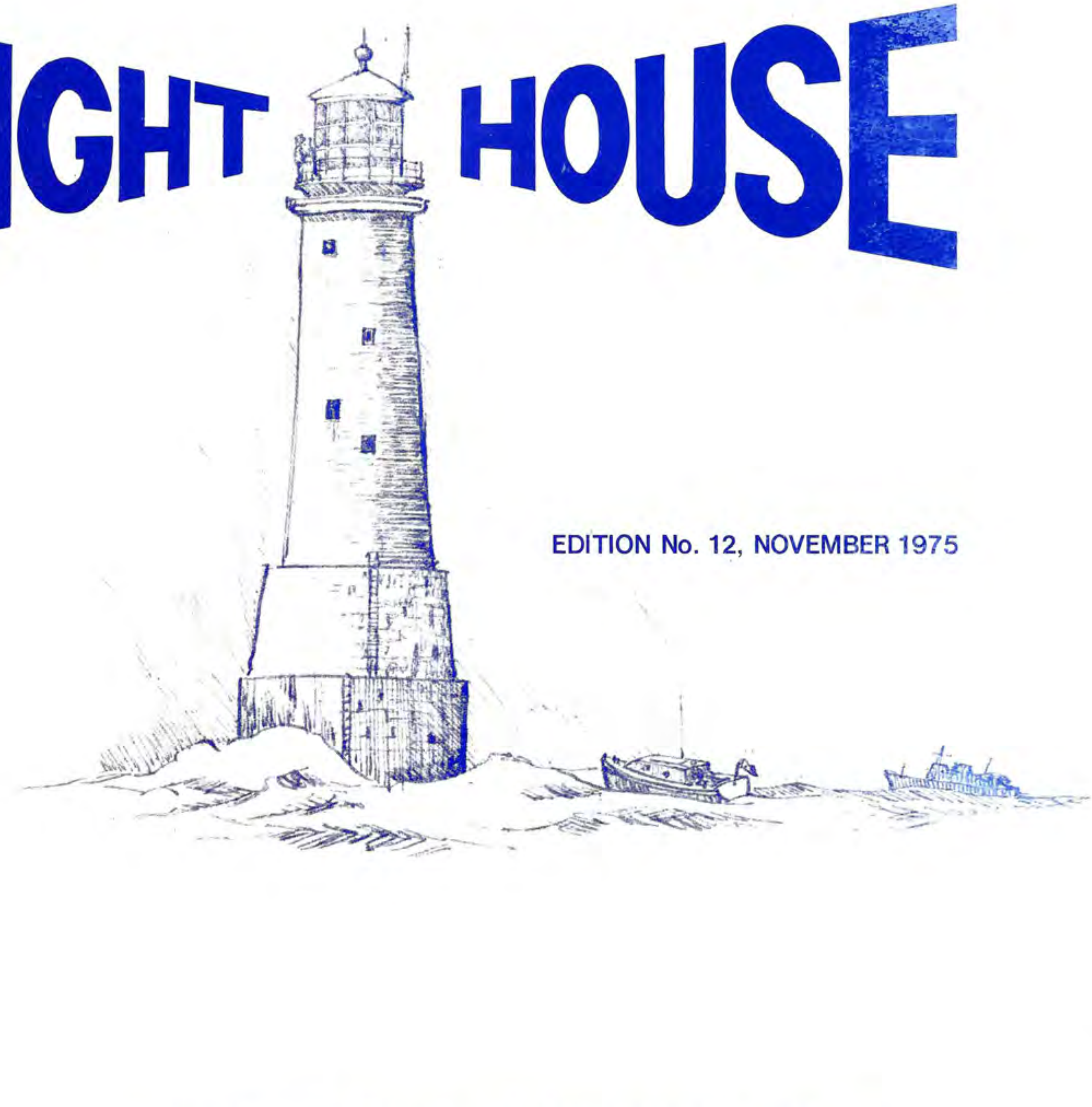
LIGHTHOUSE



EDITION No. 12, NOVEMBER 1975

Journal of the Canadian Hydrographers' Association

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Canadian Hydrographers Association

867 Lakeshore Road
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October 21, 1975

Dear Fellow Member:

I am very pleased that "LIGHTHOUSE", the official publication of the Canadian Hydrographers Association, is again available to our membership and that the journal will be published semi-annually. Under the enthusiastic Editor, Adam J. Kerr of Central Branch, "LIGHTHOUSE" will be published in March and November of each year.

I sincerely hope each of you will support this journal by submitting technical articles, noteworthy Branch or Regional activities, or any other articles or stories which would be of general interest. Although we encourage all those with a Hydrographic interest to join our Association, you do not have to be a member to contribute to or receive this journal. All articles are welcomed and will be considered by the Editor.

This particular issue of "LIGHTHOUSE" has been widely distributed. We hope that it has reached all individuals or organizations who have an interest in Hydrographic activities. If you are not a CHA member and wish to receive future copies please advise the Editor. If you require information about the aims and objectives of the Association please contact any one of our Branch Vice Presidents or myself. The Branch Vice Presidents are as follows:

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Yours sincerely,

Earl Brown
Earl Brown
National President

PUBLICATION/SUBSCRIPTION

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INTRODUCTION

This journal is the first in a new series. Although the C.H.A. Lighthouse persevered for quite a number of issues under the able George Macdonald as its editor, the lack of copy on a national basis began to dry up. Many felt that it was too good to be buried and a new editor was found. The existing unpublished copy was dusted off and the obsolete material either thrown out or brought up to date.

The Association asked that the 'Lighthouse' continue in much its same style. As the reader can see, it is not quite the same. Whether the new style is acceptable depends on the readers, and their comments to the editor on this matter will be valuable.

This particular issue seems to have taken a historical turn and we range from Captain Cook to the ASIA and thence to some obscure navigator in the Antarctic. Once again Mike Eaton has come to the fore to bring us up to date on SATNAV. PANDORA has already become a seasoned vessel and although the original article was written before the ship actually made an Arctic voyage, this new edition has been brought up to date. Incidentally, the author of that paper has also been very helpful in reviewing and editing the material. The dilemmas facing an editor when he must resolve the differences between a reviewing editor and an author are interesting and require some diplomacy. For example, who would have realized that James Cook could not have been apprenticed to the firm of John and Henry Walker but had to be apprenticed to one man, namely John Walker!

A number of articles have been promised and it is hoped that the Spring issue will contain news of what hydrographer has done what, both in the government and in industry -- but honestly -- unless you, all of you get writing and provide material, this journal will expire once again, like a codfish in the bottom of a dory!

EDITORIAL

JOINING

This journal is only in existence because of a phenomenon called 'joining'. The reasons that people join clubs, societies, associations and other organizations is worth examining. Joining is probably a protection mechanism even though the organizations themselves would advocate a dozen other reasons. Perhaps the main reason for joining is that people do not want to be left out. In some cases, such as trade unions and professional societies, they cannot financially afford to be left out.

The reason that people join scientific or technical societies is generally supposed to be for the sharing of knowledge. Today there are perhaps two main vehicles that a society will use to promote this knowledge sharing. One is the meeting, symposium or conference and the other is the newsletter or journal.

The problem with the meeting as a means of communication is that there are too many today. Almost all kinds of science and technology are much broader today than they were previously. The scientist or technician not only has meetings of his own specific discipline to attend if he is to keep informed but also those of associated disciplines. The hydrographer will not only want to attend hydrographic conferences but according to his particular interests will probably want to attend meetings on coastal engineering, shipping, remote sensing, automation, geophysics, oceanography, geodesy, cartography, photogrammetry, etc. etc. He can partially overcome this dilemma by acquiring the proceedings of the various meetings but here again he is faced with the reading of these and the digestion of the information. It should be noted that most of these meetings are arranged by specialist societies and although there may be a slight differential in the registration fee of the member and the non-member, he seldom is required to be a member.

The other communication medium of the society is a journal or newsletter. These vary greatly in content, style and frequency with which they are produced. The more scholarly examples are often subsidized on condition that they remain scholarly. This sometimes introduces the comment that such scholarly works do not really provide a communication for the majority of members. This has been overcome by some societies by having two parts of a journal or by having a journal and a supplement.

Members are usually provided with a copy of the societies' journal or newsletter or acquire it at a reduced rate. This is then promoted as an advantage of belonging to such an organization. If the matter is really examined closely most journals are read once and then shelved. Their obvious exposure on an owner's bookshelf is his stamp of loyalty to the society although he may claim that they are needed for 'frequent' reference. In truth, they are usually readily available in a close-by library. In large organizations, such as government, journals are frequently circulated. Although there may be delays in getting a copy to read, the journals themselves are not exactly the most topical. Why then should everyone have his individual journal? The answer from the producers end is very obvious because the cost versus numbers produced curve is very steep at the beginning and the project only becomes economical with large numbers.

Journals serve another important purpose besides communication between members, they are a statement of quality and of the ability the members of a society and even of a nation in that particular field. Therefore, if a society's mission is to promote the discipline and its recognition it must strive to produce a journal that is of the best quality both in content and in its ability to communicate.

But to return to 'joining'. How many organizations does a person join? We must exclude those that he may join primarily for social activity and concentrate on those that he must join for his professional well being. If he is a physician he must obviously join the medical association. If he is a scientist under the shadow of the 'publish or perish' system, then he may need to join a scientific society simply to give him an edge in getting his papers accepted. If he is a tradesman he must surely belong to a union. But what if he is a hydrographer, what must he join? Although there has been great talk about professional accreditation, it is not yet here. He can attend meetings provided the funds are available and he can read the journals from the libraries or perhaps while they are circulated -- someone must be a member in this last case. Professionally it helps if you can put on your application form for a job or on a regular appraisal form that you belong to a host of societies. Certainly it gives a certain stature to put some letters behind your name and may induce one's advancement. Probably though, except in the cases of arbitrary necessity mentioned earlier, we join because we like to be in the swim of things - basically we fear the consequences of being left out. The number of associations that we join is limited by our wallet and seldom do we examine the cold financial balance sheet of what the association will do for us.

HOW IS SATNAV. COMING ALONG THESE DAYS?

By R.M. Eaton, B.I.O. Navigation Group

I wrote about satellite navigation once before in "LIGHTHOUSE". I described it as an extraordinary breakthrough in ocean navigation; perhaps the greatest thing for oceanographers since Nansen's water collecting bottle. With average accuracy 500 m. anywhere in the world, it made possible things that would not be attempted in the days of starsights correct to 2 miles, and available only at dawn and dusk when the sky was clear. Things like laying a current meter on the ocean bed without a surface marker buoy (which the first storm might knock off anyway), and coming back four months later to release by acoustic command. But all that was somewhat "popular science" to an hydrographer; what use is ±500 m. in a hydrographic survey?

Since B.I.O. started using Satnav in 1969, there has not been any startling change in the system itself. The accuracy of the satellite's orbit prediction may have been improved a bit. Third generation receivers like the one we bought from Canadian Marconi two years ago are more efficient in acquiring and tracking satellites, and don't seem to break down, and their computer software is very easy and convenient to handle. But the big advance has come in the way Satnav has been adapted to solve hydrographic problems. Decca Lambda, Loran-C, and Doppler sonar have all been married to Satnav in a manner that has improved Satnav accuracy by an order of magnitude (scientific smoke-screen meaning "from five to fifteen times"), and virtually eliminated the serious effects of problems in the partner system, like lane-slip in Decca Lambda. It is worth getting to know something about what is going on with Satnav these days; things are getting to the stage where almost every hydrographer will run across it sooner or later.

"INTEGRATED SYSTEMS"

The strength of Satnav is that (a) although a single pass is only passably accurate, the errors tend to be random, so that they average out over a number of passes; and (b) Satnav errors are of an entirely different nature from those of earth-based navigation systems, which means that you can use one to get rid of the other's errors.

(a) It is obvious that on land you can stay in one spot for long enough to collect a number of passes and so improve Satnav accuracy, but what is not so obvious is that you can do the same kind of thing at sea. For instance you can wait until you have received three passes before saying you have a convincing Lambda Decca lane identification. Or you can compare fixes between Satnav and rho-rho Loran-C over several days to make sure you have the right drift rate for the atomic clock that runs the Loran-C receiver.

(b) Satnav does not suffer from systematic errors, such as phase lag or atomic clock drift. On the other hand it's accuracy depends critically on exact knowledge of the ship's course and speed during the pass. This makes Satnav an ideal partner for systems which have good relative accuracy (giving accurate course and speed measurement) but which are liable to embarrassing gross errors (like Decca lane-slip) that Satnav can eliminate.

I am going to outline three integrated systems: Satnav/Decca Lambda lane ident.; Satnav/rho-rho Loran-C; and Satnav/Doppler Sonar; and then say a bit about geodetic applications, and about datum shift.

SATNAV/DECCA LANE IDENT.

Shell Canada Ltd. were the first to use Satnav for lane identification, off Nova Scotia in 1970. We experimented with it on the Grand Banks in 1972, and then used on the succeeding year's offshore surveys. It works very well. Buoy-checks are only taken every few days when the ship was handy to a buoy, and on one occasion when Satnav and the buoy did not agree we found that the buoy had drifted. Since most of the survey is in deep water, a great deal of time is saved by being able to get lane ident. from any of the dozen or so good satellite passes per day, and not having to steam 100 miles to a buoy.

The procedure for a lane ident. is:

1) Record Decca readings at two-minute intervals during the pass. (One of these readings will coincide with the Satnav fix, which is computed for an exact two-minute time-mark of U.T.)
2) Compute the mean course and speed from these readings. (This takes three minutes on an off-line PDP8 or HP2100 computer.)
3) Compute the Satnav fix using this improved course and speed. (One minute on the Satnav dedicated computer.)
4) Calculate the inverse from the Satnav fix position to each Lambda transmitter, and convert this distance to a Lambda reading. You must use Paul Brunavs' phase lag corrections in the conversion (they are built into the program) or you will probably end up half a lane out. (This takes

another couple of minutes on the off-line computer.)

5) Compare Satnav Decca readings, computed as above, with the observed Decca readings. Find they differ by 0.60 lanes. Curse. Try to figure out whether Decca or Satnav is wrong.

It is rarely as bad as para 5 suggests. Two years ago, we took 113 Marconi Satnav/Decca Lambda comparisons and figured out the standard deviation of the difference between "Satnav distance to transmitter" and "Decca distance to transmitter". It was 120 metres (0.28 lanes on red, 0.44 lanes on green). Doing the approved juggling with statistics*, this means that 9 out of 10 good Satnav passes will give the correct red Decca lane, and 2 out of 3 should be right on green, which isn't bad. Furthermore, it also means there is an even chance of resolving the Hi-Fix lane, within ± 1 lane, which can allow useful work to be done on the way back to a lane check buoy.

Here's how the statistics go:

Jargon	Multiplier and Example	Meaning
Standard deviation Root mean square error (r.m.s.) 67% Probability	1σ = 120 m.	67%, or two out of three errors, will be < 120 m.
Probable Error 50% Probability	$0.67\ \sigma$ = 80 m.	There is an even chance that the error will be smaller or bigger than 80 m.
95% Probability 95% Confidence Interval	$2\ \sigma$ = 240 m.	There is a 95% Probability the error is < 240 m. or, put the other way round, a 1 in 20 (5 in 100) chance of an error > 240 m.

(These rules depend on the errors following the normal bell-shaped "Gaussian distribution", a pattern that most observables tend to follow, at least to the 95% Probability level.)

SATNAV/RHO-RHO LORAN-C

The permanent shore stations of a Loran-C chain transmit a pulse of waves at regularly repeated intervals of Universal Time (ex G.M.T.), controlled to an accuracy of ± second in 3,000 years by cesium-beam atomic frequency standards. In the shipboard rho-rho Loran-C receiver there is another atomic clock. It is generating trigger-pulses for the receiver's counting circuits at the same repetition rate as the Loran pulses are transmitted. However these trigger-pulses will not be synchronised to the instant of transmission from the shore station, so the problem is to find a time delay to apply to the receiver clock so that it's trigger pulse coincides exactly with the Loran-C transmission. Then the receiver timing circuits, which start counting on the trigger, and are stopped when the pulse arrives from the transmitter, will measure the travel time of the radio wave. This travel time is converted by the receiver's dedicated computer to a range in metres (using Brunavs' phase lags again), and combined with one or more other ranges to compute the ship's position. The computer types out position, course, and speed, at any interval required; we generally use ten minutes.

What gives us the initial synchronising time delay? You guessed it - Satnav. The way we do it is to lock onto the Loran signals and apply a rough synchronisation correction to make the ranges approximately correct (seeing we know where we are within a few km.) This will be close enough to calculate an accurate course and speed for the first Satnav pass. We use that Satnav position to recompute the Loran-C ranges accurate to a few hundred metres or so, in the same manner that we computed a Decca Lane Ident. Then we can start sounding and collecting geophysical data.

After this initial synchronisation, we sit tight until we have several more passes before making the final synchronisation adjustments, which should be good to ± 100 m.

Figure 1 shows an example from the "MINNA" survey of 1973. The data points are the correction to be made to the Loran-C master station range to make it agree with the range computed from the Satnav fix. The first Satnav pass at start-up on day 197 was off-scale, but the correction from it brought the ranges onto the bottom of the graph. After four more good passes I made a final synchronisation correction of P2 = -1.8 μ secs (540 metres). The rest of the graph shows a re-synchronisation on day 200, after we lost Loran temporarily due to antenna troubles, and then from day 201 on the Satnav agrees with Loran-C to about ± 0.2 μ sec (60 metres).

The reason that the comparisons fit a constant slope rather than a constant value is that even at an atomic clock accuracy of 1 sec. in 3,000 years, there can be differences between two cesium clocks of up to 1 μ sec, per day. We had determined before sailing that our clock was drifting relative to the Loran-C chain clock at a rate of 0.3 μ sec. per day, and that is the slope we fitted our range comparisons. (The ranges are corrected for the accumulated clock rate error in the computer before calculating the positions.)

Finally, we use Satnav comparisons when there is overland path from the Loran-C transmitter to make approximate corrections for the propagation changes. This is all described in an article by Steve Grant of the B.I.O. Navigation Group in the July 1973 International Hydrographic Review. He has found that, with Satnav, Loran-C ranges are accurate to ± 0.6 μ sec (180 m.) over water, or ± 0.9 μ sec. (270 m.) when there is some land on the path, (95% probability).

There's been a lot of talk of μ secs. Here's how they translate into familiar units:

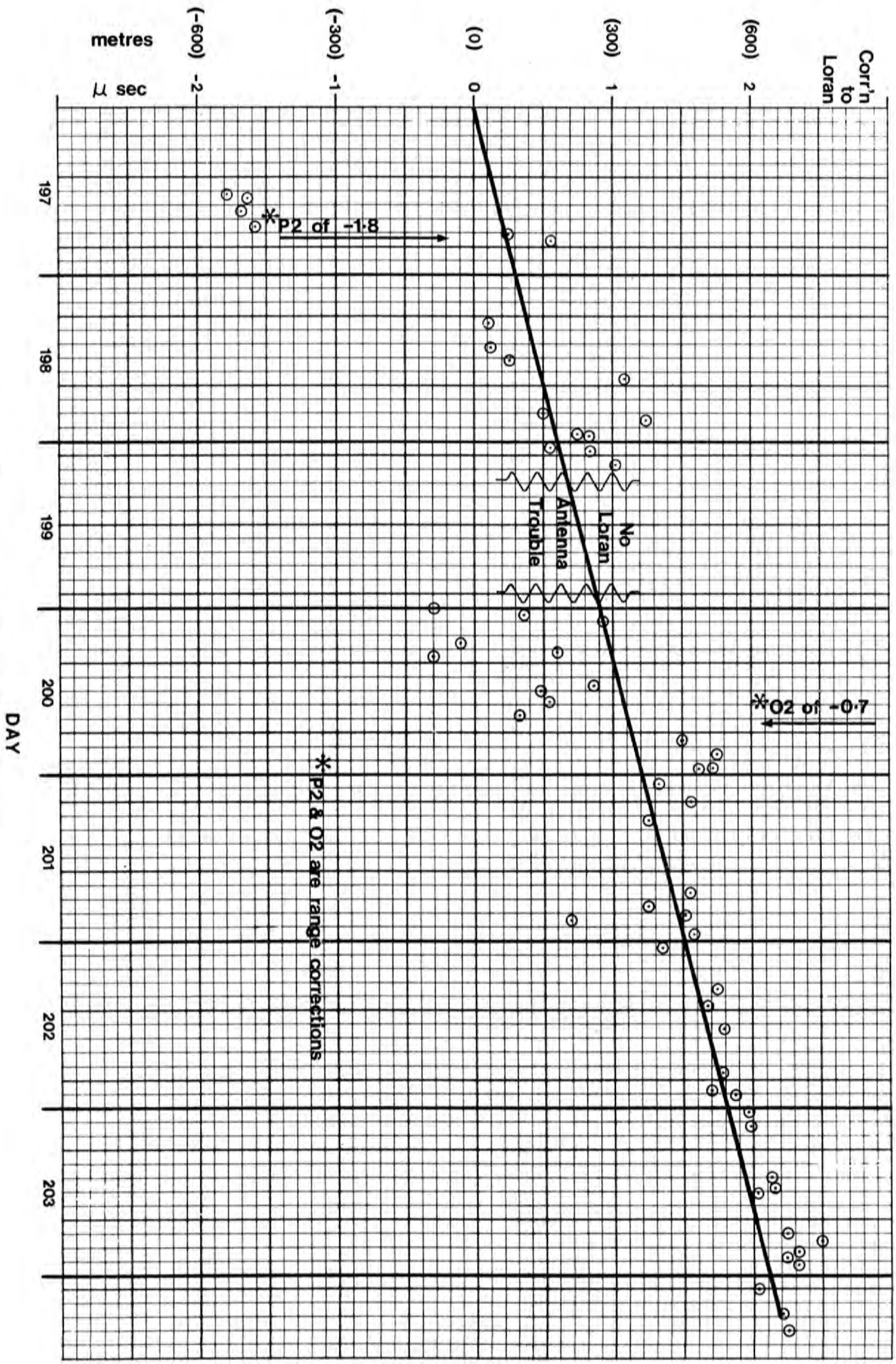


FIG. 1 - SATNAV/LORAN C COMPARISONS

(i) 1 sec. equals 10^6 μ secs
12 days is about 10^6 secs

- so comparing a μ sec to a second is like comparing two ticks of a chronometer to 12 days.

(ii) Accuracy of cesium clock $\simeq$ 1 in 10^{11}
1 second in 3,000 years $\simeq$ 1 in 10^{11}
1 μ sec in 24 hours $\simeq$ 1 in 10^{11}

(iii) In 1 μ sec a radio wave travels about 300 m.
We are looking for $\pm$ 0.2 μ sec resolution, or $\pm$60 m.

SATNAV/DOPPLER SONAR

Doppler sonar measures ship's speed by projecting a narrow sound beam obliquely forward onto the seabed; if the ship is moving ahead the frequency of the return echo will be Doppler shifted high. (Asdic operators in W.W. II could tell whether a U-boat was approaching or moving away by listening to the Doppler shift). In order to mean out certain errors, such as trim of the ship, a second beam facing aft is also added, and the mean of the Doppler shifts used. Another pair of beams facing to port and starboard measure any crabwise motion of the ship. Figure 2 gives an artistic impression of the whole set-up, (from a drawing to help the sales of the Magnavox integrated system).

The main limitation is that at the frequencies used (150 kHz for Edo sonar, 300 kHz for Ametek-Straza) the maximum depth for seabed returns is about 200 m. Beyond that depth the speed measurement is made on the very weak echoes from plankton etc. in the water mass, and is less accurate. Also, like an echo-sounder, Doppler sonar doesn't work so well in rough weather, or if the ship manoeuvres sharply.

Coupled with a good gyro, via a computer, the "Doppler Navigator" is capable of high accuracy positioning. But it must be calibrated. A gyro error of $\pm\frac{1}{2}^{\circ}$ (which is small by normal standards) represents $\pm$1% of distance run, so that after an 8-hour run at 12 kts the ship would have a 1,800 metre error in position. What do you use to calibrate it? Right first time! Satnav, which is as accurate at the end of a 100-mile run as it is at the end of a 10-mile or 1,000 mile run, and so is ideal for calibrating the gyro and the Doppler sonar. Then they in turn provide probably the most accurate course and speed available from any source for calculating the Satnav. fix.

Dabbs Control Surveys run a Satnav/Doppler sonar navigator for Mobil Oil Canada Ltd. on their tender/survey ship "Mary B. VI". It consists of an Ametek-Straza Doppler sonar and a Sperry Mk 227 gyro integrated by Magnavox with their Satnav receiver via an HP 2100 mini-computer. Dabbs had some problems in getting the system working, but it gave an impressive performance when they recently offered us an opportunity to see it, and Nick Stuifbergen of the Navigation Group went out with them to look for an abandoned drill rig site 220 km. east of St. John's, Nfld. The navigation needed to be good, as they had only the ship's sounder and an underwater TV (range about 10 metres) to find it with. The Doppler navigator was already calibrated, so when the Satnav/Doppler system said the ship was on site, they put the TV camera over the side - and found the mess of cans left by the drill rig the year before. This was a lucky run - it was certainly under ideal operating conditions - because after a post-trip gyro readjustment, the average difference between Doppler Navigator and the three Satnav fixes that were obtained was incredibly good (see the Nick Stuifbergen's Technical Report on Satnav/Doppler for details).

CHECKING UP ON THE GEODESISTS?

The Surveying Engineering Department of the U.N.B. was one of the first to exploit the potential of the Navigational Doppler Satellites for geodetic control. One early experiment that they coordinated back in 1970 involved B.I.O. and Shell Canada Ltd., with stations at Fredericton, Halifax,

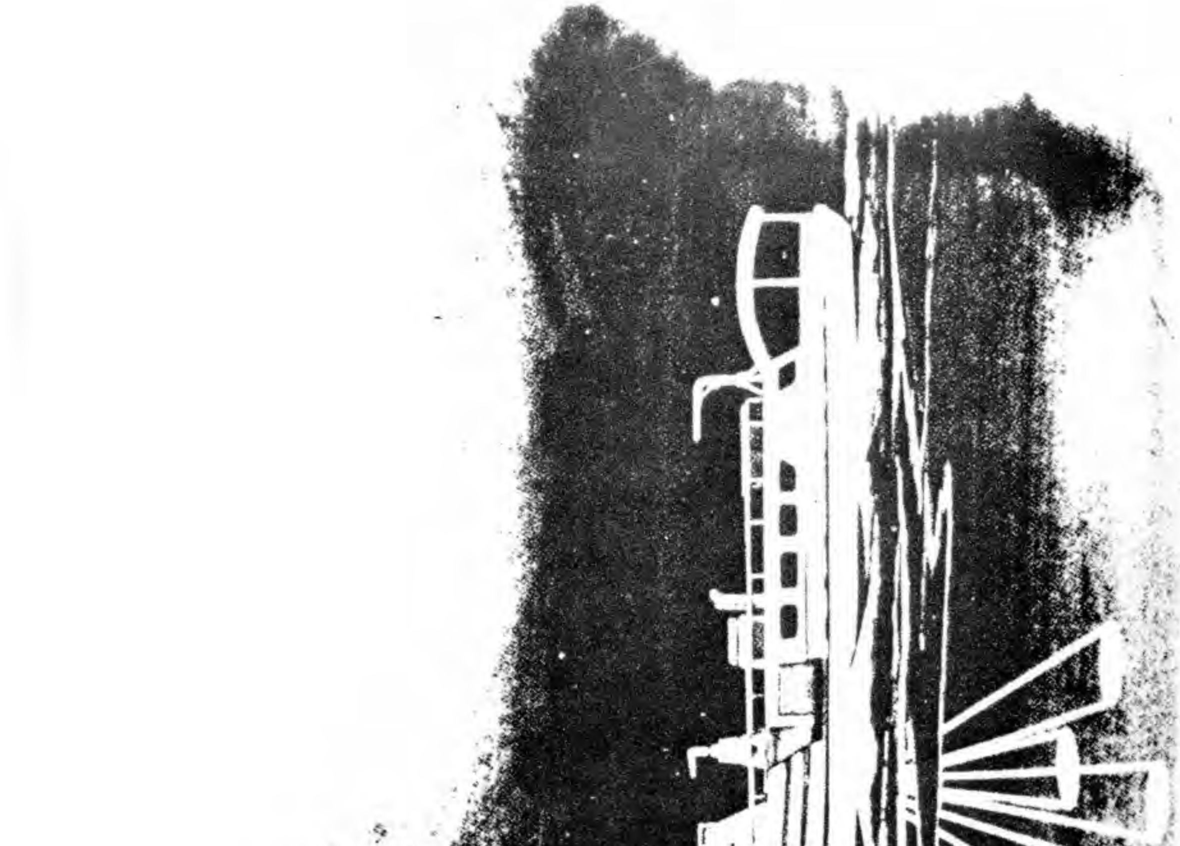


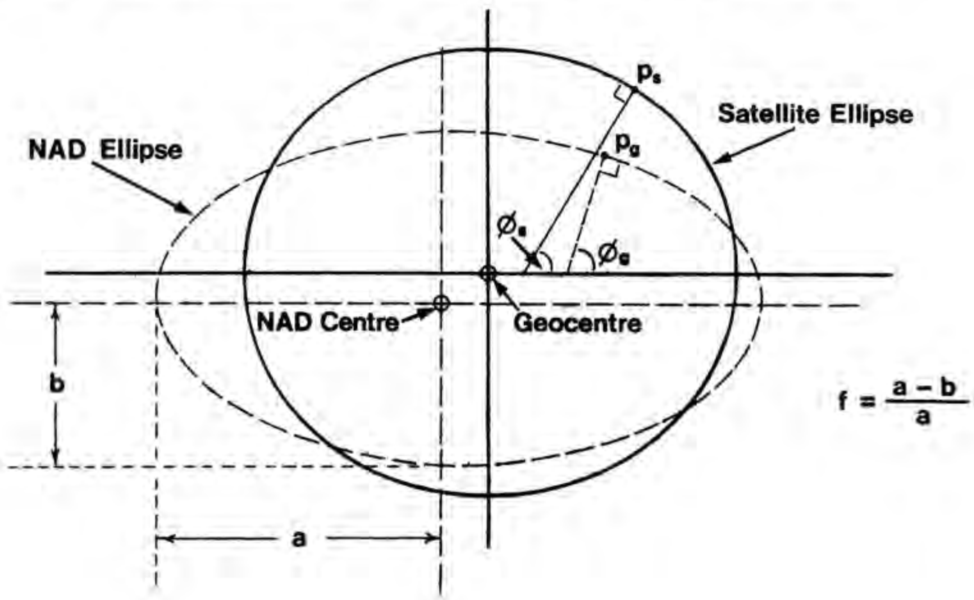
FIGURE 2 SATNAV/DOPPLER SONAR

St. John's, Nfld., and Goose Bay, Labrador. It showed that inter-station distances computed from satellite data agreed so closely with those computed from geodetic data (average difference 3 metres) that it was hard to say which was right. A recent experiment over shorter lines of less than 200 km. (where geodetic distances should be dependable) showed an average difference between Satnav and geodetic of 2 metres (Krakiwsky, Wells & Thomson in the Canadian Surveyor, June 1973). The Geodetic Survey of Canada have taken up this development, and a group under Harold Jones spent the summer of '73 tying Canada together (yes they did have stations in Quebec) from the Maritimes to the Western Arctic. At Amundsen Gulf they fixed the P.C.S.P. Decca transmitters, to provide the geodetic distances which Nautical Geodesy used to calculate the velocity of Decca over sea ice, from the readings collected by Gerry Wade's two expeditions to those parts, in April and August '73.

Of course the Americans, who we should remember provide us with navigation satellites free, have done plenty of work on these lines. Mr. E.W. Finnegan described at the 1973 Canadian Hydrographic Conference how the U.S.N.O.O. uses Satnav to establish scale and azimuth, and to tie-in isolated local surveys to a world-wide datum.

DATUM SHIFT

In the last paragraph I talked about "A World-Wide Datum". That raises a problem which was bound to crop-up sooner or later, but which has been precipitated by Satnav. The earth, as we now know from Satnav, is slightly squished, knobbly shape. In the 19th and early 20th centuries when the national geodetic surveys set out continental control networks, each region defined a regular ellipse that gave the best fit to its own part of the earth. Everyone knew that the earth was knobbly, knew that they could not calculate geodetics on the knobble but only on a regular ellipsoid, and so chose the ellipsoidal shape that best fitted the bulges of their part of the earth. Then along came satellites; by the laws of physics, satellites can only orbit around the true centre of gravity of the earth. They define a whole-earth best-fit ellipsoid which, although it is a combination of all the regional best-fits proposed so far (together with some not proposed, for lack of a geodetic survey of Antarctica, or the Pacific Ocean for example) does not agree exactly with any of them. Look at the 1927 N.A.D. It implies that if you go down into the earth a stated distance along the vertical line through a plug at Meade's Ranch, Kansas, you will arrive on the semi-major axis of the ellipsoid at a known distance from the earth's centre (we'll call it the NAD centre). And it lays down that the length of that major axis, and the flattening of the best-fit ellipsoid is that given by the values Clarke calculated in 1866. But the satellite tracking data shows that the earth is a fraction smaller at the equator, and not quite as flat as Clarke figured. It also shows that the NAD centre is about 240 m off the true centre of gravity - the "geocentre". Figure 3 is a two-dimensional attempt to illustrate the relation between "North American Datum" and "Satellite Datum", and to show how the same point p would be projected on the two surfaces, and how its <u>geodetic latitude</u> (ϕg) would differ from its <u>latitude by satellite</u> (ϕs)



Now add in two further complications:

1. There have been a number of determinations of the world-wide best-fit ellipsoid from satellite data, with space-age trade-names "Mercury"; "A.P.L. #II"; "Fischer". The best way to sort them out is by the "a" and "f" that distinguish them. The one in vogue at present has the following values, compared with NAD:

	a	f
Current Satellite ellipsoid:	6378144.0 m	1/298.23
NAD (Clarke 1866) :	6378206.0 m	1/295.0

2. If the North American geodetic triangulation was perfect, the NAD centre defined at Meade's ranch would hold for the whole network. Unavoidable errors in the network (observation errors, deflection of the vertical, etc.) upset this, with the result that so far as Eastern Canada is concerned the NAD centre is 255 m away from the geocentre, not 240 m as calculated for a wider sample of points. Its "translation components", defined as $(x_o, y_o, z_o) = (x, y, z)$ satellite - (x, y, z) NAD are: $x_o = -45$m, $y_o = 164$m, $z_o = 190$m. (Krakiwsky, 1972). The net result of all this is that in the Maritimes a Satnav position will fall about 50 metres south west of the NAD, position for the same point. To make an exact datum shift calculation, use a computer program (available from B.I.O), with the translation components appropriate for your part of the continent.

-- AND ANOTHER USE

From the MINNA data quoted earlier it looks as though the accuracy of a good Satnav pass, fed with an accurate course and speed, is about $\pm$120 m. This means it can be used to calibrate regular navigation aids such as "conventional" Decca, Loran-A, and Loran-C, without having to wait until hydrographic control of some sort is put into the area for a regular survey. We have already used it to calibrate main chain Decca and Loran-C in the Gulf of Maine.

(Look for a more detailed article on Satnav in the January 1976 issue of the International Hydrographic Review).

THE ASIA TRAGEDY

by M.J. Casey

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(Advertisement Toronto Globe, September 9, 1882)

Met. Forecast for September, 1882 (from the Globe)

"....Low pressure area situated over the Lakes region and western states."

"Lakes - fresh to strong southerly to westerly winds; fair warm weather with a few local showers....."

The synoptical weather chart for the evening of September 13, 1882 showed, among other things, a small depression situated over Manitoba. As this depression was considered comparatively unimportant it was virtually ignored. However, the next morning as the next chart was prepared it was seen that the depression had now moved to the north shore of Lake Huron. Its gradients had steepened, the curves closed up in the centre and its rapidity of translation and intensity of development heralded the birth of a hurricane. The centre had travelled over 500 miles in less than eight hours.[1]

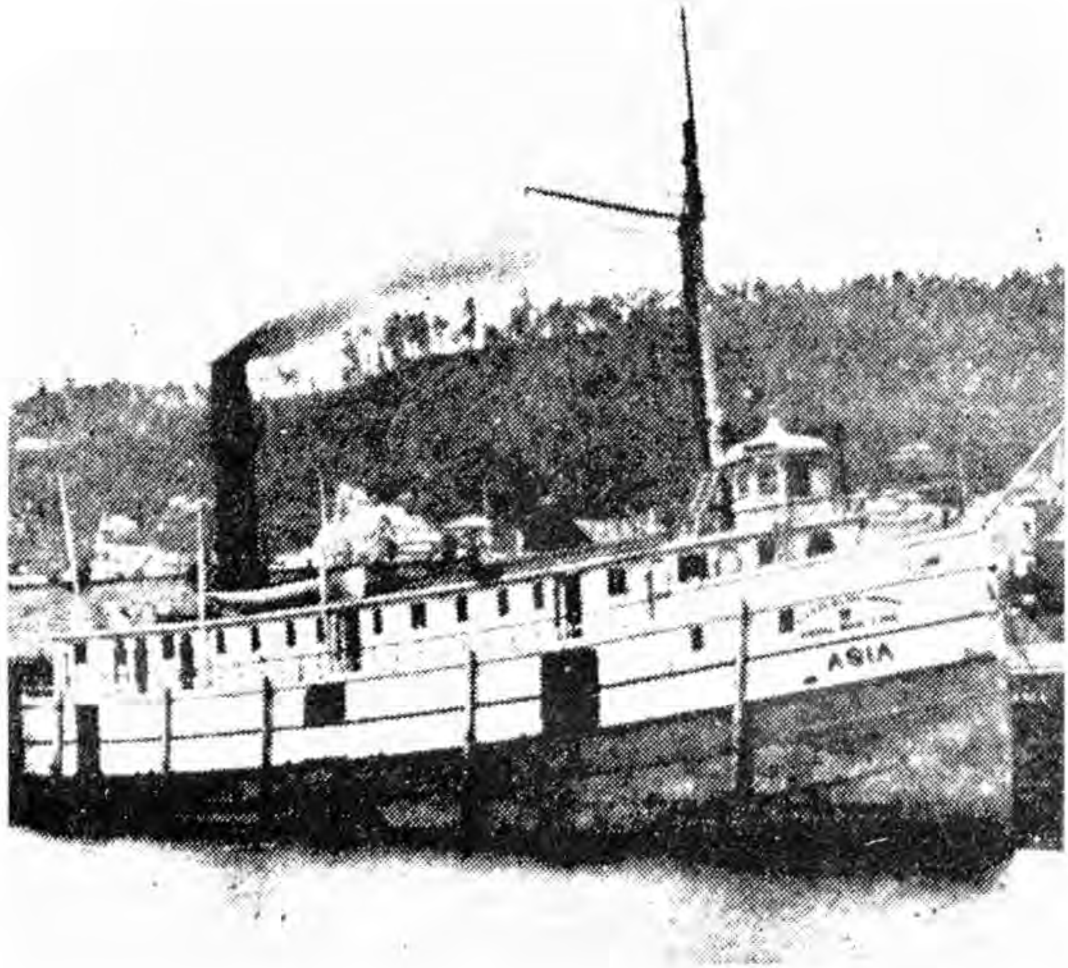

FIGURE 1

THE UNFORTUNATE 'ASIA'

About the same time as the meterologists were examining this latest chart, the steamer 'ASIA' was being prepared to leave the port of Owen Sound bound for Sault Ste. Marie via the settlement of French River.

The 'ASIA', a steamer of 347 tons, was of a class of ships known as "Old Canal Propellors" and although not designed to run on the Great Lakes was pressed into service and had served there for a number of years. She carried a general cargo and up to 120 passengers. As seen in figure no. 1, she was short, stubby and very top heavy. She wouldn't appear to inspire anyone with great confidence by today's standards. Nevertheless she was classified A-2 by Inland Lloyds and must have appeared fit enough to the 100 odd people who were on board that morning.

By nine o'clock that morning the storm was reported from Manitoulin Island to have reached the velocity of a hurricane causing much damage there before continuing on its journey.

The 'ASIA', blissfully unaware of the situation, was well on her way, her course set for French River, an intermediate port, where some of the passengers were to have disembarked.

It would appear that the course of the steamer 'ASIA' would have intercepted the course of the storm at about 11 o'clock that morning.

The Globe, Toronto, Sept. 18, 1882

"....Collingwood, September 17,

the following report has just reached here......

.......Captain A.M. McGregor...reported passing the wreckage of a steamer off the Limestone Islands. He picked up and brought with him a trunk, a door and a pillow slip marked Steamer 'ASIA'.

The loss of the 'ASIA' and all but two of her passengers was the worst shipping disaster to have happened in Canada at that time. The news was greeted with shock as it trickled down to Toronto and the nation. The two survivors, a Miss Morrison and a Mr. Tinkias, gave an account of the events preceding their rescue."......the steamer was crowded and all the staterooms were full and many passengers were lying on the sofas and the cabin floor. All went well until eleven o'clock Thursday morning when the storm struck us .... dishes and chairs were flying in every direction. We left the cabin and found difficulty in getting on deck, the boat was rolling so heavily ..."

"She rolled heavily for about twenty minutes when she was struck by a heavy sea and foundered going down with the engines working at half-past eleven."[2]

A number of people got into one of the lifeboats but it turned over several times, each time losing some of the people who were in it so that after the storm had subsided, only seven were left. Of these seven, five died of exposure, including the Master, Captain Savage and his mate Mr. McDonald. The lifeboat stranded about Pointe au Barrie* about daylight on Friday, the two survivors being spotted by an Indian who brought them to Parry Sound.

The exact location of the foundering is unknown. It was reported to be "about thirty-five miles northwest of Parry Sound and probably ten miles from the French River," in the Globe. This seems unlikely though, considering Captain McGregor's statement that the wreckage he saw was off the Limestone Islands. The lifeboat which carried the two survivors stranded ashore about

* The Globe, in its many articles about the disaster, continually made references to Pte. au Barrie. I suspect however that this refers to a point now recognized as Pointe au Baril.

ten miles northeast of these islands and a boat which had been in tow of the 'ASIA' up until two hours before foundering was recovered at Red Rock Light - about five miles east of the islands. All of this would seem to indicate that 'ASIA' foundered off the Limestone Islands and not farther north off Byng Inlet as previously suspected. The first search vessels were instructed to search the area from Pointe au Barrie to Mink Islands. As there are many small islands in this area there was hope that some survivors had reached shore and were still alive.

The search continued for many days, the perimeter of the search location gradually enlarging as the floating wreckage spread. On September 23 a body was recovered southwest of Byng Inlet.

Due to the delay in search vessels reaching the scene of the tragedy the floating wreckage had spread a good distance from the location of the actual foundering. Thus the search was operated over a relatively large area of virtually uncharted waters.

Eventually, as was inevitable in those shoal infested waters, a shoal was discovered in the search location. The Tug 'MARY ANN' reported ".....a dangerous shoal....covering five hudred acres....about twelve miles off Blackbill Islands."[2] Thus speculation arose that the 'ASIA' had not foundered as a result of being unable to withstand the storm because of poor design, but that she had run aground on an unmarked reef. This was the explanation followed by the ship's owners and in a letter to the Globe they claimed, "The shoal with numerous others not marked on our charts were reported to the Dominion Government years ago by one of our Lake captains whose knowledge of the inland seas from Montreal to Duluth is excelled by by none. This shoal will carry fourteen feet of water on it. A more dangerous shoal, and quite unknown, is one of vast extent and composed of gravel and large honey combed rocks lying east of Lonely Island at a distance of eight miles, and directly in the course of vessels from Lake Huron to French River or Byng Inlet. Upon this reef it is the writer's opinion that the late Georgian Bay disaster occurred and is explained this way. The 'ASIA' left Owen Sound Bay shortly before daylight with a strong southeast wind for French River and her drift would carry her in close proximity to this dangerous reef at about the time she foundered, say 11 a.m. The government has been asked to indicate and mark these shoals but little notice was taken of the informant's views in regard to them. The Canadian Government has been very dilatory in regard to lighting the coasts upon the Georgian Bay and shores of Lake Superior that the private individuals have had to place beacons and buoys among the different channels used by the vessels approaching and leaving the harbours upon the rock bound coast. The chief cause for disaster upon the Georgian Bay and north shores may be attributed to the want of lights, fog whistles, buoys and beacons. The harbours are nature's own and numerous, better than can be artificially made and only require the guide marks to indicate the proper channel to the storm tossed mariner and his human freight..."

The ship's owners, fearing government intervention and possible legal action may have had obvious reasons for pursuing such an explanation. An examination of the chart (fig. 2) however would seem to refute this theory. Especially in light of the fact that the first wreckage was spotted near the Limestone Islands. Nevertheless, the point was well made that the aids to navigation in that area and indeed all over the Great Lakes were woefully inadequate.

An inquiry conducted by Captain P.A. Scott, R.N., Chairman of the Board of Examiners of Masters and Mates, came to a different conclusion. According to Captain Scott "...the vessel was not in good ballast trim, and that she was of a class of vessels which were not intended to run on the Great Lakes being of that class of vessels known as Old Canal Propellers. The vessel appears to have been too light forward, and therefore unable to luff when the gale struck her, but had to bear its whole force on her broadside. It also appears that she had not sufficient cargo in her hold to enable a vessel of her description, with lofty upper works, to stand up against the gale."[1]

Later in the summation, Captain Scott says, "The question is frequently asked, was this gale such a one that even a well found and well handled ship must necessarily have foundered? To this I can only reply that I have no reports of instrumental measures, of the velocity of the wind at Manitoulin Island, as we have no anemometer there; but from the general damage done and some of the particular cases I have quoted, I believe that the force of the wind must have been almost that of a hurricane for a short time and over a limited area -- and as such gales, although fortunately rare, do occasionally pass over the Great Lakes, all vessels navigating these waters should be so constructed and equipped as to be prepared to meet them."[1]

Although it was proven through the inquiry that the presence of shoals in the area had nothing to do with the actual foundering it was obvious to Ottawa that something must be done to improve the navigational aids in the lakes. High on the list of priorities was a full scale charting program.

Charting on the Great Lakes had last been carried out in the nine years preceding 1825 under H.W. Bayfield (later Admiral) of the British Admiralty.

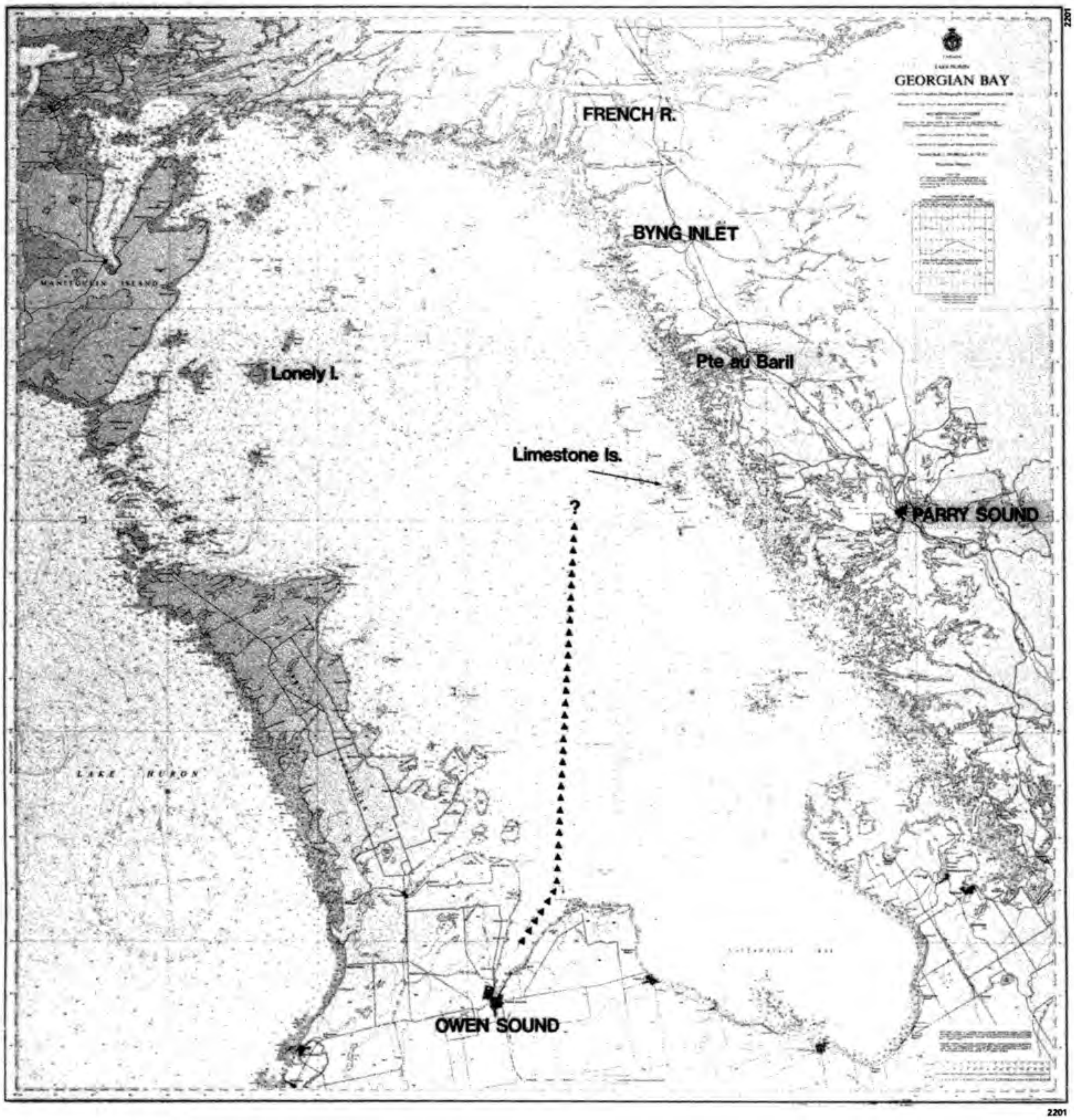

FIGURE 2

CHART 2201 -- GEORGIAN BAY

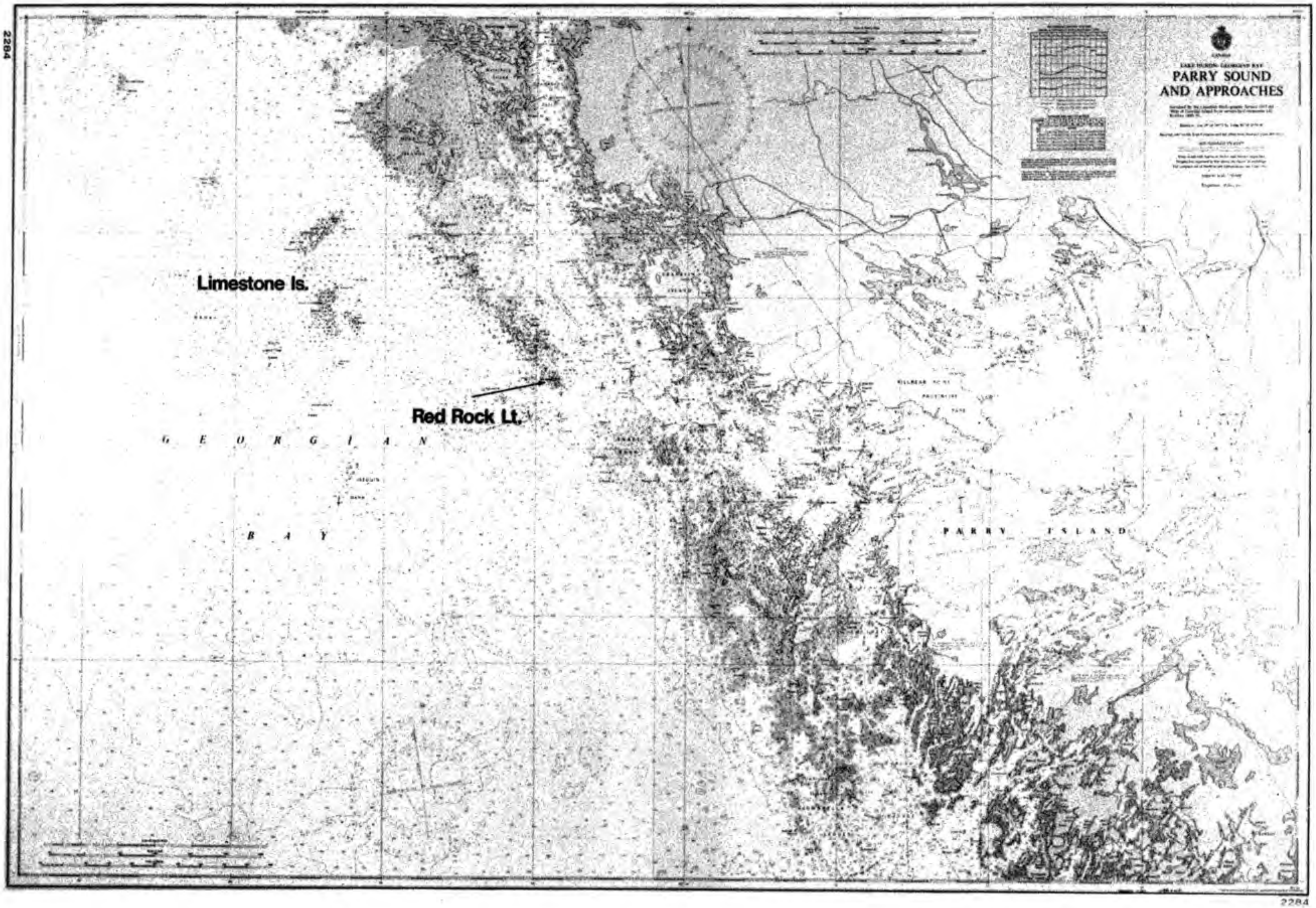

FIGURE 3

CHART 2284 -- PARRY SOUND AND APPROACHES

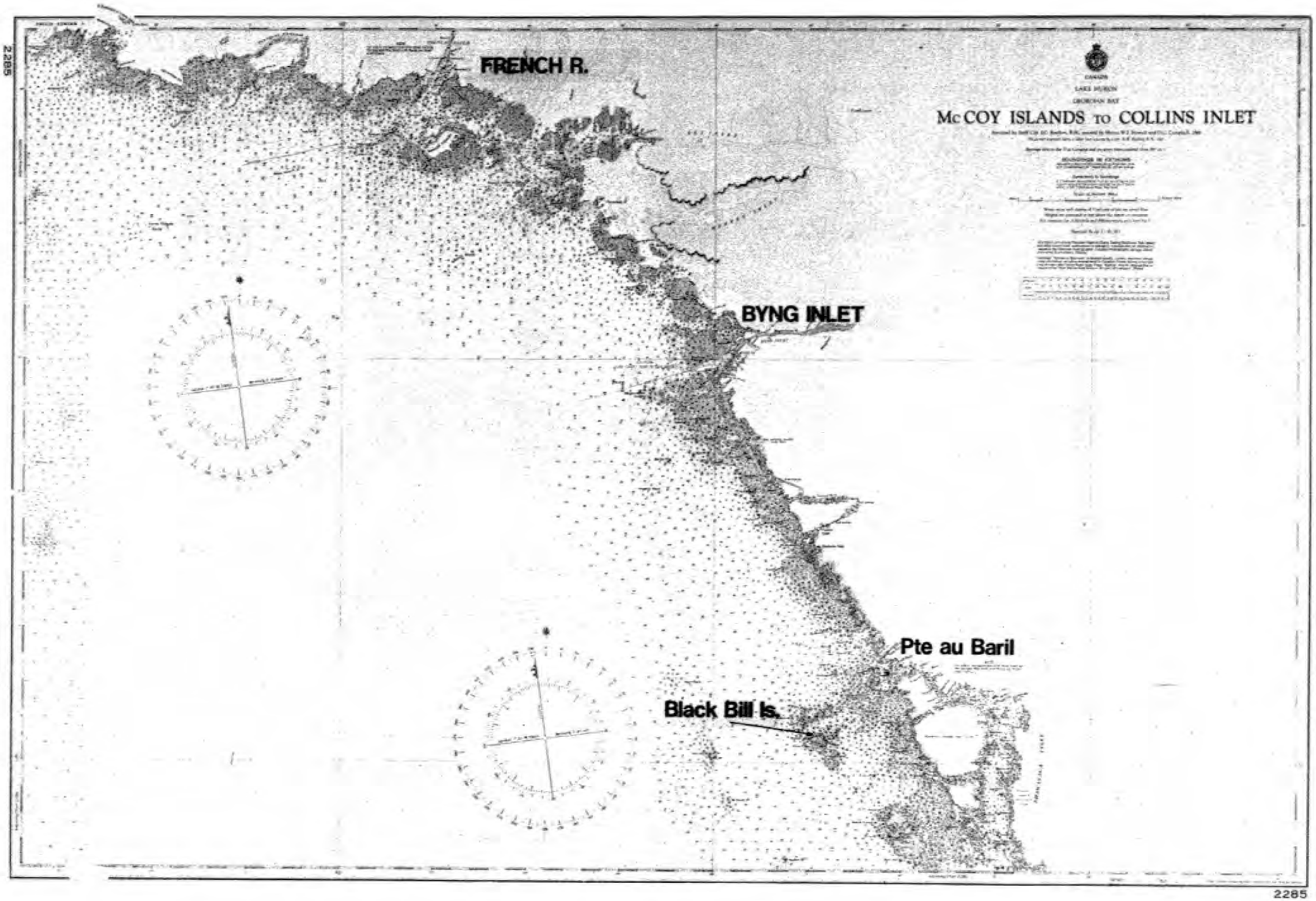

FIGURE 4

CHART 2285 -- MC COY ISLANDS TO COLLINS INLET

Accordingly the Federal Government, fifteen years after Confederation, decided to assume responsibility for charting its own waters. Up until this time all charting had been undertaken by the Admiralty. However, as British funds and personnel were required elsewhere on the globe, the Canadian Government was encouraged to exercise her new found independence and develop her own hydrographic service. As there were no Canadian suitably trained to undertake this project the British Admiralty was approached to appoint a competent hydrographer -- the understanding being that the Canadian government would supply all equipment, vessels, and assistance required. It was also assumed that suitable Canadian would be trained to be hydrographers and so eventually complete the takeover.[3]

The officer was Captain J.G. Boulton and for ten years he headed all hydrographic surveys undertaken by the Canadian government. Upon his return to England, W.J. Stewart, a Canadian, was named to the post of Chief Hydrographer (later Dominion Hydrographer).

By 1910 the last Admiralty ship had left Canadian waters and the Hydrographic Services realm of responsibility was really "*A Mari usque ad Mare*".

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Don W. Thomson

COOK AND CANADA

by G. Macdonald

PROLOGUE

Captain Cook is a name that is familiar to most Canadians and certainly to all hydrographers.

We all know he made great voyages of discovery. In fact, he explored the Pacific and mapped its islands; he travelled further south than any man before him; he explored the Great Barrier Reef; and he searched for the North West Passage.

Most of us know he was murdered by the natives of Hawaii (which he called the Sandwich Isles). The Hawaiian group was one of his important discoveries.

And some of us know he helped survey the St. Lawrence River, allowing the British forces to defeat the French at Quebec.

There are a number of biographies of the great Captain. An account of Cook's life was written by Alistair MacLean and published in 1972. A more complete biography, The Life of Captain James Cook, by J.C. Beaglehole, was published in 1974. The following is a sketch of Cook's life, with particular emphasis on his contribution to Canadian history.

JAMES COOK - MASTER SURVEYOR

James Cook was born in 1728 in a village in Yorkshire. His mother was a local girl; his father was a Scot, a farm labourer.

After a sporadic education he worked a few years on his father's employer's farm. At the age of seventeen Cook left home for the small seaport of Staithes. Here he worked in a grocer's and haberdasher's shop but at the age of eighteen left his trade to work for John and Henry Walker, shipowners, of Whitby. He was apprenticed to John Walker.

Cook served aboard the FREELOVE, a coal carrier, for the first two seasons, on a route between Newcastle and London. He then transferred to the THREE BROTHERS, which took him to the west coast of England, to Ireland and to Norway. This helped to broaden his geographical knowledge and seamanship.

When not at sea, Cook spent long hours improving his knowledge of navigation, astronomy and mathematics.

When his apprenticeship was over, Cook left the Walkers and spent over two years in the East Coast and Baltic trade. He returned to the Walker brothers as mate on their vessel FRIENDSHIP and later in 1755 was offered the command of the FRIENDSHIP. But instead, he joined the Royal Navy as an Able Seaman.

To have been offered a command at the age of twenty-seven, Cook must have impressed the owners with his qualities as a seaman, navigator and leader of men. It is surprising that he passed up the command of a merchant ship for the lowest rank on a naval vessel.

Cook was a secretive man. In his wanderings over the world, his officers would frequently complain that they never knew where they were going until they got there. True to form, he offered no explanation of his jump to the navy.

He joined the navy on June 17, 1755 and was assigned to the EAGLE, a sixty gun ship. Within a month of joining, Cook had become a Master's Mate. Not long afterwards the EAGLE'S captain was replaced by Captain Hugh Palliser. Palliser was later to become Governor of Newfoundland and a Lord of the Admiralty. It was he who first recognized Cook as a man of genius and destiny.

Cook remained on the EAGLE from 1755 until June 1757. The Seven Years' War began in 1756. The EAGLE spent most of this time blockading the French coast.

His first appointment as Master was to the SOLEBAY on June 30, 1757. On October 27, Cook joined the PEMBROKE, a sixty-four gun ship, as Master. In February, 1758, they sailed for Canada and arrived in Halifax May 9. The

PEMBROKE'S Captain, John Simcoe, was the father of the first Lieutenant-Governor of Upper Canada, John G. Simcoe.

The war was going badly for the British in North America. To take the pressure off the colonial forces on the eastern seaboard, it was considered necessary to launch an attack against the French in the north. The centre of their military power, Quebec, was the main objective.

There is no evidence that Cook took an active part in the taking of Louisburg, which guarded the gateway to the St. Lawrence River. The fortress was taken by General Wolfe, who was to die the following year in the taking of Quebec.

The day after the surrender of Louisburg Cook was ashore at Kennington Cove. Here he met Samuel Holland who later became surveyor-general of Quebec. Holland instructed Cook in the use of the plane table, and Cook's survey of Gaspe Bay and harbour (which resulted in his first printed chart) was a result of Holland's influence. Together they compiled charts of the Gulf and River St. Lawrence, including Chaleur and Gaspé Bays.

By May of 1759 advance units of the British forces had moved up the St. Lawrence River to within a few miles of Quebec. Navigation at this point of the river becomes more difficult if the channel is not accurately buoyed. On this occasion it was not. The French had removed the buoys to restrict the passage of British naval vessels.

Cook and the Masters of a few of the other vessels, were assigned the task of re-charting and re-buoying the channel. The task lasted several weeks, and Cook and the others spent most of their time within range of the French guns. They frequently worked at night. The French had a habit of sneaking out from shore in canoes when it was dark, and cutting away buoys, which had to be replaced the next day after new soundings were taken.

By June the survey was complete and the entire British Armada (over 200 ships) safely traversed the buoyed channel. Most of the credit went to Cook, and he was referred to as "Master Surveyor" in official dispatches.

After the capture of Quebec, most of the naval vessels, including the PEMBROKE, returned to England for refit. Cook was transferred, and remained in Canada aboard the NORTHUMBERLAND, flagship of the commander-in-chief, Lord Colville.

At the request of Admiral Colville, Cook continued to chart the coastal waters of Canada for the next three years. He worked in the St. Lawrence River and in the coastal waters of Newfoundland.

James Cook returned to England in November, 1762. In December he married Elizabeth Batts.

In the spring of 1763, he returned to Canada and spent the summer surveying and charting the east coast. In the winter he returned to England and drew up his charts for publication. During the next four summers he repeated this pattern, and was given command of his own schooner to help him in his work.

Cook's charts appeared in the "North American Pilot" in 1775.

When Cook left Canada in 1767, he was still a non-commissioned officer.

EPILOGUE

Because of his origins, because he was poor, and because he had sailed before the mast in the Navy, Cook did not qualify for a commission. The Lords of the Admiralty were convinced that officers and gentlemen were born and not made.

However, by the time he left Canada, the Admiralty recognized Cook as a great seaman, navigator and cartographer.

The Lords of the Admiralty were compelled to make Cook a Lieutenant, since he was their only choice to lead an expedition in search of the Great Southern Continent. In those days, a temperate continent (not Antarctica) reaching up almost to South America and New Zealand, was believed to exist.

This was the first of three great voyages of discovery made by Cook: voyages which led to the charting of New Zealand and the discovery of Australia's Great Barrier Reef; voyages into the Antarctic in search of the southern continent; and a voyage into the western Arctic in search of the North West Passage. While en route to the Arctic, Cook spent four weeks at Nootka Sound on Vancouver Island.

Cook was the Commander of the ships ENDEAVOUR and DISCOVERY when he made his second visit to the Sandwich Isles (now called the Hawaiian Islands). The master of the ENDEAVOUR, William Bligh, and a mid-shipman on the DISCOVERY, George Vancouver, would later make a place for themselves in history.

On February 14, 1779, in an attempt to take back his large cutter, which had been stolen during the night, Cook was murdered by the natives of the Sandwich Isles. He was fifty years old.

Cook's remains were buried at sea on February 22nd.

C.S.S. PANDORA II

by R.W. Sandilands

The latest addition to the Ocean & Aquatic Sciences fleet is the PANDORA II, Canada's first mothership for submersibles, which is on a five year contract from Christensen Canadian Enterprises Ltd., of Halifax, N.S.

At a ceremony held at the Bel-Aire Shipyard in North Vancouver on Saturday 16 February 1974 she was officially named by Margaret Davis, wife of the then Environment Minister, Jack Davis.

The PANDORA II will serve as a mothership to the submersible PISCES IV, which was built by International Hydrodynamics of North Vancouver, and acquired by the Department in November 1972.

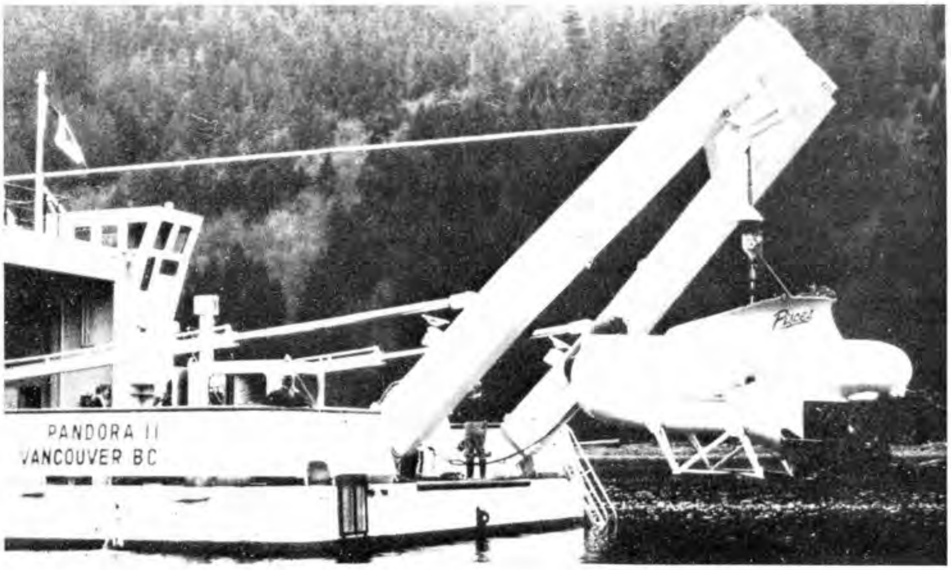
PANDORA II is a vessel of 1,200 gross tons and is 191 feet overall with a top speed of 14 knots and a cruising range of 40 days at sea at 12 knots; her draught is 15 feet. She carries 7 officers and a crew of 12, with total accommodation for 36. She was originally laid down as an offshore oil rig supply vessel, but construction halted at an early stage and the vessel was redesigned to meet OAS*requirements. These modifications included an increase in length, extra accommodation, and an ice breaker bow. She is also equipped with a heavy lift hoist on the stern for handling the submersible. PANDORA II is ice-strengthened and is capable of operating on a world-wide basis.

This is the first time that the DOE has negotiated a long term charter before a vessel was actually built, a first that has drawn favourable comments from the shipping industry.

Historically the name has strong West Coast hdyrographic connections as PANDORA was a much used name in the Royal Navy.

In Greek mythology, Pandora was a woman created by Zeus to bring misery on mankind - a point that Ship Division may have overlooked in perpetuating the name! The God had given her a box in which he had enclosed all the evils

*Ocean & Aquatic Sciences



PANDORA II HOISTING
PISCES SUBMERSIBLE

PANDORA II

to which humanity is subject. Overcome by curiosity, Pandora opened the box, thus letting loose all its nefarious contents, deceptive "hope" only remaining at the bottom of the box.

The first Royal Navy ship of the name was launched in 1779 and was sent in search of the BOUNTY's mutineers in 1790. After apprehending those mutineers who had stayed in Tahiti, she was wrecked on the Great Barrier Reef in 1791 with some loss of life.

Fearful of another mutiny, Captain Edwards had the mutineers closely confined in a cell, or box, on the afterdeck, where they suffered severe hardships. This cell was known onboard, and eventually throughout the Royal Navy, as 'Pandora's box' (Mackaness).

The second ship of the name also brought ill-luck to those who sailed on her. She was originally the French brig PANDOUR, which was captured by the CAROLINE in the North Sea in 1795. She foundered in the North Sea two years later.

The third PANDORA was an 18 gun sloop launched at Yarmouth in 1806 which met her end on Skaw Reef in the Kattegat in 1811.

The next ship of the name was again a brig sloop and she was launched at Deptford in 1811. She was converted to a ship sloop in 1825 and was eventually sold out of the Service in 1831.

The fifth PANDORA, 1833-1862, was the ship with the West Coast connections. She was designed as a packet brig, 90 feet overall with a draught of 13 feet aft, laid down in August 1831, and launched at Woolwich on 4 July 1833. She was 319 tons and her building costs were £5398. She served on the Falmouth station of the packet service, which at that time was run by the Admiralty. They maintained the following services for mail, the period mentioned being for a round trip:

Weekly to Lisbon	32 days
Monthly to Cadiz, Gibraltar, Malta & Corfu	51 days
Monthly to Barbados & the Windward Islands	12 weeks
Monthly to Halifax (and for the U.S.A.)	9 weeks
Monthly to Barbados, Leeward Islands & Jamaica	14 weeks
Monthly to St. Domingo, Jamaica, Vera Cruz, Tampico & Managua	18 weeks
Monthly to Madeira, Teneriffe, Rio, Bahia & Pernambuca	20 weeks

On 1 January 1842 she completed her time in this service and was paid off into reserve.

She was modified for surveying duties in 1842-1843 and in 1845 Lieutenant James Wood was appointed as Lieutenant and Commander, i.e., Lieutenant in Command, a function rather than a rank, and she commissioned for surveying duties on the west coast of the Americas in company with HMS HERALD, Captain Henry Kellett.

As a survey ship she carried a crew of about 65, and was armed with six guns whose calibre I have been unable to verify.

She sailed from Plymouth on 26 June of 1845 in company with HERALD and called at Teneriffe, Rio, and the Falkland Islands. The ships lost touch in bad and extremely cold weather off the Horn, but met again at Valparaiso, the PANDORA arriving first. After self refit there they sailed north on 7 January 1846, visiting Callao, Payta, and the Galapagos Islands before beginning a survey of the Gulf of Guayaquil, working northwards to Panama. Here on 25 March they received their first mail from home.

On 16 April they sailed for Vancouver Island for the northern summer surveying season. Two days out of Panama the PANDORA encountered a waterspout but suffered no major damage. They arrived at Neah Bay, (Washington), and there met HMS CORMORANT, a paddle wheel sloop, who gave them a tow but overshot Victoria.

They anchored in Cordova Bay and made their way to Victoria the following day, entering the harbour on 27 June 1846.

The CORMORANT was the first steam paddle ship of the Royal Navy to reach the northwest coast and an important part of her duties was the towing of sailing ships of the Navy up the Straits of Juan de Fuca.

The HERALD and PANDORA carried out surveys of Esquimalt and Victoria harbours and also the anchorages at Port San Juan, Neah Bay, Port Townsend, Becher and Pedder Bays, and Cordova Bay during that surveying season (Sandilands).

In the surveys of Esquimalt harbour, Lieutenant Wood was assisted by a Mr. Inskip, who was a Naval Instructor onboard HMS FISGARD, which was also on station that year, and the islands, points, etc., in the harbour were named after various officers of that ship. PANDORA gave her name to a street in Victoria, a peak at Port San Juan, a hill on Discovery Island and Pandora Head at the entrance to Grappler Sound, but Wood himself does not appear to have any feature named after him.

After surveys for the 1846 season were completed on 2 September, the two ships took leave of Mr. Finlayson, who was in charge of the Hudsons Bay fort in Victoria, and thanked him for hus "uniform hospitality and kindness".

They carried out a coastal running survey as far south as San Diego Harbour which the PANDORA entered. After a visit to Alcapulco they sailed on 19 January 1847 to continue the survey of the Panama area. This was broken off at the end of April, and after collecting water from Boyba Island they proceeded to Callao. Late in July they resumed the surveys in the Guayaquil area and worked northward till late November, when they had a break in Panama.

The following April the HERALD was detached to take part in a search for Sir John Franklin in conjunction with HMS PLOVER, which was on her way out from U.K. The PANDORA was detached to go on Oahu to leave Kellett's orders for PLOVER and then proceed back to British Columbia to clew up the surveys there.

She reached the Strait of Juan de Fuca on 7 August, and three days later entered Esquimalt Harbour. Her work that season extended the surveys into the Strait of Georgia, completing the season's work on 19 September. She then sailed for San Francisco but stayed there only to water, since the discoveries in the gold fields of California, which eventually led to the great gold rush of '49, were increasing the temptations of desertion. After a fairly leisurely passage back to U.K., she entered Devonport on 20 November 1849.

After refitting, she went briefly into reserve, but in September 1850 she was docked for recoppering and refitting prior to further surveying duties on the Australia station.

On his return to U.K., Wood was promoted to Commander, and in 1855 he was given charge of the survey of the northwest coast of Scotland. As a native born Scot, it pains me to quote Commander L.S. Dawson's Memoirs of Hydrography: "The climate of the North of Scotland proved too severe for a constitution weakened by exposure for many years under a tropical sun; his health gave way, and he rapidly sank on 12th April 1860, at the early age of 47".

On 21 February 1851 the PANDORA sailed from Devonport under Commander Byron Drury, for surveys of the coast of New Zealand. She called at the Cape and there just missed her old chummy ship HERALD, which, having been released from her Arctic service, was on her way home west about. PANDORA was away from U.K. for over five years, and under most trying circumstances, surveyed much of the coastline of New Zealand. Dawson relates the following anecdote: "The stormy coasts of New Zealand were often a source of no small peril to those engaged in this survey onboard the PANDORA. On one occasion an earthquake having taken place at night, accompanied by a heavy storm with thunder, lightning and much rain, the vessel twisting and wrenching violently at her anchors, the word was passed, probably without authority, to call the boats away. Some even thought that the end of the world was at hand. These proceedings were, however, checked by an old Quarter-Master remarking, 'That if so be the end of the world had come, why, where were the boats to pull to?". Which argument, it is believed, proving unanswerable, effectually prevented the idea of lowering the boats being followed up. In another instance the PANDORA was blown high and dry on the coast, and for some time remained in imminent peril of becoming a total wreck."

Incidentally, Commander Drury figures in hydrographic history as having taken his family to New Zealand and eliciting the remark from Admiral Beaufort, Hydrographer of the Navy, that "wives were always conducive to mischief when onboard" (Day).

However, PANDORA survived these and other perils and returned to Devonport on 29 May 1856 and then paid off into reserve.

The following year on 29 September an Admiralty order authorized her transfer to the Coast Guard for service as a watch vessel.

In 1862 she was sold to Messrs. Marshall for £600 by an Admiralty order dated 11 January 1862.

A model of this PANDORA is held by the National Maritime Museum in England showing her at a scale of 1/48.

The sixth vessel to bear the name PANDORA also has a connection with Canada. She was a wooden, screw, gun vessel of the RANGER class, launched at Pembroke Dockyard in 1861. In 1875 she was sold to one Allen Young, an officer in the Merchant Navy, who had taken part in the search for Franklin with Captain M'Clintock in the FOX in 1857, this being the party that discovered records and relics that finally revealed the story of Franklin's ill-fated voyage.

In 1875 he set out in PANDORA to attempt the navigation of the Northwest Passage in a single season, but heavy ice in Peel Sound turned him back just north of the latitude of Bellot Strait. His second attempt in 1876 was even less successful and he spent the entire summer season attempting to navigate the difficult ice in Smith Sound (Pilot of Arctic Canada).

This PANDORA was eventually renamed JEANETTE, and was used by the ill-fated U.S. expedition to the Arctic under de Long in 1879-81. She broke up after a deep penetration into the Arctic from Bering Strait, and her wreckage eventually drifted to southern Greenland. This drift information was used by Nansen in 1893 (Day).

Undaunted, Young bought the NEWPORT, another RANGER class gun vessel and renamed her PANDORA. She too was lost in the ice.

The name PANDORA did not appear in Navy Lists again till 1900, when a third class protected cruiser of the PELORUS class was launched at Portsmouth Dockyard. She was sold in 1913.

The eighth ship of the name was the first to have a connection with submersibles or submarines. She was built in Russia as the SETI and was purchased by the Admiralty in 1914 on the recommendation of Sir Roger Keyes.

She was a coal burner of 4,350 tons and a top speed of 11 knots, and carried a crew of 70. In 1924 she was renamed DOLPHIN, probably to perpetuate the association of this name with submarine depot ships, a previous vessel of this name having been taken out of commission that year. This name was eventually passed to another submarine depot ship and then came ashore as the name of the submarine base at old Fort Blockhouse, Gosport.

The DOLPHIN served with the fleet for many years,eventually sinking under tow to Blyth for conversion to a blockship in 1939.

However, the underwater connections of the name were re-established in 1928 when a submarine, laid down as PYTHON was renamed PANDORA. She was built by Vickers-Armstrong at Barrow in 1929 and saw action in the Mediterranean in 1940-41, and took part in Malta convoys in the hectic days of 1942 where she eventually met her end at the hands of Italian aircraft in Malta. She was raised and beached in 1943 and broken up in 1957.

The Canadian Register of Shipping shows a yacht PANDORA, and for this reason it was necessary to add the suffix II for our vessel.

Thus, tracing the history of the ships that have borne the name, we can see the appropriateness of the choice of the name PANDORA for our latest vessel. She has hydrographic surveying; submarine depot; or mother ship; Canadian Arctic and West Coast connections.

It is hoped that this latest PANDORA will continue to add lustre to the name.

Acknowledgements

Grateful acknowledgement is made to the Maritime Museum of British Columbia for the use of their research facilities.

Alaska!! Semisopochnoi Island.

Alaska also has the northernmost point, Point Barrow, and the westernmost point, Amatignak Island.

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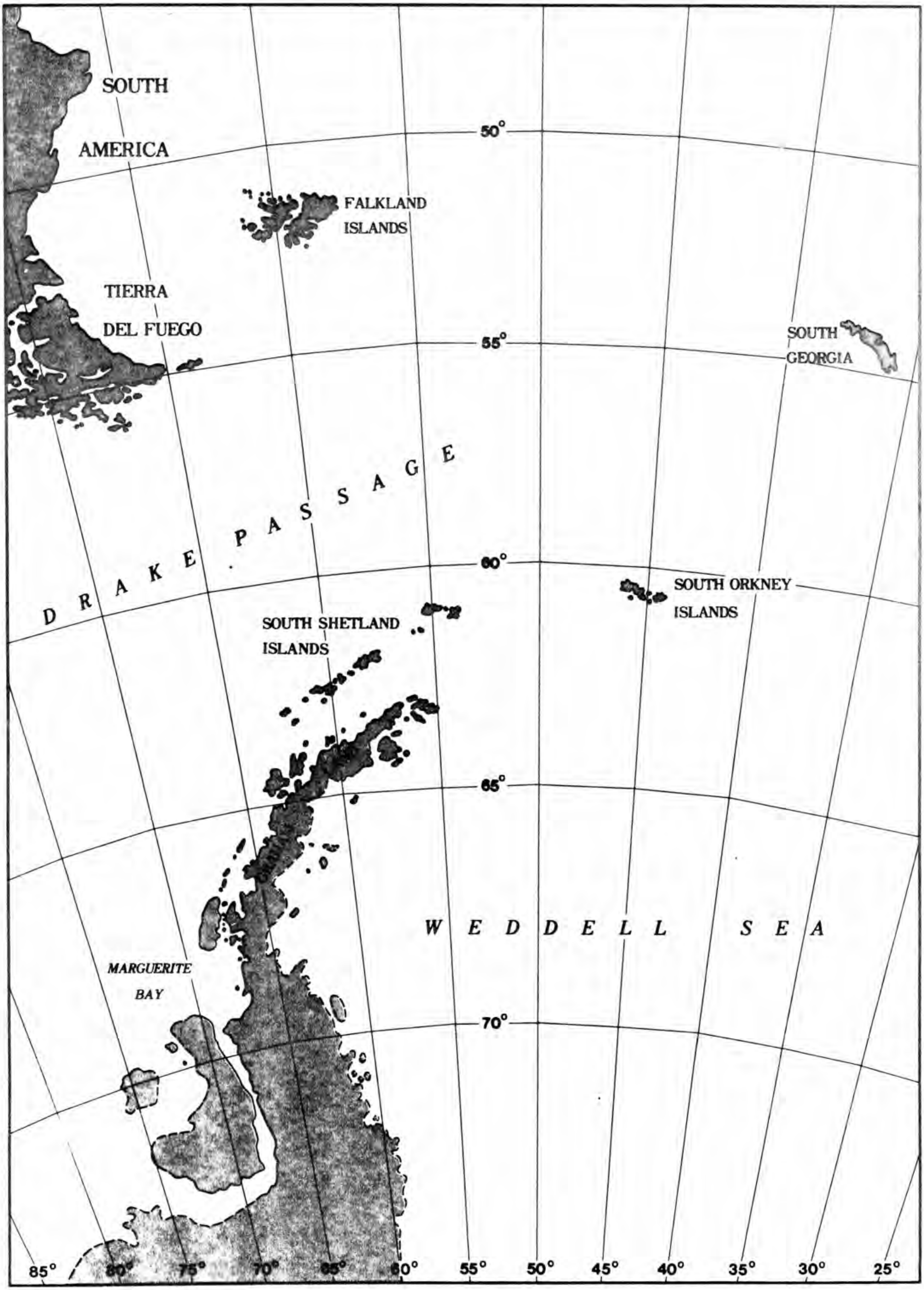
ANTARCTIC SURVEY - TWENTY YEARS AGO

by A.J. Kerr

One of the advantages of increasing age is that one can reminisce, much as it may bore a youthful generation. Almost exactly twenty years ago the writer sailed to the Antarctic as the navigating officer aboard a small British research and resupply vessel SHACKLETON, named after the famous explorer Sir Ernest Henry Shackleton. At the time the sovereignty of the Antarctic was in some dispute and the most northern part that reaches an icy finger towards South America, known to the British as Graham Land and to the Americans as the Palmer Peninsula, was claimed by the British, Chileans and Argentines. As a bolster for their arguments of sovereignty, each of these three countries maintained 'scientific' bases along that desolate Antarctic shore. SHACKLETON's task, along with a more manful vessel, JOHN BISCOE, was to resupply the British bases each year with men and materials. If time permitted, the ships could be employed on some survey or scientific study themselves.

Although similarities did exist at that time, between the British operations in Antarctica and the Canadian operations in the Arctic, there were also many differences. The attitude of the British was very different, they followed the great exploratory traditions. The little ships leaving Britain sailed with much fanfare and there was television coverage and many newspaper articles. By contrast, in Canada, the icebreakers slipped away to the Arctic as part of their everyday business. In the field itself the British held on to the older proven equipment and methods far longer than the Canadians. The British manhauled the supplies from the landing beach to the base or if they were lucky a dog team, or even a small tractor would be available. At the same time, in Arctic Canada the bulldozer was vital equipment in the building of the Dewline and Joint U.S.-Canadian Weather


SOUTH
AMERICA
50°
FALKLAND
ISLANDS
TIERRA
DEL FUEGO
SOUTH
GEORGIA
55°
D R A K E P A S S A G E
60°
SOUTH ORKNEY
ISLANDS
SOUTH SHETLAND
ISLANDS
65°
W E D D E L L S E A
MARGUERITE
BAY
70°
85°
80°
75°
70°
65°
60°
55°
50°
45°
40°
35°
30°
25°

In 1955 SHACKLETON was equipped with a small tracked vehicle but no aeroplane. The following year the Royal Navy made its presence known with an ex net laying vessel, H.M.S. PROTECTOR, equipped with a helicopter. The terms of use for the helicopter, involved the putting and taking off of immersion suits and other strict regulations tending to inhibit its use as a survey vehicle.

Graham Land, being perhaps the most accessible part of the Antarctic had been visited by numerous explorers of many nationalities from the Russian Belinghausen to later French, Belgian, American and British explorers. Still to the navigator in 1955 it presented a picture of unknown coastlines, identified by dotted lines on the charts and only the vaguest idea of the water depths.

Fortunately the Master of SHACKLETON was a wily old Irishman who knew the area well and under his skilled hand we sailed the coast. It is a very beautiful land with the peninsula rising to heights over 2000 metres. All but the steepest mountain sides and cliffs are covered in a thick ice cap. Even the numerous, small offshore islands had their miniature ice caps and in many bays the sound of calving icebergs could be heard continually. At the time of my first visit there were, I believe, some ten bases to be supplied by the two ships. These bases were mainly on the west side of the peninsula as the east side borders the Weddell Sea which is filled with pack ice for most of the year. It is in the Weddell Sea, incidentally, that Sir Ernest Shackleton's ship ENDEAVOUR was crushed by the ice, leading to his epic voyage in an open boat from Elephant Island to South Georgia. The most southern base at that time was in Marguerite Bay at approximately 68° South. The northern bases were established on the South Shetland Islands and South Orkney Islands.

H.M.S. PROTECTOR WIT
HELICOPTER ON DECK

WORK BOAT USED FOR UNLOADING
CARGO AND FOR HYDROGRAPHY

R.N. HYDROGRAPHIC SURVEY
LAUNCH

R.R.S. SHACKLETON AT DECEPTION ISLAND
WITH WORK BOAT

AIRCRAFT USED BY HUNTING
AERO SURVEY

At that time, although an aerial survey was commencing, the results were not available to us. Coastal detail was mapped in from the radar as we passed along the coast. The ice cliffs which bordered much of the coast were deceiving and it was difficult to tell by eye whether there was a bay, an island or that the coast lay straight. Later when we looked at some of the photographs we were able to see places that we thought were bays were actually channels and vice versa. The air surveys were being carried out by Hunting Aerosurveys from London, England, but there were a number of Canadians amongst the crews.

We carried aboard a fine, sturdy, open work boat and a big wooden barge. These were primarily designed for unloading the stores but the work boat was equipped with an echo sounder and doubled as a survey launch. Its only shelter was a folding canvas dodger and we crouched behind this shielding the sextants from the icy spray.

During the first year we had no real capability to put in ground control. Consequently survey operations in the launch were limited.

During the summer of 1956 SHACKLETON returned to England. Submitting our amateurish hydrographic work to the Admiralty we were able to persuade them that if they gave us a short course our future contributions could be much better. Consequently, four of us found ourselves at the naval hydrographic training school in Chatham, under the careful training of a Lieutenant Commander Haslam who is today Hydrographer of the Navy.

Returning to the Antarctic again in the summer of 1956-57 both SHACKLETON and JOHN BISCOE were much better equipped to collect hydrographic information. Not only had the officers undergone some training in the basic principles but we were equippped with theodolites, station pointers, drafting material and all the other requirements of a standard hydrographic survey. The Admiralty Manual of Surveying rested in the shelves of the chartroom and we knew how to triangulate and to tell a swinging fix from a solid one.

It was still a time of considerable artistic licence and plastics were not yet around. Field sheets were drawn on linen backed paper and the beauties of colour washes with their accompanying distortions could also be employed! The Admiralty manual and the hydrographic course had stressed the needs for developing elegant parallelograms and insuring their adjustment. In retrospect, I realize how we went overboard in this area as our observing capabilities, particularly since we used antiquated Cook theodolites, did not warrant the mathematical skill used in the adjustments.

In one or two places we were fortunate in having professionally prepared base maps since a few land surveyors from the Ordnance Survey were included in the base personnel. In other places we established our own control. The difficulties of erecting marks ashore were considerable. As it was mentioned earlier, even the small islands were covered with ice caps and the ice caps contained some deep and potentially hazardous crevasses. Therefore, to erect a mark or visit a station, the survey crew would frequently be obliged to don crampons and rope together. Along certain stretches of coast it was quite impossible to get ashore because of the ice cliffs. We wondered how best to put survey marks in these places and considered dye and spears with flags attached but, as there was great danger of large areas calving off, abandoned all these ideas.

During the second year in the South the Admiralty had decided to support us with some professional hydrographers. A regular naval hydrographic survey party equipped with a proper survey launch was shipped south. Working with H.M.S. PROTECTOR this group was able to accomplish far more than we were with our improvised equipment and limited knowledge. However, in such remote places as the Antarctic every little piece of information helps. Besides, it was an unforgettable experience for us all.

ANNOUNCEMENT

"The 15th Annual Canadian Hydrographic Conference will be held April 20-22, 1976, in Ottawa, Ontario, utilizing the facilities at the Canadian Government Conference Centre and the Chateau Laurier Hotel.

Anyone wishing to present a paper must submit an abstract by December 31, 1975.

Additional information may be obtained by contacting:

Mr. L.P. Murdock or Mr. S. Van Dyck
Co-Chairman
15th Annual Canadian Hydrographic Conference
Canadian Hydrographic Service
Department of the Environment
615 Booth Street
Ottawa, Ontario, CANADA, K1A OE6".

SALT AND SOUNDINGS

CARIBBEAN SURVEY

A lover of the sea, President Franklin D. Roosevelt often recuperated from his strenuous duties by taking fishing trips. Summoning an aide, he would say, "Call the Hydrographic Office and find out where the fishing is good." During the 1930s, funds for hydrographic survey work were scarcer than usual and Hydro was especially anxious to survey areas rarely entered by merchant or Navy ships, but considered strategically important. For several years, therefore an inspired gentleman at Hydro would reply that the fishing was particularly good in the Caribbean.

While the President happily fished from the deck of a cruiser in areas remote from shipping traffic, Fathometers obtained the soundings Hydro needed to complete its bottom contour charts of the Caribbean.

____Contributed by Paola E. Coletta (January 1960)
U.S. Naval Institute Proceedings, October 1973

THE CHART SCHEMER'S THEME SONG

I am the greatest schemer
The best in all the land
I'm dreaming when I'm scheming
Just to beat the band.

I'm always jiggling templates
This-a-way and that
The templates I am jiggling
Til I'm not sure where I'm at!

There's AO size of paper
For harbour charts and strips
And also for the ship charts
So we must come to grips

With a whole new type of scheming
A different set of charts
The old ones we'll we be leaving
To use for playing darts.

The scales we must consider
In multiples of ten
No more odd-ball scales now
They'll just be a "has been".

When it is completed
The schemer should be pleased
And glad it is all over
With the   well appeased.

Then I shall retire
With pension-plus by then
But now I must get busy
In multiples of ten.

14/August/1975

In which State is the easternmost point in the United States?
(Answer on Page 49)