Lighthouse

JOURNAL OF THE CANADIAN HYDROGRAPHERS' ASSOCIATION

Edition No. 23, April 1981

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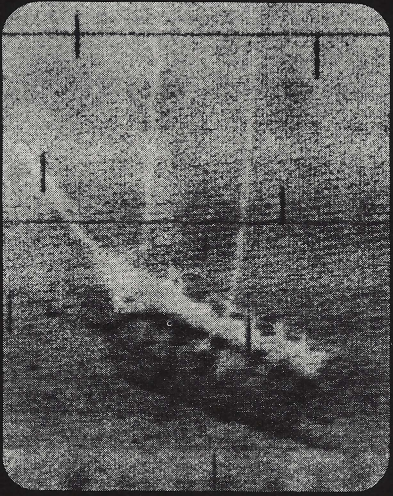
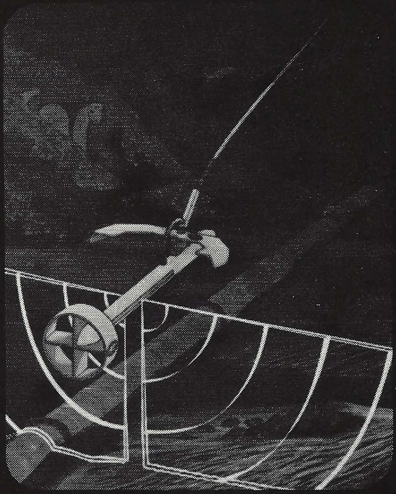


American Schooner Hamilton which sank in Lake Ontario in the war of 1812 [Courtesy Royal Ontario Museum and Canada Centre for Inland Waters].



Klein HYDROSCAN Side Scan Sonar Record of the Ironclad U.S.S. Monitor [Courtesy of the Harbor Branch Foundation].

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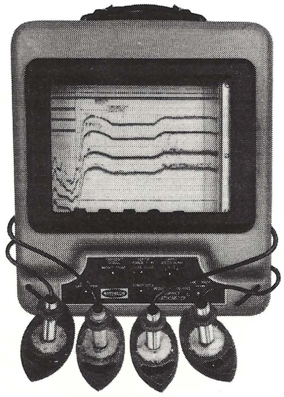

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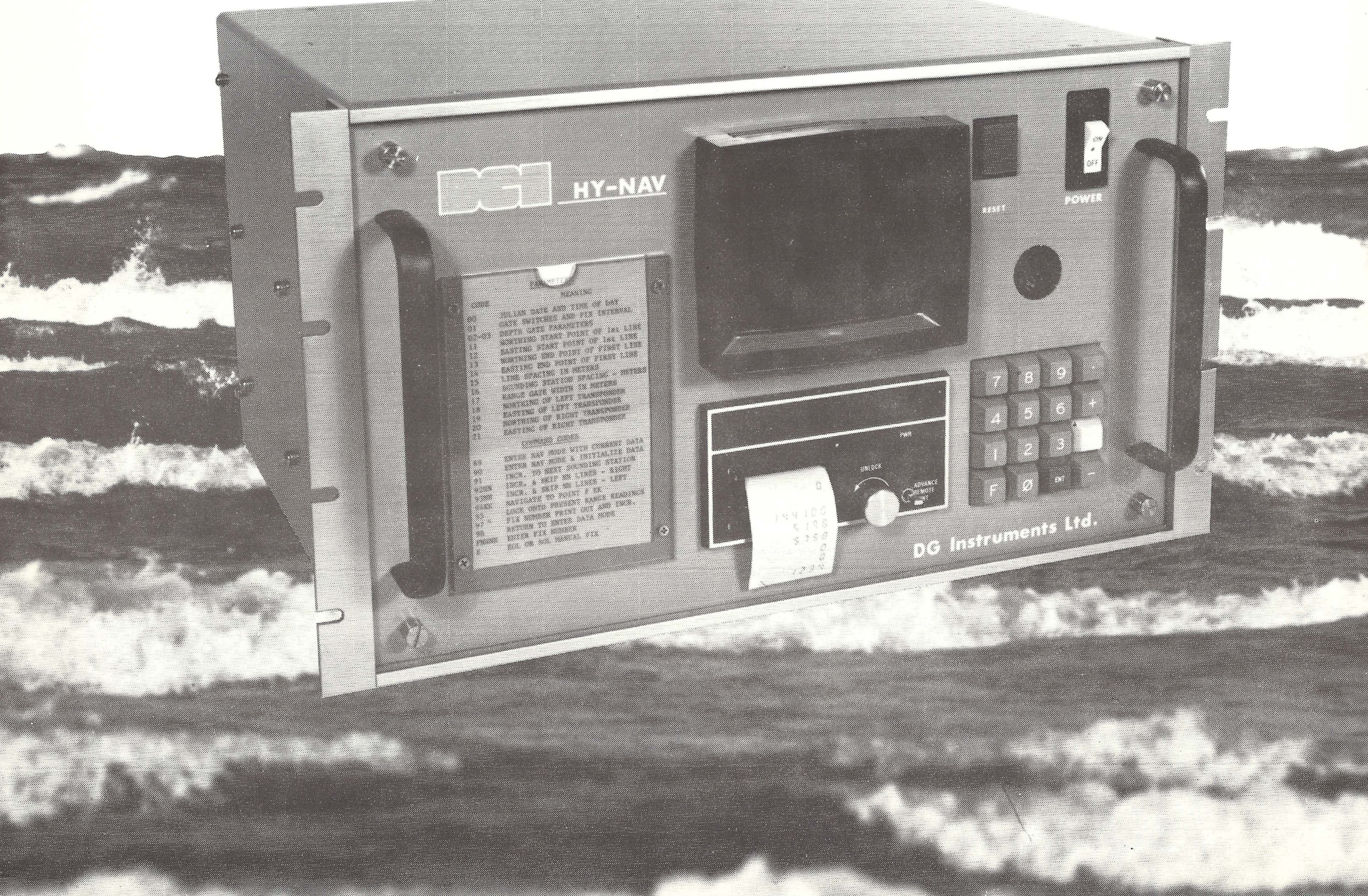

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internav

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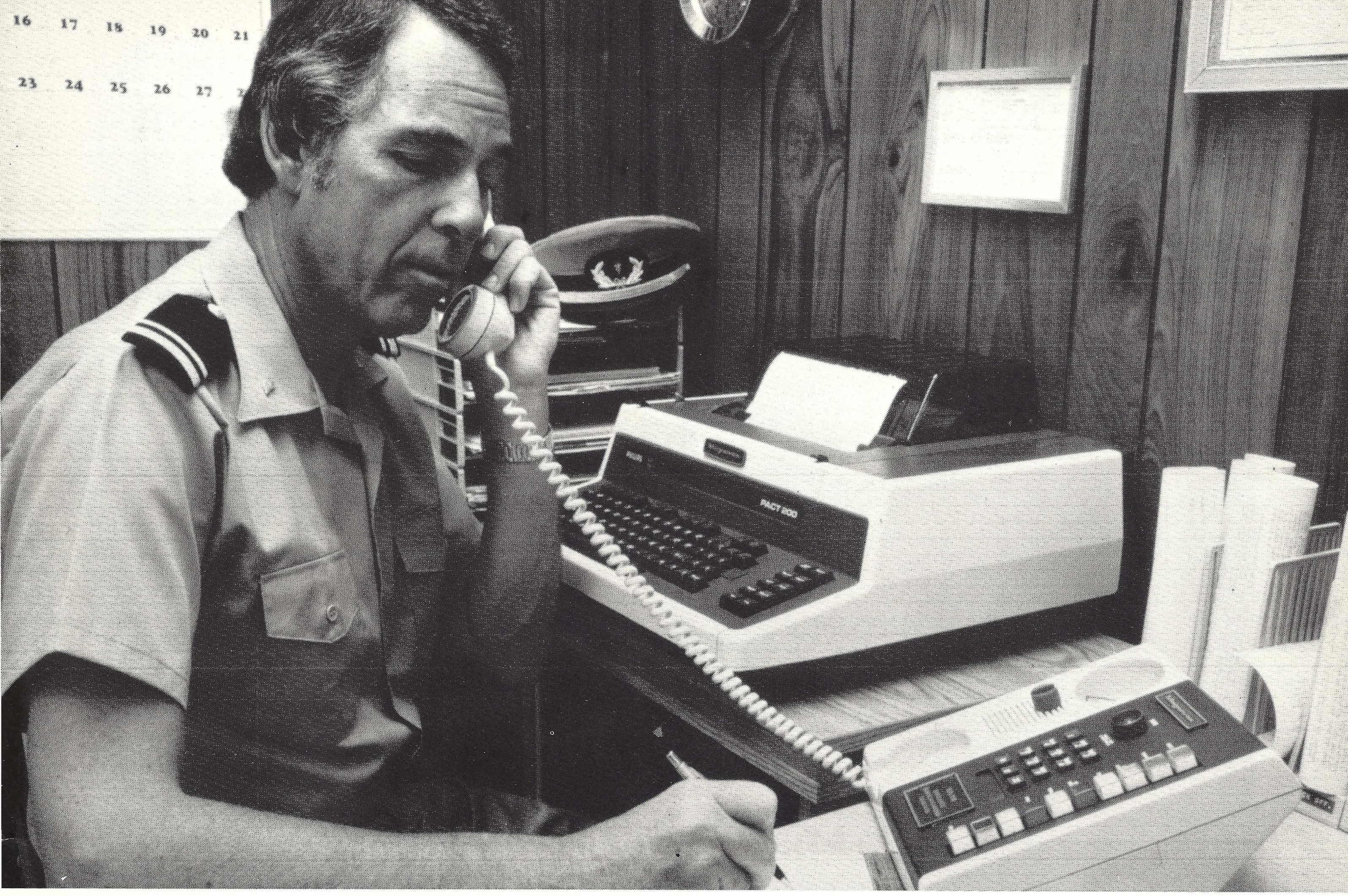

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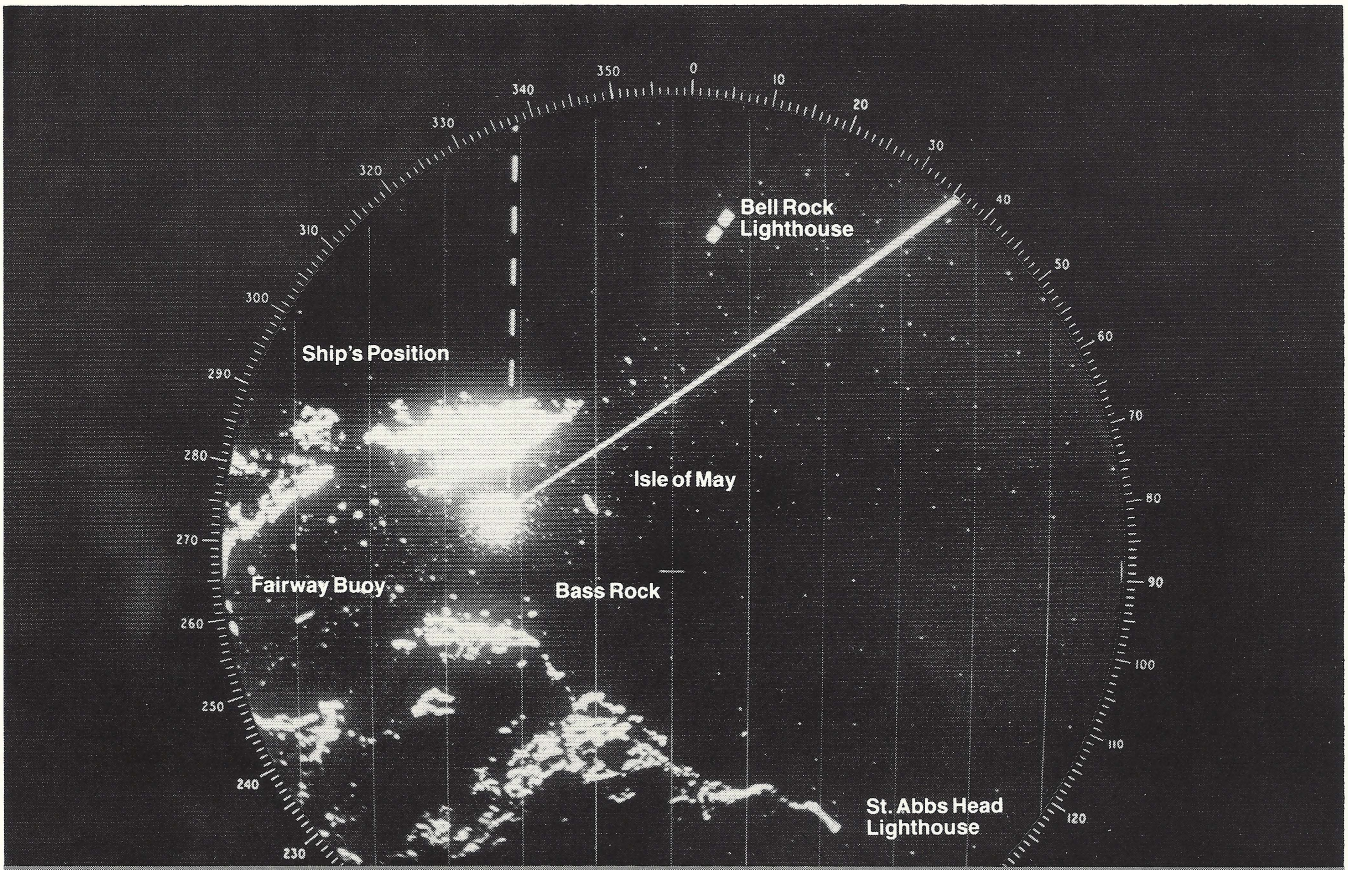

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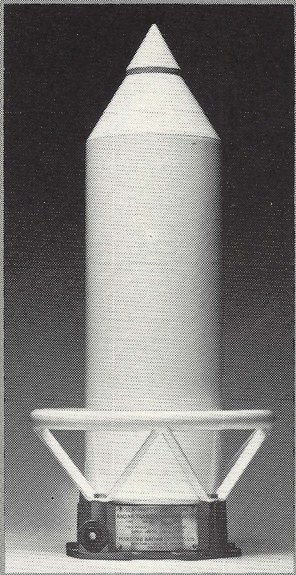

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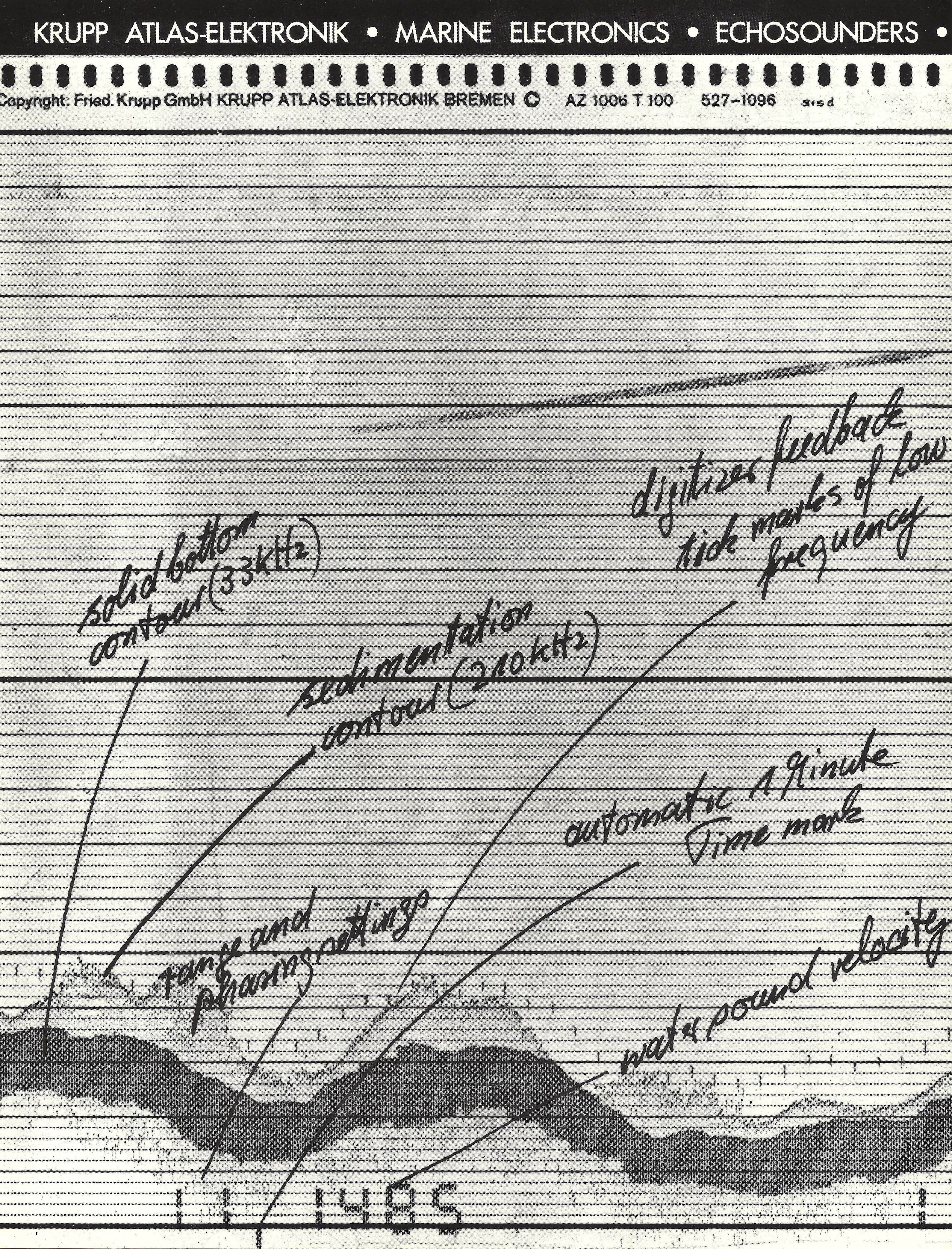
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EDITION No. 23

LIGHTHOUSE

APRIL, 1981

JOURNAL OF THE CANADIAN HYDROGRAPHERS' ASSOCIATION

LIGHTHOUSE is published twice yearly by the Canadian Hydrographers' Association and is distributed free to its members. Subscription rates to non-members are $3.00 per single issue or $6.00 yearly.

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A Message from the President

I take the office of national president of the Canadian Hydrographers Association with some trepidation. In three years time we will be able to look back and see from whence we came but at this time the course we are to follow is not clearly defined. One landmark that we will encounter will be the effect that professional recognition and certification of hydrographers has on hydrography as a career. I welcome public discussion on that question.

Speaking of landmarks and public discussion, what better place to discuss such an important issue than 'Lighthouse'? 'Lighthouse' is the greatest asset of the Canadian Hydrographers Association. In fact to many of our members, particularly those outside of the Canadian Hydrographic Service, it may be our only asset. Responsibility for 'Lighthouse' is moving to Atlantic Branch into the capable hands of Adam Kerr. I appeal for articles suitable for publication in our journal. Only by producing an informative and professional 'Lighthouse' can we continue to maintain a position of high stature in hydrography both nationally and internationally.

As I lay off our course for the next three years I am counting on receiving regular 'Positioning' information from members across the country. With your help I won't find any hazards to navigation the hard way.

A.D. O'Connor
President
Canadian Hydrographers Association

Subtense Two

J.V. Crowley

Pacific Region
Canadian Hydrographic Service
Sidney, British Columbia

INTRODUCTION

Several positioning variations were recently employed in a large scale survey of Cowichan Bay wharf. The simplicity of launch positioning, note keeping, plotting, dividing of the boatboard, along with the precision of positioning and the general flexibility of operation may make these techniques of general interest.

At the head of Cowichan Bay on Vancouver Island is a long timber wharf belonging to the Canadian National Railways. It is used as a terminal for a train ferry and for shipping lumber. The shallow mud flats behind the wharf are used for sorting logs and consequently are a-bristle with piles and dolphins. Our mission was to survey the navigable waters within about 600 feet of the wharf. The field sheet was to be drawn at a scale of 1:1200.

Horizontal control was established with a braced quadrilateral using new stations at either end of the wharf and two old plugs half way up each side of the bay. Using the line spacing specified in Standing Order 65-17, (which incidentally accounts for the use of imperial units in this paper), we nailed down a long baseline along each of the two arms of the wharf. Additional secondary control points were established near the ends of the wharf and two flags were nailed to convenient piles at strategic locations behind each end of the wharf. The significance of the placement of these marks will be explained later. These sounding marks, 3 navigation lights and 3 prominent dolphins were cut in. Additional data, (approximately 100 points), were positioned by a conventional stadia survey. This is all routine C.H.S. survey practice. The interesting part is in some of the launch positioning. A sextant and theodolite were used to define the lines of position (LOP's) in the following four variations: check lines, wharf face lines, perpendicular lines, and fans. Since the check line method is familiar to most hydrographers and since the second approach is trivial in concept, neither will be discussed at length.

CHECK LINES

Check lines were run with conventional sextant fixes. Resections were plotted later, rather than on-line, with the familiar 3 arm protractor.

WHARF FACE LINES

Lines were run along wharf faces with the transducer about 6 feet off by estimation. Fixes were obtained visually every 100 feet as the launch passed below the baseline stations. On the back of the wharf we fixed beside light standards which had previously been plotted by stadia. They were also about 100 feet apart.

PERPENDICULAR SOUNDING LINES

Perpendicular sounding lines were run towards the long wharf face with sextant fixes taken every 100 feet from 600 feet to 100 feet and a final sextant fix at 50 feet. The end of line fix was estimated at 12 feet off the wharf face. (The sextant fixes were actually measured from the baseline, not the wharf face, a difference of about 3 feet.) For this operation it was necessary for the instrument man to set up a theodolite on the pre-marked baseline station, turn 90° and con the launch down the crosshair. This was taken as one line of position. Communication was by portable VHF radios, (Motorola PT 300's), or occasionally by hand signals. Once talked onto the sounding line, the coxswain was able to pick a semi-natural range to assist in the line definition. The instrument man and distant background detail were usually quite easy to see at these ranges. A coxswain who understands this process and has the patience and discipline to maintain concentration throughout a full day's sounding is a decided asset. One who does not should be set to building battery boxes. In instances where a close or featureless background make it difficult or even impossible for the coxswain to pick a range, the task of the instrument man becomes more demanding. Because precise communication between these two individuals is so important to the integrity of the line keeping, it may be worthwhile running some practice lines and establishing a jargon before commencing the serious work.

For the second LOP we used a sextant angle at the launch. Portable flags on four foot standards were set 200 feet apart on baseline stations. The hydrographer in the launch set precomputed angles on his sextant, waited for the two flags to coincide in the mirrors and pushed the sounder's remote fix button. (A hand-held remote fix button is a virtual necessity for large scale surveys. It is held with the sextant, eliminating timing errors caused by fumbling for the machine or reaction time problems associated with an extra man to tend the sounder.) The flags stayed on the same spots through the running of the seven sounding lines that fell between them. These seven lines represented only four separate angular situations. The last three are the mirror image of the first three. The four sets with seven fixes on each were computed, printed in colour code on a card (Table 1.) and taped to the arm of the sextant. After the seven lines were run it was necessary to reset the flags before running the next group of seven.

Two hundred feet was chosen as an appropriate length for a subtense base. We tried to maximize the sextant angle, particularly at the outer end of the line where accuracy would be eroding, while still having the subtense base short enough to subtend less than 140°, (the sextant maximum), at the fifty foot fix. Since speed of setting, as opposed to reading of angles was important, we found it convenient to use a micrometer reading sextant. Setting angles on a vernier type sextant is a much slower business. We also removed the telescope to increase the width of field and to make it easier to pick up the fast moving targets, particularly at the close-in end of the line.

At the six hundred foot fix an angular error of 1 minute represents about one half of a foot displacement of the

Table 1 Sextant Card

25 ft. & 175 ft.			50 ft. & 150 ft.		
(Dist.)	θ		(Dist.)	θ	
600	18°	39'	600	18°	48'
500	22°	09'	500	22°	25'
400	27°	12'	400	27°	41'
300	35°	01'	300	36°	02'
200	48°	19'	200	50°	54'
100	74°	17'	100	82°	53'
50	100°	37'	50	116°	34'

75 ft. & 125 ft.			100 ft. & 100 ft.		
(Dist.)	θ		(Dist.)	θ	
600	18°	54'	600	18°	55'
500	22°	34'	500	22°	37'
400	27°	58'	400	28°	04'
300	36°	39'	300	36°	52'
200	52°	34'	200	53°	08'
100	88°	13'	100	90°	00'
50	124°	31'	50	126°	52'

Sample computation

$$\theta = \arc\tan\left(\frac{50}{600}\right) + \arc\tan\left(\frac{150}{600}\right)$$

$$\theta = 18^\circ\ 48'$$

sextant LOP. Misplacement of the flags and misalignment in the mirrors would add to this figure. The accuracy of the theodolite LOP was a function of coxswain and instrument man skill and coordination. Instrument error was insignificant. Line keeping was usually within an estimated 3 to 4 feet.

With one man ashore to handle the theodolite and the flags and two in the launch, we proceeded to run the lines. Forty-five lines were completed in a little more than a day. Six times the flags had to be shifted and forty-five times the theodolite had to be set up. After two or three practice runs very little time was lost due to rejected lines or missed fixes despite having to phase twice on each line. When sounding the launch was run at slow speed and always toward the wharf. The arrangement of flags and sounding lines is given in Figure 1.

Plotting of lines, fixes and divisions was all done later in ink. It was quickly accomplished using a scale to divide one line and a straight edge and set square to draw in the other divisions and fixes as straight lines. The finished pattern in this instance was a 1/4" grid. Different colours were used for fixes and divisions. Notes were recorded on-line on the sounding roll without benefit of fix numbers. Lines were identified by chainage and fixes by offset. Time was recorded at the end of each line. Regular note paper was used later to accommodate the soundings and tidal reductions.

FANS

The fourth technique is perhaps the slickest in the field though a little more tedious when it comes time to plot the lines and fixes and divide the boatboard. The lines are plotted with a protractor and a straight edge, the fixes with a scale and a pair of compasses and the divisions with the aid of a set of multiple dividers. On outside corners of the wharf we ran radial lines converging at the corners. The theodolite was set up at the corner station and progressive angles were turned at 2° intervals. Inside ends of lines were cut short in a staggered fashion to avoid spending too much effort at the convergence of the lines. Fixes along each line were obtained at the launch by setting a pre-determined angle on the sextant and waiting for two flags to line up. These sounding marks had been previously set and positioned so that continuous use of a given pair could provide broad cuts and large sextant angles over a wide range of the fan and the total length of each line. Assuming there are no complicating factors such as intervening ships or dolphins, a pair of sounding marks could be used on every fix of a 90° fan (about 290 in Figure 2.). For the illustrated fan we used a set of eight sextant angles at: 18°, 21°, 25°, 30°, 40°, 50°, 60°, 80°. The 18° value was chosen to correspond to about 600 feet from the wharf (a distance that would vary, depending on the sector of the fan in question). The 80° fix was closest to the wharf. Intermediate

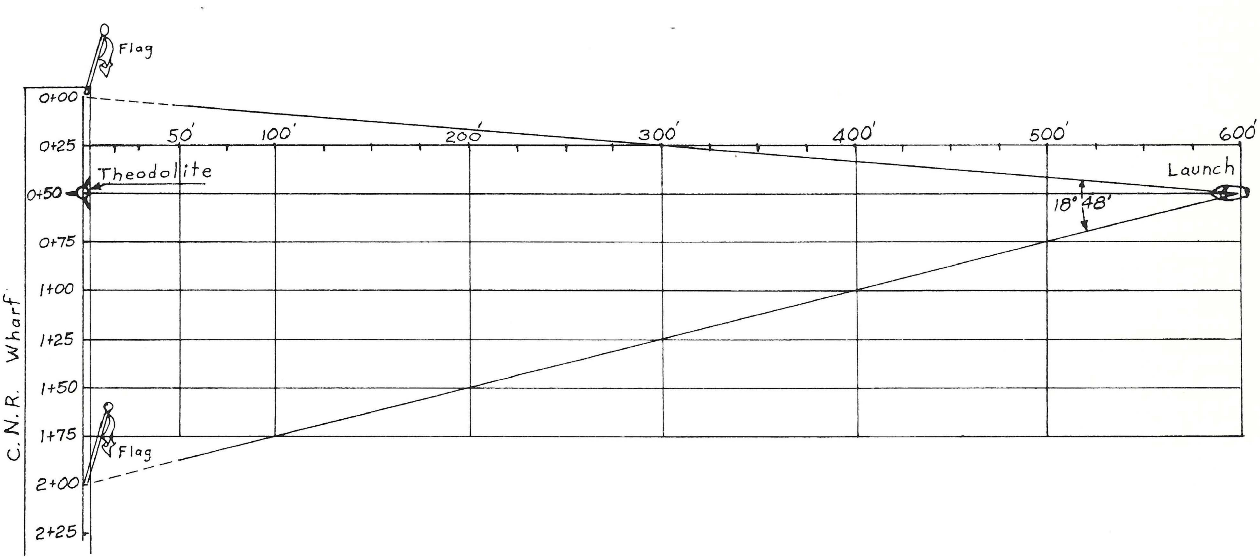
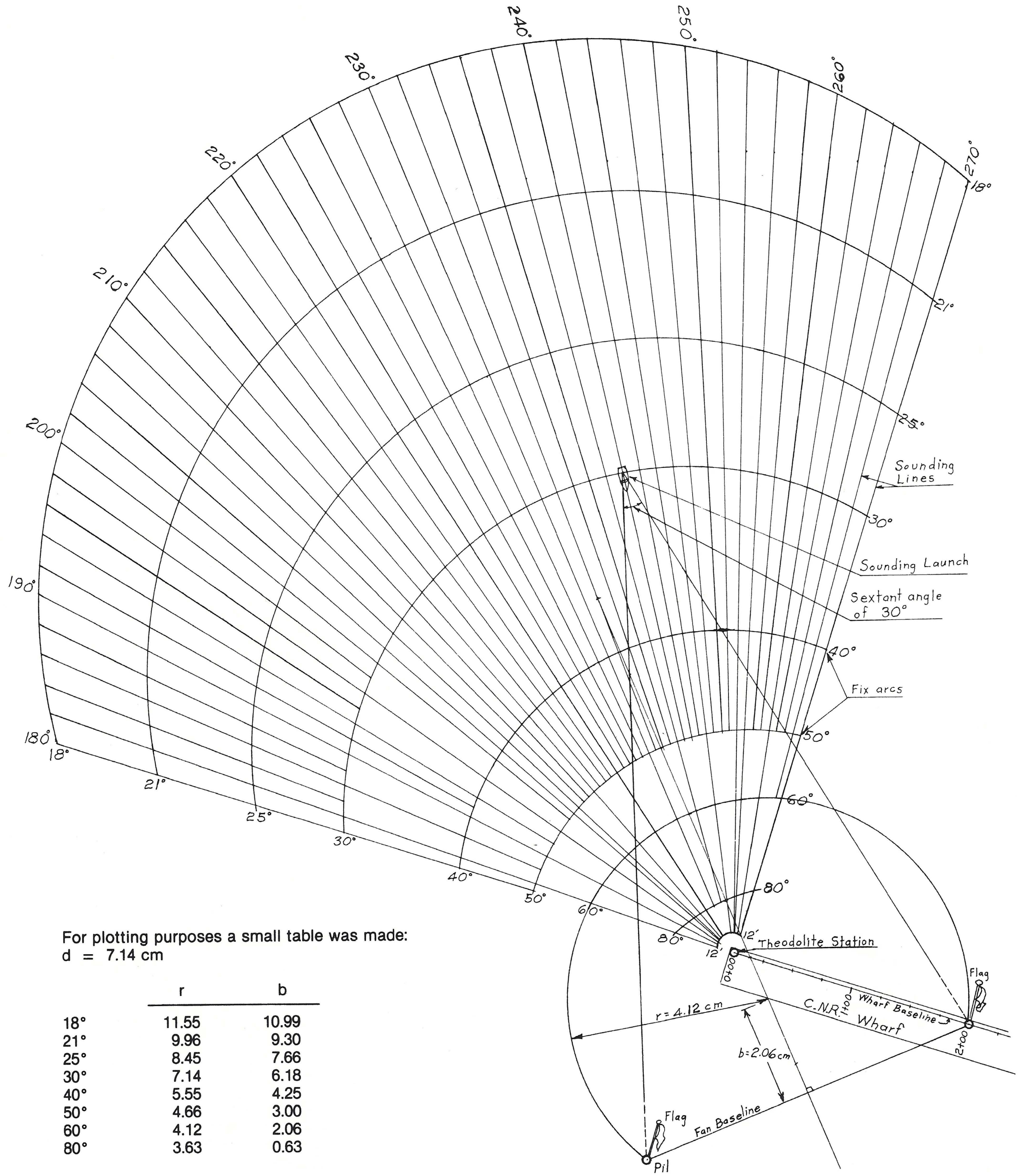


Figure 1. Location of Flags and Sounding Lines



For plotting purposes a small table was made:
d = 7.14 cm

	r	b
18°	11.55	10.99
21°	9.96	9.30
25°	8.45	7.66
30°	7.14	6.18
40°	5.55	4.25
50°	4.66	3.00
60°	4.12	2.06
80°	3.63	0.63

Figure 2: Sounding tracks at the north end of Cowichan Bay wharf.

angles were chosen to provide fixes about every inch at field sheet scale. Other angles (θ) could be set but odd angles tended to slow down the note keeping and plotting processes. Plotting was done by drawing the lines with protractor and straight edge and the fixes with a pair of compasses. A short computation was necessary to determine the proper radius $\left(r = \frac{d}{2 \sin \theta}\right)$ and baseline bisector offset $\left(b = \frac{d}{2 \tan \theta}\right)$ for each of the eight fix arcs. The distance (d) between the stations was a factor and could be found by inverse computation or, in a pinch, it could be scaled off the field sheet.

To maximize the usefulness of a given set-up, it is desirable to set the sounding marks so that they provide good fixes over a wide area. This implies large sextant angles and strong LOP intersections. While I have no proof of the matter, I suspect that for maximum coverage inside a given accuracy lobe each mark should be about equal distance from the theodolite (Figure 2.). This puts the theodolite more or less on the 90° fix on the baseline bisector, or stated more simply, at the right angle of a right angle isosceles triangle. While this is a desirable configuration, it is by no means a rigid requirement. Some experimentation with compasses and protractor will illustrate the flexibility of possible arrangements. There may be some accuracy advantage to be gained by setting the flags further away from the theodolite than shown in Figure 2. This would increase the length of the sextant angle subtense base. For instance if we had set the flags one thousand feet instead of two hundred feet from the theodolite, the offset error might have been halved. This is deduced from comparisons of position errors induoed by assuming one minute of arc error at the outer end of the sounding line in each of the two cases. For the set-up actually used, the error of 1 minute at 18° represents a distance of about 10 inches. For a hypothetical set-up with a baseline five times as long, the 1 minute error at the outer end of the line, (now at about 60° on the sextant), represents a distance error of 5 inches. Thus by multiplying the baseline length by 5 and the sextant angle by 3.3, we can double the apparent end of line position accuracy. Consideration of misalignment and resolution factors would probably combine to further reduce the size of the apparent accuracy advantage of the longer baseline. By the same consideration the system we used with the shorter baseline is about five times as accurate in the offset dimension as the widely used subtense board method.

SUMMARY

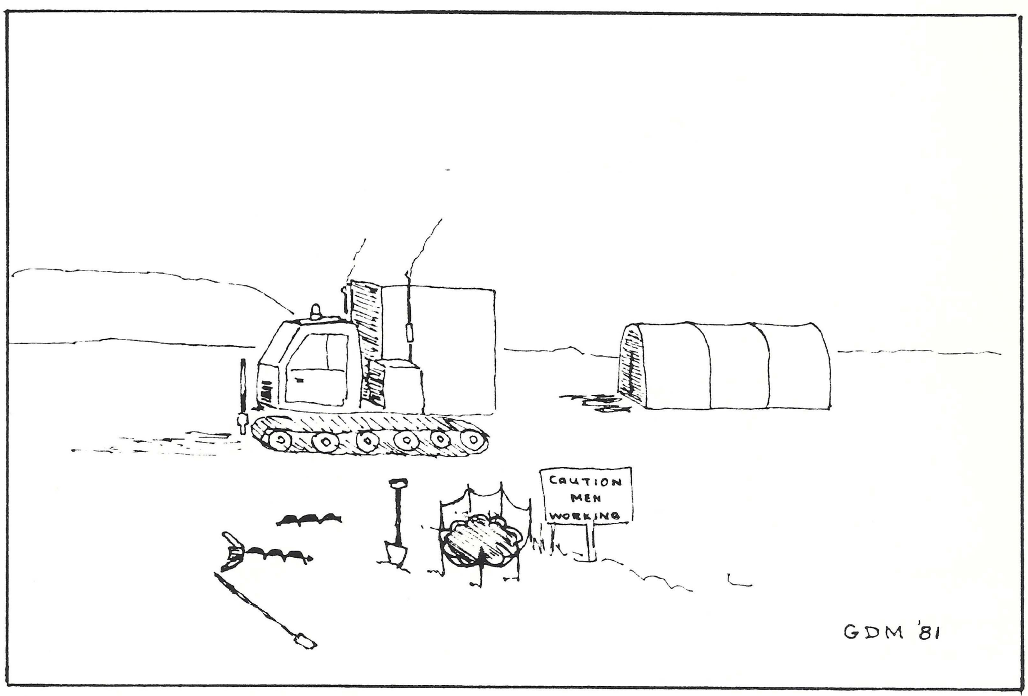
These methods have several features that may recommend their consideration by the hydrographer planning a large scale survey:

1) Two hydrographers and one coxswain are all the manpower required.
2) The survey equipment required, one theodolite and one or two sextants, are commonly available.
3) The plotting and dividing functions are simple and straightforward.
4) The systems are flexible enough to suit nearly any situation.
5) Range and accuracy are both superior to other methods commonly accepted for wharf surveys.

During our survey of Cowichan Bay wharf we approached neither the limit of range nor technique possible with this equipment and these principles. Other means of propagating lines of position are possible. Other combinations of LOP's are possible. Techniques can be refined and expanded. The hydrorapher is challenged to explore the limits.

REFERENCE

Admiralty Manual of Hydrographic Surveying, Volumes 1 and 2



Lighthouse. Edition No. 23, April, 1981

Integration of NAD 83 Into The Charting Programs In The United States and Canada

W.J. Monteith
National Ocean Survey
Rockville, Maryland

and

D.H. Gray
Canadian Hydrographic Service
Ottawa, Ontario

BACKGROUND

On May 14, 1979, acting upon formal recommendations of the Great Lakes Charting Advisers, the United States-Canada Hydrographic Commission (USCHC) established the ad hoc Committee on Horizontal Datums. The purpose of this Committee was to identify and study anticipated problems expected to be encountered by the Canadian Hydrographic Service (CHS) and the National Ocean Survey (NOS) when each agency converts its charting program to a new geocentric horizontal datum.

The work of the Committee began in Ottawa, Ontario, on May 16, 1979, when a meeting was convened with several representatives of both agencies to clarify Commission objectives and to identify other related and pertinent subjects for the Committee to consider. On August 2, 1979, the Committee met in Rosslyn, Virginia, to consider the problems previously identified and to discuss the course of action necessary to prepare the required report for presentation at the next scheduled Commission meeting.

PROBLEMS CONSIDERED

The problems considered by the Committee and the answers or recommended course of action for each are presented below:

What is the name of the new North American Datum?

The name of the new datum is "North American Datum of 1983." The accepted acronym is "NAD 83." This name and acronym will hold true regardless of the date the new datum becomes effective.

What is the expected date that NAD 83 will become effective for use by Canada and the United States in their respective surveying and mapping programs?

The Geodetic Survey of Canada (GSC) and the National Geodetic Survey (NGS) of NOS advise that the framework of primary horizontal control adjustments for North America has slipped by 12 to 18 months so that it is now estimated that the NAD 83 primary adjustment will be completed in late 1984. Secondary and tertiary control will be adjusted or transformed to new coordinate values soon after that date.

Besides conversion to an earth-centered (geocentric) system, what other results will be produced by NAD 83?

A major reason that the NGS and GSC are desiring the NAD 83 is to eliminate errors in the existing North American Datum of 1927 (NAD 27) and to provide the surveying and mapping programs of Canada and the United States with one common horizontal datum based on a world reference ellipsoid. For example, some known problems in the NAD 27 are:

1. 100 ppm scale error in the north British Columbia coast and Alaska Panhandle
2. 10 meter misclosure in the west Lake Superior area
3. 10 ppm scale error in the Maritime Provinces

These problems and similar ones in the lower order surveys may mean that some charts may have to be reconstructed from the original data once the lower order control has been properly adjusted to the primary control framework. Reconstruction will depend on the magnitude of the errors and must be based on a chart-by-chart analysis.

What are the expected changes in latitude and longitude between NAD 27 and NAD 83?

The NGS has published preliminary changes between NAD 27 and NAD 83 in NOAA Technical Memorandum NOS NGS-16, dated April 1979. These composite latitude and longitude differences (in meters) for North America are shown in Figure 1.

Will there be differences between charts published by the Defense Mapping Agency (on World Geodetic System 1972 Datum) and charts published by NOS and CHS (on NAD 83)?

Ground positional differences between these two eath-centered coordinate systems will be inconsequential for both the hydrographer and the mariner since it is estimated that the maximum diffrence will be about 5 meters, with the average difference being less than a meter. The Committee concludes that the difference between these two datums will not be observable when charts compiled on each datum are visually compared.

What is the horizontal datum of the present charts?

The majority of the charts produced currently by CHS and NOS are on NAD 27, others on a variety of horizontal or reference datums, such as:

Old Hawaiian Datum
North American Datum of 1902 (U.S. Standard Datum)
Various Astronomic Datums
Uncontrolled Reference Datums

For the 977 charts currently published by the NOS, the following datums are used:

(cont'd on next page)

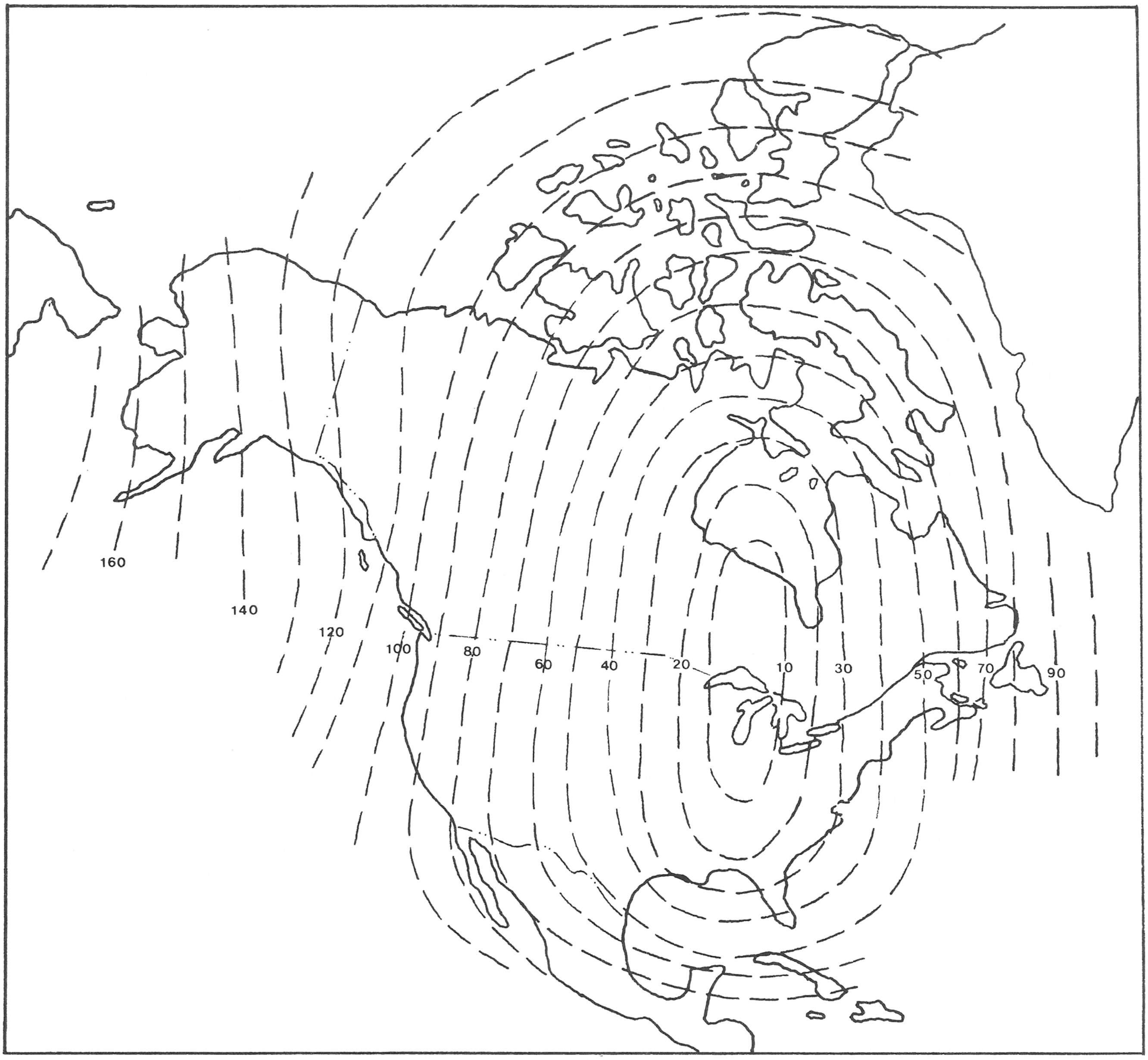


Figure 1. Anticipated Position Shift (in metres) due to Change to Earth-Centred Ellipsoid.

Datums	Charts	%
North American Datum of 1927	844	86.4
North American Datum of 1902 (Great Lakes)	50	5.0
Old Hawaiian Datum	36	3.7
Puerto Rico Datum	24	2.5
Local Astronomic Datums	21	2.2
Guam 1963 Datum	2	0.2
	977	100.0

Datums used by the CHS on charts currently published are:

North American Datum of 1927
North American Datum of 1902 (originally U.S. Standard Datum)
Local Astronomic Datums
(Chart distribution on these datums is not available)

When should CHS and NOS publish charts on NAD 83?

Depending on the work load priority comprising each agency's chart production schedule, the decision "not to convert to NAD 83" was recognized as a viable option for a limited number of charts currently produced. However, the Committee considered the relatively small number of charts which might fall into such a category and answered this question on the assumption that CHS and NOS would ultimately convert all of their charts to NAD 83. The Committee agreed that conversion to NAD 83 should not begin until the final datum computations and adjustments have been completed and reliable positions are available for converting all existing chart data to the new datum. Unless some unforeseen reasons occur beforehand, the Committee recommends that production of charts on NAD 83 should be scheduled to begin in January 1985, or as soon thereafter as the data will permit.

How should a chart be converted to NAD 83?

The Committee assumed that both manual and automated cartographic techniques would be available to each agency to accomplish this datum conversion. It was also decided that the cartographic method selected would be dependent upon the magnitude of the difference between NAD 83 and the various existing chart datums, the scale of the chart, and an evaluation of the basic survey data from which the chart was compiled. Whether performed by manual or automated techniques, the procedures expected to be used are:

1. conversion of grid projection points to NAD 83 using ΔX, ΔY, and ΔZ of nearby (or charted) geodetic control.
2. recompilation of survey data used for compiling the chart including offshore hydrography acquired using hyperbolic or range-range survey positioning techniques.
3. survey of selected charted features to obtain NAD 83 coordinates when the existing chart datum is in question.

The Committee recommends that each agency selects the best method for conversion to NAD 83 based on a chart-by-chart analysis of all factors.

How will existing digitized data be converted to NAD 83?

The conversion method selected will be dependent on the source information. Since the digitized data are often used at a scale larger than the conventional chart manuscript, the Committee recommends that the accuracy standards for converting existing digitized data to NAD 83 be established to assure that a greater accuracy is achieved than is necessary for charting. NOS expects to use an existing computer program to apply a least squares adjustment to convert its existing digital data base to NAD 83 on a chart-by-chart basis. This program requires that the position of the four neatline corners of each chart be known on NAD 83 and will be solvable using the procedures cited in the previous discussion of "How a chart should be converted to NAD 83". There is the potential problem that some data might be transformed twice and safeguards should be established to eliminate this error.

How long will it take to complete the conversion of all NOS and CHS charts to NAD 83?

The Committee recognized that a reasonable time required for each agency to accomplish full datum conversion would depend on several factors with the most important being whether each agency (beginning in 1985) would have the cartographic capability to compile the changes at a rate to meet the projected printing cycle for each chart. The Committee assumed this capability would exist with now-developing methods and, therefore, concentrated its efforts on estimating the reasonable time that would be required to produce new chart editions on NAD 83. The NOS issues about 500 new editions per year.

The NOS has eight distinct printing cycles for charts. These cycles and the number of charts affected are listed below:

Print Cycle	Number of Charts	
6 months	12	(Includes 1 mineral lease chart)
12 months	279	(Includes 3 mineral lease and 3 training charts)
18 months	9	
24 months	193	(Includes 1 mineral lease and 2 training charts)
36 months	112	
48 months	270	
96 months	32	(Includes 7 special use charts)
144 months	70	
	977	

Theoretically, the 12-year print cycle charts would extend the conversion period to 1996 if datum conversion were begun in1985 and if 1984 were the latest edition of these 12-year charts. However, a review of the NOS long-range chart production schedule indicated that both the 8- and 12-year print cycle charts could be converted to NAD 83 by the end of 1991 (see below).

Charts Printed

Year	8-year Edition	12-year Edition
1985	12	0
1986	5	4
1987	4	18
1988	3*	20
1989	4*	10
1990	1	10
1991	3	8
	32	70

* Special Use Charts for U.S. Navy

There are approximately 1,000 CHS navigational charts in stock at any one time. The number changes slightly as new charts are published and old ones are withdrawn. In any one year approximately 10 new charts, 95 new editions, and 98 corrected reprints are published. The distinction between new edition and corrected reprint is that the latter differs from the previous printing by application of information published in Notices to Mariners (NM) and hence the previous printing is not cancelled. Corrected reprints are issued to replace stock of a chart when there are no new surveys or to reduce the amount of hand corrections (the application of items published in the NM) that are necessary for a chart. At first glance it might appear that with almost 200 charts coming off the presses each year, that it would take only 5 years to go through the 1,000 navigational charts. Unfortunately, some charts are not printed as frequently as that and some much more frequently. By inspection of the CHS chart indexes, it takes about 7 1/2 years to get through approximately half of the charts, 15 years for three-quarters of the charts, and 30 years for 99 percent of the charts.

Over half of the charts sold are newer than 7 1/2 years old since they are in greater demand, whereas there is little demand for charts that are printed once every 30 years. Nevertheless it is obvious that CHS cannot match the NOS prediction of conversion of all charts to NAD 83 in 7 years. It will take a concerted effort by CHS to reduce the conversion period even to 15 years.

What would happen to existing chart stock?

Until all charts are converted to NAD 83, the Committee recommends that a NM statement should be published annually which would identify each chart not on NAD 83 at that time and the respective $\Delta\varphi$ and $\Delta\lambda$ conversion values between the existing chart projection and NAD 83.

As conversion to NAD 83 occurs through the printing of new editions in conformance with prior established edition cycles, existing chart stock will continue to be treated as obsolete and cancelled, as is the present practice.

Should CHS and NOS recognize that people use obsolete editions of charts and therefore, recommend the publishing of NM information on individual items in the new and old chart datum for an interim period?

No! The publishing of information on more than one datum would be too confusing. Canadian and United States law require the use of the latest editions of charts and it is believed that any action to promote or support the use of obsolete charts would be inconsistent with the legal positions of both countries.

How can a chart not on NAD 83 be referenced to, or used with, NAD 83 information?

The Committee recommends as an interim measure the addition of a "transformation" note on the chart which will inform the user of the amount of correction needed to shift the chart projection to NAD 83.

How will NM information be published?

The Committee considered two basic procedures for publishing NM information. The first would require information be published consistent with the datum of the chart affected. Multiple charts affected by a single NM item could mean publishing that information on more than one datum, especially in the early transition period. It would be expected that the size of the NM would remain large until the number of charts not on NAD 83 is significantly reduced. This procedure will also require developing a fail-safe data checking system to assure a high credibility level for the data published. The CHS presently handles NM information affecting charts of different datums and scales in this way.

The Committee also considered the impact of publishing (after January 1985) NM information exclusively on NAD 83, regardless of the datum of the affected chart(s). This would also present a formidable task. Included in the NM would be a special note advising the user on how to transform the NM information to the datum of each chart affected. This note would be opposite in content to the note proposed in the answer to the previous question. It is believed the use of a note could reduce significantly the size of each NM and still enable the user to utilize this information correctly. The following is an example of a note in a NM pertaining to a NOS chart of Cape Hatteras:

PLOTTING ADJUSTMENT

Geographic positions of data given on North American Datum 1983 (NAD 83) may be plotted on this chart by applying the following corrections:

Latitude: +0.48", or +12.4 meters, or +13.5 yards
Longitude: -1.04", or -32.0 meters, or -34.0 yards

The World Geodetic System 1972 (WGS72) datum is considered equivalent to NAD 83 for this chart.

The Committee believes this question can be answered following future discussions between CHS, Canadian Ministry of Transport, U.S. Coast Guard, Defense Mapping Agency Hydrographic/Topographic Center, and the NOS. These discussions would be scheduled in a period 3 to 6 months in advance of the implementation of NAD 83 into the respective charting programs of both countries. This question should be made a point of future discussions by the Commission as well.

Should charts be drawn with a double border, one on NAD 83 and the other representing the existing chart datum?

No! Cartographically, it would mean drawing the neatline (border and projection ticks) twice, initially to show the old and new datum projections, and later to show only the NAD 83 projection. In the first case, it is believed the users would be confused by the two projections displayed, particularly in the adaptation of NM information. Until the charts are compiled on NAD 83, it is recommended that an interim note and example be added to the existing chart to instruct the user how to transfer from existing chart datum to NAD 83.

Will chart borders and lattices have to be redrawn?

Analysis to date indicates there should be no visible difference in charted area between chart neatlines (borders) drawn based on ellipsoid parameters defining NAD 83 and any other datum previously used, such as NAD 27 (Clarke's Reference Spheroid of 1866). The neatlines of a chart define the "window," or the area charted, and regardless of the datum used in compiling the chart, the window remains the same even though the chart projection may be shifted. Where the chart projection interesects the neatline, new subdivisions will be required to reflect this projection shift to NAD 83.

Electronic positioning lattices, however, will probably have to be redrawn since both the ellipsoid parameters and the geographic coordinates of the electronic positioning system transmitters have been changed. These changes will produce non-uniform differences between new and old data used to generate these lattices.

OTHER CONSIDERATIONS AND SUMMARY

Although predicted shifts between NAD 27 and NAD 83 appear to be systemic and predictable, the Committee has concluded that there are many charts compiled on older datums and based on older surveys where a predicted shift in coordinates is not feasible. An individual analysis of each chart will have to be done to resolve the effect of shift in datums.

Beginning in early 1985, or as soon as final coordinates for charting control are available from NGS and GSC, the Committee recommends that chart projections (grids) be shifted to the NAD 83 at the New Edition stage of construction. It is further recommended that a list of chart projection shifts (latitude and longitude) should be published (annually) in NM for the mariner who wishes to change datums prior to an edition of the chart being published on NAD 83.

The Committee has not determined whether NM, Light Lists, Sailing Directions (Pilots) and other publications quoting geographic positions would use the projection datum of the current edition of the chart (if not NAD 83) or would use NAD 83 exclusively. Further study and coordination in this area is required prior to 1985. It is recommended that the Commission identify this for Charting Advisers action at a later date.

Electronic positioning system lattices will have to be redrawn on the new datum. Some offshore surveys done in hyperbolic and range-range mode will require replotting because of the non-uniformity of the shifts in transmitter positions and because of new ellipsoid parameters. It is expected that CHS and NOS will not be able to handle this replotting manually, but will require automated cartographic techniques to effectively and efficiently accomplish transformation to the new NAD 83.

The Tidal Streams Surrounding Vancouver Island

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Canadian Hydrographic Service
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INTRODUCTION

In the past seven years the Tides and Currents Section, Pacific Region, has circumnavigated Vancouver Island with current surveys. We began close to home in Juan de Fuca Strait and the Strait of Georgia before progressing counter-clockwise through Johnstone Strait, Queen Charlotte sound and down the west coast past Brooks Peninsula and Estevan Point (Figure 1.). We recovered current meters on the west coast of the Island in September 1980, ending a seventeen month program to measure currents and tidal heights near shore and out to 100 km from the coast. With the survey completed, we thought it appropriate to describe the progress made in our surveys to the readers of LIGHTHOUSE.

JUAN DE FUCA STRAIGHT

The Tides and Currents Section maintained a current meter mooring at Race Rocks for eighteen months to provide accurate current predictions for shipping and small craft navigation. Tidal streams can reach three knots in the centre of the Juan de Fuca Strait south of the rocks, and up to six knots close to the rocks themselves. We recently installed another mooring near the rocks, with assistance from students of the Lester B. Pearson College of the Pacific, who wish to explore the potential of the region as a marine park for divers.

Although the magnitude of the tidal streams is less in the

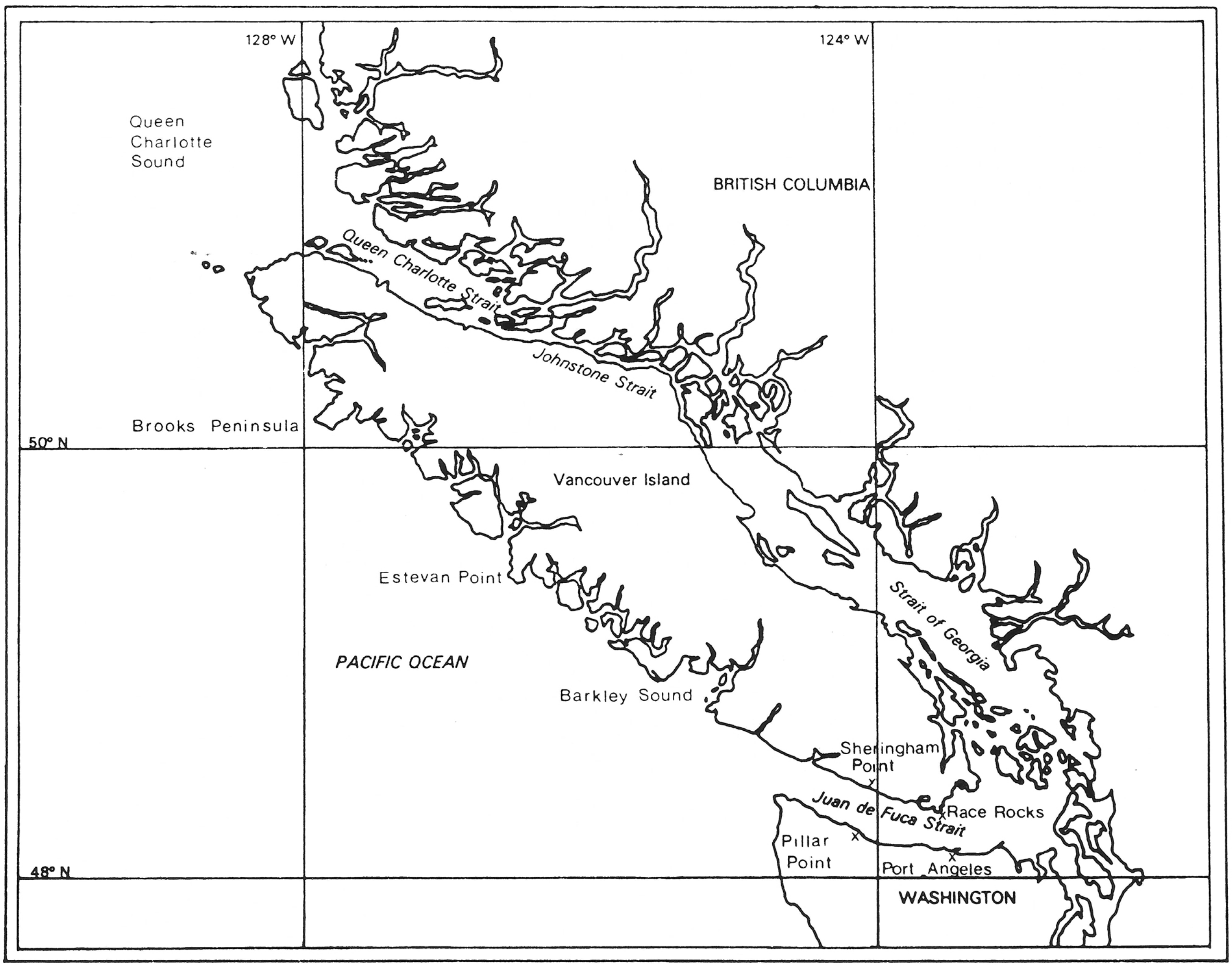

Figure 1. Vancouver Island

portion of Juan de Fuca Strait west of Race Rocks, it appeared possible to determine the transport of water through the Strait and to measure surface speeds and their relation to sea levels from several short but thorough surveys. In 1973 we deployed 23 current meters on six moorings spanning the Strait. The idea was to moor as many current meters as possible in Juan de Fuca Strait and Johnstone Strait simultaneously so that we could estimate the transport of seawater around the island (1). In Juan de Fuca Strait we deployed CMDR current meters, an old type which punches a paper tape to record speed and direction. Although their performance was poor, there was sufficient return to generate the chart of residual circulation (Figure 2.).

bottom of the line in case the top float is cut away by tug boats. In 1979 a tug with barge in tow broke off the top float and current meter of a Juan de Fuca mooring and carried both to Astoria, Washington. The lower float, meter and release were recovered on a routine cruise later in the year.

The tide gauge shown in Figure 3 was part of an experiment to compare near surface currents with cross-strait pressure differences. The link between the two depends upon Coriolis force which is due to the rotation of the Earth and deflects any ocean current to the right in the northern hemisphere (3). In the open ocean away from boundaries, the current generated by the sudden passage of a storm will flow in a cir-

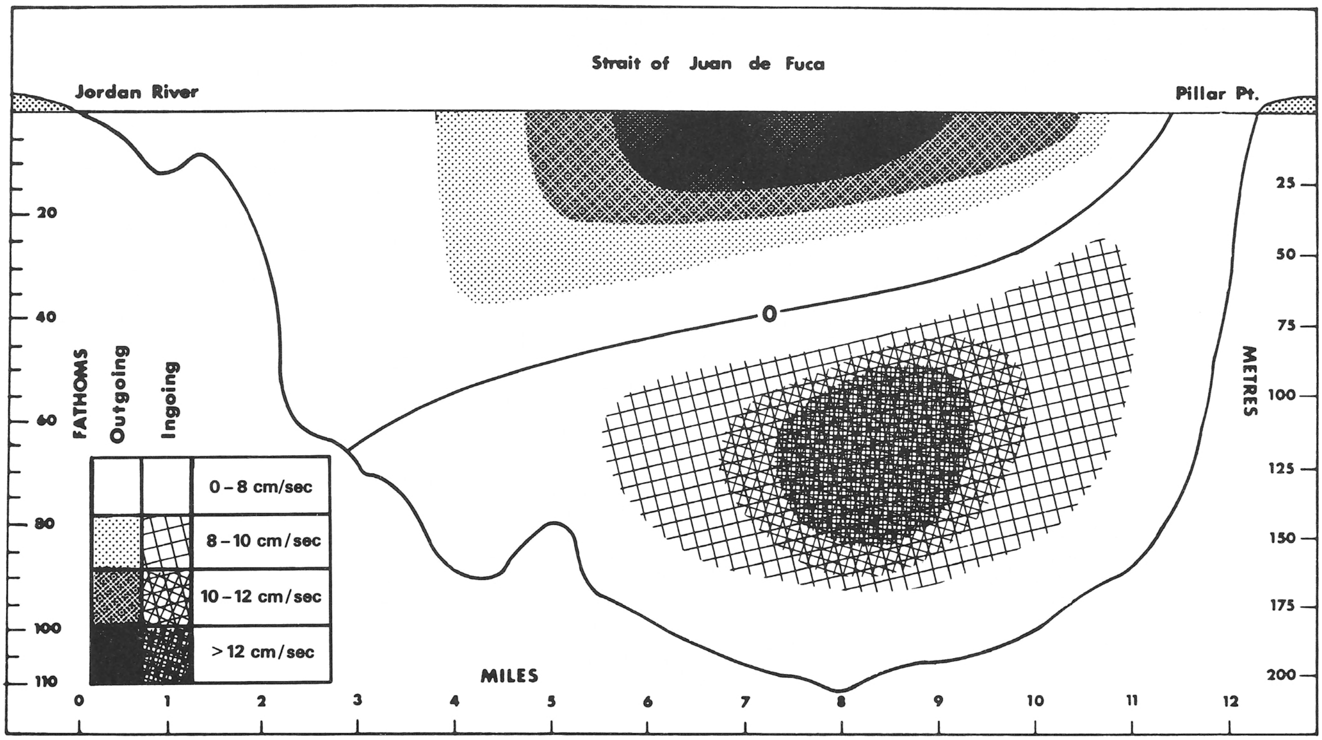

Figure 2. Residual Currents in Juan de Fuca Strait

Both Juan de Fuca and Johnstone Strait behave as estuaries with an average outflow on the surface and inflow on the bottom. Any net flow present is the small difference between these two larger flows, which cannot be reliably computed. However, the transport of nutrients out of Juan de Fuca Strait across this section has been computed by David Mackas of the Institute of Ocean Sciences for input to the nutrient budget of the fishing banks off the southern portion of Vancouver Island.

The Juan de Fuca survey was repeated in 1975 with nine Aanderaa current meters on five separate moorings extending from Pillar Point on the United States side to Sheringham Point on Vancouver Island (2,3). The moorings used during this experiment are shown in Figure 3. The float is left 18 metres below the water surface with the Aanderaa current meter just below it. The long fin on the current meter directs the rotor into the flow. Speed, direction, temperature, conductivity and water pressure are recorded on magnetic tape at intervals of 10, 15, 20, 30 or 60 minutes. The mooring is recovered by sending a four tone sonar signal to the acoustic release, which lets go the anchor. Our underwater, internally-recording tide gauges were intially manufactured by Aanderaa, but recently we have purchased some Applied Microsystems gauges. On recent cruises we have substituted shorter aluminum floats for the long steel cylinders shown in Figure 3, and normally place a float at the

cle until it gradually dies away; whereas near land the current causes the water to pile up near shore until the resulting pressure gradient aligns the flow parallel to shore. The 1975 survey showed that the currents along the Strait determined from the pressure differences across the Strait agreed to within 20% with the measured currents, but a comparison of just the tidal streams gave a much closer agreement.

The shallowest current meter in each mooring gives the data from which we generate the tidal current predictions found in the Canadian Tide and Current Tables (4). For Juan de Fuca surveys this depth was 20 metres. Floats and meters closer to the surface are too easily hit by tow lines or deep draft ships, and the wave motion often contaminates the data.

In the last few years our worries have increased about oil spills from tanker traffic. If Port Angeles is to become a major oil port, then the tanker traffic will be confined to Juan de Fuca Strait. Can we predict an oil spill given the present knowledge of currents? Because such a spill is confined to the top few centimetres where wind effects are large, the 20 metre deep currents may not be accurate. This problem was tackled by Al Ages of the Tides and Currents Section who designed and built oil spill markers (now commercially available) to track the movement of the oil. Field trials in Juan de Fuca Strait to the west of Port Angeles show the markers tend to drift to the south, a result which has been repeated on several occasions. Only markers placed near the shore flow parallel to the coast. If the oil follows the route of these markers, then Vancouver Island may escape the effects of a major oil spill in the western Strait. In the region east of Race Rocks, currents are less regular and oil lost from a ship in this region could go anywhere.

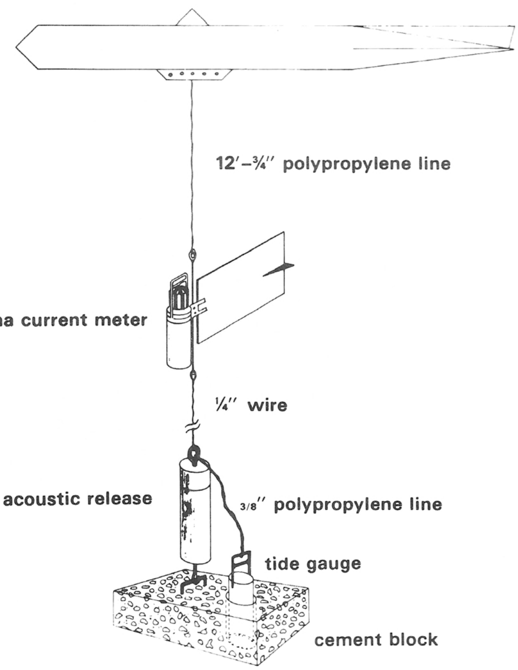

Figure 3. Current Meter Mooring

GULF ISLAND PASSES

In these narrow constrictions between the Gulf Islands, the passage of the tide from Juan de Fuca Strait into the Strait of Georgia is choked. A pressure head of up to 750 millimetres can build up along these passes. Our previous current predictions are based on short time-series using drifters and it was felt they could be improved. Michael Woodward of the Tides and Currents Section placed Applied Microsystems underwater pressure recorders at the ends of Active Pass, Porlier Pass, Gabriola Passage, and Dodd Narrows (Figure 4.). They recorded for a year to give a long time series of the pressure heads. At each pass the current was measured for a two week period using a small Neyrpic impellor mounted on a frame on the side of a launch (5).

Ship traffic through these passes is considerable. Active Pass is the route for all ferries between Tsawwassen and Swartz Bay - more than one an hour in the summer. The point where the current measurements were made is a favourite with salmon fishermen. Tidal streams attain speeds up to 8 knots in some of these passes and slack waters are brief, usually less than 10 minutes, thus requiring accurate predictions. From the relation between tidal head and current, and with a year of record of tidal head, it is hoped to improve the predictions of the tidal streams in these passes. We expect to apply this method to Quatsino Narrows at the north end of Vancouver Island and to several other passes in northern British Columbia.

STRAIT OF GEORGIA

Once the tide passes through the Gulf Islands and the San Juan Islands it quickly settles. Current meter moorings at the southern end of the Strait of Georgia showed tidal streams of one and a half knots, and the longer period currents were similar in magnitude at 50m depth, but much less at 200m depth. Ship traffic is concerned more with eddies generated in and near Boundary Passage to the south, and around the various islands and channels in the Strait. Dr. Patrick Crean of the Institute of Ocean Sciences has generated a numerical model of tidal streams in Juan de Fuca Strait and the Strait of Georgia. A chart of these streams during flood (Figure 4) illustrates the large confused flow in Boundary Passage and the large eddies to be found off the Gulf Islands. We have confirmed these eddies with drift observations and reports from mariners. This chart is one of 12 which we have produced from data generated by Dr. Crean's model. They will be bound together in an atlas and sold to mariners.

Our current meter observations at moorings between Vancouver and the Gulf Islands have proven useful in an unexpected way. The Government of British Columbia required historical data on currents in relation to proposals for a fixed link between Vancouver Island and the mainland; B.C. Hydro and a gas pipeline company required data to bring natural gas and electric power to the Island through submerged lines. These projects show the usefulness of current surveys through the straits surrounding large population centres. SeaKem Oceanography Ltd. is now conducting additional current meter surveys of bottom currents in the Strait of Georgia for the proposed natural gas pipeline.

SEYMOUR NARROWS

At the northern end of the Strait of Georgia all shipping in the inside Passage must navigate several narrow channels. In Seymour Narrows (one of the most famous channels) tidal streams can reach speeds of 15 knots. The large eddies and whirlpools of the Narrows make this channel treacherous. Since Ripple Rock was blown out of the centre of the channel in 1958, the passage is now safe for navigation at slack water. Seymour Narrows is the narrowest part of Discovery Passage, which runs between Quadra and Vancouver Islands. Slack water predictions began in the narrows in the early 1900's following three years of observations in the late 1800's and early 1900's. At that time, the British Admiralty performed all analyses and predictions of tides and tidal streams in Canada.

Following the blasting of Ripple Rock, the Tides and Currents Section surveyed the tidal streams and slack waters again. We measured currents by positioning floating poles placed into the flow upstream of the Narrows. We now provide our own predictions of slacks and currents in Seymour Narrows, and we have no plans to examine them more closely.

DISCOVERY PASSAGE, JOHNSTONE STRAIT, QUEEN CHARLOTTE STRAIT

We first studied these channels in 1973 as part of our combined Johnstone Strait and Juan de Fuca Strait project. We placed current meters in that portion of Johnstone Strait (Figure 5.) through which all waters flowing north out of the Strait of Georgia must pass (2). On the average, waters flow westward on the surface and eastward along the bottom. The tidal streams of the semi-diurnal current (the fastest tidal stream) has a maximum near the bottom with a large time lag between top and bottom. Richard Thomson of the Offshore Oceanography Group at the Institute of Ocean Sciences, examined the density and tidal stream data from this experiment and speculated that the large semi-diurnal streams near the bottom are associated with baroclinic motions (currents modified by the density stratification) generated by the tide propagating over Newcastle Sill to the east of the observation region (6).

Tides and Currents Section combined with the Offshore Oceanography Group of the Institue of Ocean Sciences to examine this flow in 1976, 1977, 1978. By combining conductivity, temperature and depths (CTD) data with water current

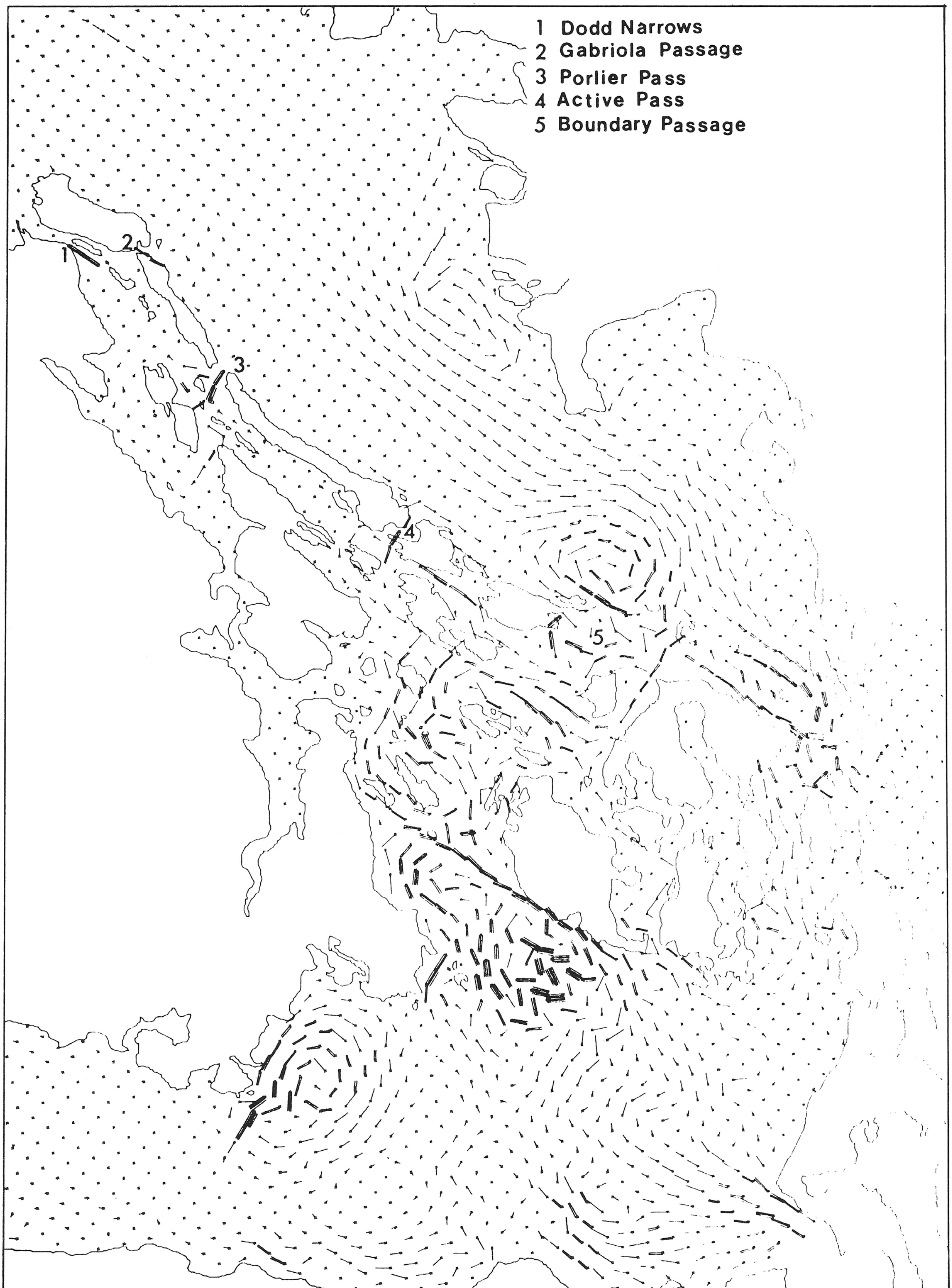

Figure 4. Flood Current Near South Vancouver Island

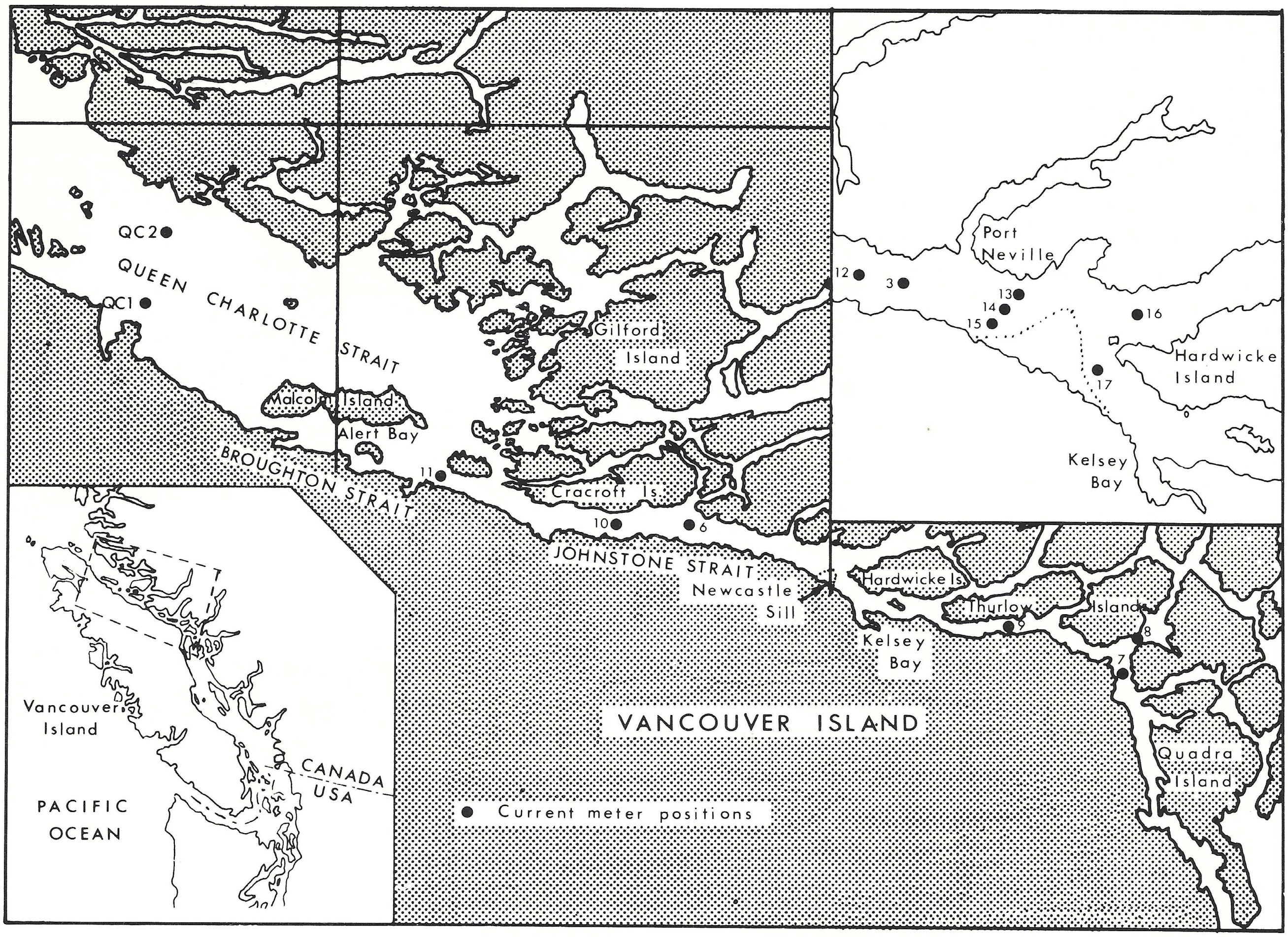

Figure 5. Johnstone Strait

studies, Richard Thomson was able to show that the semi-diurnal tide propagated downward and westward from Newcastle Sill. Within a few kilometres of the sill the baroclinic current speed may exceed 30% of the total current, but this percentage decreases to 10% at 30 km west of the sill. Because the baroclinic currents are dependent upon the density structure for their behaviour, their nature varies throughout the year as the density of the Strait changes (7,8,9).

The narrowness of Johnstone Strait allowed us to use few moorings to sample currents along its length in 1976, 1977 and 1978. At the two positions indicated in Figure 5 we moored lines of current meters across the Strait. At the other locations a single mooring was positioned in mid-channel. We found that the baroclinic effects and the configuration of the Strait modified the strength of the currents along the Strait. On the surface east of Kelsey Bay the maximum flood and ebb currents are 2.4 knots, and do not seem to exceed this speed, but drop when the tides are predominantly diurnal. West of Hickey Point the ebb current runs at 1.5 knots and the flood at 1.0 knot. Times of maximum currents through the passes at each end of the Strait are the same, but slack water times vary considerably due to the strong ebb and flood biases of the upper and lower waters in the Strait. The demarcation point between the out flow and the inflow is the line of no residual current. It occurs at about the 115m depth west of Newcastle Sill and the 75m depth east of Kelsey Bay.

As a result of these surveys the Canadian Tide and Current Tables now have predictions for currents in Johnstone Strait Central, with ten secondary ports along the Strait. Maximum currents are found south of West Thurlow Island, where speeds reach 7.0 knots.

QUEEN CHARLOTTE SOUND AND STRAIT

In 1977 we undertook a survey of the waters between the Queen Charlotte Islands, Vancouver Island and the mainland. The observations were to complement the study of the approaches to Kitimat for the proposed tanker route from Alaska. Our current, tidal and wind data formed the base of an environmental impact study conducted recently by local consulting firms for the proposed Alaskan oil tanker route to Port Angeles. The semi-diurnal tide dominates the currents in this basin, but storms passing through appear to accelerate strong inertial currents in Queen Charlotte Sound. These are currents which are turned to the right by the Coriolis force, and turn clockwise circles in the centre of the Sound with 15 hour periods. The uniformity of these currents over Queen Charlotte Sound is being investigated by Richard Thomson.

WEST COAST

The Queen Charlotte Sound survey finished at the same time as Canada declared a 200 mile fishing limit. Because of our lack of knowledge of the offshore waters, we began a year round survey of currents along the west coast of Vancouver Island in 1979. The expected increase in fishing by Canadians in areas previously dominated by foreign fleets attracted research groups within the Institute of Ocean Sciences and these groups combined, under the acronym CODE (Coastal Ocean Dynamics Experiment) to examine the waters along the west coast of Vancouver Island.

Again, in a joint effort with the Offshore Oceanography Group, two lines of current meters and tide gauges were deployed; one line of three moorings ran west of Brooks Peninsula (Figure 1.), and another line of five moorings ran out from Estevan Point. We modified old CMDR current meters to record on magnetic tape and also installed Geodryne current meters.

It was new territory for us. The waters on the continental slope west of the Island are 2500m deep and we wanted sub-surface floats 50m below the surface, an impossible requirement with nylon or wire rope. Michael Woodward suggested Kevlar, with less than a 0.1% creep and very little weight in water. He added his own improvements to the manufacturer's suggested method for terminating the rope and over a period of seventeen months no terminations ever let us down (10). Thirty-five current meters, two anemometers and eleven underwater pressure recorders were installed in May 1979. We serviced them on three occasions and finally recovered the gear in September 1980, with minimal loss. The top 50m of one mooring holding a current meter disappeared over the winter, and one mooring is still in place to be recovered by dragging in 1981. All other gear was retrieved and the Kevlar appears in good shape.

Currents along the coast are unusual. Figure 6 shows a short section of the record recovered from a current meter that was moored 50m below the surface, in 120m of water, 15km

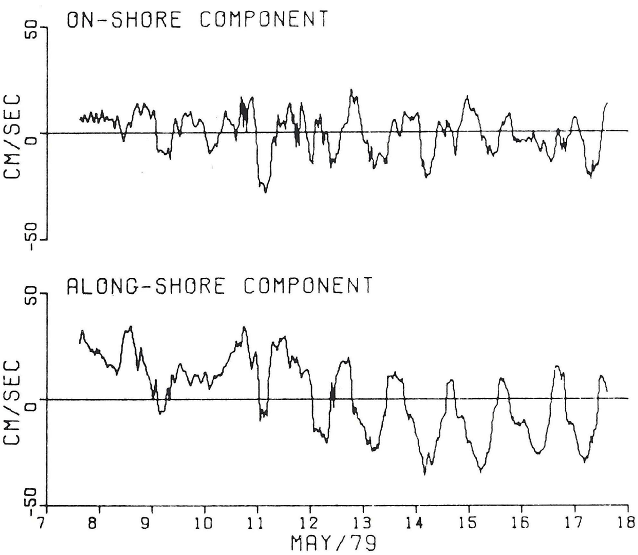

Figure 6. Currents Near Estevan Point

from Estevan Point. The two traces are the alongshore (lower line) and cross-shore (upper line) currents, and they reveal two classes of currents. The short period oscillations are the diurnal tidal streams which dominate over the semi-diurnal streams. This diurnal stream appears to be uniform with depth and with distance alongshore. It exceeds the semi-diurnal stream in magnitude off the west coast of Vancouver Island on the continental shelf. Off the coast of Washington and all through Juan de Fuca Strait and the Strait of Georgia, the semi-diurnal stream dominates.

The currents in Figure 6 also show a longer period component which can equal the tidal streams in magnitude. To examine this current, we filtered out the tides from the current and sea level records, and plotted them, along with the alongshore component of the wind, in Figure 7. The mooring E01 is 15km off Estevan Point, and E02 and E2A are 30 km off the Point. Estevan wind mooring No. 2 was 40km west of Estevan Point and the Nootka sea level gauge was 10km north of the Point, in a protected cove. The similarity among the records, especially with the near-shore currents, indicates that the alongshore component of the wind drives these longer period currents. Even at a depth of 83 meters the currents are wind driven, due to the secondary circulation set up by the response of the surface currents to the wind and the rotation of the earth.

This response, called Ekman divergence, brings cold, nutrient rich, oxygen poor water to the surface whenever a strong northwest wind blows. This is the prevailing direction during the summer. It also causes the water column over the shelf to flow toward the southwest. This upwelling of cold water, together with tidal mixing over the shelf, brings the cold water into Long Beach on Vancouver Island in the summer and freezes the swimmers. It also generates a pool of cold nutrient rich water off Barclay Sound in the summer. Recently Kenneth Denman and Howard Freeland have also found this pool just to the south of La Pereuse Bank west of Barkley Sound. The full significance for fisheries is not yet understood, but Dr. Freeland noted that in mid-September 1980 this patch of water was full of Russian Hake trawlers. It appears that the Hake and the Russians knew of its existence already!

The recovery of the meters in September 1980 completed our current surveys around Vancouver Island. We have a great deal of data to analyze and a year and a half to prepare for our next survey in the Queen Charlotte Islands.

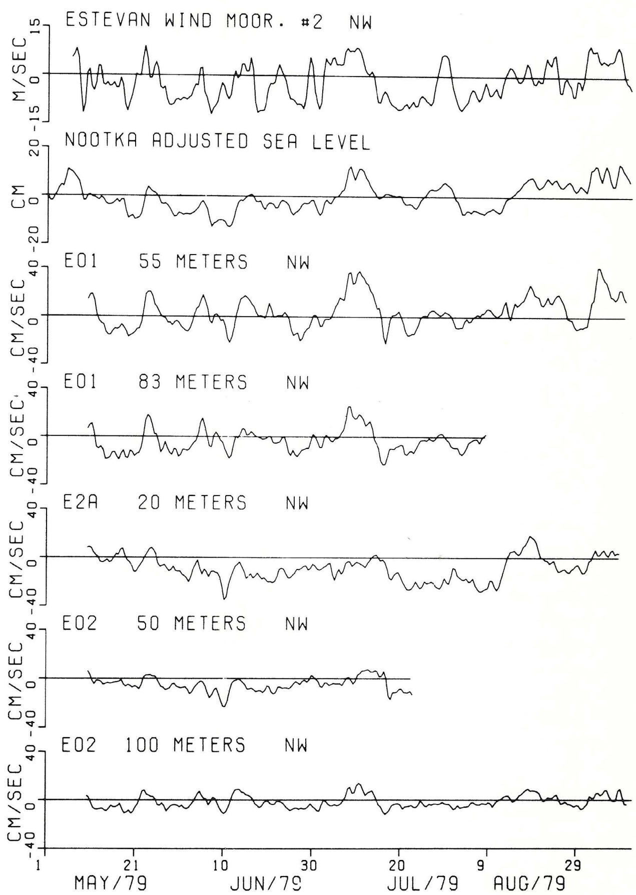

Figure 7. Currents, Winds and Sea Levels Near Estevan Point

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Taking A Poke

The year is 1984. Since paper money is worthless, gold has become the standard currency. Five hydrographers enter a bar to relax, have a drink, complain about the latest cutbacks, and talk about the most recent winner of the bent prop award.

The bartender is new and not used to accepting payment in gold dust but, as the boss suggested, he carefully weighs the bags of gold dust (pokes) which are tendered in payment.

When Al and Bruce treat each other to a drink the bartender weighs their pokes together and finds they contain 12 grams of gold. Bruce and Charlie then drink together and their combined pokes weigh 13 1/2 grams. The pokes of Charlie and Dennis together hold 11 1/2 grams and those of Dennis and Ed hold 8 grams. Al, Charlie and Ed have a round and together their three pokes hold 16 grams of gold.

At the end of the evening the saloon keeper empties all the gold together into his own bag, but when he begins to reckon the accounts for settlement he is unable to untangle the accounting. Can you?

Answer on page 28

Lighthouse: Edition No. 23, April 1981

Large Scale Surveys with the AGA Geodimeter 120

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Paper originally presented at the NOS Hydrographic Conference in Norfolk, West Virginia from Jan. 12-16, 1981.

ABSTRACT

The distance to a moving vehicle can be measured very accurately with the AGA Geodimeter 120. This tracking ability makes the instrument useable for large scale hydrographic positioning. It is less expensive and more accurate than other electronic positioning systems; it has greater range and better accuracy than most traditional methods used for large scale work.

INTRODUCTION

For some time, the Canadian Hydrographic Service (CHS) has recognized the need for a high accuracy positioning system that may be used for large scale surveys. The recent acquisition of an AGA Geodimeter 120 will help fill this need.

The Geodimeter 120 is a short-range, light-weight instrument that fits conveniently on most theodolites and is moderately priced compared with other electronic positioning systems. This instrument uses infrared light for distance measurements and is equipped with a vertical angle sensor. It can measure vertical angles up to ±30degrees and distances greater than 3 kilometres. These features make it a very useful survey instrument, but the most interesting feature from a hydrographic point of view is its tracking capability. The Geodimeter 120 can track at up to 4 metres per second or about 9 miles per hour. This capability allows the distance to a moving vehicle to be measured very accurately and at a relatively low cost.

The present methods used for positioning on large scale surveys are adequate for many requirements. Good results can be achieved up to 125 metres offshore with the subtense method used by the CHS. "Along line" position is determined by subtense measurements on a marked 4 metre board. The survey boat is kept "on line" by following ranges (or transits). However, the increasing volume of traffic and the large number of deep draught vessels has created a demand for large scale surveys that cover greater areas than in the past. Lines more than a kilometre long can be run with the Geodimeter 120, thus giving high accuracy well beyond the limits of measurements made using a subtense board.

HISTORY

Traditionally in the CHS, large scale surveys were carried out with very elementary equipment: the sounding lead, a measured wire or "stretchline", range poles, and a dory. On the shore a baseline was established and ranges were set up perpendicular to the baseline. The oarsman kept himself on line by sighting a range and the leadsman took the depth. Distances off the baseline were determined by marks on the stretchline. An improvement on this method was the use of subtense measurements on a marked 4 metre board to determine distance off the baseline. This was much faster than "stretchlining" and an echo sounder could be used for depth determination. At one point, experiments were carried out using a horizontally mounted sounder transducer to measure distances from a wharf face. This idea did not prove to be practical.

There are probably as many variations in carrying out large scale surveys as there are surveyors. These include combinations of sextant and theodolite positioning methods in combination with various electronic systems. As the areas of coverage increase, these methods require added manpower and time. Also, many electronic systems do not meet the accuracy requirements for large scale surveys. It is inefficient to use equipment that could be more effective on smaller scale jobs.

USING THE AGA GEODIMETER 120

An AGA Geodimeter 120 (figure 1.) was purchased in March 1980 to use during the field season. It proved to be very easy to operate. The instrument mounts on an adapter attached to the telescope of a theodolite and is connected to a small 12 volt battery which clips to the tripod. Atmospheric corrections for temperature and pressure are calculated in parts per million (by a slide rule provided) and are easily entered into the instrument. The operator has the option of selecting height difference, vertical angle, slope distance or horizontal distance. He can also select whether he wants one measurement, the mean of all measurements or the tracking mode. The telescope of the theodolite is pointed at the reflecting prism and the measuring button is pressed. The distance is displayed in a few seconds on the digital display.

A check of the geodimeter was carried out on the Halifax baseline. This baseline was established by Geodetic Survey of Canada with the Mekometer and spirit level. The geodimeter performed within specifications: ±(10mm + 7ppm) with internal mean calculation, ±(10mm + 10ppm) for normal measuring, and ±(20mm + 10ppm) in the tracking mode. Some preliminary tests were undertaken in order to determine a useable procedure for positioning a sounding launch. The instrument was placed on the launch and the reflector was set up on shore. This approach did not work because the narrow beam width of the geodimeter and the motion of the launch made it impossible to point the geodimeter at the target.

The unit was then properly mounted on a Wild T-2 theodolite, located on shore, and the reflector placed aboard the launch. The coxswain followed a range and steamed towards the shore. First, the instrument was pointed at the reflector without the aid of the T-2 telescope, but this gave poor results. By using the T-2 telescope to point the geodimeter, it was possible to follow the reflector to within about 60 metres of the wharf face where the instrument was located. A closer approach was not possible due to the elevation of the wharf deck. The vertical angle to the reflector could not be changed fast enough with the tangent screw to keep a signal. In an attempt to create a larger, low cost reflecting surface, bicycle reflectors were used in place of the reflector prisms but range was limited to about 150 metres. These tests demonstrated that the Geodimeter 120 could be used to position a moving launch; it was now a matter of improving the methods.

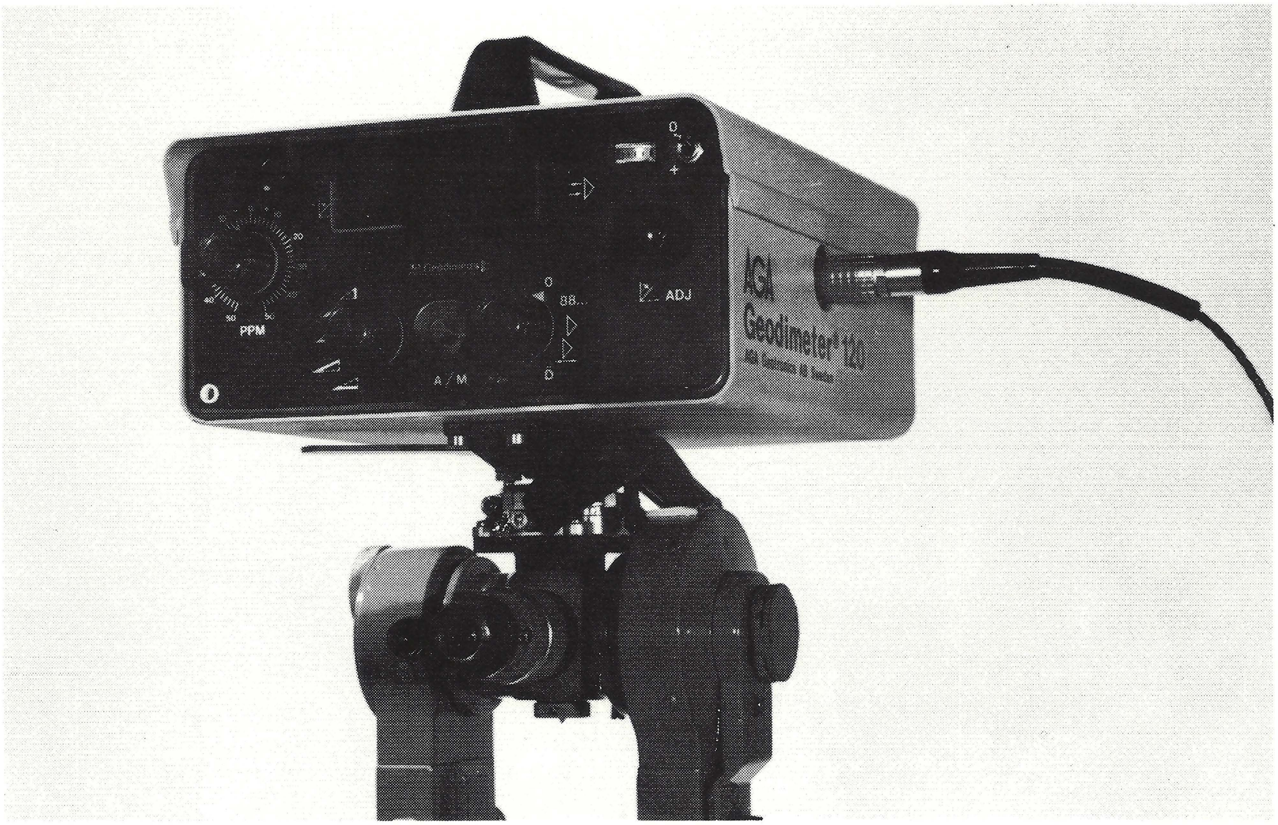

Figure 1: AGA Geodimeter 120 mounted on Wild T-2 Theodolite.

For most large scale work, the sounding vessel is kept on line by having the coxswain follow a suitable range. When higher "on line" accuracy is required, the launch is conned from shore by theodolite.

It was decided to use the following procedure with the Geodimeter 120. The theodolite, with the geodimeter mounted, was set up ashore on the baseline, in line with the range for the sounding track. The desired angle was set on the theodolite and the coxswain used the ranges to bring the sounding launch on line. Small corrections were then signalled or radioed to the boat as it approached shore. Sounding lines of at least one kilometre in length were possible. This method required extra care, good weather, and a competent coxswain. The first opportunity to use the system in the field was on a survey of the approaches to the Canso Canal near Port Hawkesbury on Cape Breton Island, Nova Scotia. Survey specifications required a scale of 1/1200, sounding coverage to a depth greater than 15 metres, and lines 200 metres long. Baselines were established, sounding lines were marked off and ranges were set up on wharves which extend from each end of the canal. This layout work was done with the Wild T-2/Geodimeter combination. Time was saved during this part of the survey because short distances, required for site preparation, were measured with the geodimeter instead of a tape.Sounding lines 125 metres long were run by the conventional subtense method. These lines were extended to 200 metres in length with the Geodimeter 120 (figure 2.). The reflecting prism, mounted on a range pole, was attached to the side of the sounding boat, directly over the transducer of the sounder (a Raytheon DE719). The ranges were used as a guide for the coxswain. The personnel on the launch consisted of the coxswain to operate the boat and a hydrographer to tend the sounder and keep notes. Two men were required on shore — one to tend the geodimeter and direct the launch, another to read the display and radio the fixes at predetermined intervals to the launch hydrographer. After the regular lines were run, check lines were run across the entire sounding area. Lines over 600 metres long were run without difficulty. When the soundings were scaled, excellent agreement was obtained at checkline crossovers and where Geodimeter lines overlapped conventional lines.

The Geodimeter 120 proved to be a useful tool; we were able to run long lines with relative ease. This instrument provided excellent accuracy along the sounding line; however, when the sounding vessel moved "off line" more than the allowable error, it was rerun. Experience showed that a good coxswain could maintain ± 2 metre accuracy with few course corrections radioed from shore, provided that good ranges were established.

When the AGA Geodimeter 120 is not being used as a positioning system, it is not sitting idle. It is excellent for large scale surveys of wharves, buildings and the coastline, operations which have, to date, involved stadia distance measurements. The only restriction is the visibility of objects to be positioned. Stadia surveys with conventional methods require frequent setups, and the best accuracy possible is ± 0.3 metres. The geodimeter is fast, very accurate, and with 3 prisms has a range from 0.2 metres to 2200 metres. Often this work can be done from one setup. Short traverses can be carried out quickly and accurately. The distances to elevated objects such as navigation lights can be measured simply by placing the reflecting prism on top of the object. This way there is no need for offset, and ground level obstructions are avoided. Placing a radio wave system on top of a light structure is difficult at best and impossible most of the time.

OTHER POSITIONING METHODS

There are a number of ways to position large scale surveys (figure 3.). Electronic positioning systems such as Mini-Ranger, Trisponder, Artemis and Tellurometer MRD-1 may be used. All of these systems are very expensive compared with the Geodimeter, and only Artemis and Tellurometer will provide the accuracy required for most large scale surveys. In the

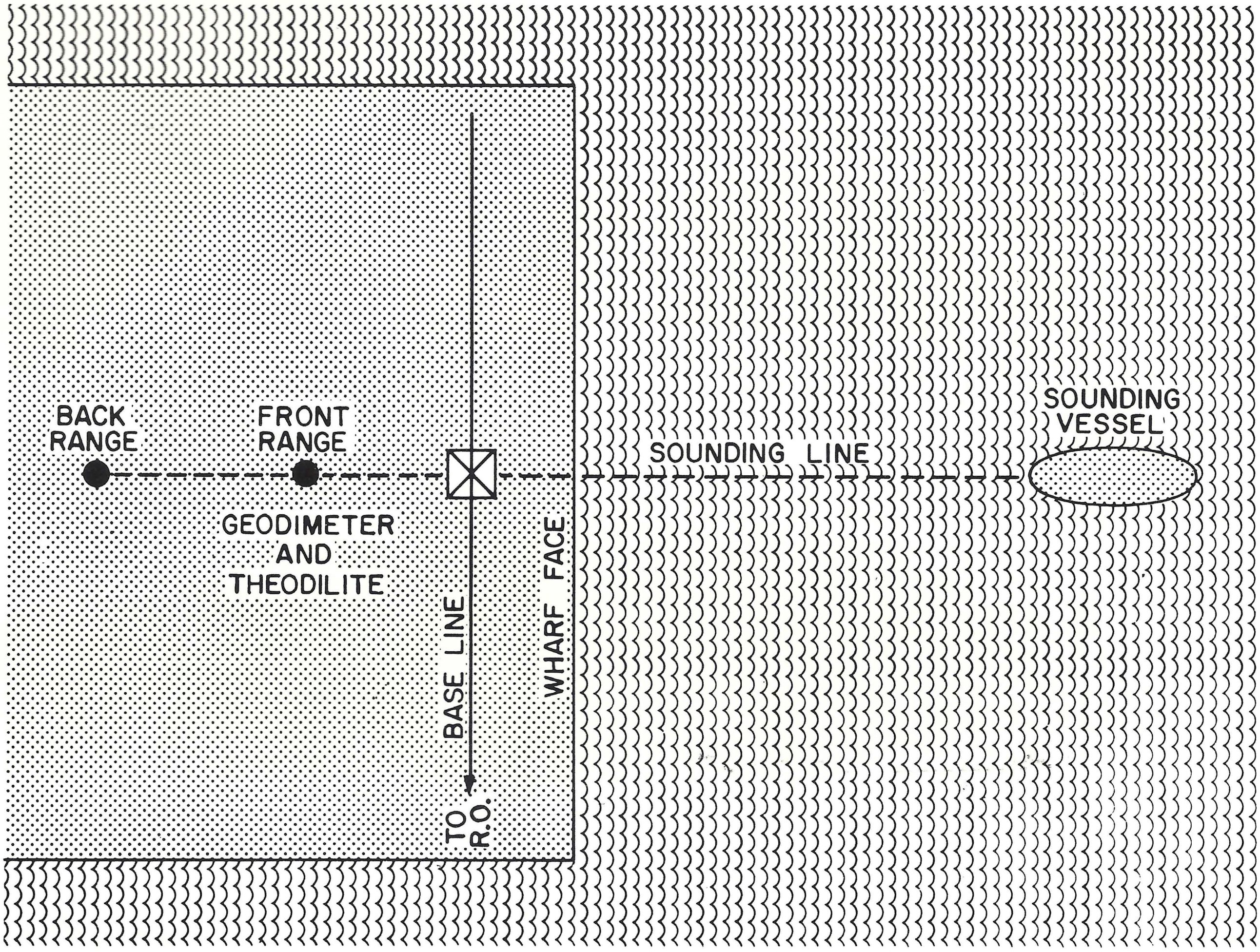

Figure 2: Typical setup for a large scale survey

System	Approx. Cost (CDN $, 1980)	Accuracy		Comments
Artemis	$150K	Range ± 1.5m Arc ± 2 minutes		Subject to signal losses due to obstructions and competing transmissions.
Mini Ranger III	50K	± 3m	with best geometry	
Trisponder	44K	± 3m	with best geometry	
Tellurometer MRD1	82K	± 1m	with best geometry	
Horizontal Sextant Angles	1K	± 3m		Fix interval too long.
Subtense and Ranges	1K	± 2m		Not accurate beyond 125m.
Stretchline	1K	± 2m		Time consuming; spot soundings only. Limited distance.
Theodolite Angles	15K	± 1m		Time consuming; fix interval too long.
Geodimeter 120 and Theodolite	17K	Range ± .2m Linekeeping ± 1m		Time consuming.

Figure 3: Some positioning systems used for large scale surveys.

CHS, large scale surveys are often done in small open boats, where the installation of electronic gear is difficult and the equipment is open to the elements. The method of subtense measurements on fixed ranges works quite well; no expensive equipment is required and it is quick and easy to do. However, this method is only accurate for relatively short distances. Simultaneous horizontal sextant angles have parallax errors that become significant at large scales. Angles cannot be taken fast enough to properly control the sounding vessel. The old method of using a measured wire and ranges can be quite accurate if care is taken, but it is time consuming, limited in distance and only spot soundings are obtained. One of the most accurate methods of positioning is with simultaneous theodolite angles from control points on shore. This method requires communication between all persons involved and, as with sextant fixing, these fixes cannot be taken fast enough to properly control the launch. There are probably many other variations or combinations of the above methods. All have limitations in accuracy, speed or cost.

CONCLUSION

The AGA Geodimeter 120 is useable as a positioning system, but methods to improve its use will continue to be sought. "On line" control with a theodolite is time consuming and often frustrating for everyone involved. It may be possible to use sector lights or lasers to keep the sounding launch on line rather than ranges and a theodolite. Either a radio controlled event marker or a remote display on the launch would reduce the chance of time delay which occurs when calling a fix to the sounder man. A major option available for the Geodimeter is the Geodat 120, a small data acquisition device. Fixes may then be called to the launch on a time basis. The distance and fix number will be stored in the Geodat with the push of a button. One person may then point the Geodimeter without the need for a second person to read the display and call the fixes at predetermined distances. Implementation of these ideas is possible in the future, but they will add expense to the system.

The AGA Geodimeter 120 and a theodolite combined with sensitive ranges will provide excellent accuracy at a relatively low cost. The main drawback is time consumption. All equipment must be moved and set in place for each sounding line. If the launch drifts beyond the tolerance set for "on line" control, then the line must be rerun. In cases where less accuracy will satisfy survey requirements, ranges can be used by themselves for "on line" control to reduce survey time. More work needs to be done before a system is perfected, but the AGA Geodimeter 120 can provide the basis for a relatively inexpensive and very accurate positioning system suitable for large scale surveys. When it is not used for sounding work, it pays its way as an excellent survey instrument on shore.

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Reprint From the United States Notice to Mariners
Weekly Edition No. 40, 1980

SECTION III **NM 40/80**

OCCASIONAL REMARKS

(Under this heading are included items of information not primarily intended to correct charts and publications but which are sufficiently relevant to be of general maritime interest)

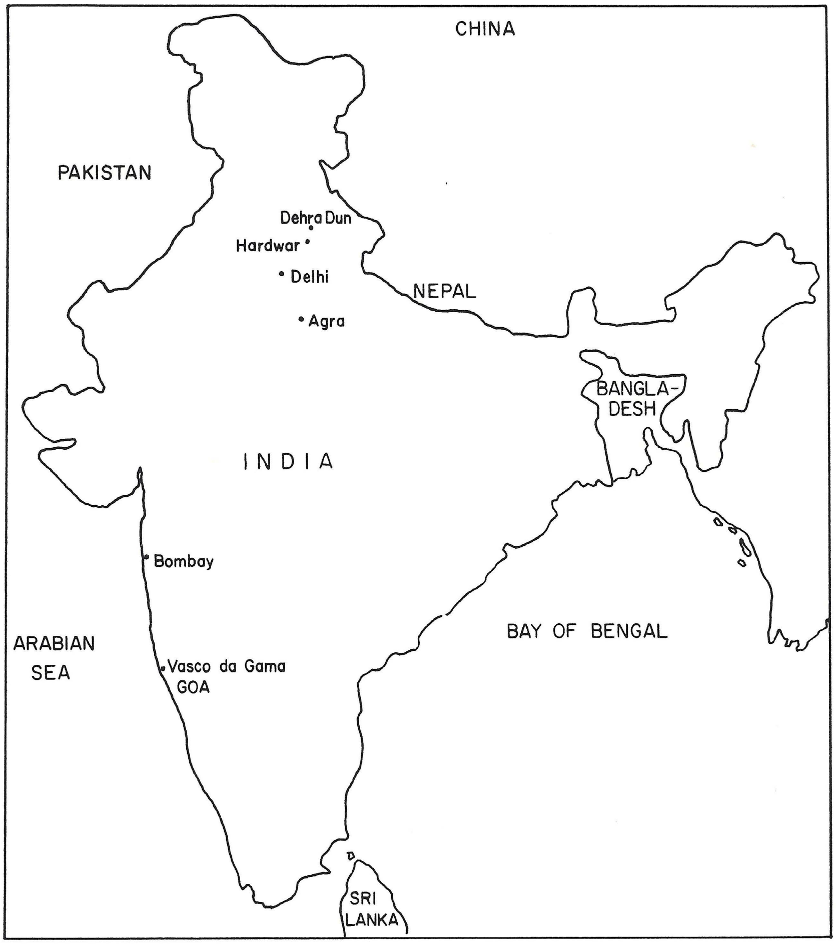
Sounding by whale. In the modern-day scheme of things, depths at sea are most commonly determined by the time-lapse measurement of sound waves propagated through water by a transducer of electrical energy. To a lesser extent, the lead line is used, primarily the hand lead line. The lead line sounding machine is also available, but its use is problematical and doubtlessly best remembered by at least a full generation of schoolship pollywogs as a wire-reeled mechanical contraption seemingly devised for the encouragement of peevish exasperation. Also remembered is the lead line procedure of Matthew Fontaine Maury—the dropping of cannon shot attached to a ball of twine of known length—but this, too, is seldom used, the scarcity of cannon balls being what it is today. Similarly seldom used is depth sounding by means of a lead line having an attached whale serve as weight, though oddly enough this rather peculiar method was indeed once actually reported a number of years ago.

It was on February 21, 1939. The steam whaler Ulysses was in the South Indian Ocean whaling grounds several hundred miles north of Queen Maud Land on the Antarctic coast. Its whalecatcher, Kos XI, was in approximately 63°42'S, 36°10'E when the catcher's gunner shot and harpooned a whale in quite ordinary fashion. Before it could be hauled alongside, however, and pumped afloat with compressed air, the leviathan sank, pulling down with it a stout manila line that has been hurriedly married to the harpoon messenger. After paying out for some 250 fathoms, the line stopped, tended up and down and thereafter slackened periodically with the rise and fall of the swell, indicating thereby the whale had probably reached bottom. The gummer subsequently heaved in a bit, pulling up his catch until the full weight of the whale was carried on the line, and then paid out once more until the line slackened, confirming to his satisfaction a depth of 250 fathoms.

In this manner a sounding of sorts was surely obtained. The sounding, however, does not now appear on U.S. charts, for reasons that may be attributed to intrinsically unorthodox method ("fishy" would be too strong), but the reported use of an 80-ton whale as the weight at the end of a 7-inch manila lead line must certainly rank as unusual among the several procedures available for determining the ocean's depths.

Se non è vero, è bene trovato.

Lighthouse: Edition No. 23, April 1981

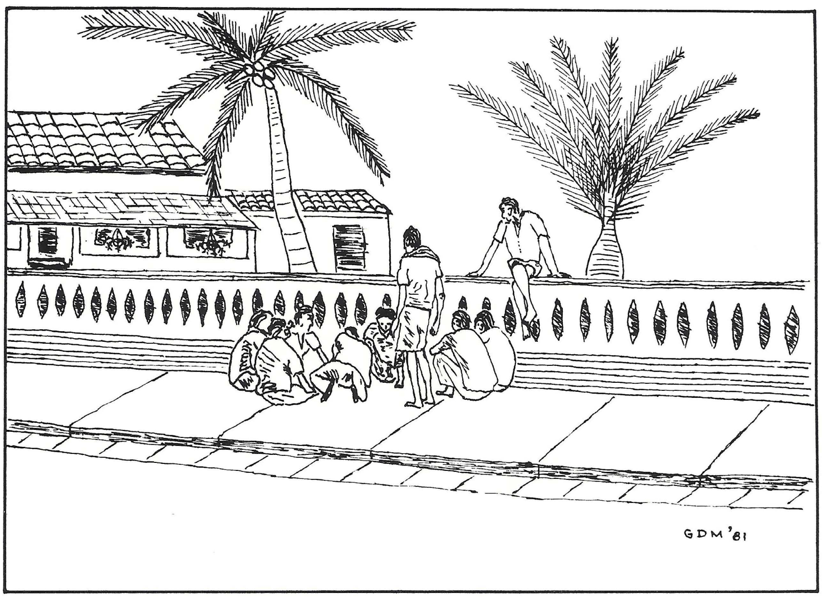


FROM A HYDROGRAPHER'S SKETCHBOOK IMPRESSIONS OF INDIA

We left for the airport at dusk. Salt and snow mixed to obscure our vision as the wipers tried in vain to keep the windshield clear. It was New Years day in Toronto, and as the 747 left the ground we were excited about our impending adventure. Sleep did not come easy in the cramped space on the big jet, and an eight hour stopover in London did not help us to get any rest. As we sat on a bench in the waiting lounge at Heathrow Airport we were able to close our eyes and reflect on the events of the past few months.

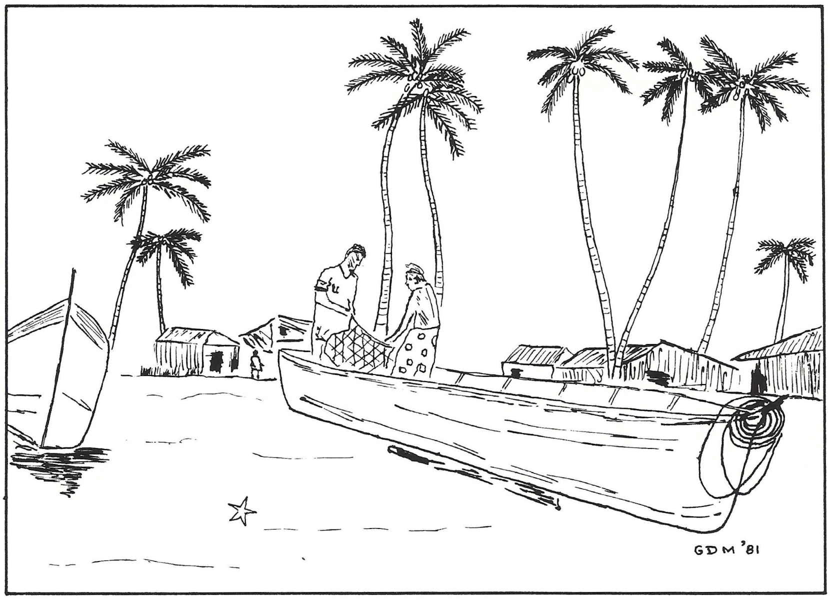
As part of an IMCO-UNDP* manpower development project, experts in various fields had been asked to lecture at the Indian Hydrograhic School in Goa. I was on my way to talk about automated data logging and processing. It had taken two months to finalize travel arrangements and to compile lecture notes, slides and flow charts.

After another sleepless night on a crowded jetliner, we were met by a naval officer in a bright white uniform and sunglasses. Customs and immigration formalities were a blur as the navy whisked us past officials in record time. We had arrived in Bombay. Twelve hours later we were settled into our quarters on the naval base in Vasco da Gama, home of the Hydrographic School. We had been travelling for thirty-nine hours.



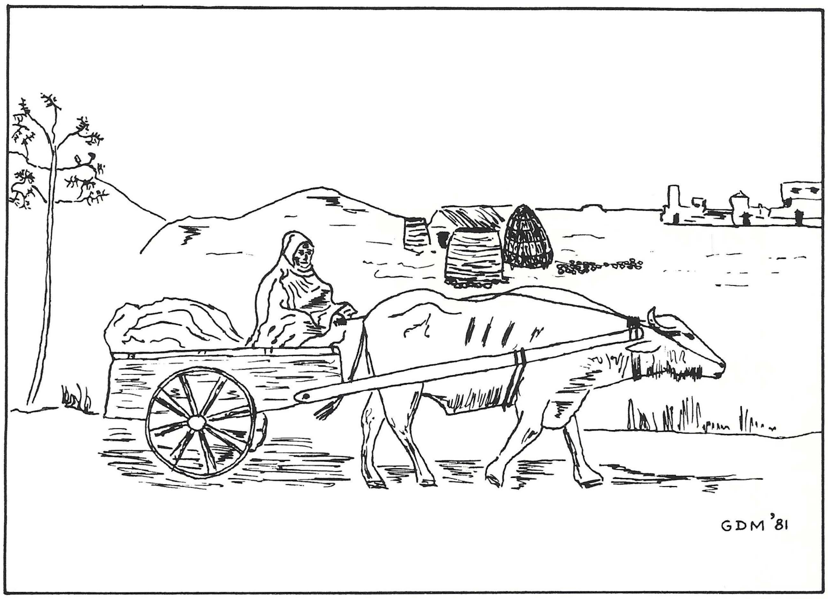
We were well rested by the time we began to roam around Vasco da Gama, camera and sketchbook in hand. The town is named after the Portugese explorer who first discovered the sea route to India. Goa remained a Portugese colony for over five hundred years until it was liberated in 1961. We found it quiet, relaxed and unspoiled by commercialism. The mediterranean influence is evident in the architecture; the countryside is scattered with old monestaries and convents. Most shops are closed between 13:00 and 16:30 while people relax. Some play games in the street.

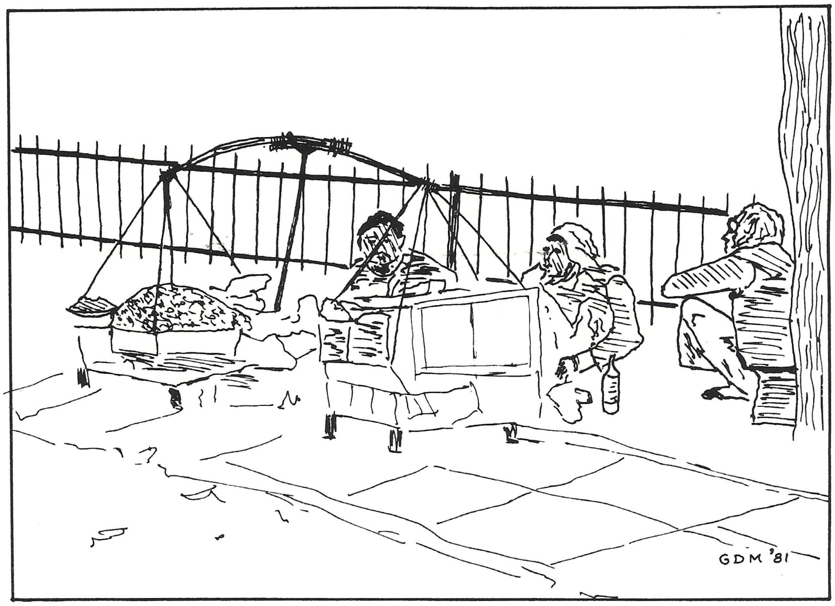
* IMCO-UNDP Inter-governmental Maritime Consultative Organization - United Nations Development Program



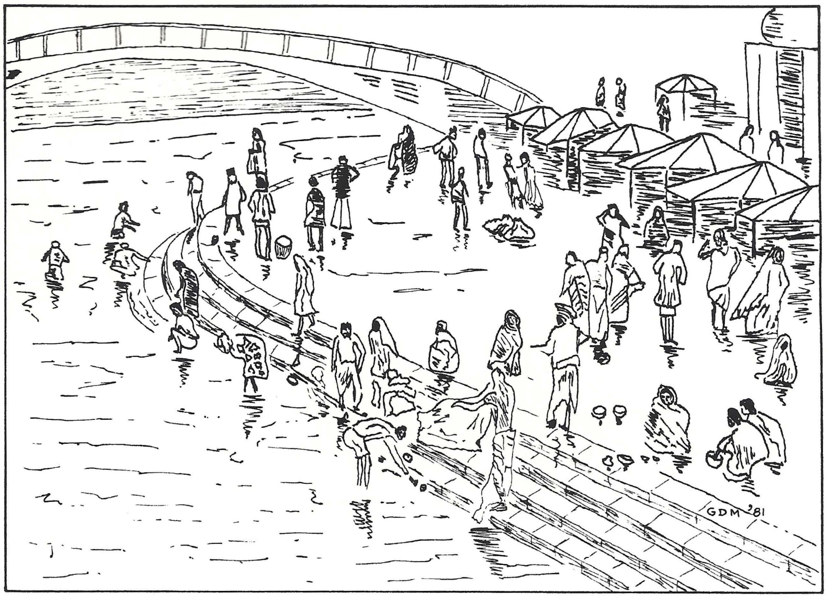
The Arabian Sea washes the excellent beaches of Goa with a warm, gentle surf. Swimming and sunbathing are popular pastimes, but we never found the beaches too crowded. The villagers live on the edge of the ocean, in huts woven from palm leaves. The long fishing boats are pulled up on to the beach at night.

In the cities the most usual modes of transport are taxis, scooters, bicycles, rickshaws and buses. Once outside the city, the two-wheeled cart, drawn by oxen, horse, camel or water buffalo, is a most common site. We saw a lot of goods being moved from field to market or factory by these hard working animals.



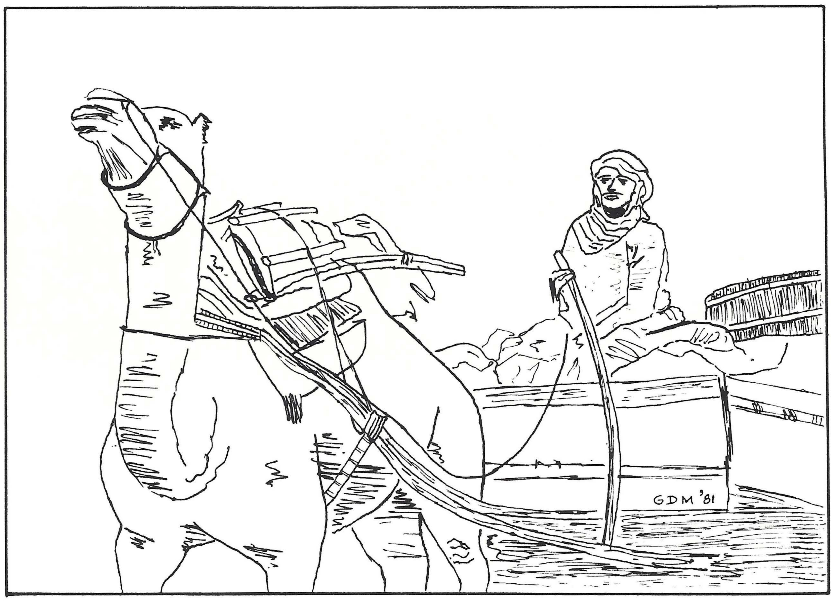


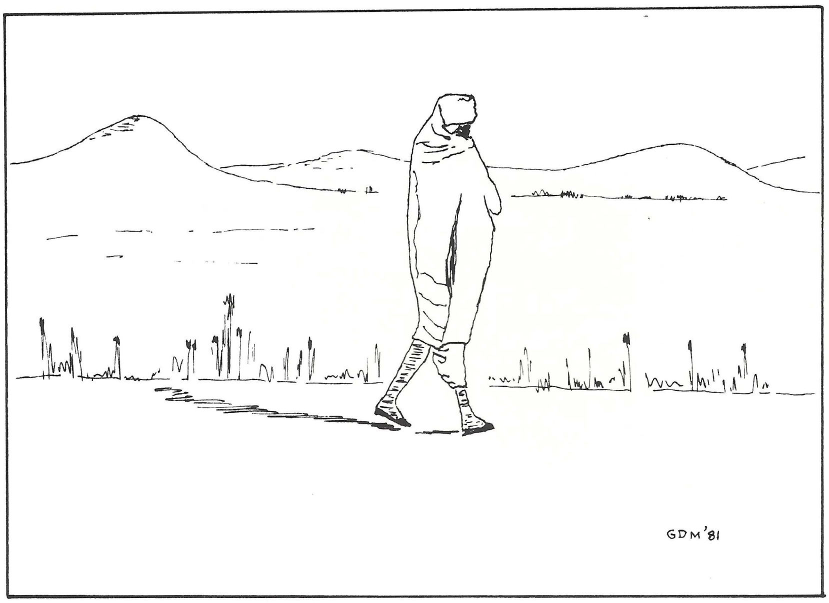
Poverty and success are both part of the personality of Delhi. Less than twenty percent of the Indian population dwell in urban centres. City life seemed painful for the poor and unemployed, but the well publicized government slogan 'food and work for all' gave us hope.



We travelled to the River Ganga which originates in the Himalayas, land of the gods. Hindus believe the river to be holy, and that the water will purify them. People bathe in the river at Hardwar, and empty the ashes of the dead into the cold water. At night, leaf cups are filled with flowers and a lighted candle. Then they are set afloat on the river.

The trip from Delhi to Hydrographic Headquarters gave us an opportunity to see some of the Indian countryside. We passed through crowded towns where the number of people on foot, on bicycles, in rickshaws and in carts brought our transport (a UNDP car and driver) to a standstill. Outside the towns we passed through picturesque farm lands and shared the road with numerous buses and animal-drawn carts. We were able to see the Himalayas from Hydrographic Headquarters in Dehra Dun.





We saw many Muslims in India. Mohammed, born in Arabia six-hundred years after Christ, taught the people to worship one god, and eventually united Arabia under Allah. In the thirteenth and fourteenth centuries, Muslim and Moghul invaders brought the religion with them to India.

We travelled by bus to Agra to see the Taj Mahal. In 1632, Emperor Shahjahan built the mausoleum when his favorite wife died. It took twenty-thousand men over twenty years to build the white marble structure on the banks of the River Yamuna. The emperor was deposed by his son before he was able to complete his plans to build a similar structure, in black marble, on the opposite side of the river. He spent the rest of his days under house arrest at Fort Agra.

Some of our free time was spent admiring the many forms of Indian art. The traditional drawings inspired some of our own.

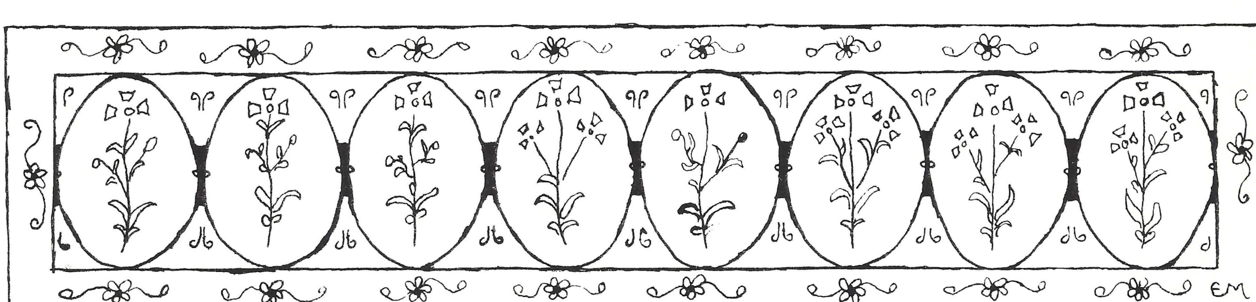
At 2 A.M. on January 21st, we took a taxi to the Delhi Airport. We were taking with us a mind full of memories, a diary full of events, a suitcase full of exposed film and souvenirs, and a changed outlook on life. We are grateful to all of you in Goa, Delhi and Dehra Dun who made our stay so memorable.

Eva

Eva Macdonald

George

George Macdonald



Lighthouse. Edition No. 23, April, 1981

Range Errors In Microwave Systems

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INTRODUCTION

At coffee the other day, in the course of discussing corrections for clock synchronization and clock rate in rho-rho Loran-C, one hydrographer said "What I like is something simple; something you just turn on, and it comes up with the right numbers, like Miniranger."

Well, table 1. shows what happened when we turned on Miniranger at the Margaretsville Dolphin on four occasions during the Bay of Fundy Loran-C calibration in April 1980. The readings have errors varying from 10 to 50 m.

To clear up one point right away, we think the problem is due to low signal strength, and so would occur on any pulse-measuring microwave system, (i.e., Miniranger or Trisponder). Hence the title of this note. (The problem might or might not occur on phase comparison microwave systems (Hydrodist, Autotape) depending on whether the cause of low signal strength was destructive interference from reflections, or attenuation.)

Other people have made extensive tests of the accuracy of pulse-measuring microwave systems, particularly as a function of range and beam patterns (Anderson, Lusk and Coldham, 1970; Mortimer, 1972), while others have investigated range holes (Allistone, 1976; Gilb and Weedon, 1976). Casey's work, to be reported at the 1981 CHS conference, will probably shed a lot more light on the topic. This note enlarges on the "Margaretsville Dolphin errors" and suggests some steps to guard against undetected bad fixes.

READINGS AT MARGETSVILLE DOLPHIN

The interesting thing about the very large errors at Margetsville Dolphin is that on four occasions elsewhere in the calibration area we ran into what was probably a range hole in the Ile Haute transmission at distances of between 21 000 and 23 000 m, just where these readings fall. The range hole was off Black Rock, where we got good readings on Ile Haute at 13 km, on a baseline crossing (table 2), so there doesn't seem to have been any obstruction on that bearing which might otherwise account for the gap in coverage. There was no obstruction on the Ile Haute -Margaretsville line either, as shown by the crossing of that baseline at 14 km from Ile Haute (table 2).

These baseline crossings plus the tellurometer calibration (table 3) show there was nothing wrong with the control or the calibration settings. So it looks as though the error of + 28 m (average) at Margaretsville is connected with being on the edge of a range hole, where destructive interference from the reflected wave was reducing signal strength. Note that the error is worst on day 117 when wet fog was probably reducing signal strength further still. Not surprisingly, the code 3 transponder, 95° off beam centre, was affected even more on that day.

The dangerous thing about these errors is that we could not tell just by looking at the range console that there was anything at all wrong.

ANOTHER CAUSE OF RANGE ERROR

In Mahone Bay we were measuring a baseline crossing by taking readings every few seconds, and wondering as we looked out of the window what was going to happen when the transponder on Aspotogan Hill went behind the trees on Tancook Island, which lay between us and Aspotogan. What did happen was that the range, which had been increasing very slowly, abruptly jumped by 30 m, and changed from being smooth (±2m) to being very jittery (±15m).

Day/time (AST)	Ile Haute Code 2 (30° off beam centre)			Ile Haute Code 3 (95° off beam centre)			Weather
	Reading	Std. Devn.	Error	Reading	Std. Devn.	Error	
116/0640	22 865	±3	+23	Not interrogated			Calm. Fog on hilltops.
116/1935	22 852	±1	+10	22 865	±2	+23	Calm. Fog on hilltops.
117/0730	22 893	±24	+51	Would not respond			Calm. Wet fog.
118/0800	22 870	±4	+28	Not interrogated			Calm. Fog/haze.

Range computed from survey: 22 842

Table 1: MRS ranges (metres) on Ile Haute measured at Margaretsville.

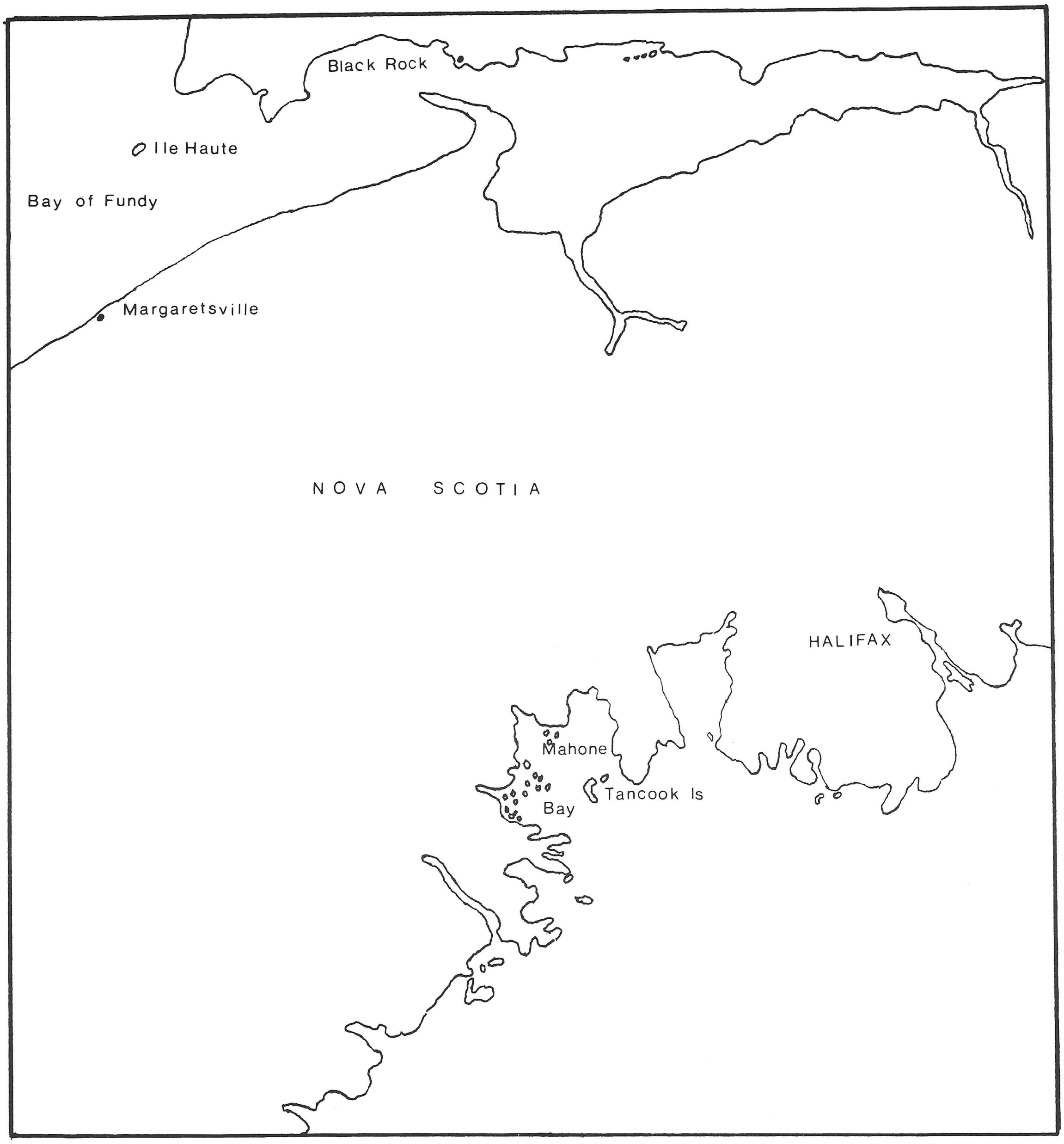

Figure 1. Survey Areas.

Transponders forming baseline (Approx. Ht.)	(Approx. dist. from crossing point)	Minimum sum on baseline crossings	Calib. corrn.	Obs. base-line	Comptd. baseline
Ile Haute Code 2 (110 m) (14 km)	— Margaretsville Lt. Ho. (12 m) (9 km)	22 887 22 887	-2	22 885	22 883
Il Haute Code 2 (110 m) (13 km)	— Black Rock (10 m) (8 km)	21 152 21 152	-3	21 149	21 150
Il Haute Code 3 (110 m) (13 km)	— Black Rock (10 m) (8 km)	21 150 21 152	-2	21 149	21 150

Table 2: MRS checks by baseline crossings.

Transponder	Corrn. at 3 845 m	Corrn. at 19 312 m
Ile Haute Code 2	0	-1
Ile Haute Code 3	0	0
Margaretsville Lt. Ho.	+1	-4
Black Rock	0	-2

Table 3: MRS calibration against tellurometer

We were able to see what was happening on this calm day, with a slowly changing range, but there was no break in the "video received" indication and if we had been running lines on a rough day the error would have been hard to detect.

THE PROBABLE EXPLANATION

The applications note on Motorola's signal strength counter for use with the MRS III includes a graph of range error versus signal strength which shows an oscillating error of ± 5 m as a critical low signal level is approached, followed by a dramatic increase in error as soon as the signal goes below that level. However, this accuracy break-point occurs well above the signal strength threshold of the receiver, so that there is a zone of low signal strength within which the receiver is still tracking and the "video received" is flashing regularly, but the ranges have large errors. We were probably in this zone on the edge of a range hole at Margaretsville Dolphin, and when looking at Aspotogan through the trees of Tancook Island.

HOW CAN WE ELIMINATE GROSS RANGING ERRORS?

The most immediate solution is probably to use a signal strength alarm to detect and reject readings on weak signals. Casey's work at CCIW in the summer of 1980 showed that Motorola's signal strength meter is a senstive indicator of the accuracy break-point. It can be interfaced with an alarm which burns a red light when the signal strength falls below a preset level. Each range console/receive-transmit unit fitted with the alarm has to be individually calibrated in the lab to find the accuracy break-point, and to set the signal strength alarm a safe distance above this.

A longer term solution is to implement automatic data logging at a high data rate and, most importantly, to introduce multi-range logging. We have some chance of detecting errors with a computer by analysing trends and scatter from data recorded every few seconds. A parallel and more effective approach is to record all transponders that can be received and look at the residuals from the multi-range fix. These are generally a sensitive indicator of positioning problems from a variety of sources. Signal strength (which can also be recorded digitally) can be used in conjuction with residuals to help sort out whether the cause lies in the range measurement or elsewhere (such as errors in control). Many oil companies now insist that their survey contractors measure a minimum of 3 ranges(Riemersma, 1979). The Canadian Hydrographic Service lags behind industry in this respect.

Finally, we should test the "space diversity" option, consisting of two receive-transmit units (RTUs) mounted one above each other. RTUs are expensive, but so is moving transponders around to cover range holes. At least one private contractor uses space diversity and says it helps.

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Gilb, T.P. and G.F.C. Weedon. 1976. "Range Holes and what to do about them" LIGHTHOUSE edition 13.

Mortimer A. 1972. "An evaluation of the Trisponder positioning system" Pacific Marine Science Report 71-9.

Riemersma, J.G. 1980. "Quality Control of Offshore Positioning Surveys" International Hydrographic Review LVII(2)

Answers to Taking A Poke

Al	5 1/2 grams
Bruce	6 1/2 grams
Charlie	7 grams
Dennis	4 1/2 grams
Ed	3 1/2 grams

Sounding operations in Atlantic Region were disrupted when the survey crew took time out to enter the Whaler Race during the 1980 Joseph Howe Festival in Halifax. The Regional Hydrographer , with shouts of "Get the lead out!", egged the team on to a fifth place finish in their heat. The crew were: Doug Frizzle (cox'n), Peter Morton, Jim Ross, Adam Kerr, Dave Roop and Allan Smith (rigging the transducer).

CHA Personal Notes

Pacific Branch

In February, seven of the hydrographers travelled to Vancouver to write their CLS examinations - The results are not back yet, but we wish them all success; a lot of hard work went into preparing for those exams. Congratulations to our recently installed national president, *Tony O'Connor* and vice-president, *Jim Vosburgh;* we know both of you will do a super job during your terms of office. Congratulations also to *Barry Lusk* and *John Smedley* for their recently received Suggestion Awards. Curling is winding to a close and our Mariners softball team is well into spring training (spring starts before June out here); so far no arm injuries have been reported either on or off the field. The seasonally mild weather has made it difficult for the many ski buffs in our region to find good snow; however four diehards, headed by our past vice-president, *John Watt,* apparently found sufficient snow on a local hill for a week of enjoyable skiing and while there, are rumoured to have offered their professional services to survey a hot tub or two. *Tony O'Connor* reports that he and his survey party are eagerly awaiting the arrival of the HUDSON and the hydrographers from other regions who will all too soon be joining the Beaufort Sea Polar Bear Club. The training courses being taken in preparation for this survey have produced a proliferation of certificates on office walls - no graduates of the University of Tuktoyaktuk however.

Central Branch

During the first three weeks in January, *George Macdonald* lectured on Automated Data Collection and Processing at the Hydrographic School in Goa, India and visited Headquarters in Dehra Dun. Shortly after his return, George presented an interesting non-technical account of his travels in India. *John Dixon* co-ordinated this year's CHS display at the International Boat Show in Toronto, Ontario. The display included demonstrations of the steps required to produce a chart. Congratulations are extended to *Paul Davies* and *George Fenn* for receipt of their Suggestion Awards. Paul suggested range extenders be installed on Polar Continental Shelf Project helicopters so that the previously unused portion of the fuel tank could be filled and thereby reduce the number of fuel stops. George's idea was to replace the lumber used to construct survey targets with reuseable aluminum. Six hydrographers from Central Region wrote the Canada Lands Surveyor's legal exams in Toronto on February 19th and 20th. A great deal of effort went into the preparation for these exams and we wish all the participants success. The region lost the services of *Brian Tait* as he moved to Ottawa to assume the duties of the Chief of Tide, Currents and Water Levels. We wish *Brian* good luck in his new position. *Helen Fuchs* and *Denis Pigeon* joined the cartographic section as term employees. We welcome them both to Central Region and hope their stay is permanent. The Hydrographic and Tidal field parties left for McClintock Channel and Norwegian Bay respectively at the end of February. The Hydrographic Base Camp, which was left standing the previous year, remained relatively intact and sustained only minor damage.

Ottawa Branch

The Ottawa Branch sponsored another successful Christmas luncheon which was attended by 100 past and present members of the CHA and/or CHS. Plaques commemorating combined service of 100 years were presented to three senior staff members who retired in December: *Frank Strachan* who retired as Chief of Cartographic Support Services, *Fred Pittman* who retired as Chief of Chart Production, and *Warren Forrester* who retired as Chief, Tides, Currents and Water Levels. In December a new organization of the Chart Production Branch was announced. The position of the Chief of this section is expected to be filled on a rotating acting-assignment basis for the next two years. *Brian Tait* came to Ottawa in February to assume his duties as Chief of Tides, Currents and Water Levels. Two new term employees joined the CHS early in 1981. *Lynn Preston* joined the Planning Section and *John Narraway* joined Geoscience Mapping. *Jean Papineau* has joined the Nautical Information Section as a permanent employee. *Doris Erwin,* Secretary to the Dominion Hydrographer, is currently on a one-year assignment with the Fisheries Economic Development Directorate. After 15 years with the CHS, *Mario Piamonte* is leaving the Cartographic Systems Section to join DEMR as the Head of Software Development for Topographical Surveys. *Russ McColl* of the Technical Records Section returned from French language training just before Christmas. *Jim Bruce,* Chief of Nautical Information has now been joined by *Neil Anderson,* Director of Planning and Development on French language training. *Harold Comeau* returned to Ottawa to assume his added responsibilities as CHA Vice-President of the Ottawa Branch, after spending two months in Dartmouth as acting-Chief, Chart Production. *Bert Smith,* from Atlantic Region is now in Ottawa on a special three-month assignment.

Atlantic Branch

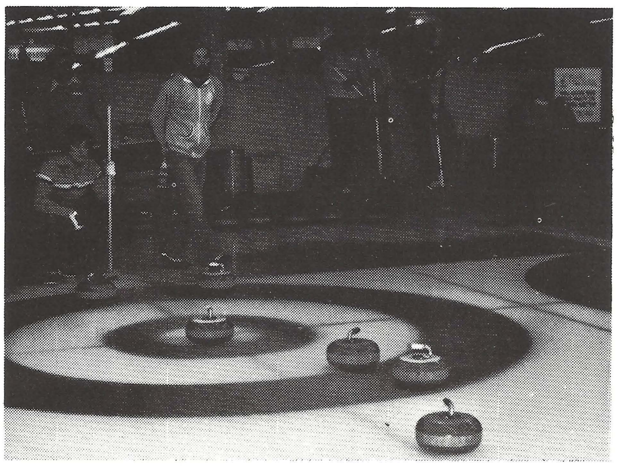
Over the past few months there have been a few personnel changes here in the Atlantic Region; *Reg Lewis* joined us from Burlington as head of Hydrographic Planning and Records; *Ted Radmore* transferred to the Aeronautical Charting Division of E.M.R. in Ottawa; and *Charles Legasse* resigned. *Julian Goodyear* will be representing the C.H.S. this summer in the U.S./Canada exchange program. A two year exchange will see *Paul Bellemare* joining us here and *Kent Malone* going to Quebec. Congratulations are extended to *David Roop* and *Bruce MacGowan* on their recent marriages. Several staff brought new hydrographers and cartographers into the world this year; *Dave* and *Theresa Blaney* - a boy; *Julian* and *Gail Goodyear* - a girl; *Roger* and *Rhoda Jones* - a boy; and *Charlie O'Reilly* and wife - a girl.

Quebec Branch

Paul Bellemare has accepted a two-year exchange to the Atlantic Region where he will be working on the aerial hydrography project. *Kent Malone* will replace *Paul* during his prolonged absence. *Danielle Simard* has recently returned from Central Region where she had the opportunity to study their technical records system. *Ed Lischinski,* from Atlantic Region, is presently training our cartographic staff in the use of our new photo-reproduction lab. *René Lepage* is our newest supervisor. *Richard Sanfaçon* has been elected branch vice-president of the Canadian Hydrographers' Association. The secretary-treasurer is *Patrick Hally,* and the two executive members are *Jean-Yves Poudrier* and *Ron Saucier* (Past vice-president).

H_2O Bonspiel

On Feb. 14 curlers gathered at the Humber Highlands Curling Club to participate in the 10th anniversary of the H_2O Bonspiel sponsored by Central Branch of the Canadian Hydrographer's Association. This year's Bonspiel co-ordinator was Craig Fisher, many thanks Craig for a fine day of curling.



"The Valentine's Day Massacre"

The rink dubbed "the untouchables" skipped by Danny Mahaffy emerged as the winners of the "A" event.

(From Left) Linda Collins, Geof Thompson, Dennis St. Jacques and Danny Mahaffy

The "B" event was won by Boyd Thorson's rink

(From Left) Bob Covey, Mike Powell, Francine Daechsel and Boyd Thorson (seen here shaking hands with Craig Fisher)

Valentines Day "Turkey Shoot"

This years recipient was Joanne Tinney (or was it the Bonspiel co-ordinator)

Donations for the bonspiel were gratefully received from the following companies:

- Motorola Military and Aerospace Electronics Willowdale, Ontario
- Marinav Corporation, Ottawa, Ontario
- Wild Leitz Canada Ltd. Willowdale, Ontario
- Port Weller Dry Dock, St. Catharines, Ontario
- J.W. Davis Company of Canada, Thornhill, Ontario
- Molson's Brewery (Ontario) Ltd. Hamilton, Ontario
- Ross Laboratories Incorp., Seattle Washington
- Letraset Canada Limited, Burlington, Ontario
- The Royal Bank of Canada, Burlington, Ontario
- Carling O'Keefe, Rexdale, Ontario
- Tracked Vehicle Repair, Mississauga, Ontario
- Rapid Blue, Hamilton, Ontario

Central Branch C.H.A. Broomball

The 1980-81 Broomball season was a resounding success; a total of twelve games were played this season. Larger turnouts than in previous years are indicative of the spreading enthusiasm for the sport amongst the cartographers and hydrographers.

News from Industry

Towing Curve Report from Klein Assoc.

Klein Associates has put together a 16 page report on the towing characteristics of Side Scan Sonar towfish. The Report includes computer-made charts detailing the amount of towcable required to tow the fish at a desired depth. Also, it demonstrates how the use of depressors, both dead weight and hydrodynamic, can increase the effectiveness of the tow.

The charts detail calculated towing curves when towing with dead weight depressors to 1,000 pounds as well as hydrodynamic depressors. The Report should be helpful in planning equipment needs and approximating time requirements for surveys.

To obtain a copy of the Report, contact Bill Key, Marketing Specialist, at Klein Associates, Inc., Klein Drive, Salem, New Hampshire, U.S.A. 03079, Telephone (603) 893-6131, Cable SONAR, Telex 947439.

MARIN Formed from Merger of NSMB and NMI

The merger of the Netherlands Ship Model Basin (NSMB) in Wageningen and the Netherlands Maritime Institute (NMI) in Rotterdam, will be legally effected on 1st January 1981.

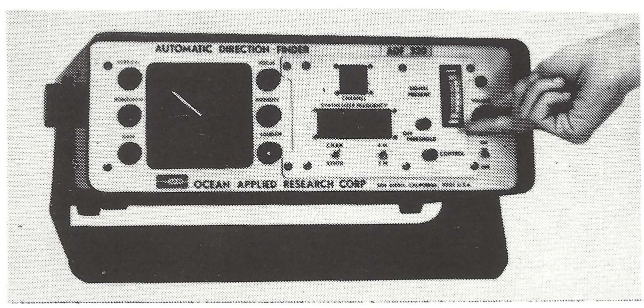
Negotiations between the Boards of both foundations led to the conclusion that a full amalgamation would eliminate duplication of research efforts. The reciprocal addition of fields of specialization, will enable the new combination to widen the scope of its research and consultancy services, and to intensify an interdisciplinary and integral approach in solving both theoretical and practical maritime problems.

For further information;

MARIN - Rotterdam
P.O. Box 1555
3000 BN ROTTERDAM
The Netherlands
Telephone: + 10-114768; ext. 136
Telex: 27067 nemar nl.

O.A.R. Introduces New VHF Direction Finders

New, "wide frequency range" variations of the popular Model ADFS-320 VHF Band Automatic Direction Finder were recently announced by O.A.R., a Division of General Indicator Corporation. O.A.R. manufactures a line of compact, portable, radio locating aids for security, law enforcement, search-and-rescue, air traffic control, marine navigation, industrial communication, and military applications.



Customers can now order the Model ADFS-320 as a standard, stock item with full frequency coverage between 108 and 174 MHz. Wider range versions such as 70-250 MHz, 25-250 MHz, and 100-500 MHz are also available. The compact, portable receiver contains a CRT direction display, field-strength meter, speaker, all operating controls, and runs from battery or AC power. Tuning is accomplished using a manually programmed synthesizer with 1 kHz resolution. Several "custom-design" type features are offered as standard options with the Model 320, including choice of interchangeable automobile roof/aircraft or ship/base-station type antenna mounts; factory pre-programming of the synthesizer for switch selection of 1 to 99 customer specified frequency channels; addition of frequency scanning circuit; addition of "track-and-hold" for the CRT direction display (to retain bearings on short signal transmissions); digital bearing readout (in addition to CRT display); and an economical "remote control" system, with microprocessor based computer, for operating 1 to 10 distant ADF sites over telephone lines or microwave link.

Notes

CIS Law Courses

As part of the certification program for Canada Lands Surveyor, the Canadian Institute of Surveying sponsored two law courses during the past year. The courses, entitled "Acts and Regulations" and "Survey Law" were presented by the Canadian International Boundary Commissioner, Dr. A. McEwen. A total of 32 CHS personnel attended the courses which were offered in Ottawa, Ontario during March and April, 1980; in Burlington, Ontario during October, 1980; in Sidney, British Columbia during November, 1980 and in Halifax, Nova Scotia in January 1981. Of the 27 candidates from CHS that attempted the examinations for the law courses, 18 were successful.

For those hydrographers interested in applying for CLS certification under the grand fathering provisions, please note that the deadline for applications is September 13, 1981. The last special examination for these candidates will be held in February, 1982. For many this is a once in a lifetime opportunity and you are encouraged to take full advantage of it. Bonne chance.

Navigation Group to Meet

The International Omega Association will hold its 6th Annual Meeting on 18 to 20 August 1981 in Montreal, Quebec, Canada. Topic of the meeting will be "OMEGA--A Positive Future". Papers are planned to emphasize Information Processing, Special Applications, and Operational Problems and Procedures. A system review including current status and plans will also be presented.

Formed in 1975, the International Omega Association exists for the benefit of individuals and organizations having a common interest in the art of navigation by means of the International Omega system.

Further information is available from the association at P.O. Box 2324, 1720 S. Eads Street, Arlington, Virginia 22202, USA.

Hydrographic Surveying Career Booklet Published

An international guide to careers in hydrographic surveying has been published by the Hydrographic Society. The two-part publication comprises an international section together with a national supplement in pocket insert form.

The international section outlines full details of the world's three principal hydrographic institutional organisations as well as required standards of competence, courses, qualifications and general career opportunities. A UK national supplement, setting out all leading professional associations and learned societies together with available courses and qualifications, is provided as a special pocket insert. Other national supplements are to be supplied for additional insertion as and when they become available.

Copies of the booklet, price 75p each, are available post-free from The Hydrographic Society, North East London Polytechnic, Forest Road, London E17 4JB (Tel: 01-590 7722).

North American subscribers may obtain copies, price $1.80, from The Society's US Branch at 6001 Executive Boulevard, Rockville, Maryland 20852 (Tel: (301) 443-8013).

Fourth Canadian Symposium on Navigation

The Fourth Canadian Symposium on Navigation will be held in Halifax, Nova Scotia on Nov 18th and 19th, 1981. The Symposium is sponsored by the Navigation Society of the Canadian Aeronautics and Space Institute. The purpose of the Symposium is to exchange information and discuss the future of Marine Navigation in Canada. Papers are invited on the following topics:

1) Administration & Government Operation (e.g. the Regulatory Framework - National and International; Aids and Facilities for Traffic Management; Surveillance, S.A.R., and Enforcement Operations; Training)
2) Exploration (e.g. Offshore Positioning and Survey; Undersea Operations; Ocean Science)
3) Commercial Operations (e.g. Marine Transport; Offshore Support Services; Fisheries; Pipelines)
4) Recreation and Pleasure Craft
5) New Developments in Equipment (e.g. Navstar/GPS; Radio Positioning Systems; Collision Avoidance Radar; Dead Reckoning Systems - IN and Doppler)
6) Air and Land Applications

Submissions including abstracts and names and addresses of authors should be sent before July 17th, 1981 to:
The Executive Secretary
Canadian Navigation Society
Saxe Building, 60-75 Sparks Street
Ottawa, Ontario K1P 5A5

International Symposium in Southampton

The Hydrographic Society is planning a four day international symposium, to be held at the University of Southampton on 14-17 December, 1982. The Canadian Hydrographers' Association has been asked to co-sponsor the symposium.

The symposium will include sessions on acoustic navigation, data acquisition and processing, and Civil Engineering as applied to the offshore industry.

More information may be obtained from the Functions Organizer, The Hydrographic Society, North East London Polytechnic, London, E17 4JB, England.

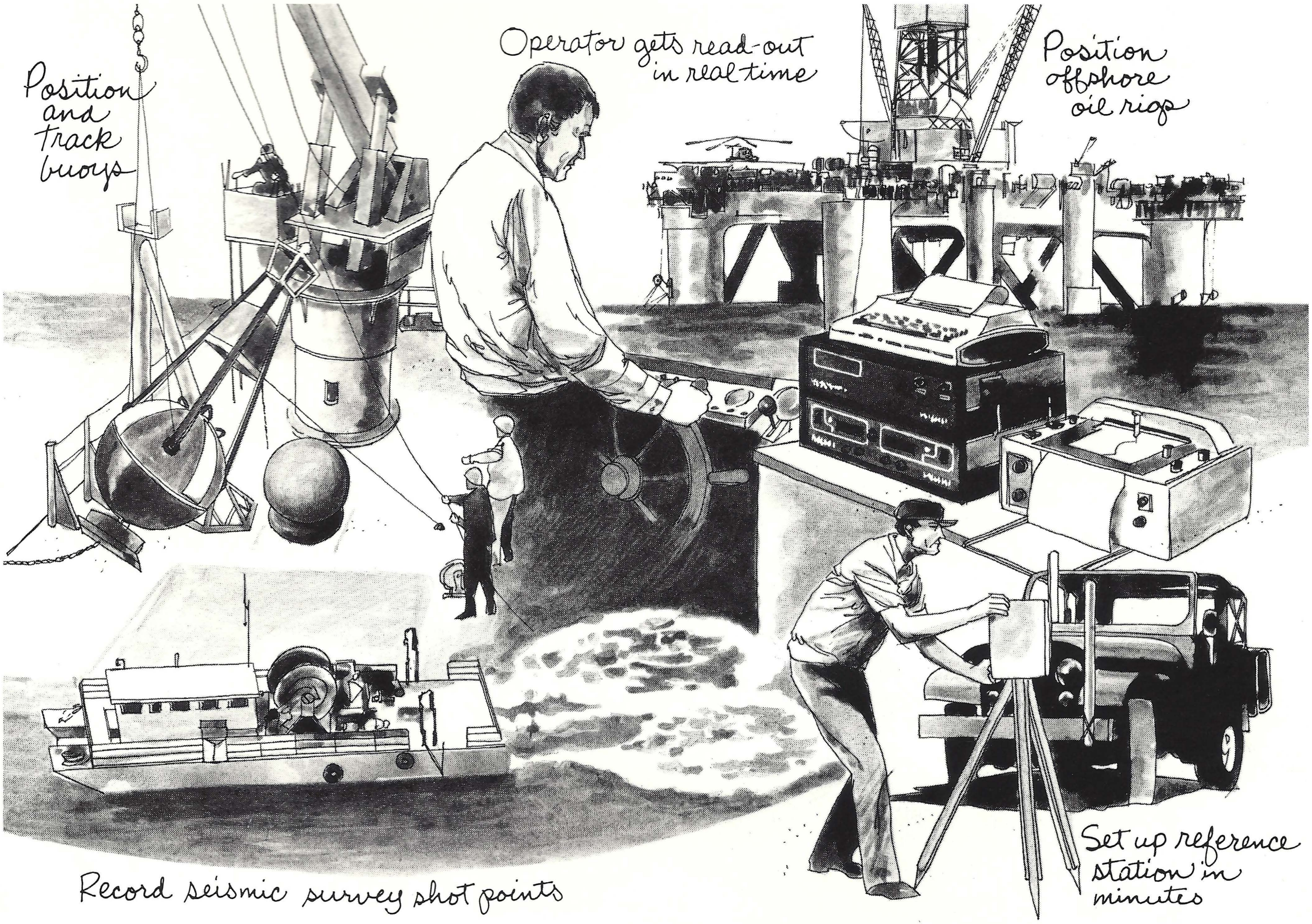
International Symposium on Ship Operations

Those engaged in the hydrographic discipline are invited to attend the International Symposium on Ship Operations from November 17 to 19, 1981, in New York City, U.S.A.

Sponsored by the Maritime Association of the Port of New York, the American Institute of Merchant Shipping, the Council of American Flag-Ship Operators, The Hydrographic Society and The Council of American Master Mariners, the symposium is intended to be the most comprehensive treatment of ship operations the industry can develop.

Topics will include: Navigation, Communications, Hydrography, Logistics of Vessel Procurement, Ship Operations and Maintenance, Regulatory Standards, Training and Ship Performance.

For more information contact: Maritime Association 34th Floor
80 Broad Street
New York, N.Y. 10004 U.S.A.
Attention: ISOSO-1981



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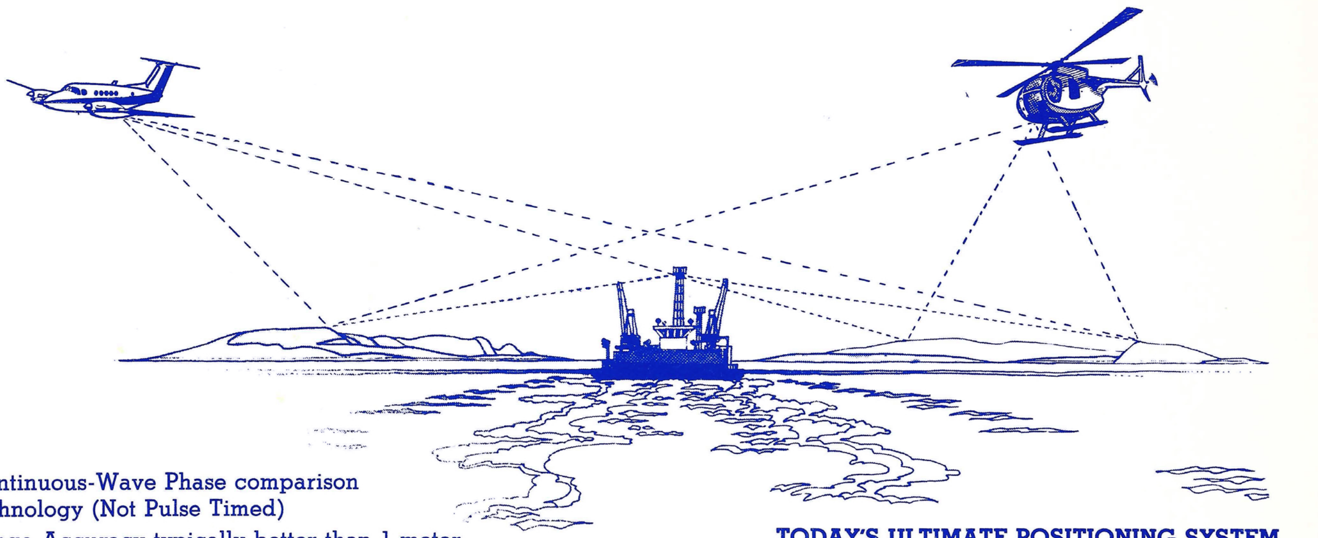

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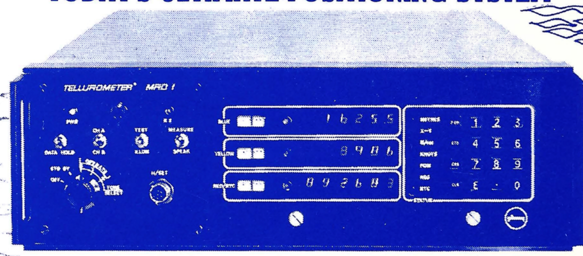

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