

SAMPLE		MEAN DEPTH
1 m Contour	Size 34	1.02 ± 0.60 m
2 m Contour	Size 33	2.06 ± 0.68 m
4 m Contour	Size 44	5.27 ± 1.53 m

NOTE: The contour samples were taken in the areas of maximum displacement.

TABLE 5

examination of the shapes of the contours on the field sheet and on the photo interpreted field sheet we concluded that the photo interpretation is extremely good at depths of 1 to 2 metres but unfortunately loses its reliability as depths increase. Nonetheless the photo interpretation method does provide coverage of all shallow waters within the survey area and as such is an extremely useful tool.

Cost Comparisons

Recognizing that we were entering into very dangerous waters we did attempt a cost comparison between the launch survey, the photogrammetric lidar combination survey and the photo interpretation survey. These costs are summarized in Table 6. It was virtually impossible to reduce all the factors to a common denominator even after the following assumptions were noted:

	PHOTO/LIDAR		PHOTO INTERPRETATION		CONVENTIONAL	
FIELD WORK (CHS)	Control	$ 54,575	Ground Truth	$11,800	Operating & Maintenance	$11,500
	Salaries	$ 10,000	Salaries	$ 5,000	Salaries	$30,000
	*Overhead	$ 15,000	*Overhead	$ 7,500	*Overhead	$45,000
PROCESSING	TRS/Laser	$ 63,738	Interpretation	$31,402	Shoreline Plots	$ 1,450
	Photogrammetry	$186,205			Office Salaries	$ 4,000
	Copies Photos	$ 4,000			*Overhead	$ 5,000
OTHER	Costs absorbed by CCRS	$ 75,000				
TOTAL COSTS (50KM Shoreline)		$408,518		$55,702		N/A
Costs Plot No. 1		$ 98,044		$13,368		$ 2,500
Cost of 4km shoreline — area of FS 8084	(Depths in only 24% of water) area > 6m)	$ 32,681	(100% hazard coverage reliable contours to 2m)	$ 4,456	(profiles — 25m spacing, includes depths > 6m etc.)	$97,950
SCALE	1:10,000		1:10,000		1:5,000	
Extrapolated Cost	(to cover 100% water area 6m)	$136,171				

NOTES * CHS overhead assumed = 1.5 × (Salary + overtime)
Note: No capital depreciation costs applied to CHS equipment.

TABLE 6.

- — CHS overhead costs = 1.5 × (salaries including overtime).
- — Photogrammetric costs are buried in the combined photogrammetric/laser bathymeter (Photo/Lidar) costs.
- — Conventional survey covered only the 4km × 4km calibration area at double scale of other approaches.
- — Photogrammetric depths were only in 24% of water area and an extrapolated cost of 100% does not reflect the fact that conventional methods would be required where this technique failed.
- — Capital equipment depreciation values for CHS gear were not applied in any of the approaches.

Thus it is left to the reader to choose suitable combinations of approaches and alter the necessary assumptions to arrive at cost figures where direct comparison is presently impossible.

The cost comparison for Plot No. 1 is one where there is a common denominator and it should be noted that the conventional shoreline plot omitted many details that appeared on the photo interpretation plot. The same lack of detail is noted on the shoreline supplied with the photogrammetric plot. Over all, it would appear that the combination of the photo interpretation plots and conventional surveying techniques would be cost effective due to the number of hazards noted on the photo interpretation plots.

Conclusions

From these tests we were able to recommend to management that very little effort be expended in the future on the photogrammetric approach. The photo interpretation aspect, on the other hand, is extremely promising and efforts can and should continue in that line. The lidar system performed well beyond expectations but we felt it will not become truly efficient until it is modified into a scanning system in which the laser beam is swept back and forth across the aircraft's track. Work on developing a contract for such development is currently underway.

References

1. Aerial Hydrography Pilot Project, Pall Rept. #5F/80 prepared for CHS, July 1980.
2. Reid, D.B., Dow, A.J., Masry, S.E., Gibson, J.R., "System Concept and Results of the Canadian Aerial Hydrography Pilot Project". Presented at the Laser Hydrography Symposium, Adelaide, Australia, October 1980.
3. MacDougall, J.R., "Canadian Aerial Hydrography Systems" Presented at National Ocean Survey Conference, Norfolk, Va. January 1981 and the Canadian Hydrographic Conference Burlington, Ontario, April 1981.

Letters to the Editor

Henderson's (1982) interesting account about survey of Fury and Hecla Strait leads me to draw attention to equally interesting fiction (Forester 1945) and articles (Pearsall 1973; Barr 1975— about the type of vessel, i.e. the so-called "Bomb", used by Sir W. E. Parry and others in arctic survey and about some of his observations there (e.g. Greenler et al. 1977). On his first voyage to the region Parry had obtained subsurface temperature data in Lancaster Sound (Campbell 1958) and on the second voyage he obtained similar data in Fury and Hecla Strait (Parry 1824, p.342). Nevertheless, it seems likely that the first modern oceanographic observations there (Table 1) are those of "Eastwind" in 1948 when four casts for

Table 1. Some early oceanographic data (to 1961) in Fury and Hecla Strait indicating the year obtained, name of ship, Cruise Reference Number and a literature reference. An asterisk indicates that the reference is a data report or contains data in tabular form.

Year	Ship	CRN	Reference
1948	USCGC "Eastwind"	31EW03760	Metcalf 1949*
1956	HMCS "Labrador"	219	Campbell 1958
1960	CCGS "Labrador" and CSS "Baffin"	340	Anon. 1964*
1961	CCGS "John A. Macdonald"	344	Anon. 1966*

serial salinity and temperature were made; additional serial data were obtained in 1956 and 1960 by "Labrador" and in 1961 by "John A. Macdonald" (Fig. 1). The "Macdonald" program began in Nansen Sound after completion of the annual supply mission to the weather station at Eureka (Stead 1963) and was carried out by the hydrographic team. In Fury and Hecla Strait this comprised H. Blandford, R. MacKay and J. Clarkson, but with some assistance from the ice observer (Dunbar 1962). The first direct current observations there appear to have been made 11-12 September 1960 by a group (Fig. 2) in "Baffin".

F. G. Barber,
Ocean Science and Surveys
Ottawa, Ontario K1A 0E6

References

Anonymous. 1964. Data record, eastern arctic — 1960. Can. Oceanogr. Data Centre 18:203 p. and 1966. Data record, arctic — 1961. Can. Oceanogr. Data Centre 12:322 p.

Barber, F. G. 1965. Current observations in Fury and Hecla Strait. J. Fish. Res. Board Can. 22:225-229.

Barr, W. 1975. From Wager Bay to the Hebrides: the duties of an 18th century bomb vessel. Musk-Ox 16:32-52.

Campbell, N. J. 1958. Recent oceanographic activities of the Atlantic Oceanographic Group in the eastern arctic. Prog. Rep. Atl. 69:18-21.

Dunbar, M. 1962. Ice conditions in the areas visited by CMS "John A. Macdonald" in the summer of 1961. Def. Res. Board Can. D. Phys. R(G), Rep. Misc. G-9:15 p. and 9 maps.

Forester, C. S. 1945. Commodore Hornblower. Little, Brown Company, Boston, 384 p.

Greenler, R. G., A. J. Mallman, J. R. Mueller, and R. Romito. 1977. Form and origin of the Parry arcs. Science 195:360-367.

Henderson, G. W. 1982. The hydrographic survey of Fury and Hecla Strait. Lighthouse, Edition 25:32-35.

Metcalf, W. G. 1949. Oceanographic program U.S. Navy Task Force 80 arctic operation, summer 1948. Woods Hole Oceanogr. Institution Tech. Rep. C-2:67 p.

Parry, W. E. 1824. Journal of a second voyage for the discovery of a North-West Passage from the Atlantic to the Pacific; performed in the years 1821-22-23 in His Majesty's Ships FURY and HECLA. John Murray, London: 568 p. illustrated.

Pearsall, A. W. H. 1973. Bomb vessels. Polar Record 16:781-788.

Stead, G. W. 1963. Arctic probes by the Canadian Coast Guard. Can. Geogr. Jour. 66, 67:176-187.

Figure 1: Some scenes relating to the work of "Macdonald" during the 1961 season (courtesy Moira Dunbar).

Figure 2: Oceanographers in "Labrador" moved to "Baffin" in order to carry out the brief series of current observations of 1960 (Barber 1965). The group comprised (from the left) W. Watt, J. Lazier, F. Barber and G. Taylor.

CHA/CHS News

ATLANTIC REGION

PERSONALS

Atlantic Region would like to welcome Roland Perrotte to the CHS. Roland comes to us from Laval University, where he was doing research for his doctorate in geography, specializing in cartography.

Grant MacLeod returned from Washington after an interesting and worthwhile exchange at NOAA. We were very happy to have Bud Schantz here in return. Bud returned home to a new position with NOAA and we all wish him the best of luck.

We will all miss Gary Landry, who left CHS to continue his father's lighthouse keeping duties on Green Island.

Dave DeWolfe also left CHS to start his own consulting firm. Best of luck Dave!

Cartography lost Peter Morton to Dalhousie University — Peter decided to go back to school full time.

We would like to thank Sev Crowther for all his help over the past few months.

Congratulations to Chris Rozon and David Hughes on passing the Hydrography I course.

Paul Bellemare sailed back to Quebec after an eighteen month assignment in Atlantic Region. Lighthouse would like to thank Paul for all his work translating the news column.

Bruce MacGowan and Charlie Stirling each spent their rotation year building new homes. Gary Henderson spent his rotation travelling across Canada and even managed to send us a postcard.

Kirk MacDonald spent his summer bicycling across Arizona, and then France, before spending two weeks on the Maxwell in the Miramachi.

Walter Burke, Hank Boudrea, and Gerard Costello have all headed off for university. Good luck to all of you!

Karen Coates won the position for a term cartographer. Karen has worked with CHS before, and we welcome her back.

Every year BIO has a pumpkin contest. This year Roger Jones was the only Hydrography entrant, and his pumpkin placed fifth.

Sandra Weston and Roland Perrotte are attending the first Carto II course.

Alan Smith spent a month with the Tide Section, diving for tide and current meters.

This year's term and summer students included: Darlene Gillis, Lyle Fisher, Bill Armstrong, Darlene Hardy, Dale Nicholson, Mike Gorley, Lewis Cordosa, Sean Duffey, Mike Collins, Fred Devlin, Anne Ryan and Linda (Flash) MacMillan.

REGION DU L'ATLANTIQUE

NOTES PERSONNELLES

La région de l'Atlantique souhaite la bienvenue à Roland Perrotte au sein du S.H.C. Roland a étudié à l'Université Laval où il a obtenu un doctorat en géographie avec spécialisation en cartographie.

Grant MacLeod est de retour de Washington à la suite d'un échange intéressant avec N.O.A.A. Nous avons été très heureux de recevoir Bud Schantz durant cet échange. Bud est retourné à N.O.A.A. pour occuper une nouvelle position. Nous lui souhaitons tous un bon succès.

Gary Landry a quitté le S.H.C. pour succéder à son père en tant que gardien de phare à Green Island.

Dave DeWolfe a également quitté le S.H.C. Pour ouvrir sa propre firme de consultant. Bonne chance Dave.

La section de cartographie a perdu les services de Peter Morton qui a décidé de retourner à l'Université pour y suivre des cours à plein temps.

Nous voudrions remercier Sev Crowther pour l'aide qu'il a fournie durant les quelques mois passés dans notre région.

Félicitations à Chris Rozon et David Hughes qui ont complété avec succès le cours d'Hydrographie I.

Paul Bellemare a monté les voiles pour retourner à Québec après avoir passé 18 mois dans la région de l'Atlantique. La revue Lighthouse voudrait remercier Paul pour le travail qu'il a fait en transcrivant les colonnes de nouvelles.

Bruce MacGowan et Charlie Stirling ont tous deux passé leur année de rotation à bâtir une maison. Gary Anderson passa son année de rotation à voyager à travers le Canada et a même réussi à nous envoyer une carte postale.

Kirk MacDonald a écoulé une partie de l'été à pédaler à travers l'Arizona puis ensuite la France avant de s'embarquer pour deux semaines sur le "Maxwell" pour travailler dans la baie de Miramichi.

Walter Burke, Hank Boudreau et Gérard Costello sont retournés à l'Université. Bonne chance à tous.

Karen Coates a remporté le poste à terme en cartographie. Karen a déjà travaillé pour le S.H.C. Nous lui souhaitons un bon retour parmi nous.

A chaque année, B.I.O. organise un concours de citrouille. Cette année Roger Jones était le seul hydrographe participant et sa citrouille s'est classée bonne cinquième.

Sandra Weston et Roland Perrotte suivent présentement le premier cours de Carto II à Ottawa.

Alan Smith a travaillé un mois à la section des marées durant lequel il a fait de la plongée pour installer et récupérer des courantomètres et marégraphes.

Cette année, notre équipe d'employés à terme et d'étudiants se composait de Darlene Gillis, Lyle Fisher, Bill Armstrong, Darlene Hardy, Dale Nicholson, Mike Gorley, Lewis Cordosa, Sean Duffey, Mike Collins, Fred Devlin, Anne Ryan et Linda (Flash) MacMillan.

GENERAL NEWS

Ed Lischenski gave a talk on reprogaphics to the cartographers. Everyone found the talk helpful and informative.

NOUVELLES GENERALES

Ed Lischenski a présenté aux cartographes un exposé sur les procédés reprographiques. Cet exposé s'est avéré très utile et informatif.

CENTRAL REGION

PERSONALS

Debbie Borris plans to leave McElhanney and the Lake Manitoba survey to study medicine.

Congratulations to Chris Gorski for successfully completing the Cartography I course in Ottawa.

Boyd Thorson and Brent Beale are presently attending the inaugural Cartography 2 course in Ottawa. Business at the 'Last Chance' should pick up!

Dan Chase, Sean Hinds and Bruce Richards all successfully completed the Hydrography I course in Ottawa and Patricia Bay.

Congratulations to Jim Elliot for winning the competition for Navigational Information Officer.

Denis Pigeon is now a permanent employee of the CHS in Cartography. Congratulations Denis.

Ray Treciokas has returned from a month's holiday in the U.S.S.R. He enjoyed the free vodka and caviar.

George Macdonald has taken to two-wheeling it and can be seen zooming along hwy 403/QEW mornings and evenings on his new motorcycle.

Congratulations to Bernie and Mary Eidsforth on the birth of their daughter Aug. 12, 1982. Congratulations also to Tony and Vicky Bonnici on the birth of their daughter on July 9, 1982.

Derek Cooper retired as Staff Assistant to Mr. McCulloch, Director General of Bayfield Laboratory, as of December 31, 1981. However, he stayed on in that position on a contract basis until recently. Best wishes to Derek and Joan on their retirement plans.

Gerry Wade has retired as an instructor in Hydrography at Humber College. Once he gets through Jeannie's list of 'things to do' around the place, he and Jeannie plan to do a little travelling.

Rick Bryant has moved within M.O.T. (from Toronto) to Vancouver, where he is the Regional Manager of Aids and Waterways.

Bayfield Laboratory would like to welcome Angela Evans as a new term employee in Cartography.

Congratulations to Mike Casey for winning a competition in Geoscience Mapping in Ottawa. Mike will be leaving our region for the nation's capital in December/January.

EVENTS

CCIW Hockey League and the CCIW Curling Club have both started up for the season.

REGION CENTRALE

NOTES PERSONNELLES

Debbie Borris entend quitter la compagnie McElhanney et le levé du lac Manitoba pour pouvir étudier la médecine.

Félicitations à Chris Gorski pour avoir complété avec succès le cours de Cartographie I donné à Ottawa.

Boyd Thorson et Brent Beale sont présentement à Ottawa pour suivre le cours de Cartographie II. Les affaires devraient reprendre au "Last chance".

Dan Chase, Sean Hinds et Bruce Richards ont complété avec succès leur cours d'Hydrographie I qui se déroulait à Ottawa et à Patricia Bay.

Félicitations à Jim Elliot pour avoir remporté le concours d'agent d'informations nautiques.

Denis Pigeon est maintenant cartographe permanent du S.H.C. Félicitations Denis.

Ray Treciokas est de retour d'une vacance d'un mois en U.R.S.S. Il a apprécié la vodka et le caviar gratuits.

George Macdonald s'est acheté une motorcyclette. Matin et soir, on peut le voir passer en trombe sur l'autoroute 403/QEW.

Félicitations à Bernie et Mary Eidsforth à l'occasion de la naissance de leur fille le 12 août 1982. Félicitations également à Tony et Vicky Bonnici, heureux parents d'une petite fille née le 9 juillet 1982.

Derek Cooper a pris sa retraite en décembre 1981. Monsieur Cooper travaillait comme assistant de Monsieur McCulloch, Directeur général du laboratoire Bayfield. Cependant, Monsieur Cooper est demeuré à ce poste sous contrat, jusqu'à récemment. Meilleurs voeux de bonheur à Derek et Joan dans leur projets futurs.

Gerry Wade a pris sa retraite alors qu'il était professeur d'hydrographie au collège Humber. Une fois qu'il en aura terminé avec la liste de son épouse concernant les choses à faire à la maison, Gerry et Jeannie ont l'intention de voyager.

Rick Bryant a changé de poste au sein du Ministère de Transports de Toronto à Vancouver, à il est le Directeur Régional des aides à la navigation

Le laboratoire Bayfield aimerait souhaiter la bienvenue à Angela Evans comme nouvelle employée à terme en Cartographie.

Félicitations à Mike Casey qui a remporté un concours en Cartographie géoscientifique à Ottawa. Mike partira de notre région en décembre ou janvier pour la région de la capitale national.

EVENEMENTS

Les ligues de Hockey et de Curling de C.C.I.W. on débuté la saison.

OTTAWA BRANCH

PERSONALS

Congratulations to Lung-fa-Ku whose doctoral thesis on "The Computations of Tides from GEOS-3 Altimeter Data" has just been accepted.

Welcome to Paul Holroyd who has recently joined the Cartographic Development Section.

Congratulations to all the new parents: Candice and Guy Levy, Carole and Jeep Seguin, Kim and Don Vacon, Sue and Gregg Dahms, and Mr. and Mrs. David Gray.

George Yeaton has been building a new house this summer. He must be getting proficient at it, since this is the third house he has built, or is he moonlighting?

Sid van Dyck's daughter is studying fashion design in London England this winter. No more winter trips to Atlanta, Georgia, eh Sid?

GENERAL NEWS

The last of 18 GEBCO sheets went to press in March 1982, marking the end of an eight-year project. The series was warmly received in Monaco in April, and all members of the GEBCO drafting unit received a certificate of appreciation from Prince Ranier of Monaco.

SECTION D'OTTAWA

AVIS PERSONELLES

Nous tenons à féliciter Lung-fa-Ku suite a l'acceptation de sa thèse de doctorat intitulée "The Computation of Tides from GEOS-3 Atlimeter Data".

Bienvenue à Paul Holroyd qui a recemment joint la section de developpement cartographique.

Nous félicitons tous les nouveaux parents: Candice et Guy Levy, Carole et Jeep Seguin, Kim et Don Vachon, Sue et Gregg Dahms, et Mr et Mme David Gray.

George Yeaton a été très occupé cet été à la construction d'une nouvelle demeure. Il doit commencer a avoir de l'experience, car c'est la troisieme maison qu'il bâtit . . . ou a-t-il un emploi nocturnel?

La fille de Sid van Dyck étudie la haute couture cet hiver à Londres en Angleterre. Il n'y aura plus de voyages hivernals a Atlanta Georgia n'est-ce pas Sid?

NOUVELLES GENERALES

La dernière de 18 cartes GEBCO a été envoyée à l'imprimerie en mars 1982. Ceci marque la dernière année d'un projet de huit ans. La serie de cartes a été chaleureusement acceuilli a Monaco en avril et tous les membres de la division GEBCO ont reçus un certificat d'appréciation du Prince Ranier de Monaco.

PACIFIC REGION

PERSONALS

John Watt, CHA vice-president of this branch in 1980, has accepted the position as President and General Manager of JMR, Calgary. We wish him well in his new endeavors, and hope to hear from him as an active participant in the activities of the embryonic Calgary Branch of CHA.

Ernie Sargent will participate in an exploratory exercise with the Institute of Ocean Sciences' Frozen Sea Research group in the Antarctic this fall.

Congratulations to Sandy Sandilands, Stan Huggett, Jim Vosburgh, Willie Rapatz, and Graeme Richardson, all of CHS, and Ian Campbell of Coast Pilot Ltd., who were successful in becoming qualified Canada Land Surveyors. This region now has 9 hydrographers with these qualifications.

Three new hydrographes have joined us fresh from the B.C. Institute of Technology. They are Ron Woolley, Rob Hare, and Carol Strand (this region's first lady hydrographer). All three will be participating in Hydrography 1 at Ottawa in January 1983. Congratulations also to Knute Lynbery, Ken Halbro, and Maurice Bastarache on passing the last Hydrography 1 course. Maurice has decided to continue his education and has resigned from CHS to attend the U.N.B. Survey Engineering Course. We wish him luck!

During August our Branch Vice-president Stan Huggett spent a well-deserved four week vacation in Japan.

REGION DU PACIFIC

NOTES PERSONNELLES

John Watt, vice-president de l'A.C.H., section du Pacifique en 1980, a accepté le poste de président et gérant général de la compagnie J.M.R. à Calgary. Nous lui souhaitons du succès dans ses nouvelles entreprises et espérons entendre parler à nouveau de lui comme membre actif de la branche embryonnaire de l'A.C.H. à Calgary.

Cet automne, Ernie Sargent participera à un exercice exploratoire dans l'Antarctique avec un groupe de l'"Institute of Ocean Sciences Frozen Sea Research".

Félicitations à Sandy Sandilands, Stan Huggett, Jim Vosburgh, Willie Rapatz, and Graeme Richardson, membres du C.H.S. qui ont obtenu leur brevet d'arpenteur-fédéral. Cette région compte maintenant 9 hydrographes possédant ces qualifications.

Trois finissants de l'Institut technologique de Colombie-Britannique ont été engagés comme hydrographes. Ce sont Ron Wooley, Rob Hare et Carol Strand, première technicienne en hydrographie de cette région. Tous trois suivront le cours d'Hydrographie I à Ottawa en janvier 1983. Félicitaions à Knute Lynbery, Ken Halbro et Maurice Bastarache qui ont réussi le cours d'Hydrographie I. Maurice a décidé de continuer ses études en sciences géodésiques à l'Université du Nouveau-Brunswick et a donné sa démission au C.H.S. Nous lui souhaitons du succès dans ses études.

Durant le mois d'août, notre présent vice-président Stan Huggett s'est offert une vacance bien méritée de quatre semaines au Japon.

From the Chart Production side — Sev Crowther, recently elected to the founding Board of Directors of the Institute of British Columbia Cartographers, left for a three month assignment in Atlantic Region. We hope to see him back before this issue is published.

Du côté de la production cartographique, Sev Crowther, récemment élu au sein du conseil d'administration de l'Institut des cartographes de la Colombie-Britannique, a été transféré dans la région de l'Atlantique pour une période de 3 mois. Nous espérons qu'il sera de retour avant la publication de ce numéro.

Ron Bell and Laurie Thompson are spending a month in Ottawa to participate in the first Cartography 2 course. Gerry Kidson, Heather Pite, Dave Jackson and Harvey Pfluger are our most recent graduates of the Cartography 1 course. Congratulations!

Ron Bell et Laurie Thompson sont à Ottawa pour une durée d'un mois pour suivre le premier cours de cartographie II. Félicitations à Gerry Kidson, Heather Pite, Dave Jackson and Harvey Pfluger qui ont réussi le cours de cartographie I.

A welcome is extended to Meira Tennent, the new part-time secretary/typist in Chart Production, and also to the region's newest cartographer, Bruce Tuck.

Bienvenue à Meira Tennent. la nouvelle secrétaire à temps partiel de la section de la Production des cartes ainsi qu'à Bruce Tuck, notre nouveau cartographe.

In the last issue, this column reported that four cartographers would be going into the field to work alongside the hydrographers. Michael Jennings, Al Schofield, Bernard Kenney and John Gould report that the experience was very rewarding.

Dans le dernier numéro de la revue, on mentionnait que quatre cartographes iraient sur le terrain avec les hydrographes. Michael Jennings, Al Schofield, Bernard Kenney and John Gould ont trouvé l'expérience très enrichissante.

Ray Chapeskie's home was the scene of a stag party held to pay respects to cartographer Gerry Kidson, who is scheduled to abandon bachelorhood on Thanksgiving weekend.

Une soirée d'enterrement de vie de garçon a été oranisée à la maison de Ray Capeskie en l'honneur du cartographe Gerry Kidson qui entend abandonner le célibat durant la fin de semaine de l'Action de Grâces.

EVENTS

Both IOS Mariners softball teams had successful seasons in their respective leagues. The "fun" team finished its season with 12 wins and 4 losses. The "serious" team captured first place in its league, losing in the playoff final to a team from MOT. Besides taking part in various tournaments during the season, the Mariners sponsored their 1st Annual Invitational Softball Tournament in which 8 teams participated. The Mariners took third and sixth places, but all teams triumphed at the bar and on the dance floor of the post-tournament barbeque/dance.

Over 50 golfers participated in the 12th Annual Hydrographic Invitational Golf Classic held on July 23rd. The finest round of the day was turned in by Alan Douglas with a 78. Sue McKenzie and Kathy Creighton tied for the "most honest golfers" status with scores of 174.

EVENEMENTS

Les deux équipes "IOS Mariners" de balle molle ont complété avec succès leur saison respective. L'équipe des moins professionnels a terminé sa saison avec 12 victoires et 4 défaites tandis que l'équipe de plus professionnels a décroché une première place dans la saison perdant en finale contre une équipe du Ministère des Transports du Canada. A part leur participation dans différents tournois durant la saison, les Mariniers ont parrainé leur premier tournoi annuel invitation de balle-molle dans lequel huit équipes participèrent. Les Mariniers décrochèrent les troisième et sixième places dans le tournoi. Tous cependant remportèrent la première place au bar et sur la piste de danse lors du barbecue organisé après le tournoi.

Plus de 50 golfeurs ont participé à la 12e classique invitation de golf du Service hydrographique qui a eu lieu le 23 juillet. Le meilleur parcours de la journée fut terminé par Alan Douglas qui joua 78. Sue McKenzie et Kathy Creighton ont terminé à égalitié pour le titre de "golfeur le plus h onnête" avec un pointage de 174.

GENERAL NEWS

The "Polar Circle", the vessel chartered for surveys in the corridor of the Beaufort Sea this past season, returned from her three month survey on September 26. Jim Vosburgh, Officer-in-Charge, indicates that a large amount of work was completed under difficult conditions. Though the ice was not a problem this year, the weather was poor thoughout the survey. The return passage took 14 days, and GEBCO data was gathered on both the trips north and south.

NOUVELLES GENERALES

Le "Polar Circle", navire affrété pour le levé du corridor de la mer de Beaufort, cette saison, est revenu de son voyage de 3 mois le 26, Septembre. Jim Vosburgh, hydrographe-en-charge, a indiqué qu'un travail considérable avait été effectué durant cette mission malgré des conditions difficiles. Quoique la glace ne fut pas un problème cette année, il n'en fut pas de même pour la température qui fut mauvaise. Le passage de retour fut d'une durée de 14 jours et des données pour GEBCO furent rassemblées durant les deux voyages vers le nord et vers le sud.

REGION DU QUEBEC

AVIS PERSONNELS

Bienvenue à:
— Richard Sanfaçon, notre actuel vice-président de l'ACH qui a remporté le concours visant à combler le poste d'hydrographe laissé vacant par le départ de Ronald Saucier, maintenant avec

QUEBEC REGION

PERSONALS

Welcome to:
— Richard Sanfaçon, our present CHA vice-president, who recently won the hydrographic position left open by the recent departure of Ronald Saucier, who's now with Marinav. Richard pre-

Marinav. Richard nous vient de la cartographie où il y oeuvrait depuis deux ans après avoir été en charge des archives techniques.

— Marc-André Baillargeon et à Paul-Emile Bergeron, deux nouveaux hydrographes. Marc-André comble le poste laissé vacant par le départ de Denis Trudel qui a été transféré à la Division des petits ports en juillet et Paul-Emile comble un nouveau poste.

— Alain McDonald notre nouveau cartographe, qui remplace Richard Sanfaçon.

Peter Kielland est retourné à l'Université Laval pour y poursuivre ses études en 2e année de Sciences géodésiques.

Jean-Paul Racette a suivi le cours de Cartographie II à Ottawa en octobre.

Le club des célibataires endurcis de la région a perdu un de ses vieux résistants en la personne d'Alain Gagnon qui s'est fait passer la corde au cou au cours du mois d'aoôt dernier. Il se remet lentement . . . .

Félicitations à:
— Normand Doucet pour sa réussite du cours d'hydrographie I.

— Guylaine Tessier et à Diane Demontigny pour leur succès dans le premier cours de Cartographie I à être donné en français.

NOUVELLES GENERALES

Quinze étudiants ont été embauchés dans le cadre du programme d'emplois d'été axés sur la carrière durant l'été dernier. Onze en hydrographie pour les levés provenant de la faculté de Géodésie de l'Université Laval ainsi que du collège Limoilou (option géodésie) et quatre autres (en cartographie) dont trois provenaient du Collège Limoilou (option cartographie) et un de la faculté de géo graphie de l'Université laval.

Le mois de septembre a vu le retour de Paul Bellemar, revenant d'un séjour d'un an et demi dans la région de l'Atlantique où il a oeuvré dans divers projets rattachés à l'hydrographie par méthodes aéroportées.

R. K. Williams, J. P. Racette et P. Hally ont assisté à la conférence du Centenaire du C.I.S. en avril dernier à Ottawa.

P. Bellemare a assisté au symposium de la commission II de la Société Internationale de Photogrammétrie et de la Télédétection sur "les progrès dans l'instrumentation pour le traitement et l'analyse des données photogrammétriques et de télédétection". Apparemment, le contenu des sujets traités fut aussi élaboré que le titre de ce symposium.

R. K. Williams a assisté à la réunion du Conseil Canadien sur les Levés et la Cartographie en octobre à Québec.

viously spent two years as a cartographer and was in charge of technical records prior to that.

— Marc-André Baillargeon and Paul-Emile Bergeron, our new hydrographers. Marc-André occupies the hydrographer's position left open by the recent departure of Denis Trudel who was transferred to Small Craft Harbours, while Paul-Emile occupies a new position.

— Alain MacDonald, our new cartographer who replaces Richard Sanfaçon.

Peter Kielland has returned to Laval University to continue his studies in Geodetic Sciences.

Jean-Paul Racette took the Cartographer II in October.

Our bachelor's club lost one of it's most ardent members in the person of Alain Gagnon who tied the knot in August. He's slowly recovering . . .

Congratulations to:
— Normand Doucet for successfully completing the Hydrography I course.

— Diane Demontigny and Guylaine Tessier for successfully completing the first Cartography I course to be given in French.

GENERAL NOTES

Fifteen students were hired under the "Career Oriented Summer Employment Program" during the last summer. Eleven (with field surveys) came from the Laval University Geodesy Faculty and the Limoilou College Geodesy Option while from the other four (with cartography) three came from the Limoilou College Cartographic Option, and one from the Laval University Geography Faculty.

The month of September saw the return of Paul Bellemare who spent the last year and a half in the Atlantic region where he worked on various projects related to hydrography using airborne methods.

R. K. Williams, J. P. Racette and P. Hally attended the CIS Centennial Conference held last April in Ottawa.

P. Bellemare attended the ISPRS Commission II symposium on "Advances in Instrumentation for processing and analysis of photogrammetric and remotely sensed data". Apparently the content of the subjects discussed were as elaborate as the title of the symposium.

R. K. Williams attended the October meeting of the Canadian Council on Surveying and Mapping in Quebec.

We would like to hear some news from all our non-CHS members.
If you have anything to contribute to our NEWS column, please write to:

The Editor, 'Lighthouse',
The Canadian Hydrographer's Association
Bedford Institute of Oceanography, P.O. Box 1006,
Dartmouth, Nova Scotia, Canada B2Y 4A2

Reminiscences of the Admiralty Newfoundland Survey

R. W. Sandilands

CHS Pacific

The Admiralty was active in hydrographic surveys in Newfoundland, using a charter ship, from 1891 to 1912. The principal ship used was the *Ellinor*.

She was built for Prince Albert of Monaco as the *Princess Alice* and used by the prince in his oceanographic research. Her next owner was a Baron von Brimoville who renamed her *Eberhard* and she had an exciting career under him. He sailed for the Pacific with a party of fellow scientists to conduct gravity/magnetic surveys which came to an abrupt end when the party, while observing ashore, was disposed of by cannibals in their traditional way. On her passage back to Europe, *sans* Baron and party, a mutiny took place and to the end of her career the walnut and maple panelling in her saloon bore the scars of the fighting. These scars of course made for blood curling stories for later officers to relate to guests visiting the ship. Her last owner was a Mr. Chapman who renamed her *Ellinor* and as such she was chartered to the Admiralty Hydrographic Service.

The description of the times, the surveys and the personalities, which follows is to be found in the files of the Hydrographic Office at Taunton, (Miscellaneous file 54) and are the reminiscences of Captain L. Garbett, CBE, RN, (Retd.).

The winter base of the survey up to 1908 was in Charlottetown, Prince Edward Island. The crew, with the exception of the officers and a few specialised hands, were paid off here at the end of the season. The harbour was completely frozen over during the winter months and sleigh and ice boat traffic made full use of it. The island was cut off from the outer world, and the only way of transporting passengers and mails to and from the island was by ice boats, an uncomfortable and precarious journey, sailing and manhandling the boats over great hummocks of ice.

No doubt the seclusion of the island suited Captain Tooker who was of a very retiring nature. He lived ashore with his wife and family. He was a strict disciplinarian and I suppose, in these days, would have been called a hard taskmaster; nothing less than the very best satisfied him. Woe betide the young surveyor who failed to use sufficient weights on his straight edge, or properly chiselled edged pencils, and take the proper stand for ruling a line; the mention of a cocked hat sent him a fury. He was a fine surveyor and I felt myself fortunate in having my early training in the surveying service under him. If Tooker had a hobby, other than surveying, it was boat handling and he was a master boat handler under sail. Social life did not appeal to him and the social activities of his newly appointed young bachelor officers, lionised by the female population cut off as they were from the outside world, sometimes led to censure from the Captain, but Mrs. Tooker, his wife, was kindness itself and always steered us through our difficulties.

During the winter the ship was completely boarded in and moored alongside a pontoon off the pier — the surrounding ice had to be broken away almost daily — the approaches to the ship were often knee deep in snow and had to be traversed by means of snow shoes. There was an excellent office onshore where the winters work was done under the eye of our very exacting chief.

The surveying season commenced in May, usually the latter part, but was governed by the ice condition off the coasts of Newfoundland and the western approaches to the Straits of Belle Isle. It was tedious waiting at the ice edge until a safe lead through was found as there was always the danger of being caught in the ice. Captain Tooker had had much experience in these waters and was a good forecaster as to its movements, and indeed of the weather generally. A shift of wind would cause the ice floe to close on the harbours and often block them up completely, and if unfortunate enough to be inside it was a case of getting underway and moving out as quickly as possible, this of course always happened in the middle watch! Landing on an iceberg was sometimes resorted to in an endeavour to push the ship clear but this usually ended in a ducking for those concerned.

It was usually well on in June before the approaches to the Straits were clear of ice. It was the normal practice to work on the west coast at the beginning of the season, then go to the NE coast as the weather improved. The Newfoundland and Labrador coasts are lined with innumerable islands, shoals, and rocks and with dense fogs, on occasions occurring twenty days in the month, and with frequent strong winds and gales it was a difficult coast to navigate, but there were always harbours to be surveyed when the weather was too bad for work outside. Expeditions onshore to erect stations on the mountains and high hills were always looked forward to. Large tripod stations were built for fixing on the lines across the Straits of Belle Isle. On one occasion on revisiting a station a caribou was disturbed resting inside, it was away in a flash leaving behind a somewhat dilapidated station!

Much of the work was done in service whalers, the crews were chiefly Newfoundland fishermen, fine hardy seamen. The old methods of sounding were used — a man in the bow continuously sounding and the officer and recorder fixing and plotting the position of the boat at frequent intervals. It was always exciting when the monotonny was broken by a sudden shoaling. I can recall many a tough beat back to the ship, arriving alongside with the boats crew soaked to the skin, late in the evening after a 6 AM start. At other times in foggy and bad weather, the ship would be out searching for the boats, playing a game of hid and seek amongst the islands before being picked up, and then the days work had to be plotted before retiring for the night.

I think our most uncomfortable job on this survey was sounding on the Banks of Newfoundland where for nights on end we'd lay at anchor on the main steamship route in a thick fog — how desperately we rang our tinkling bell when a steamers fog horn was heard. Often one could see the masts of a ship passing, and hear voices, but no hull was visible.

Many fishing schooners both American and European, kept us company and a boat load of cod was easily obtainable gratis, or in exchange for ships tobacco. Our doctor's services were gladly made use of by the fishermen.

The rocky coast of Labrador was particularly treacherous and on one occasion when approaching the coast the ship went aground on an uncharted rock, a pinnacle, fortunately the ship was going slowly, as a boat was about to be lowered to send ashore for a local pilot — the shock caused the boat's crew to take the water quicker than intended but without casualty. Soundings showed thirteen fathoms over the stern and nine fathoms over the port bow. On the ship taking a dangerous list, the boats were lowered and ships documents, charts, etc., transferred, the local mail steamer tried to haul the ship off but without much success. The ship was lightened as much as possible and after 36 hours came off. A considerable length of the fore part of the keel was badly damaged which necessitated a return to harbour for examinations and repair. Had the *Ellinor* been a steel ship she would undoubtedly have been badly holed and probably have foundered.

Captain Tooker was relieved in April 1908 by Captain Combe, R.N., a completely different type to his predecessor — gay, sporting, and sociable. The prospect of seclusion in the winter quarters in Charlottetown did not appeal to him and he arranged to move to Halifax, Nova Scotia for the next lay up season. The change of captains brought other changes too. Combe was strenuous at both work and play, he was always up and about before anyone else. Boats had to go away in all weathers to their surveying ground, sheltering if necessary under the lee of islands, ready to commence work at the earliest opportunity. On the boats return late in the evening the captain was usually at the gangway and however fed up one felt oneself he always had a cheerful welcome for one —"Glad you are back, you must have had a rotten day, come along and have a drink". After this we were expected to change for dinner and often play a game afterwards. The plotting remaining to be done at a more favourable opportunity, not always satisfactory from the point of view of the surveyor. However, it was Combes' way, for he felt after a long day in a boat one was not fit to plot on return.

Although on the whole we worked longer hours with Combe than with Tooker, on days when surveying was not possible, and provided all plotting was completed, he organised picnics, fishing and shooting trips, (salmon and trout abound in the rivers and game, large and small, on the plains and in the hills). These excursions were much enjoyed by officers and men alike and gave an incentive to work harder when occasions demanded. Captain Combe was very popular on the coast and his contacts with local residents facilitated the supply of fresh provisions etc., the white ensign helped in this respect.

In Tooker's time the *Ellinor* wore the blue ensign but in Combe's, the white. On one occasion meeting the Fishery cruiser flying the Commodores flag he asked by signal, on what authority the *Ellinor* flew the white ensign, Combe replied, We belong to the Royal Yacht Squadron, the bluff succeeded and we were never challenged again.

The *Ellinor* was under sail whenever winds permitted and lines of soundings seaward were carried out in this way rather than under steam, fixing by solar and stellar observations was the usual practice. On passage, with her fine spread of canvas, the *Ellinor* logged 12 knots under favourable conditions the Captain was always reluctant to reduce sail and we had some fearsome times, (even to those of us who had had experience in full rigged sailing ships) carrying on, in spite of increasing winds in thick and stormy weather.

On one particularly stormy night, the boom took charge and swung from side to side across the deck threatening to decapitate anyone in its way, until the topping lift was let go and the end of the boom went into the sea. It was badly damaged before it was secured in board again. As Number One, I suggested to the Captain that we should have a shorter boom when it was replaced, which could be more readily handled by the crew available, however, he demanded one 6 feet longer, but I was relieved we didn't get it!

Our winters in Halifax were very gay. Our offices were in the old Naval Hospital in the dockyard until it was taken over by the Canadian Navy, the Captain lived there and the officers had accommodation outside. The Surveying Service was in high favour in Halifax due no doubt to the balls and entertainments given by the Captain and Officers of *Ellinor*. After two (?three) winters in Halifax Combe decided that St. Johns, Newfoundland, was the most appropriate place for the surveys winter quarters and we moved them there.

During our last season in St. Johns we surveyed the harbour and a rock, now known as Ellinor Rock, was found in the narrows. H. M. S. *Cornwall* was approaching the harbour when sweeping operations were going on and was warned not to enter, however she was able to do so later.

In September 1912 the *Ellinor* was ordered to Jamaica and we proceeded south all much regretting leaving the hospitable shores of Newfoundland. A survey of Port Royal and approaches was carried out. I remember on one occasion when anchored off the Myrtle Bank Hotel, Kingston the Quarter Master reported a fight, with knives and spears, going on in the gardens. A party was sent ashore to investigate and much amusement was caused when the fight turned out to be a rehearsal by an American film company. The actors were later entertained onboard the *Ellinor*. After the surveys in this area were completed we returned to England and the *Ellinor* was paid off and returned to her owners and I believe was broken up.

News from Industry

GEOMARINE ASSOCIATES
M/V BRANDAL, a Halifax based survey vessel, has done a site survey for production platform locations on the Venture structure off the southeast end of Sable Island. Lauchie Meagher, of Geomarine in Halifax was the chief scientist on board.

The ship carried a full complement of seafloor survey equipment, including side-scan sonar and a magnetometer. Three different sub-bottom profiling tools were on board, along with a highly accurate electronic navigation system.

The last comprehensive look at the geology of Sable Island was by Dr. Noel Games in his 1966 Dalhousie MSc thesis. Geomarine has been involved in almost twenty site surveys around Sable Island since 1975. Mobil Oil has started a new phase of research to answer some of the practical engineering questions that concern the design of the foundations of the proposed production platforms. Geomarine is part of this research which will add greatly to the store of knowledge about Sable Island.

Mobil, in August 1982, commissioned an Environmental Impact Statement. Geomarine has drafted a section, entitled "Geology & Soils", that is now into Mobil for integration in the overall Statement.

Geomarine Associates (Newfoundland and Labrador) Ltd. announces it's move to 205A Kenmount Road in St. John's, Newfoundland. Geomarine Associates (Newfoundland and Labrador) Ltd. with some ten persons, is part of Geomarine Associates Ltd., of Halifax, Nova Scotia, where a further fifteen persons are located.

For further information contact
Mr. Alan Ruffman
Geomarine Associates Ltd.
P.O. Box 41, Station 17
5112 Prince St., Halifax
B3J 2L4
Phone (902) 422-6482

KRUPP ATLAS-ELEKTRONIK
Krupp Atlas-Elektronik announces the LARA-90, a new four unit series of laser range finders. This battery powered, binocular-type series may be used against natural or passive reflectors such as walls, river banks, and moving vessels up to 350 m. Extended range to 5 km is possible with the use of triple prisms. These units have digital continuous range display, updated 10 times per second with an accuracy varying between 0.1 m to 0.5 m (depending on mode used) ± 0.05% of mesaured range. All units provide 5-digit BCD parallel range output facilities.

For further information, contact
David Goodfellow
23 Derby Avenue
London N12 8DD

MARINAV
Oceaneering Purchases Assets of Marinav Corporation

The Purchase of the assets of Marinav Corporation of Ottawa, for USD three million was completed on November 1, 1982 by Oceaneering International, Inc. of Houston, Texas.

The new worldwide survey organization, combining both Marinav's and Oceaneering's offshore survey and positioning businesses, will be known as the Marinav Offshore Survey Group.

For further information contact
C. Derek Paget-Clarke
Oceaneering International, Inc.
10575 Katy Freeway, Suite 400
Houston, Texas 77024
or
Mark V. P. Jodein
Marinav Canada, Inc.
1140 Morrison Drive
Ottawa, Ontario K2H 8S9

MESOTECH
Mesotech announces the following additions to its underwater equipment line.

An integrated azimuth drive has been added to the Model 952 Dredgemaster's Sonar, to enable the plotting of profiles at any bearing. The sonar has a range of 160 m and can resolve 0.09 m (0.01 m via R5-232C output). Scan arc of the pencil sonar beam is ± 22.5° to ± 180° in a vertical plane; resolution is 0.75°.The unit may be deployed from any size vessel.

The Model 914N Portable Power Case, for use with the Model 601P Release Command Unit, combines Rechargeable batteries and storage for headphones and transducer in an environment-proof housing.

Model 611 Range Display Receiver may be used with Model 601P to display the slant range in metres to a transponder. Four LED's monitor activity on the four frequency channels.

NAVIGATION COMMUNICATION SYSTEMS, INC.
Navigation Communications Systems, Inc., (NCS) a subsidiary of Varo, Inc., Garland, Texas, introduces SAT PAK.

The system consists of: MERIDIAN, the automatic version of NCS' most popular Sat Nav; Magnetic Compass sensor that transmits heading to the MERIDIAN; SAT WHIP, the standard MERIDIAN, 8 inch, whip-type antenna; SAT BAT, an emergency back-up battery.

The MERIDIAN Sat NAV updates position every second between satellite fixes. It is low power (6 watts) and the LCD displays lat., long. and UTC.

For further information, contact:
NCS, INC.,
20100 Plummer St.
Chatsworth, California
91311, U.S.A.

SONATECH, INC.
Reg Cyr, President, Sontatech, Inc. has announced the relocation of its headquarters to 640 McCloskey Place, Goleta, California. The manufacturer of underwater acoustic sysems has its Engineering, Finance, Marketing and pilot Production Operations in Goleta, with Manufacturing in Ventura (California), and System Software in Cowallis (Oregon).

SONATECH, INC.

Sonatech announces the Model NS-012, a 16 channel acoustic transceiver. There are two selectable transmit frequencies, 4, 8, 12 or 16 receive channels, three range displays, 780 selectable command codes and manual or automatic interrogation.

For further information contact
Len Leondar
Marketing Manager
Sonatech, Inc.
640 McCloskey Place
Goleta, CA 93117
(805) 683-1431

TELLUROMETER

Tellurometer announces Hydroplex, a new integrated hydrographic survey data acquisition. Hydroplex is designed for the retrieval, processing and direct visual presentation of survey data. Hardware includes a Hewlett Packard 85 micro-computer and a derivative of the Tellurometer MRD 1 microwave position fixing system with Left-Right indicator. Provision is also made for the additional connection of an auxiliary printer for off-line processing. Software is extensive and written in the Basic language suitably structured for ease of understanding and maintenance.

Positioning is triple-range, requires no calibration, is accurate to 1 m or better, and has an operational range of between 100 m and in excess of 40 km depending on radio line-of-sight and newly-developed fanbeam remote and space diversity master antenna configurations. They also provide the positional inputs for the SUSY 30 automated hydrographic survey-processing systems developed by Krupp Atlas-Elektronik.

For further information contact
Don Davis of Telefix Canada

TARGA COMES TO THE RESCUE OF DATA LOST AT SEA.

Career Opportunity

TELEfix CANADA
PRECISION SURVEY SYSTEMS INC.

TELEfix CANADA is being restructured to play a major new role in the Canadian Hydrographic community. An ambitious and enterprising program is planned for introduction at the Canadian Hydrographic Conference, April 5 - 8, Ottawa.

We require a career oriented individual to help us meet our long term objectives and obligations.

The Position: National Sales Co-ordinator

Qualifications: The successful candidate will have an extensive background in hydrographic surveying, or sales of hydrographic equipment. The individual must be well organized, self disciplined, conscientious and thorough in his/her approach to business. Above all, this individual must have excellent communicative skills.

Parameters: Applicants will be considered from various cities across Canada - Relocation to Toronto is not necessary. A substantial amount of travelling will be required, particularly in the initial stages. Salary and benefits commensurate with experience.

Application and resume should be sent to:

Donald R. Davis, President
50 Doncaster Ave., Unit 8,
THORNHILL, Ontario. L3T 1L4

We hope to fill this valued position by April 1, 1983.