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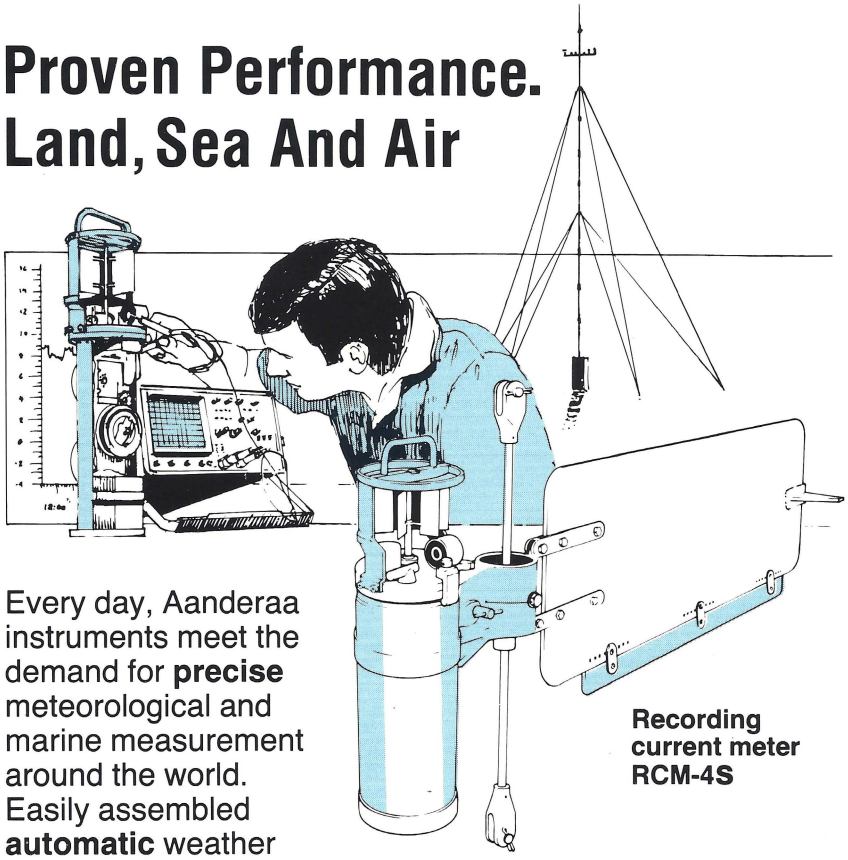

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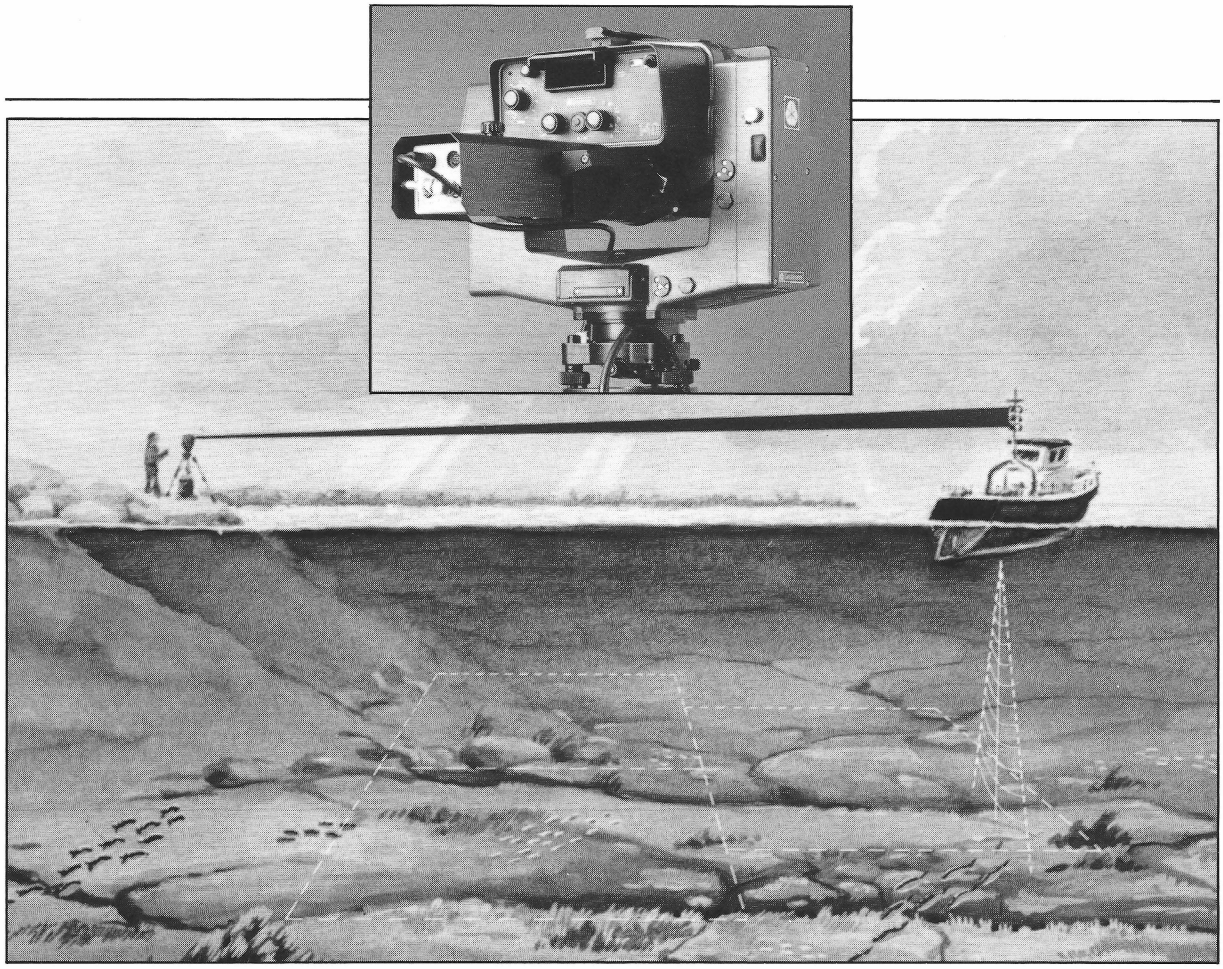

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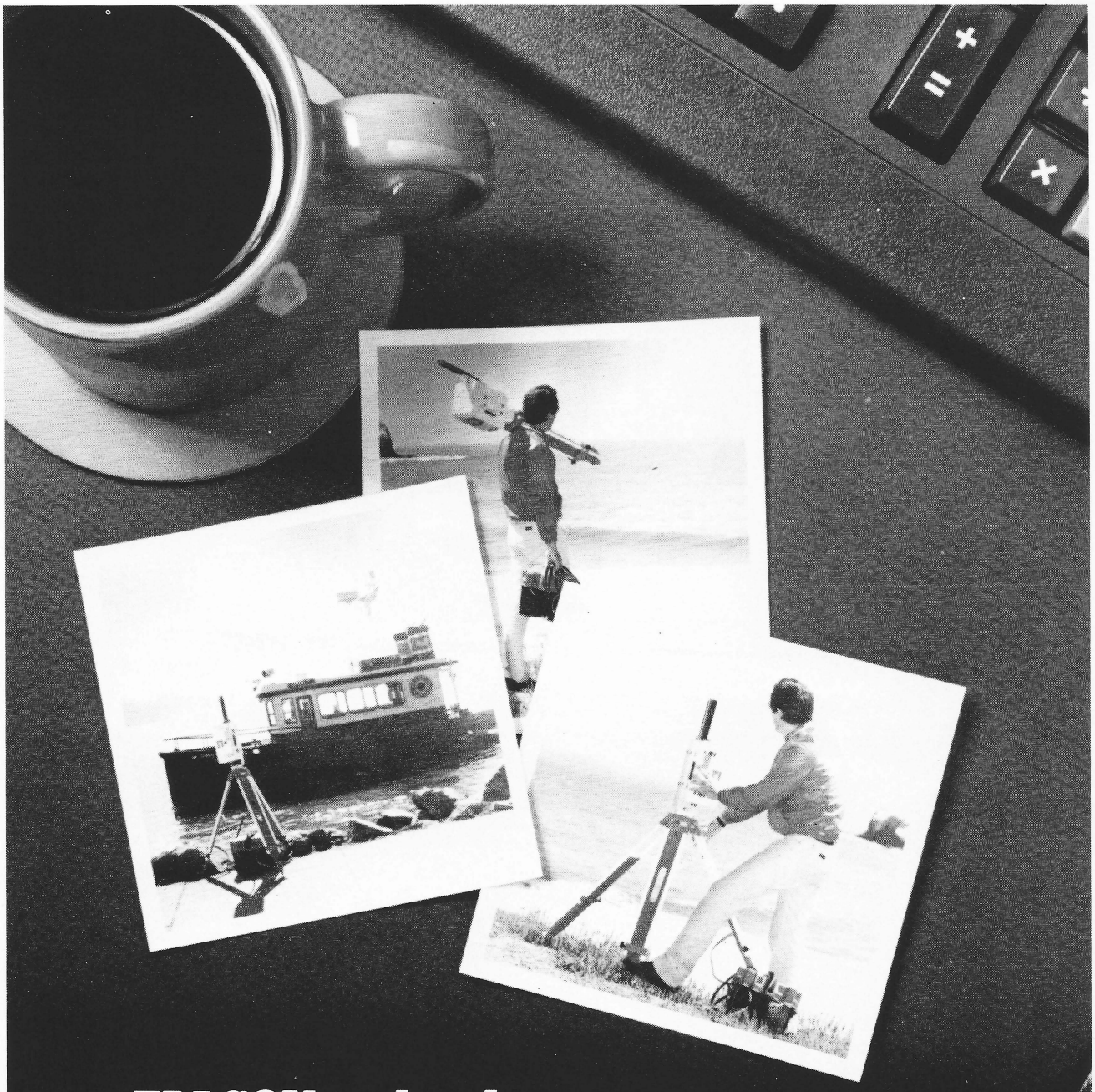

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Back Issues of LIGHTHOUSE

Back issues of LIGHTHOUSE, Editions 24 through 35, are available at a price of $10 per copy. Please write to the Editor.

Closing dates for articles and advertising are:

April issue	March 1
November issue	October 1

Editor's Notes

XIIIth International Hydrographic Conference
An important event since the last issue of the LIGHTHOUSE has been the XIIIth International Hydrographic Conference held at Monaco from 5-15 May, 1987. These periodic conferences are special occasions for the Member States of the International Hydrographic Organization (IHO) to take stock of the accomplishments of the previous five years and to plan the strategies and work programs for the forthcoming years. Consequently, the conference agenda includes a whole series of technical as well as administrative and procedural matters.

One of the more spectacular accomplishments of the IHO has been the rapid introduction of the international chart program which entails the production of a single worldwide series of INT charts at medium and small scales, constructed to standard specifications. Some 106 charts have already been published and the IHO Regional Hydrographic Commissions are actively engaged in substantially enlarging this coverage.

The Organization has been fairly quick in responding to the rapidly advancing technologies in hydrography by introducing suitable measures, including the establishment of expert committees to develop, for instance, standard formats for exchange of digital data and the progressive introduction of the Electronic Chart Display System.

One of the matters of considerable concern to international organizations is the transfer of technology aimed at strengthening the technical capabilities of third world countries in certain specific fields of activity - hydrography and nautical charting in the case of the IHO. Here, unfortunately, the Organization has not been nearly as spectacular in its achievements.

The conference was attended by delegations from the 50 Member States of the IHO together with invited observers from some 35 countries and professional institutions.

A series of "morning lectures" and a Hydrographic Seminar provided the opportunity for the presentation of some most interesting papers which dealt with a variety of subjects including new ship designs, airborne bathymetric survey systems, cartographic plotting systems and marine safety information.

The industrial exhibitions, held in conjunction with these conferences, are always highly successful and this time there were over 50 exhibitors from around the world. The latest equipment and instrumentation was on display together with demonstrations conducted in the port of Monaco. At least four Canadian firms were exhibiting and these included Terra Surveys, Quester Tangent, Optech Inc. and International Submarine Engineering who were demonstrating the DOLPHIN. Hydrographic ships visiting Monaco during the conference included the KANE from the U.S.A. and the DONUZLAV and the AKADEMIK NICOLAY STRAKHOV from the U.S.S.R.

The highlight of the conference is the election of a new Directing Committee, consisting of three directors who will hold office for the next five years. Our congratulations go to the members of the new Directing Committee:

Rear Admiral Sir David Haslam (U.K.) - President
Mr. Adam J. Kerr (Canada)
Rear Admiral A. Civetta (Italy)

New Appointments
Our very best wishes go to Stephen MacPhee on his appointment as Director of Science, Scotia-Fundy Region, and to Ross Douglas on his appointment as Dominion Hydrographer.

President's Message

Once again we have the pleasure of receiving our most welcome journal **Lighthouse**. If you are anything like me, you look forward, each April and November, to receiving our journal and the anticipation of its arrival is always exciting.

This is the 36th edition of **Lighthouse** and it marks the transfer of the editorial responsibility from Rear Admiral D. C. Kapoor of Erindale College to Mr. G. Macdonald of Central Branch in Burlington.

Admiral Kapoor has been the editor of Lighthouse since January 1985, and has been responsible for six editions which culminates with this November, 1987 issue. During the period that Admiral Kapoor has been at the reins, **Lighthouse** has continued to improve. It is read and respected throughout the world. The change in editorial responsibility is designed to consolidate our efforts and to allow our editor to be more closely associated with the day-to-day activity of production. This will work more effectively from a central location.

I would like to thank Admiral Kapoor for his enthusiasm for **Lighthouse** and for the many unpaid hours that he has spent working on the journal. I am sure that he will have a continuing interest in the Association and the journal.

Edition 37, the April 1988 issue of **Lighthouse**, will be produced in its entirety at Central Branch of CHA. As you are all aware, Lighthouse is the CHA's most visible and most influential activity. It is important for **Lighthouse** to succeed in its present form. It must be self-sufficient; advertising and subscription rates must pay for the production costs. But excellent professional papers are just as important: our reputation will only be enhanced and Lighthouse will only succeed if our editor receives quality articles. Each CHA subscriber has a responsibility to see that the editor receives articles of outstanding quality well in advance of each publication.

We must remember that many developing countries look to Canada for leadership in Hydrography and now that we have the reputation we must maintain it. **Lighthouse** is an important vehicle for the dissemination of this information. **Lighthouse** is the only Canadian publication dedicated to Hydrography. We must continue to work towards a successful **Lighthouse**, because **as Lighthouse goes - so goes the CHA**.

I would like to wish the new editorial staff in Burlington the best of good fortune with upcoming issues of **Lighthouse**. Every member of the CHA is indebted to you for your willingness to tackle this very big job.

Barry Lusk
National President

Electrostatic Plotting: POD (Print-On-Demand) and Related Projects

by
D. Vachon
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Canadian Hydrographic Service, Ottawa

INTRODUCTION

This paper describes the status of the Print-On-Demand (POD) project, specifically the development of full-colour chart printing by way of electrostatic plotting. The efforts to implement this on-demand printing and the results are discussed. A review of other electrostatic-based projects is also included, e.g. the generation of colour proofs, photo-positives/negatives, patches and other customized charts by the electrostatic method.

POD PROJECT REVIEW

Interest in electrostatic plotting was stimulated by a paper published in Lighthouse which explored the established and more recent plotting technologies. The POD concept was discussed using a hypothetical scenario. Encouraged by the interest, a second paper dealing strictly with the POD concept was written. Also at that time, "Hydrographic Development" was establishing specifications for a CHS-wide data distribution network. "Marine Cartography" promoted the POD concept and encouraged the purchase of an electrostatic plotter. This effort was successful and a contract was signed with IDC (International Datacasting Company) for the implementation of a prototype Chart Distribution/Printing Network. Based on preliminary test results and, having monitored two of the available plotters in operation, a recommendation was made to purchase the Versatec 3436, 400 dot-per-inch Colour Electrostatic plotter to meet the printing requirements of the contract. The primary reasons for selecting this plotter were superior colour registration and processing/plotting throughput. The unit was delivered to CHS Headquarters in September of 1986.

The initial task was to provide colour linework plots (no colour fill) from NEWNTX-formatted vector files. Having accomplished this, the next phase was to provide full-colour charts (colour fill). Universal Systems Ltd.'s polygon generation software was evaluated on its ability to define the vectors required for colour fill. Their software met requirements and they were subsequently contracted to implement the "write function" code as well as preprocess some of the prepared digital chart files. Then, via several iterations and modified coding, full-colour, ready-to-use charts were printed.

NTX TO VRF CONVERSION PROGRAM (NTXVRF)

The requirement to provide VRF (Versatec Random Format) plot data from CHS' NEWNTX formatted data was met with the development of the NTXVRF conversion program. The top layer CHS utility modules were linked to the lower level VersaPlot routines, which provided the necessary output functions. These routines set plot parameters such as orientation, shading or colour selection versus lineweights. A special series of modules were also implemented to handle area fill data.

To enable processing of fill data by our utilities, the structures governing individual data types were maintained and a special set of feature codes was provided. This allowed advantage to be taken of the power within the utilities to merge and separate files, obtain statistics on files, and to generate the colour separation files. The colours chosen were from the predefined colour table. Up to 256 colours as well as patterns can be defined, to match chart colours more closely.

RESULTS TO DATE

Phase 1: Symbolized Linework Plots (no colour fill)

The first goal of this project was to produce colour linework plots from NEWNTX files. Five chart files were converted from OLDNTX (CH9995, CH7935, CH7552, CH5373 and CH7740) to NEWNTX as test data. Text, insets and bar scales were added to these files, and editing was done to make the file resemble the actual printed copy. Development of the new STARS (Symbolization program) benefited from this project by providing a much quicker turnaround over the photoplotting method. Feedback was obtained in less than one hour versus days. Once the 6 files were converted and transferred, they were plotted on the electrostatic plotter and scrutinized by Cartographic Development, Hydrographic Development, Quality Control and their respective managements. The quality of the linework was found to be quite exceptional considering the 400 dots-per-inch resolution. Table 1 lists some of the timing values obtained while processing and plotting the converted files.

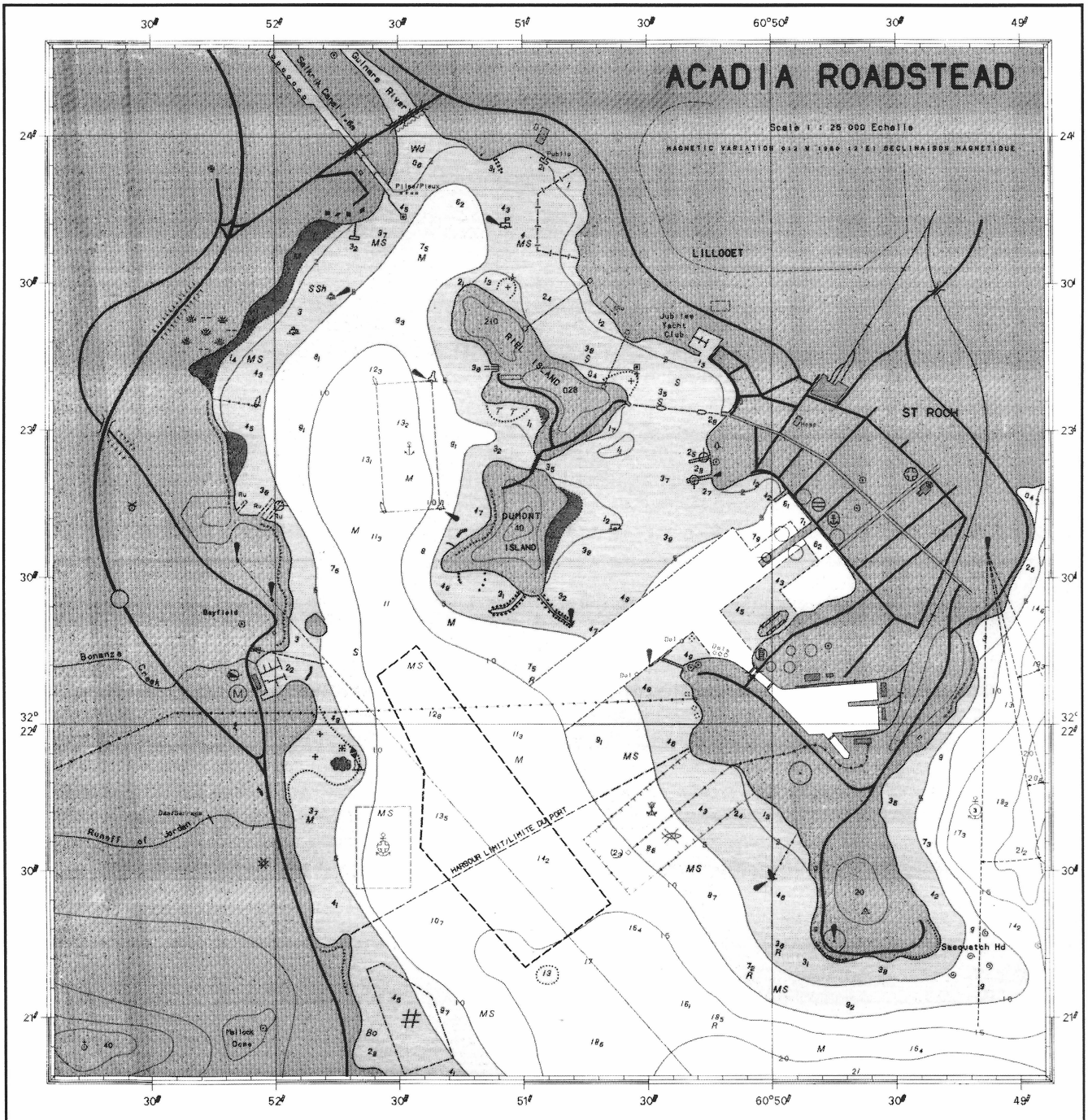

Figure 1: Inset of Chart 9995

Phase 2: Full-Colour Charts

The second goal was to produce full-colour charts which closely resembled the final printed version. Two files were processed by USL (CH9995, CH7935) to obtain the pseudo-NTX data required by NTXVRF for colour fill. This data was then merged with a symbolized version of the chart, converted, transferred and plotted in colour (Figure 1: Inset of Chart 9995). The timing results are given in Table 2. To be noted, CH7935 took 45 minutes to plot due to the large number of vectors and polygons in this file. If 10 consecutive CH7935s were plotted, the average time per plot would be 11.7 minutes. This is due to the vector data having already been ordered and rasterized.

Though the electrostatically-produced chart may not be as aesthetically pleasing as present-day printed charts to some eyes, the ability to produce a ready-to-use, full-colour chart in a little over 3 hours (CH9995) versus a total aggregated time of 4 to 6 months (based on past processing/printing of CH9995) demonstrates the potential of this technology. The present method of printing charts (from a NEWNTX digital file) involves many processes. They are:

Table 1: Timing Results - Linework Files

File	File Size (DADS)	Conversion Elapsed time	CPU time	Number of Vectors	Transfer Time (elapsed)	Plot Time (elapsed)	Total Processing and Print Time (elapsed)*	CPU Use
TABLES	27,900	15:10	4:07	161,277	5:00	13:00	33:10	Moderate
CH9995	11,000	13:11	3:10	197,183	5:00	13:00	31:11	Moderate to heavy
CH7935	13,000	23:19	5:41	370,430	10:00	17:00	50:19	Heavy
CH7740	12,000	3:25	3:12	207,540	3:30	12:00	18:55	Low
CH7552	14,500	5:26	4:32	350,905	10:00	16:00	31:26	Low

Table 2: Timing Results - Full-Colour Charts

File	File Size (DADS)	Conversion Elapsed time	CPU time	Number of Vectors	Number of Polygons	Transfer Time (elapsed)	Plot Time (elapsed)	Total Processing and Print Time (elapsed)*	CPU Use
CH9995	12,000	2:40:26	1:06:01	197,463	74,303	12:00	25:00	3:17:26	Moderate
CH7935	18,500	8:02:53	4:12:29	380,414	127,734	15:00	45:00	9:02:53	Moderate

* Subsequent plots will not require reconversion or retransferring of plot data.

	Process	Estimated Time(hours)
1	Separate digital file by colours (NTXCOL)	2.00
2	Convert to GC3 format for photo-plotting on Kongsberg (NTXKNG)	4.00
3	Photo-plotting	10.00
4	Photo-processing	0.35
5	Produce negatives	0.50
6	Make peel-coats	0.25
7	Peeling	2.00
8	Spot or patch negatives	4.00
9	Make colour proof	1.00
10	Verification (reiterate if required)	8.00
11	Plating	1.00
12	Printing (3 months average delay)	N/A
Total		**33.10**

For a sample chart (CH9995), an estimated 34 hours processing time would be required, assuming immediate turnaround for all indicated steps. Taking into account all delays, the estimated elapsed time for CH9995 would be one to two months, to go from the NTX digital file to plating. It is also estimated that the entire task (as outlined above), including plating and printing would take four to six months total time. Therefore, on an immediate turnaround basis, the electrostatic method provides a 91% process reduction time, and when including all delays, a process reduction time of 99.7 to 99.8% is possible.

To obtain a more in-depth feedback on the quality and presentation of the electrostatically-generated chart, Chart 9995 was shown to members of Chart Production and Cartographic Research. They were asked to critique the chart. Though there were some resolvable problems, feedback on the product was very favourable and an eagerness to integrate this technology within the production process was expressed. The production turnaround combined with the quality of the final product, has in pseudo-production tests demonstrated a potential for shortening many of the chart production cycles.

PHOTO POSITIVE/NEGATIVE GENERATION

Since the POD charts met the needs specified for the low-volume, high-change and/or custom charts, investigations were started on other uses for the electrostatic plotter. One of these was the generation of photo-positives (on film) for subsequent printing by the existing method. This was to try and meet some of the existing preprint requirements while increasing the overall efficiency. The linework results on the film media were less satisfactory than those obtained on paper due to higher percentage of dot-flaring (*). Versatec promises this problem will be minimized by improved film media. Due to the amount of "spotting" (duffing) still required when producing negatives from photo-positives, investigations into direct negative plotting by electrostatics was initiated. Versatec has indicated that the monochromatic plotters (400dpi) presently have the capability for negative (or complement) plotting and that their development staff are

(*) "Dot-Flaring": Due to the quality of the initial media, the excitation of adjacent nibs within the writing head would cause toner to be deposited erroneously. The media's threshold has been improved and the amount of flaring significantly reduced.

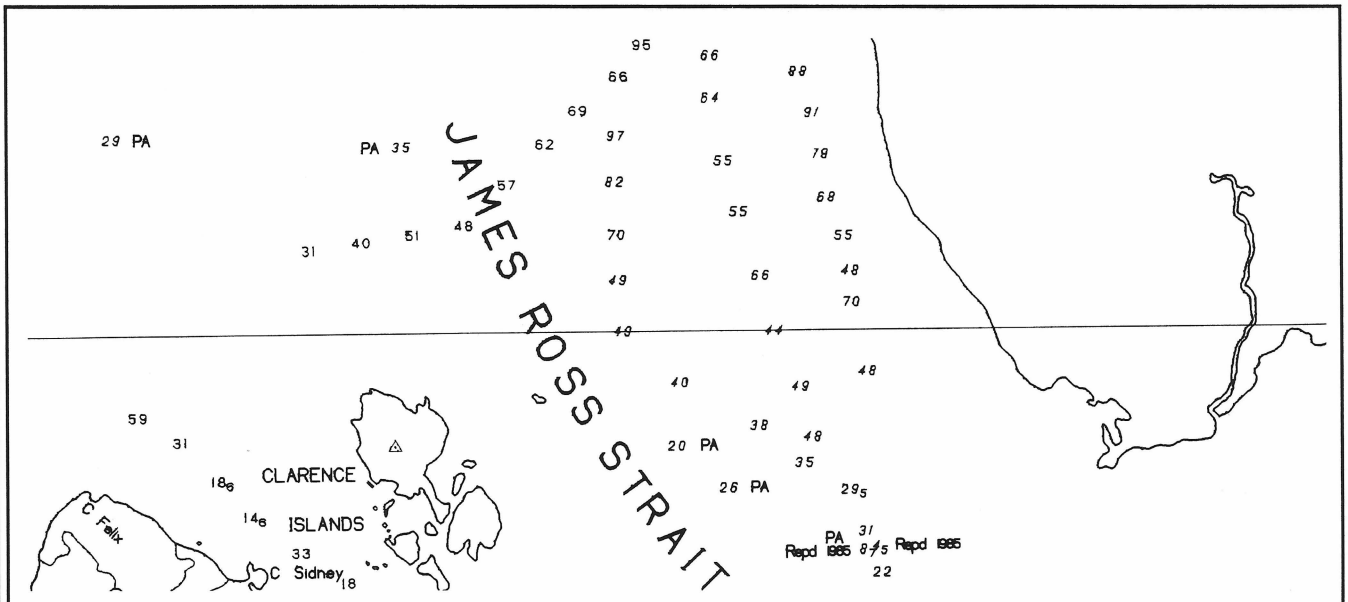

Figure 2: Patch Generation

implementing this feature on the colour version. For the time being arrangements have been made to plot CH 7935 in negative form, on their monochromatic plotter.

The total elapsed time for the conversion to VRF of CH7935 (for photo-positives) was 37 minutes 40 seconds and a total CPU time of 7 minutes 39 seconds. The total transfer and plot time was less than 1.5 hours. Should negative plotting prove successful, this particular usage for high-volume charts will be considered.

COLOUR PROOF GENERATION

With the successful production of full-colour charts it became obvious that, with the use of a suitable material, we could indeed produce colour proofs using the electrostatic plotter. This would eliminate a lot of processing, use less material and reduce deficiencies associated with errors (reiteration). The entire process would be reduced to that of converting, transferring and plotting the data - a process which requires 1 to 5 hours (depending on density and type of data) instead of many days. There would be a saving on reprographic material since the entire process is done in one step. Once the proof has been accepted, POD plotting, direct negative plotting or conventional photoplotting could be initiated (from the same data). Matte-back polyester film (4 mil thick) has been requested to conduct a feasibility test. This product is a dimensionally stable electrographic media with a non-fibrous matte drafting surface. It accepts ink, plastic and graphite leads for drawing, update or correction. Quality Control have indicated a willingness to use such a proof especially if it can be produced on an 8 or 9 mil thick matte.

PATCH GENERATION

Another potential application is that of generating patches. A Notice to Mariners was found for one of the converted files, CH7740. CARED (USL/CARIS) was used to enter, modify or delete information as per the Notice. The following table gives the elapsed times for digital data correction:

Process	Elapsed Time (minutes)
1 CARBLD	5.00
2 Windowing	2.00
3 Writing out to NTX	.08
4 Build windowed data (CARBLD)	.33
5 Editing/final write to NTX	10.00
Total	**17.41**

The next table lists the elapsed times to plot the patch:

Process	Elapsed Time (minutes)
1 Conversion to VRF	.42
2 Transfer to Plot-Queue system	.07
3 Plot patch	5.00
Total	**5.49**

Figure 2 contains a copy of one of the patches generated in 22.9 minutes (Manual tracing took 35 minutes). The patch overlayed perfectly with the tracing. Not only were we able to produce a tracing in less time, but we additionally produced the patch and updated the digital data at the same time. With the availability of a small-format plotter (Versatec, 17" x 11", 400 dpi, ink-jet), capable of producing colour plots from the same VRF format, a new door has opened for the application of this technology.

SMALL PORT CHARTS

With the same small-format plotter mentioned above, it becomes feasible to also produce Small Port Charts.

These charts could be produced on demand, with the most up-to-date information being shown. Also, the number of colours could be increased substantially without incurring any additional processing costs. Colour fill could also be added, but this would incur a larger processing time.

COMPUTER-ASSISTED COMPILATION

Another potential application resulted from the tests conducted in early January of 1987 on "Computer-Assisted Compilation". A special version of the NTXVRF program was implemented which "colour-banded" sounding depth ranges. The user selects from a table of 256 colours for up to 5 depth ranges. NTXVRF then converts the sounding value to an appropriately colour-coded dot. Figure 3 contains one of the preliminary test results. This is a subset of some field data being processed for the Hydrographic Data Base (HDB) prototype. The electrostatic plotter has an advantage over pen-plotters for this type of application since the overlapping of two depth range dots creates a third colour. With proper colour selection these exclusive dots can assist in the generation of contours in the chart-making process. More work has to be done so as to enhance this program's capabilities (i.e. dot size selection) and to define this tool's usage for "Computer-Assisted Compilation". However, initial results encourage further development in this area.

SUMMARY

POD

The first objective of the Print-On-Demand project has been met, that of printing full-colour charts by means of an electrostatic plotter. The results of these plots and the initial response from the cartographic community would indicate a potential acceptance for this method of printing charts. With the return of the plotter from field trials and subsequent fine tuning of the presentation quality, there will certainly be a place within the CHS for this printing technology.

To take full advantage of Print-On-Demand would require up-to-date digital chart data. The forthcoming HDB promises the availability of such data as a processed subset. However, the time frame for implementation of the HDB, and subsequent processing to the chart data level is certainly "long-term".

According to Ottawa chart distribution figures (1986), there are 370 charts with a distribution level of 50 or less and 673 charts which are at a level of 100 or less. Also, there are over 67 charts which for 1986 have a total correction value over 5,000, 36 which are over 10,000 and 21 which have a total correction value of over 20,000 (based on the annual list of charts requiring hand amendments). These figures (though not including Pacific distribution and corrections) clearly indicate a potential cost saving by the reduction and/or elimination of chart storage, handling, waste and maintenance for the low-volume and/or high-change charts. Specialized charts could also benefit from the electrostatic printing method due to their customary low-volume demand. Though the data and system requirements for supporting print-on-demand are still unclear, work in this area will continue, with a potential benefit to all forms of digitally-produced charts (i.e. POD, Electronic Chart, Chart Production).

Photo Positive/Negative Generation

Though the first results from this investigation produced an inferior line quality, the assurances obtained from Versatec indicate that this quality can be improved with the new film media under development. Plotting photo-positives, though reducing actual plotting and processing times considerably (80%), incur a larger "spotting" time, making an improvement in total aggregated time minimal. However, the capability of producing negatives directly promises a total plotting and processing time reduction of 70 to 87%. Should the quality also prove acceptable, this process might provide a faster turnaround for the higher-volume charts requiring more frequent press runs.

Figure 3: Computer-Assisted Compilation

Versatec have been given CH7935 (colour-separated) in VRF format so that they may plot them in negative form (on film) on their 400 dpi monochromatic plotter. The results of this test will determine the feasibility of direct-negative plotting on electrostatic plotters.

Colour Proof Generation

With the quality of presentation of the POD charts approaching that of colour proofs, it became feasible to examine this method's capability of generating colour proofs directly. This would not only expedite the generation of the proof, but would also minimize waste, not only in person-hours (NTXKNG, plotter operation,

media handling and processing) but also in media waste (due to process reiteration). With a potential for plotting on matte-back polyester film (up to 8 or 9 mil). Quality Control has indicated that this process might produce an acceptable colour-proof.

Matte-back polyester film has been requisitioned and a series of proofs for assessment will be produced (based on already converted charts and "in production" versions). Based on the appraisal, a production implementation plan will be made.

Patch Generation/Small Port Charts

The preliminary experiment in updating digital chart data and producing a patch from the results was quite impressive. The accuracy of the output patch was excellent when compared to the manual tracing. The fact that it took 35% less time not only to produce the tracing (patch) but to simultaneously update the digital chart file demonstrates a potential for maintaining up-to-date digital chart files while incurring no extra labour. There would, however, be a requirement for access to a colour graphics editing station to make the updates, window the data and convert to a plot-ready format. With the availability of a small-format VRF based colour plotter (11" x 17", 400 dpi, $16K) it might be feasible to remotely (Regions/Chart Dealers) print patches and small port charts.

Computer-Assisted Compilation

Initial results would indicate a unique and informative method of colour-banding depth ranges, which could be of benefit to interactive compilation. More development is required here to make the program more user-friendly and efforts will be made to do so.

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A Canadian Technical Cooperation Programme

by
Rear Admiral D. C. Kapoor
Surveying Science Department
University of Toronto

"The States Parties to this Convention .....
Conscious that the problems of ocean space are closely interrelated and need to be considered as a whole,
Recognizing the desirability of establishing through this Convention, with due regard to the sovereignty of all states, a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans, the equitable and efficient utilization of their resources, the conservation of the living resources and the study, protection and preservation of the marine environment,
Bearing in mind that the achievement of these goals will contribute to the realization of a just and equitable international economic order which takes into account the interests and needs of mankind as a whole and, in particular, the special interest and needs of developing countries, whether coastal or land-locked ....."

The sentiments expressed above are enshrined in the preamble to the United Nations Convention on the Law of the Sea (LOS) 1982.

THE NEEDS OF DEVELOPING COUNTRIES

The reference to the special needs of developing states is most pertinent when viewed against the fact that these states have now acquired new rights to exploit extended zones of jurisdiction on an unprecedented scale. But they also face important responsibilities and obligations arising out of the new legal regime. The initial task alone, of conducting systematic hydrographic surveys for the purpose of establishing a modern chart coverage, calls for considerable resources in vessels, equipment and trained personnel. Generally speaking, progress towards the creation of any national capabilities in hydrography has been extremely slow in developing countries. This is perhaps inevitable considering the large capital outlay required, and the fact that the limited economic resources have to be diverted to more pressing problems facing these nations. A contributing factor has been the failure of the old colonial administrations to realize the need for a national charting programme in the newly emerging nations. On the other hand, in most cases a good infrastructure was left behind in the field of topographic and land mapping activities.

The new legal regime for the oceans and seas has now brought to the forefront the need for a national hydrographic surveying and charting programme. But, more importantly, it has focussed attention on the immediate task of defining the new national boundaries in the offshore zones. The boundary-making process, its negotiations and the connected legislative actions call for coordinated action between the legal, diplomatic and technical experts acting as a team. The availability of proper technical support is a crucial factor which needs to be urgently addressed, considering the fact that no more than a mere handful of hydrographers and cartographers have been actively associated with boundary determination and the other technical tasks emerging out of the implementation of the LOS Convention.

CANADIAN ASSISTANCE

The needs of developing countries in this field of activity were recognized by Canada in the context of the technical cooperation and assistance programmes.

In order to help developing countries to manage their ocean resources and related activities, the Canadian government created a new Crown Corporation, the International Centre for Ocean Development (ICOD), within the Canadian development assistance structure. The mandate of ICOD pertains to a number of different fields of ocean activity and training constitutes an important component.

Consequently, with ICOD sponsorship, a special training course programme in Maritime Boundary Delimitation was designed in the Surveying Science Department of the University of Toronto for selected personnel from developing coastal states. The course is structured for hydrographers and land surveyors who have a fairly solid background in the various aspects of the surveying and mapping profession, combined with practical experience with a national agency such as a hydrographic unit or a directorate of land surveys. It has been emphasized in the course description that middle-management personnel are likely to derive the maximum benefit from this course particularly as it will be this cadre of staff which will be called upon to perform the technical tasks during the boundary-negotiating process. These tasks will assume considerable importance bearing in mind that each coastal state will have to negotiate one or more boundary agreements with its neighbours. In addition, each coastal state will have to frame suitable legislation pertaining to the outer limits of its various zones of jurisdiction and deposit, with the

Secretary-General of the United Nations, copies of the relevant charts or list of coordinates showing these limits.

OBJECTIVES OF THE PROGRAMME

The main objective of the programme is to train selected personnel in the technical aspects of offshore boundary delimitation taking into account the provisions of the new legal order for the world's oceans and seas enshrined in the United Nations Convention on the Law of the Sea. The programme covers the following broad areas of study:

a. Review of hydrographic surveying technology: data acquisition, processing and exploitation. Bathymetric surveys; geomorphology of the oceans; nautical cartography and chart construction; geodetic factors relative to boundaries; horizontal and vertical datums.

b. Historic development of the Law of the Sea. Obligations and duties of coastal states;determination of baselines; outer limits of the territorial sea, contiguous zone, exclusive economic zone. Determination of the parameters of the continental shelf. Archipelagic baselines and waters. Geometric methods for construction of delimitation lines; boundary agreements. Geometric factors arising out of the decisions of the International Court of Justice.

c. Concept of the Freedom of the High Seas; Innocent Passage; scientific research, fisheries protection and enforcement. Proposed Seabed Authority and its machinery.

d. Exposure to connected survey disciplines including land boundary law, photogrammetry, remote sensing and digital mapping.

The objectives listed above provide a somewhat broader perspective than the purely technical aspects of maritime boundary delimitation.

PROGRAM IMPLEMENTATION

The training course was initially conducted as a pilot project for a period of six weeks (January-February 1987). For the pilot phase, only three students were selected from amongst the personnel sponsored by governments in the Caribbean region. This is one of the priority regions in the ICOD program and the initial course had students from Antigua, Jamaica and St. Lucia. Subsequently, the duration of the course was increased to seven weeks with a student strength of six. The original course content was also modified to some extent in the light of the fact that the students had rather diverse professional and academic backgrounds.

The second course was conducted during June-July 1987, at the Erindale Campus of the University of Toronto with students from both the Caribbean and Pacific Regions, which included participants from Dominica, Guyana, Papua, New Guinea, St. Vincent, Solomon Islands and Trinidad and Tobago.

The travel, accommodation and other expenses of the participants were fully funded by ICOD.

Four of the students had a good hydrographic background whilst the other two were land surveyors with some exposure to traditional hydrographic field work methods. The fact that the students were from different regions and professional backgrounds provided extra stimulus in generating discussion concerning problems and issues affecting each of the developing countries represented in the course.

The facilities of Erindale were utilized for conducting the course which entailed 12 to 15 lecture hours per week with an extensive schedule for individual research assignments. The library and computer facility of the College was extremely useful for research assignments. A large number of case studies were conducted in "state practice" utilizing texts and charts related to national claims including straight baselines and the derived offshore limits. A number of bilateral agreements pertaining to international boundaries were also examined.

Each student was provided with material relative to his geographical area for the purpose of identifying specific problems concerning existing or proposed boundaries.

All research projects and assignments were discussed at group sessions which proved to be extremely popular and highly lively. The last week of the course was almost exclusively devoted to the examination of the decisions of the International Court of Justice, as they relate to the geometric principles used in boundary delimitation.

CONCLUSION

Nine students, drawn from the Caribbean and Pacific regions have, so far, taken advantage of this training course on Maritime Boundary Delimitation, sponsored by ICOD under the Canadian technical cooperation structure. The students attained a fairly high proficiency in the various tasks assigned to them and they expressed a great deal of confidence in their ability to undertake the technical work associated with maritime boundaries. It is, indeed, gratifying to note that on return to their countries, some participants have already been assigned duties with the national delegations for boundary negotiations.

An added project output has been the exposure that the participants received to modern technology in hydrography and the allied disciplines. The proper application of the technology will greatly strengthen the capabilities of the national hydrographic surveying units.

This is an area of activity in which Canada has rightfully taken the initiative in assisting developing countries with a training programme which provides the recipients with a much needed technical capability. The response from developing countries for participation in future courses has been most enthusiastic and it is to be hoped that the Canadian government, through ICOD, will continue to sponsor training and technical assistance in all aspects of hydrography.

PULSTRAC™

by
Paul K. Dano
Del Norte Technology, Inc.

ABSTRACT

A positioning system utilizing spread-spectrum radiolocation offers real-time extraction and correction of system biases to eliminate fixed timing errors. Utilizing a proprietary technique with the traditional number of shore reference stations, an unlimited number of passive users obtain additional lines of position as well as calibration information. The increased lines of position and continuous calibration monitoring provides a positional confidence factor to the hydrographer in real time. A single frequency can be used worldwide since "networks" are identified by code. Adjacent networks can be indicated to the user through the system description data thus facilitating network-to-network operation without operator intervention. Although the system accuracy is excellent for hydrographic survey, the automation of dynamic precise positioning is most advantageous in pilotage and navigation.

INTRODUCTION

The quest of the hydrographer is to find the ideal measurement tool which will give the location of any point at his whim. We are all eagerly awaiting the implementation of GPS to provide this for us. However, judging from the volume of papers presented in the last several years, is GPS going to provide the answer for dynamic precision positioning? A rocking and moving boat is not the ideal vehicle for gathering repetitive data of a point to take back to the office for reduction. What alternative or backup system does the dynamic surveyor have? If one were to propose an alternate system, what might it be? It appears logical that this alternate system should be capable of augmenting GPS not just paralleling it. Also, this alternate system must be capable of standing on its own, implemented at will, usable by anyone and be of reasonable cost.

The following discussion is a collection of techniques which we have learned over the last 40 years. Use of the latest technology in software and hardware is the glue which holds these concepts together to form a new system.

Figure 1 illustrates two shore stations and a mobile receiver in a passive system. Station **A** is the master and station **B** is a slave. Master **A** emits a pulse which is radiated in all directions. The slave station **B**, upon reception of the master **A** pulse, repeats the pulse. The mobile receiver **R** would see two pulses arriving at

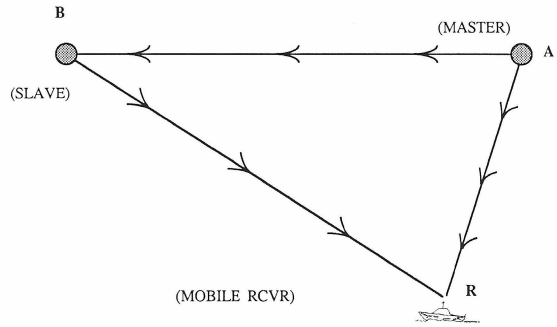

Figure 1

different times. The time difference would be dependent upon the propagation time of the master station **A** pulse from the master position to the slave position (**AB**), the propagation time of the repeated pulse of slave station **B** from the slave position to the mobile receiver **R** position, the turn-around-delay (**TAD**) of the slave station **B** and the time of propagation from the master station **A** position to the mobile receiver **R** position. The differential time (T_{AB}) relationship can be summarized by the following equation.

$$T_{AB} = [AB + BR + (TAD \text{ of } B)] - AR \qquad (1)$$

This is the basic concept of most passive systems. Of course there are many departures at this point to overcome the problems of this elementary concept such as superclocks and pseudo-ranging, however, let's continue with the basics. Since the remainder of this discussion continues to refer to baseline distances (such as **A** to **B**) and the propagation time intervals over these distances interchangeably, please excuse the misnomer.

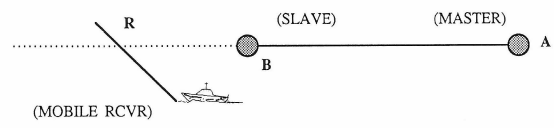

Figure 2

A standard method to check the calibration or measure the turn-around-delay of the slave station **B** is to have the mobile receiver **R** cross the baseline (**AB**) extension at the slave **B** end as shown in figure 2.

At the exact point of the baseline extension crossing **R** (special case) the basic hyperbolic equation (1) can be reduced as follows:

$$T_{AB} = [AB + BR + (TAD \text{ of } B)] - (AB-BR) \quad (2)$$
$$T_{AB} = (TAD \text{ of } B) \quad (3)$$

If it is not convenient to cross the baseline extension at the slave end, figure 3 depicts the special case when crossing the master **A** of the baseline extension.

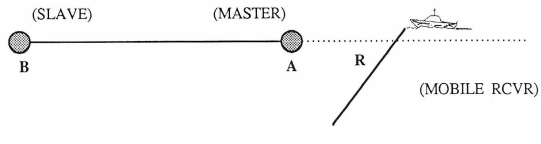

Figure 3

As before, the special case of basic hyperbolic equation (1) can be reduced as follows:

$$T_{AB} = [AB + (BA + AR) + (TAD \text{ of } B)] - AR \quad (4)$$
$$T_{AB} = 2(AB) + (T_{AB} \text{ of } B) \quad (5)$$

NEW USE OF PROVEN TECHNIQUES

Most of the time it is not convenient to cross any baseline and in fact it would be best if we could calibrate at any time and any place. If we return to figure 1 and let B_{Cal} represent **TAD** of **B**, equation (1) can be written as follows:

$$T_{AB} = [AB + BR + B_{Cal}] - AR \quad (6)$$

If we leave the mobile receiver **R** in position as in figure 1 and reverse the roles of the network stations as in figure 4, equation (1) can be written as follows:

$$T_{BA} = [BA + AR + A_{Cal}] - BR$$

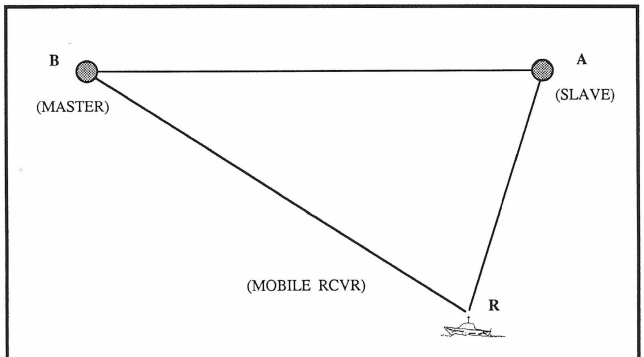

Figure 4

By combining equations (6) and (7).

$$T_{AB} + T_{BA} = [AB + BR + B_{Cal}] - AR + [BA + AR + A_{Cal}] - BR \quad (8)$$

Equation 8 reduces to:

$$T_{AB} + T_{BA} = 2(AB) + A_{Cal} + B_{Cal} \quad (9)$$

By interchanging the roles of the network stations (**A** and **B**) we have in effect performed a similar action as crossing the baseline (**AB**) extensions, however, now we have two unknowns A_{Cal} and B_{Cal}. This **reciprocity** concept effectively equates the errors introduced by the system electronics to a constant even though the mobile receiver may be anywhere within the signal reception area.

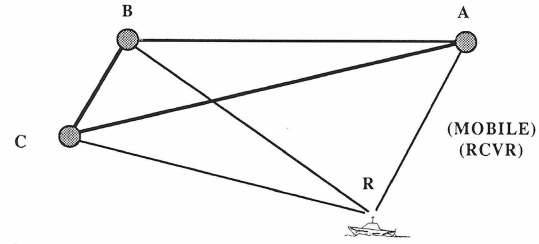

Figure 5

THE NETWORK

A three-station network where each network station in turn becomes the master can be summarized with figure 5. After a complete cycle in which each network station has assumed the master role, the mobile receiver will have accumulated six time difference measurements as follows:

$$T_{AB} = AB + BR + B_{Cal} - AR \quad (10)$$
$$T_{AC} = AC + CR + C_{Cal} - AR \quad (11)$$
$$T_{BA} = BA + AR + A_{Cal} - BR \quad (12)$$
$$T_{BC} = BC + CR + C_{Cal} - BR \quad (13)$$
$$T_{CA} = CA + AR + A_{Cal} - CR \quad (14)$$
$$T_{CB} = CB + BR + B_{Cal} - CR \quad (15)$$

Extending the reciprocity concept and combining equations:

$$T_{AB} + T_{BA} = 2(AB) + B_{Cal} + A_{Cal} \quad (16)$$
$$T_{BC} + T_{CB} = 2(BC) + C_{Cal} + B_{Cal} \quad (17)$$
$$T_{AC} + T_{CA} = 2(AC) + C_{Cal} + A_{Cal} \quad (18)$$

Since the station positions would be known, the baseline distances and thus the propagation intervals

can be computed. The three equations are solved for the three unknowns (A_{Cal}, B_{Cal} and C_{Cal}). The six mobile receiver measurements are composed of three sets of reciprocity pairs. Although the pairs must be considered redundant data and constitute only one line-of-position (LOP) per pair, it can be seen that three-station networks provide three distinct LOPs.

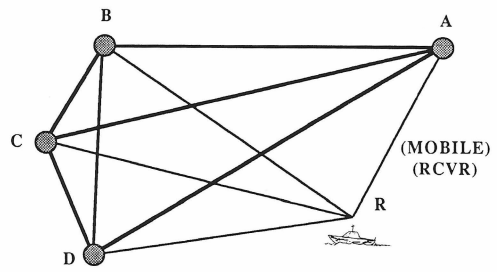

Figure 6

$$T_{AB} = AB + BR + B_{Cal} - AR \quad (19)$$
$$T_{AC} = AC + CR + C_{Cal} - AR \quad (20)$$
$$T_{AD} = AD + DR + D_{Cal} - AR \quad (21)$$
$$T_{BA} = BA + AR + A_{Cal} - BR \quad (22)$$
$$T_{BC} = BC + CR + C_{Cal} - BR \quad (23)$$
$$T_{BD} = BD + DR + D_{Cal} - BR \quad (24)$$
$$T_{CA} = CA + AR + A_{Cal} - CR \quad (25)$$
$$T_{CB} = CB + BR + B_{Cal} - CR \quad (26)$$
$$T_{CD} = CD + DR + D_{Cal} - CR \quad (27)$$
$$T_{DA} = DA + AR + A_{Cal} - DR \quad (28)$$
$$T_{DB} = DB + BR + B_{Cal} - DR \quad (29)$$
$$T_{DC} = DC + CR + C_{Cal} - DR \quad (30)$$

If the number of network stations is increased to four, as in figure 6, the LOP advantage increases. The twelve readings obtained by the mobile receiver reduce to six distinct LOPs. Thus a four-station passive system utilizing role-switching not only has the advantage of self calibration but will provide twice the number of distinct LOPs as a standard passive system of the same number of active stations and two additional LOPs over a four-station active-ranging system.

HARDWARE REQUIREMENTS

The network stations must communicate with each other and be placed for reasonable Geometric Dilution of Position (GDOP) for the work area. Passive hyperbolic systems present excellent GDOP conditions when the mobile receiver is within the network baselines, thus placing the network stations around the work area is ideal. Such an arrangement also tends to ease the network station intercommunications.

The frequency of choice for such a local area system must be high enough not to be ground wave influenced and low enough not to be totally dependent upon line-of-sight (LOS). Due to world frequency allocations, this puts the frequency in the 400 megahertz band. At 400 MHz, two to three times the LOS communication distance is obtainable with reasonable equipment, thus a separation of network stations of 50-90 kilometres is easily obtainable with moderate station heights.

Since the mobile receiver will be at different distances from the individual network stations, the signal levels will be different and in some cases very large differences will occur. The receiver must be capable of receiving these signals which are almost adjacent, since in this discussion the slave is a repeat of the master signal. Standard automatic gain controls would not be effective in this case, therefore, a little technology is necessary. By using a limiting receiver with over 100 decibels of useful dynamic range, successive signals of large amplitude variation can be received without undue circuit-propagation variation (this error must be kept to less than one metre equivalence).

The limiting receiver then necessitates that the pulse be of a frequency-type modulation. By using a spread-spectrum technique, not only is the frequency modulation accomplished, but a signal signature is transmitted which can be uniquely identified. Surface Acoustic Wave Devices (SAWDs) generate, as well as reconstruct, the "Pulses".

Figure 7 is a simplified block diagram of the signal proc-

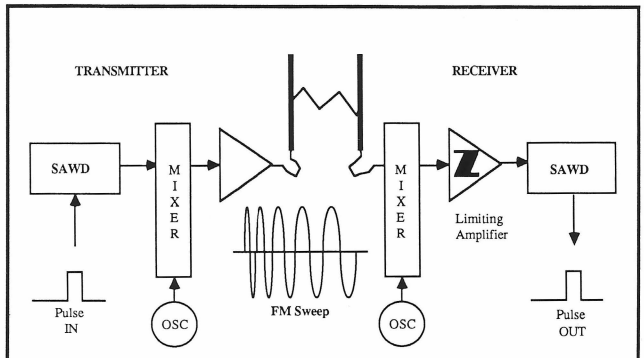

Figure 7

essing. A pulse is introduced into the SAWD which produces a frequency-sweep output as a function of the geometric construction of the SAWD. The sweep signal is hetrodyned up to the desired frequency band such as 427.5 megahertz. The original input pulse of approximately 100 nanoseconds is now a sweep through 10 megahertz of approximately 100 microseconds in duration. The signal is received and hetrodyned back down to an intermediate frequency (IF). The high gain limiting IF amplifiers have a very wide dynamic range. The signal sweep is reintroduced into the SAWD which then reconstructs the originating pulse.

The use of SAWDs to produce the spread-spectrum

technique was introduced to commercial ranging systems in early 1982. The technique has proven to produce very accurate operations under adverse signal conditions. Subsequent use of limiting receivers and digital correlation of the received pulses has shown a marked increase in maximum useable range while improving the signal-to-noise ratio.

RECOGNIZING PULSES

The mobile receiver must be able to recognize the difference between the network stations as well as adjacent network stations, also the network stations must be able to recognize which station to repeat. A very simple coding arrangement of pulse repetition intervals (PRIs) is assigned to each network with an individual code for each network station. Each network has an **A** code, **B** code and so on. When a network station determines it is to be master, it simply sends its code. This identifier alerts the other network stations and all mobile receivers that a sequence is about to start. The master, say **A** station, then transmits the next code in the network order, i.e. code **B**. The **B** network station would repeat. Next the master would transmit code **C** and so on. Each second, a different network station assumes the master role and identifies itself and goes through the remaining network codes. Thus if there are three network stations, a complete cycle takes three seconds; four stations, four seconds and so on. Adjacent networks although on the same frequency have a different set of codes.

MAKING IT PRACTICAL

Since the individual network stations communicate with each other for signal repeating and role timing, super accurate clocks are not needed in the network stations or the mobile receivers. Note that the mobile receivers are measuring relatively short pulse-to-pulse intervals and are not pseudo-ranging, therefore, only inexpensive crystal clocks are needed and one less unknown (time) is involved in the computations.

Each time a network station assumes the master role, it transmits its identifier which is used by the other network stations and all mobile receivers. Within the identifier data can be embedded, such as the position of the particular network station. Of course, other information can be placed within the identifier. Each network station has the capability of having data loaded via an RS232 port. Data within the identifier can be a constant, such as the station position and adjacent network codes, or changed periodically, such as GPS differential information.

REDUCING EVERYTHING TO TIME

Since the mobile receiver computes the baseline propagation interval using positions of the network stations and a constant for the velocity of propagation, it may be deemed more exacting to supply a correction factor for local variations. The propagation correction factor can be obtained by the network stations. For example, referring to figure 6, the receiver of network station **A** will see the signals of the other network stations. Station **A**, if considered as a mobile receiver, will see a three station network (**B**, **C** and **D**). Using the following two equations from the list of 12 possible measurements of a four station network, the correction factor can be computed.

$$T_{BC} = BC + CR + C_{Cal} - BR \quad (23)$$
$$T_{DC} = DC + CR + C_{Cal} - DR \quad (30)$$

Rewriting the above equations for **A** position instead of **R** and letting **K** be the propagation constant.

$$T_{BC} = C_{Cal} + K(BC + CA - BA) \quad (31)$$
$$T_{DC} = C_{Cal} + K(DC + CA - DA) \quad (32)$$

Subtracting equation 32 from equation 31 and solving for **K**.

$$K = (T_{BC} - T_{DC})/(BC + DA - BA - DC) \quad (33)$$

Since all the items on the right-hand side of the equation are either measured or known (derived from the network station positions), the local propagation constant can be solved. Other stations in the network can like-

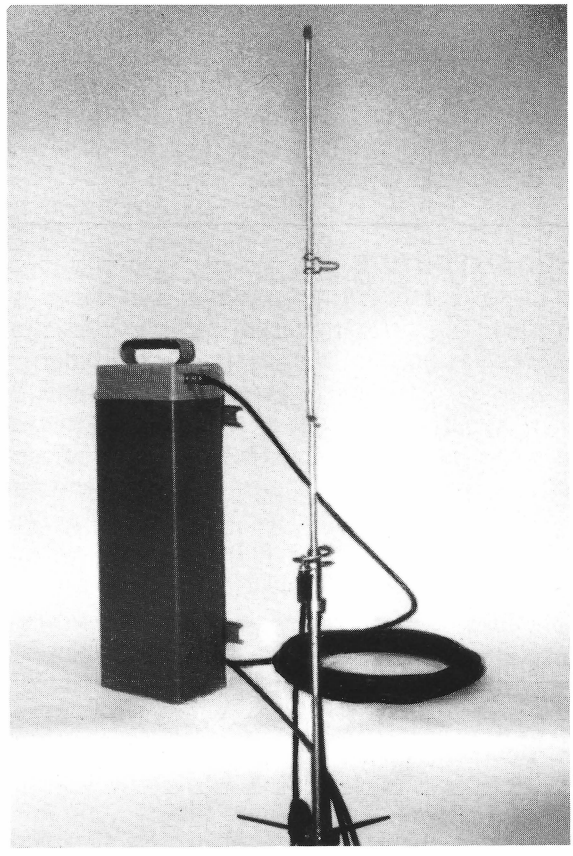

Figure 8

wise solve for the constant, however, four of the six baselines are involved in the solution of equation 33. A correction factor could be included in the network station identification.

$$\text{Correction Factor} = K / K_{(\text{Standard})} \qquad (34)$$

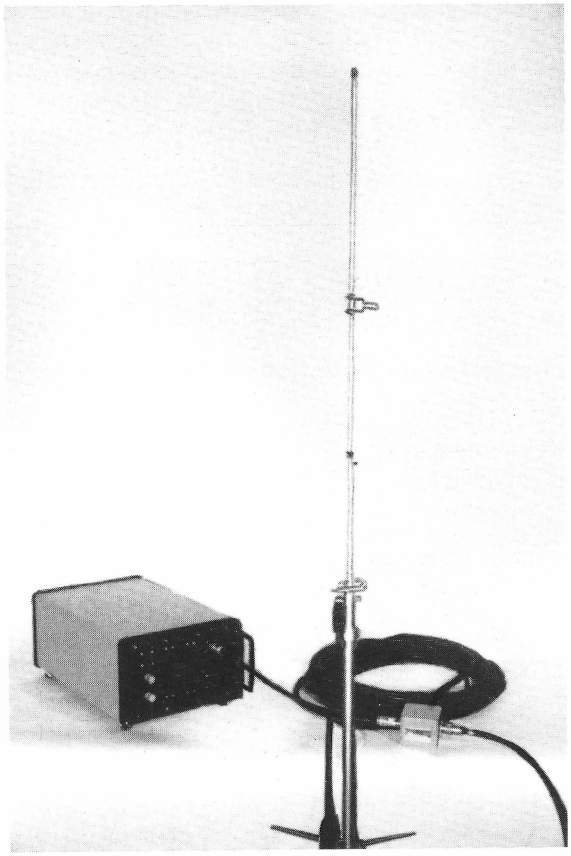

Figure 9

DEMONSTRABLE

The all solid-state network stations (see figure 8) are composed of a microprocessor-controlled transmitter and receiver housed in a weather- waterproof case. These small 72 cm long units are easily mounted. Their low (10 to 32 volt DC) power requirements are easily met using wind generators, solar cells or power line adapters. Hand held terminal programming and control make the unit easily tested and setup as well as on-line controllable. The antennas, cables and connectors are readily available from most UHF suppliers.

The light-weight mobile receiver (see figure 9) consists of an antenna, low noise preamp, antenna cable and a receiver in a waterproof housing. Again the low power requirements of 10 to 32 volt DC are easily met aboard the smallest to the largest vehicles. The output of the receiver is simply utilized by a terminal display, computer or electronic map display via standard RS232 or RS422. This allows the receiver to be placed most anywhere out of the way, thus not taking up valuable space.

Although the receiver is programmable via its RS232 port, no operational information is lost in case of a power outage and automatic operation will continue upon power restoration. The receiver normally performs all positioning computations in WGS72, however, it can be programmed to use up to 9 different spheroids including a wild card in which spheroid parameters can be entered. UTM and Lat.-Long outputting is available in controllable formats. Data outputting is also controllable for GPS differential operations.

Data taken in the Gulf of Mexico using PULSTRAC™ and TRISPONDER® (the benchmark system) has demonstrated that PULSTRAC™ has the expected accuracy of better than 2 metres under dynamic conditions. Static tests were within 1 metre accuracy.

AN EYE TO THE FUTURE

Most positioning systems to date are stand-alones and are incompatible with other systems. A complementary system will improve an existing system. Providing the data link for differential GPS as PULSTRAC™ does is a help. The integration of equipment and data from PULSTRAC™ and GPS with differential correction is a most powerful combination.

CONCLUSION

A new dynamic precise positioning system is available which uniquely combines proven techniques with newer technology and provides a complement path with GPS. The needs of the coming age of electronic mapping and electronic chart displays for more accurate sensing of position can be met with the concept. The fact that this low cost passive precision system can be implemented in selected areas throughout the world using only one frequency, even though multiple and adjacent networks may be necessary, is a definite advantage to the user community.

Offshore Construction and Inspection

by
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Hydrographic Survey Consultants, Calgary

This paper was presented to the Engineering Institute of Canada in March 1987 at Calgary, Alberta

ABSTRACT

An overview of the different types of surveys carried out during each stage in the development of an oil and gas field is provided. The trends in new concepts and techniques in carrying out these surveys are outlined based on overseas experience.

INTRODUCTION

The purpose of this paper is twofold. Firstly, to highlight the main surveying and mapping activities that are associated with offshore construction and inspection during the development and production phase of an offshore oil and gas field. Secondly, to highlight new developments that are being made within the surveying and mapping area to improve the overall cost effectiveness of these projects.

The surveying and mapping profession has been active in the exploration, development and production of oil and gas resources from the continental shelf areas and deeper waters of the world since these efforts first started. The ability of the surveying and mapping profession to develop new technologies and techniques to solve engineering problems was one of the critical factors in making the offshore oil and gas projects viable.

This paper briefly explains the various surveying and mapping activities that are associated with each stage in the development of a field. The various stages of development are covered systematically although not all of these stages will necessarily occur during the development of any one particular field. For each stage the trends in new concepts and techniques are highlighted.

SITE INVESTIGATION

A thorough site investigation should be a pre-condition for all activities that are related to the development of the field. Site investigation includes such tasks as: locating wrecks and debris; mapping the sea bed and near surface sub-strata; collecting sea bed samples and geotechnical data; collecting current and weather data; and conducting detailed Remotely Operated Vehicle (ROV) surveys.

The survey contractors have been able to achieve considerable cost savings for their clients by dramatically increasing the capability of the surveying team to process aboard the vessel all of the data collected while still at sea. This practice has been refined to the extent that the final report may be available as soon as the vessel docks.

In the future, enhanced computer power will be required so that digital modelling and mapping can become common practice. The continued integration of all systems deployed and those used for positioning will become a necessity. Survey vessels will increase in size and sophistication to meet the requirements for more space, larger numbers of survey personnel and the ability to deploy a greater variety of survey equipment.

The author believes that a future requirement for the scope of work of the contractor will be the confirmation by an ROV of wrecks and debris that have been located by echo sounder or geophysical techniques and which lie within a specified hazard zone. To allow the operator to gain a better understanding of the site environmental conditions existing during all stages of the field's development, more current and weather data will have to be collected by the surveyor.

RIG POSITIONING

The need for positioning of floating production systems, drillships, semi-submersibles and jack-ups over subsea wellheads will increase in the future. In the 'iceberg alley' off Newfoundland, the ability to be able to repeatedly re-position the semi-submersible over the wellhead was a necessity in order to carry out the exploratory drilling program. The success of Petrobas, the state-owned oil company in Brazil, has illustrated how the use of subsea production systems are ideally suited where the water is deep, or the volume of reserves is too low to justify the use of conventional fixed platforms.

The integration of satellite, surface and acoustic positioning systems will continue to be enhanced to achieve the best possible results to meet the tighter positioning tolerances set by the operators. Positioning the drillstring for re-entry to a subsea wellhead is the most critical feature of rig positioning. Acoustic positioning systems, object detection sonar and video cameras are all used to achieve re-entry.

DREDGING

Exploration and production in most areas of the arctic will require artificial islands or caisson-type structures. Prior to laying pipelines, sandwave areas may have to be levelled out to reduce excessive strain on the pipeline when it goes over the crest of a sandwave. Ports and harbours may have to be constructed or maintained to support the development of a field.

The role of the hydrographic surveyor is essential to ensure that the surveying aspects of these types of projects are well coordinated and the necessary site surveys are carried out. The site surveys should identify all hazards on the sea bed and below the sea bed surface, prior to the commencement of the dredging activities.

In the future, digital terrain modelling and mapping with associated computer power will become increasingly important to minimize the time required for data processing and to provide information to the contractor which can be easily interpreted visually.

PLATFORMS AND STRUCTURES

The variety of new designs for offshore platforms and structures that are continually coming off the designers' drawing boards is quite startling. Depending on the design chosen, all or most of the following types of surveys will be required: tow-out route surveys; site investigation at the proposed locations; positioning during tow-out and set-down; and final positioning of the platform or structure.

The specifications for the site surveys required for the proposed location should be well thought out and realistically achievable with due consideration given to the equipment to be used and the environmental conditions to be encountered. As with other offshore surveys, there should be sufficient flexibility within the scope of work to allow for any unforeseen circumstances.

The requirement for current and weather data can be critical during the tow-out and set-down phase of the operation. The continued improvement in instrumentation in the environmental area will make these tasks much easier in the future.

Providing dimensional control will become an increasingly important activity for the surveyor; for example, while construction is in progress ashore, when the topsides and other pieces of equipment are set in place and when a bridge connection is made between existing platforms.

PIPELAY

The services of the hydrographic surveyor are needed for all activities related to offshore pipeline construction as the following list indicates: planning, route and prelay surveys prior to laying the pipeline; positioning during pipe laying including the preparation of crossovers; as-laid and as-built surveys after pipe laying; and as-buried surveys after the covering of the pipeline with riprap, or burial of the pipeline.

The same comments made above with respect to site investigations apply to surveys carried out during the pipelaying stage of the development of an oil and gas field.

A significant cost-saving technique which has been employed by some construction contractors is to pre-plan the anchor patterns required for the pipelay. The positioning aboard the anchor handling tugs can be used to place the anchors at the desired location quickly without lengthy verbal directions from the barge master.

SUBSEA

The hydrographic surveyor is an essential member of the construction team involved in subsea completion works. Such work includes connecting risers and spool pieces between the laid pipeline and the platform, structure or subsea wellhead; placing templates and wellhead protection units over proposed or existing wells; and providing diver and ROV support. These are only a few of the tasks in which the surveying and mapping profession is involved in this rapidly growing area of offshore construction.

Acoustic positioning systems will continue to be the main method used for these surveys. These systems will have improved accuracy and reliability. Developments are under way to increase the performance of acoustic positioning systems to be able to operate in offshore environments which are acoustically very noisy.

The importance of divers in subsea work will continue to be reduced, and many of the tasks the diver was previously performing will be undertaken by an ROV for safety and cost reasons.

INSPECTION

The inspection by diver or ROV of blow-out preventer (BOP) stacks, the anchor patterns of semi-submersibles and drillships and the scouring around the cams of jack-up rigs are relatively straight-forward tasks. However, the inspection of platforms, structures and pipelines is becoming increasingly complex and sophisticated. Non-destructive testing that can be carried out by an ROV is continually being improved. The introduction of underwater stereoscopic camera systems has allowed better interpretation of damaged areas.

The number of sensors carried on an ROV during a pipeline inspection survey can be quite amazing. The

following list indicates the sensors carried during a recent pipeline inspection survey in the North Sea: left, centre and right colour video cameras; black and white, and colour still cameras; roll and pitch sensors; object avoidance sonar; scanning profiler; buried pipeline profiler; a cathodic protection measuring device attached to the manipulator; a gyroscopic compass; and an acoustic positioning beacon.

In the future it will be possible by the integration of computer software to arrive at a position for an event, such as damage to a pipeline, and to document that event while an ROV tracks the pipeline at a speed of a knot or more. However, the present practice of stopping the ROV to carefully examine any damage found so that still photographs and video can be taken and any measurements made will be continued.

The clearance of debris by a diver or an ROV will continue to require the same attention to detail. Accurate positioning data and lucid sketches of the area surveyed and cleared are essential.

SUPPLEMENTARY

The hydrographic surveyor becomes involved indirectly in a large number of tasks when working in the offshore. Examples include the demarcation of safety zones around platforms and structures; general navigation and ship handling; search and rescue operations; assistance in salvage operations to confirm the position of the vessel if it has sunk or the possible extent of damage if it is aground; manned submersible navigation; and dry-docking support.

SUMMARY

The surveying and mapping profession is continually improving and developing new skills and equipment to resolve the complex and difficult problems which arise while carrying out offshore construction and inspection tasks.

The involvement of the surveying and mapping profession during the initial start-up phase of an offshore project and continuation of this involvement through to the completion of the project will definitely improve the cost effectiveness of any offshore project.

As Canada moves towards the development and production of its offshore oil and gas resources, the engineering profession represented in the offshore industry can rely on the practical expertise that the surveying and mapping professional has to offer.

POET'S CORNER

Or: That's What It's Like In The Field

Then our fair survey
(On only our nerve, eh?)
Stayed in Killarney all night.
We awoke in the morning
To a loud scratchy warning
And some of us got quite a fright

Of mice in the walls
And the ceilings and halls,
But it didn't bother us much.
We awoke every morning
To the same scratchy warning
Of mice and of vermin and such.

M. LLoyd
October, 1979

CAPTAIN VANCOUVER BRANCH

The members of Captain Vancouver Branch extend their sympathies to Randy Kjar on the passing away of his father at the early age of 56.

Don Jarvos has taken leave of absence from the British Columbia Institute of Technology whilst he attends the Hydrography II course in Ottawa.

Janet Lawson has temporarily forsaken the private sector while she treads the halls of academia. She graduated at the top of her class at B.C.I.T. in 1986 and has recently accepted a temporary teaching position in the Surveying Department at the Institute.

Having just returned from a week-long retreat on the island of Madeira for division managers of Simrad Sub Sea, Carl Christensson is now trying to convince his fellow members that it was all work. Have some Madeira, my Dear!

Captain Vancouver Branch were the guests of Pacific Branch at a joint meeting in June of this year. The meeting was held on board the three-decked survey barge "L. Pacifica" moored in Vancouver Harbour, and featured a barbecue. The invitation said "spouses and/or girl friends being specially and warmly invited"... ("Darling, have you met my wife?"). The weather was perfect, and there was a great turn-out of members (and spouses etc). It was a really fun evening with a good time had by all. Not to mention the fact that at last our better halves now know what we do for a living!

Members of the Captain Vancouver Branch were among the guests attending a reception for Charlotte and Gordon Murray on the occasion of his retirement on October 1, 1987. He was a principal of the firm of Murray and Associates, and of Aplin and Martin Engineering Limited, and was the president of Northwest Hydrographic Surveys Limited.

The reception was held at the University Golf Club at Point Grey, Vancouver, in the company of some 75 friends and associates. During the evening Gordon was presented with a beautiful water colour.

Gordon has now officially retired and is free to enjoy some well-earned rest, but in fact he will be busier than ever as the 1989 Hydrographic Conference approaches! The Captain Vancouver Branch will be hosting the next Hydrographic Conference at Vancouver on March 6 to 10, 1989, and we look forward to welcoming all the members of the Canadian Hydrographic Association to Vancouver for the occasion. And bring all your friends, too!

PACIFIC BRANCH

Mike Woodward and his branch executive continued their work in a lower key during the summer. Tony Mortimer, recently returned with a whole new accent from Quebec, will fill in for Rob Hare as executive member responsible for membership. Rob has started the survey engineering program at the University of Calgary.

A campaign soliciting sustaining memberships from companies and organizations on Vancouver Island has been started with some success. Congratulations and thanks to Terra Surveys on becoming Pacific Branch's first sustaining member.

Alex Raymond had the pleasure of hosting a meeting of the Captain Vancouver Branch on board L. PACIFICA in Vancouver Harbour.

The branch executive will be arranging seminars and tours selected from the list below for the winter edification of the membership.

Seminars

1.	LIDAR - 1987	Jim Vosburgh Terra Surveys
2.	Optical Disk Technology	Turner
3.	Vancouver Harbour Survey	Alex Raymond CHS
4.	China - The Long Tide	Willie Rapatz CHS
5.	1987 Commonwealth Conference	Stan Huggett CHS
6.	Institut Maurice Lamontagne	Tony Mortimer CHS
7.	Digital Surface Modeling	Northwest Digital
8.	Hydrographic Techniques Applied to Mine Counter-Measures Tasks	John Watt Quester Tangent

Tours

1. Canadian Coast Guard facilities - Victoria
2. Rotating wine and cheese - local technology companies
3. Cruise ship tour
4. Pacific Marine Center - Seattle

CHS Pacific Region Activities

CHS Pacific Region deployed two barges and the RICHARDSON during the 1987 field season. Alex

Raymond and his team in L. PACIFICA surveyed Vancouver Harbour using new Hurston launches. Alex will be reporting in detail on his completely automated survey.

Vern Crowley and his crew in PENDER continued their surveys in Tofino Inlet on the west coast of Vancouver Island. They finished the season wallowing in Hot Springs Cove.

Frank Coldham with George Schlagintweit, Mike Ward and Geoff Meuthen have been working in RICHARDSON surveying off Cumshewa Inlet in the Queen Charlotte Islands.

Graham Richardson and George Eaton have made several revisory surveys in southwestern B. C. Barry Lusk, taking time out from his other onerous responsibilities, has been following the LIDAR survey in Hecate Strait.

Travellers from the Branch this summer included:
- John Watt, Jim Vosburgh and Mike Bolton to Monaco as exhibitors at the International Hydrographic Conference.
- Willie Rapatz, with Marg in charge, to Beijing for a Tsunami conference.
- Stan Huggett, also with wife, to Cambridge, England to present a paper at the Conference of Commonwealth Surveyors .
- John Watt to Australia and New Zealand where he met with Larry Robins, an international member of CHA.
- Murray Farmer, Al Schofield and Bernard Kenny to Ottawa for the 1987 CHS Cartography II course.
- Dave Jackson and Neil Sutherland on temporary assignments with CHS field parties.
- Ron Woolley returned from Africa with a repertoire of exotic stories.
- Sandy Sandilands et al to Castlegar and the Arrow Lakes.

People events this summer made news with marriages and their consequences. Congratulations to:
- Tony O'Connor on his August marriage to Sandra Kelly
- Mike and Jeannie Ward on their son, Gregory
- George Schlagintweit on his marriage
- Gerry and Brenda Kidson on their son, Stewart
- Dave and Viki Prince on their daughter, Jacqueline
- Bruce Lewis on his marriage
- Sev Crowthers and his bank on their magnificent new house

Reports From Industry

Terra Surveys Limited

The Larson 500 scanning laser bathymeter successfully covered large areas off the north coast of British Columbia. The survey site included the rocky shoal area off Price and Aristazabal Islands. Aircraft navigation was provided from up to 8 ranges simultaneously which greatly enhanced the sounding positioning accuracy.

At the recent International Hydrographic Conference in Monaco, a technical paper on the use of airborne laser surveys was presented by Jim Vosburgh. While at the conference Jim met with hydrographic representatives from various countries which have expressed interest in the Larsen 500.

For conventional launch surveys an advanced rangefinder system ideally suited to nearshore hydrographic surveys is now available from Terra Surveys. The portable electronic laser ranger known as "ESPRIT" is a practical approach to gathering localized and detailed hydrographic data.

Quester Tangent Corp

In continuing the export marketing initiative on the ISAH product QTC is focusing near term efforts on the Austral-Asia geographical area. John Watt has just returned from what should prove to be a productive trip to Australia. Quester has been working under the terms of a contract for the Royal Australian Navy (RAN) to define, integrate and demonstrate a system for mine surveillance applications which involves a teaming arrangement with Klien Assoc., Tracor Inc., Ferranti-O.R.E., Seismic Supply International (QTC's Australian Representative) and Quester Tangent.

On his return from Australia, John spent an interesting day in New Zealand visiting with one of the CHA's newest International members, Lt. Cmdr. Larry Robbins (RNZN).

Another of Quester Tangent's recent developments, a ruggedized EL flat screen display, has just been delivered to the Canadian Navy for evaluation in special purpose shipboard applications.

At the current time, QTC is finalizing the full geographics and coastal features, colour display applications software which will be demonstrated to the RAN in November.

OTTAWA BRANCH

Ottawa Branch has both lost and gained members this year. Steve MacPhee left Ottawa in June to assume the position of Regional Director of Science for the Scotia

Fundy Region of DFO. In recognition of Steve's generous support of CHA, and in particular Ottawa Branch, the branch presented him with a picture of a winter scene along the Rideau Canal. We wish Steve well in his new job and home, and hope he'll be back to see us soon.

Ottawa Branch is happy to claim Ross Douglas, the new Dominion Hydrographer, as one of our own. Ross was previously the Director of Hydrography, Central and Arctic Region of DFO and a member of Central Branch of CHA.

Three members of the branch have retired from CHS in the spring and summer of this year: Jeanette Desparois of the Nomenclature Section; Nick Cleary of Maritime Boundaries; and Stan Dee, Chief of Sailing Directions.

Two other members, both formerly with the Tides, Currents and Water Levels Section of CHS, have new jobs. Lung Ku is now with the CHS in Mont-Joli. Before accepting this assignment Lung was on a two-year IMO assignment in Bangladesh, assisting in establishing a tidal office there. Brian Tait is now a Senior Staff Officer in the Policy and Program Coordination Branch of DFO Headquarters.

Ottawa Branch held two seminars in the early part of this year. Mike Casey spoke on "Navigation for Everyone: From Hikers to Bikers", a presentation on GPS and electronic maps for cars. Mike Eaton presented an update on the Electronic Chart Testbed.

Gerry Dohler has just returned from a successful International Tsunami Warning System meeting in Beijing.

P. K. Mukherjee was in Trinidad and Tobago for almost two months during the summer and fall. He was there as a maritime law consultant for the IMO, to draft the Trinidad and Tobago Shipping Act in collaboration with the Chief Parliamentary Council.

Ottawa Branch members have been busy in the last few months and a number of papers covering a variety of subjects have been written and presented:

1. Terry Jolicoeur was a delegate to the Fifth United Nations Conference on the Standardization of Geographical Names where she presented a paper on "Twenty Years of Evolution in the Naming of Undersea Features by Canada" in Montreal, Quebec in August .
2. Mike Casey co-authored a paper (with Geof Morse) entitled "An Experimental Approach to Electronic Chart Delivery." This paper was presented at the CISM Annual Meeting in Charlottetown, PEI in June.
3. Ross Douglas presented his paper "A Hydrographic Survey Using an Airborne Electromagnetic Bathymetry System" at the Conference of Commonwealth Surveyors, Cambridge, England in July.
4. Tim Evangelatos presented his paper "Avoiding the Tower of Babel in the Exchange of Spatial Information" at the CISM Annual Meeting.
5. Dick MacDougall presented his paper " A Hydrographic Data Base" at the same meeting.
6. Dick MacDougall and Steve MacPhee co-authored a paper entitled "A Digital Data Base Management System for Bathymetric Data." It was presented at the Conference of Commonwealth Surveyors.

Rolly and Pat Hamilton have just returned to Ottawa after Rolly's six month CIDA-sponsored assignment to Kuala Lampur to advise the hydrographic office of the Royal Malaysian Navy on establishing a chart production unit. On their way back to Canada they stopped in London for a few days and ran into another Ottawa Branch member, Diana Pantalone, in the Piccadilly Tube station. Diana and Sal Pantalone were in London for a week before heading off for a week of sightseeing in Moscow and Leningrad.

Congratulations to Della and Jack Mallioux on the birth of their daughter, Stephanie Rachel, and to Gary and Ann Kosowan on the birth of their son, Michael Thomas.

CENTRAL BRANCH

The Branch now has 70 members, 44 of whom work for the CHS in Burlington, Ontario. We thus have a goodly proportion of members in the private sector. This year we have been making a real effort to keep in touch with these farther-flung members, and to this end have been producing a Branch news letter. This has been very popular, and will be continued to get minutes of meetings etc. out to our members.

Personal news

Congratulations to three of our families on new additions. Sean and Lynn Hinds have a son, Matthew David; Helen and Brian Trapp have a daughter, Aldelheidi Christine; and Nancy and David Murray took delivery of a long-awaited daughter, Jenna.

We have had weddings this summer, and our best wishes for many years of happiness go out to Bruce and Joanne (Carlson) Richards (16 May 1987), Trevor and Bonnie (MacLean) Dyas (6 June 1987) and Terese (Herron) and John Walker (3 October 1987).

We have also experienced sad bereavements this summer, and we extend our sympathy to John Medendorp and Sam Weller on the recent loss of a close relative.

Congratulations are in order for Raj Beri, Bruce Richards and Jon Biggar: they did well in their exams and are now commissioned as Canada Lands Surveyors. Well done!

Tony Bonnici has also done well - he has recently been awarded his BSc in Computer Science at McMaster, and made the Dean's list for each of his four years! He has now accepted a teaching position at Sir Sandford Fleming College in Lindsay, Ontario.

We would also like to note well-earned promotion for one of our Members: Ross Douglas has been appointed to the position of Dominion Hydrographer in Ottawa. It is with mixed feelings that we bid him farewell, for he was a very much respected and popular Director here in Central Region and a strong supporter of our Branch activities. We wish him all the best in Ottawa, and we'll buy him a beer at any of our evening meetings that he manages to get back to Burlington for!

Tom McCulloch continues to do good work with Oceanic Canada, and he reports that Rolly Hamilton has just returned from his Malaysian training assignment in cartography. The program is planned to continue in 1988 with further funding from the Canadian International Development Agency (CIDA).

Central Branch sponsored a team of runners on 26 April 1987 in the annual Burlington Road Race for charity. Our team is known as the CHA Shipheads. Our Branch has been sponsoring this team of Shipheads for several years now, and we are glad to support this sporting event. Our team members - Brad Tinney, Danny Mahaffy and Mike Hicks - completed the 25 kilometre distance in a very creditable 2 hours 2 mins. and 47 seconds, and Mike Hicks, in fact, even ran two legs of the relay in the absence of a team member. The members of our team wear matching designer T-shirts for the occasion, and are a credit to the CHA!

Reports from Industry

Marshall Macklin Monaghan have installed the CARIS system in their Don Mills office. It is now up and running and will be assisting in their mapping, charting and GIS activities.

Hugh O'Donnell has left MMM to accept the position of Assistant Deputy Minister of Surveys, Mapping and Remote Sensing with the Department of Energy, Mines and Resources, Canada.

Kyle Moate one of our branch members, is with J. Bryon Wieb, a firm of consulting engineers in Welland, Ontario, who specialize in the design and supervision of agricultural drainage systems.

Branch Activities

We would like to take this opportunity to welcome all our members back from their summer labours, or their golfing, as the case may be.

We have recent additions to our ranks, and Central Branch welcomed several new members this summer: Michael J. Brent, Ken Richmond, Marcia Weston, Ross Munro, Paul Wessler and Nicholas C. Valleau. Welcome aboard! We look forward to seeing you at our Branch events, and introducing you to your fellow members.

Central Branch of CHA has remained active during the summer months, and we have made every effort to keep the members informed of our activities.

Since our last General Meeting, which was held on 9 April 1987, Central Branch has scheduled two seminars, hosted a summer barbecue, and sent out two news letters. One of the seminars had to be postponed due to technical difficulties, but the seminar on CARIS II given by Brent Beale was well attended and well received. To those of our members who could not make it to the summer functions, we missed you! Hope to see you at the next one.

ATLANTIC BRANCH

This branch has spent a quiet summer, with the notable exception of July 17, when a mid-summer dance and farewell party was held for Adam and Judith Kerr at the Halifax Sheraton. Over 100 colleagues and friends were there including Ross Douglas (Dominion Hydrographer) and Steve MacPhee (Director of Science, Scotia Fundy Region). Also attending were representatives from academic, government and industrial communities of Atlantic Canada.

Steve Grant, Branch Vice-president, says it was quite a party, but everyone had recovered by August 17 when Adam left to take up his new position as a Director of the International Hydrographic Bureau in Monaco.

The branch has 74 members, and has sponsored a number of interesting events. A "Newfie Night" was held to bid farewell to the select Group of Seven who are moving to Newfoundland to set up the new regional office there. There were also two evenings at the Maritime Museum of the Atlantic where wine, cheese and technical papers made a successful mix.

Congratulations to Vic Gaudet on winning a competition for a new Atlantic EN-SUR position. Also to Julian Goodyear and Garry Henderson on earning their Command Endorsement.

Carol Beals is now back to work after a lengthy convalescence. Welcome back to BIO. Signa Ells was married on June 27 to Paul Nickerson. All the best. Welcome to Paul Parks, who joined field surveys in October. Adel Doirion left us in October for a (new) (permanent) job. We're sorry to see her go.

SECTION DU QUEBEC

Cinq réunions du conseil d'administration ont eu lieu depuis le dèbut de l'année dont une à Québec. Les principaux points soulevés lors de celles-ci, furent: la planification de la campagne de recrutement, l'élaboration du programme d'activités annuel, la gestion du projet P.D.E. et l'organisation d'un colloque d'envergure sur l'hydrographie.

Marc Journault a été nommé secrétaire trèsorier intérimaire en l'absence de Normand Doucet.

Engagée à titre d'agent administratif relationniste, Fabienne Boulanger assumera les tâches administratives reliées principalement à l'organisation du colloque. Ceci dans le cadre du programme de développement de l'emploi géré par le gouvernement fédéral.

Plusieurs activités furent organisées pour les membres de la section du Québec. La premiére s'est déroulée le 8 avril dernier. Plus de 70 personnes ont visité l'institut et ont assisté à la conférence de presse donnée par Denis Hains, président régional. L'activité obtint une bonne couverture de la presse.

Une seconde activité eut lieu le 3 juin à Québec. La conférence de monsieur Michel Leclerc sur la formation de la marée et ses effets courantométriques dans les estuaires a vivement intéressée l'auditoire évalué à plus de quarante personnes.

C'est également 40 personnes quiont participé à la soirée - conférence sur la télédétection présentée à la marina de Rimouski. Deux professeurs - chercheurs de l'université de Sherbrooke, messieurs Jean-Marie Dubois et Norm O'Neill, ont approfondi le sujet.

Le programme d'activités se compose également d'une conférence donnée par monsieur Jean-Claude Michaud, capitaine du Port de Québec, tenue le 21 octobre à Québec. Et d'un événement d'importance, vers lequel tous les efforts convergent, un colloque intitulé "L'hydrographie: dimension essentielle aux sciences de la mer." Près de deux cents personnes se rèuniront à Rimouski les 19 et 20 novembre 1987, à cet effet.

Denis Hains, président régional, a représenté l'Association à l'assemblée générale annuelle de l'Ordre des arpenteurs-géomètres du Québec, le 23 mai dernier à Sherbrooke.

Suixante-quinze personnes sont membres de la section du Québec de l'A.C.H. Soulignons également l'adhésion de trois membres de soutien: la firme d'arpentage Tremblay, Vaillancourt, Robitaille, le département de navigation de l'Institut de marine du Cègep de Rimouski et l'entreprise Topomarine.

L'adresse postale de l'Association, section du Québec demeure le:

C.P. 1447 Rimouski
Québec G5L 8M3

PRAIRIE SCHOONER BRANCH

As the summer offshore season slowly comes to a halt our members are beginning to filter back to Calgary and Edmonton. The low oil prices which have plagued our industry during the past year or so are still with us. The boom times of the early 80's have still not returned. Despite the continuing lull in offshore oil activity, some of us have managed to secure work both in Canada and abroad.

Canmar maintained their presence in Arctic waters during the 1987 season with their SSDC drilling platform off Alaska.

Cansite spent the summer performing work in Alberta, and conducted some airborne surveys in the Northwest Territories.

Challenger provided offshore survey services to Gulf's Amauligak construction project in the Beaufort Sea this summer.

McElhanney have kept busy on various projects at home and abroad. They did some work off Angola and in Southeast Asia.

Nortech spent much of the summer performing site investigations off the east coast of Canada, and had an offshore positioning project in Cameroon.

Patron Saint of Hydrographers?

"Give me chastity and abstinence. But not yet."

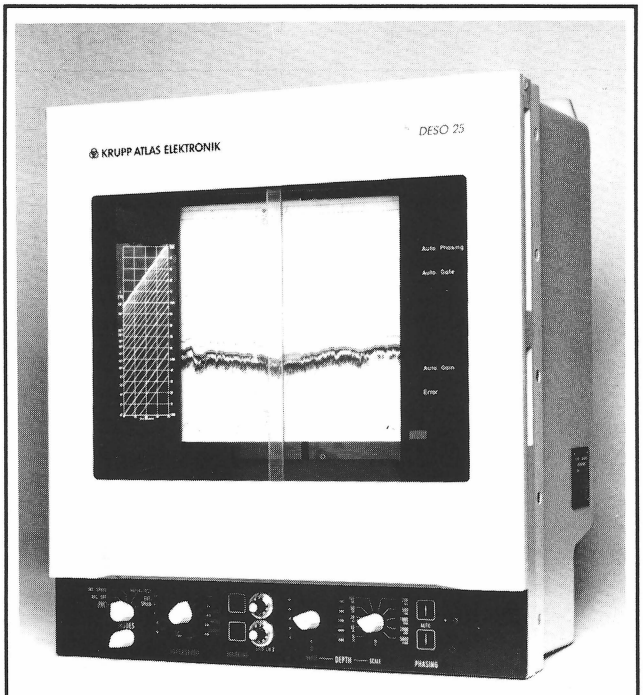
St. Augustine (354 - 430 AD)

GeoVision

GeoVision Corporation of Ottawa announces that it has signed a contract with the Tianjin Institute of Ocean Surveying and Charting, in the Peoples' Republic of China, to provide a computer software system for nautical charting. The system will be used to produce charts according to international standards, as well as to maintain a database of navigation aids, soundings, and the shoreline. The institute is responsible for producing the chart coverage of Chinese waters and adjacent areas in the Pacific Ocean.

The system will operate on a Hewlett-Packard 1000 series computer, with four high-resolution graphics work stations for data entry and edit. Data will be entered either by digitizing existing paper charts, or directly for digital data collection systems on board survey ships. A Gerber photoplotter will be used for chart construction.

GeoVision also announced that its Australian subsidiary has been awarded a contract to supply the Royal Australian Navy Hydrographic Service with a spatial information database system that will store and manage survey information collected around the Australian coasts. The new system is intended to rationalize survey data to support charting and to interact with other information systems.



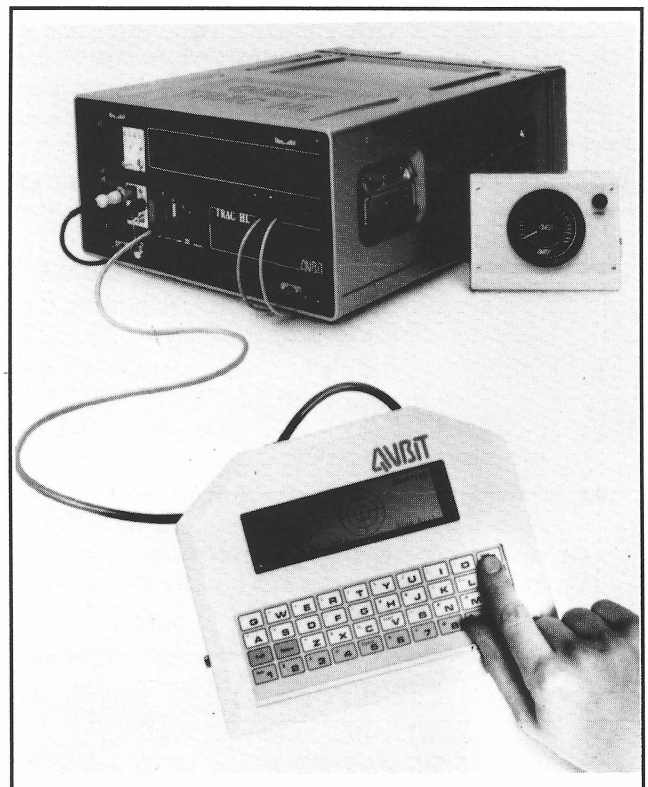
Krupp Atlas Elektronik DESO 25 Sounder

With the imminent implementation of digital seaborne and airborne automated sounding systems the Hydrographic Service is faced with the problem of handling increasing volume and variety of data.

Krupp Atlas Electronik

The Atlas DESO 25 is a new series of multi-purpose echosounders with built-in annotator facilities announced by Krupp Atlas. The echosounder is designed for operation in either active or passive mode as a master or slave (or both). The series has an incremental depth capability of 5m - 15,000 m. A choice of two frequencies, from 12, 15, 33, 100 & 210 KHz is available together with a wide range of transducers and receivers.

The series incorporates high resolution thermal recording facilities, which permit progressive shading of gradations. Other features include simultaneous registration of depth, phase range recording and signal strength thereby facilitating additional information on the nature of the bottom and changes in reflectivity.



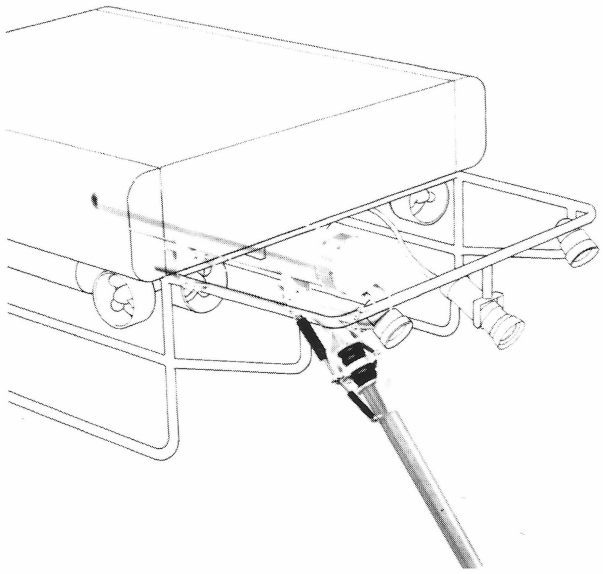
Qubit Trac HL

Qubit Ltd.

Qubit have provided 6 TRAC HL data logging systems to the British Ministry of Defence. Navigation and other data are logged during Naval exercises for subsequent

analysis by the Fleet Operational Staff. The data are stored on high capacity, 20 Mbyte removable Winchester Discs.

The TRAC HL incorporates Qubit's Q2780 interface to enable concurrent recording from up to 6 sensors including log and gyro inputs and most navigation sensors. The recorder is a compact system which can provide data logging facilities to very small craft and helicopters.



Compact Dredge

With an optional intelligent keyboard/P.A.D., the system can be used for hydrographic surveying with a high speed data recording capability, typically 10 soundings plus navigation data per second.

Alluvial Mining Ltd.

Alluvial Mining Ltd. at the U.K. have introduced a compact dredge for mounting on commercial ROVS. It complements an ROV's existing inspection systems by helping to remove materials that might be obstructing the view. The dredge could also prove a useful new tool for a wide range of dredging operations and these include operation in sand and clay sites that would be inaccessible to larger underwater dredges. It can also uncover underwater pipelines and cables, clear waste and drill cuttings. The dredge is also suitable for mineral recovery and closely controlled work around wrecks and other sensitive targets.

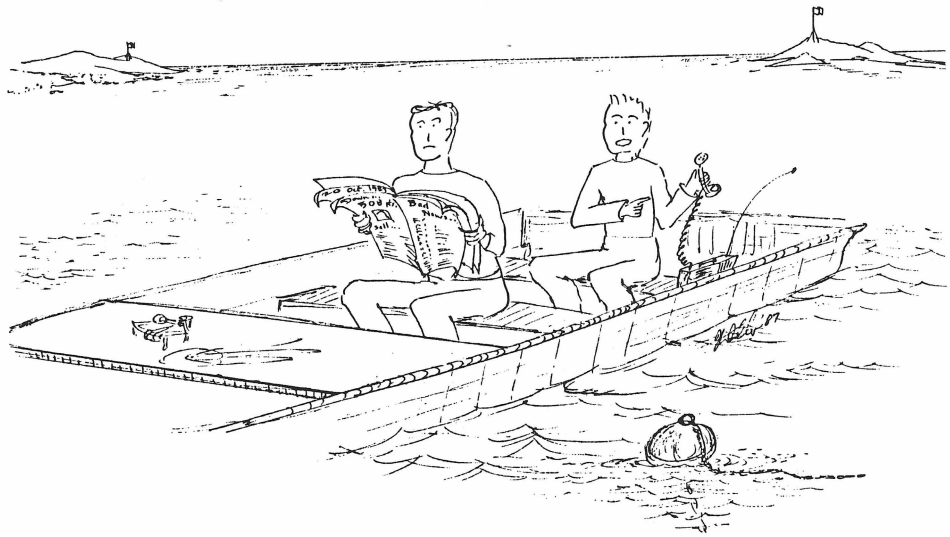
The dredge is 186 cm long and measures 80 cm at its widest point including suction head, and is aimed at mid-sized ROVs of 500 kilos and upwards.

McElhanney Personnel Announcments:

McElhanney announce the appointment of Mr. O'Brian Blackall as Vice President, McElhanney Petroleum Surveys Ltd. Mr. Blackall will manage all petroleum surveys and engineering business of the company.

The company has also provided the names of its local managers:

Bernie McKenna	Calgary
Bruce Winton	Edmonton
Aubrey Petzold	Fort St. John
Gilenn Martin	Lloydminster



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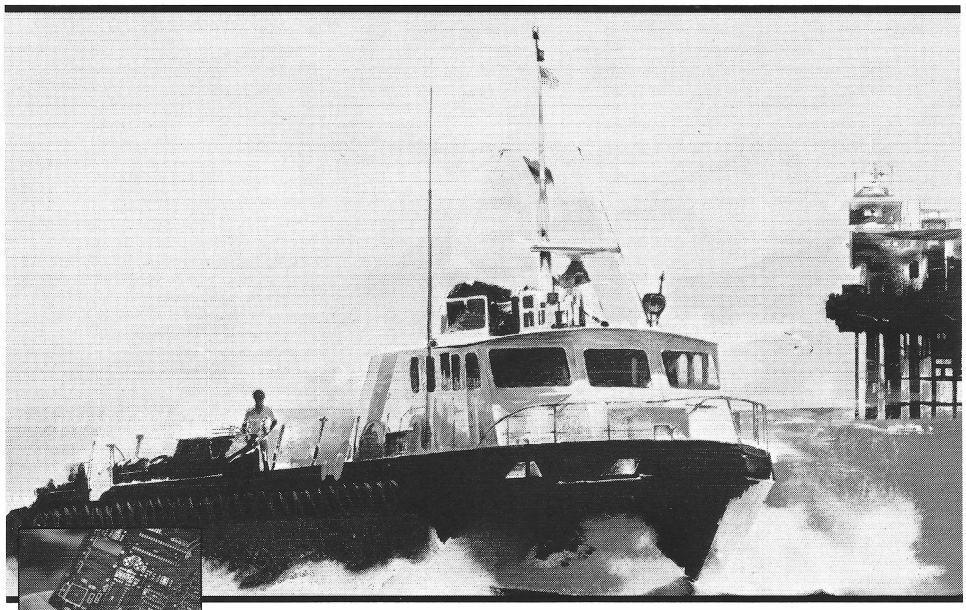

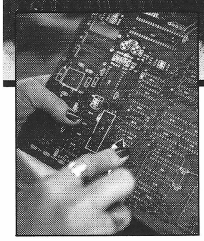

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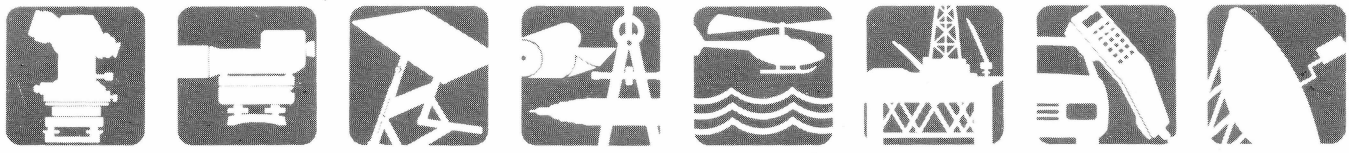

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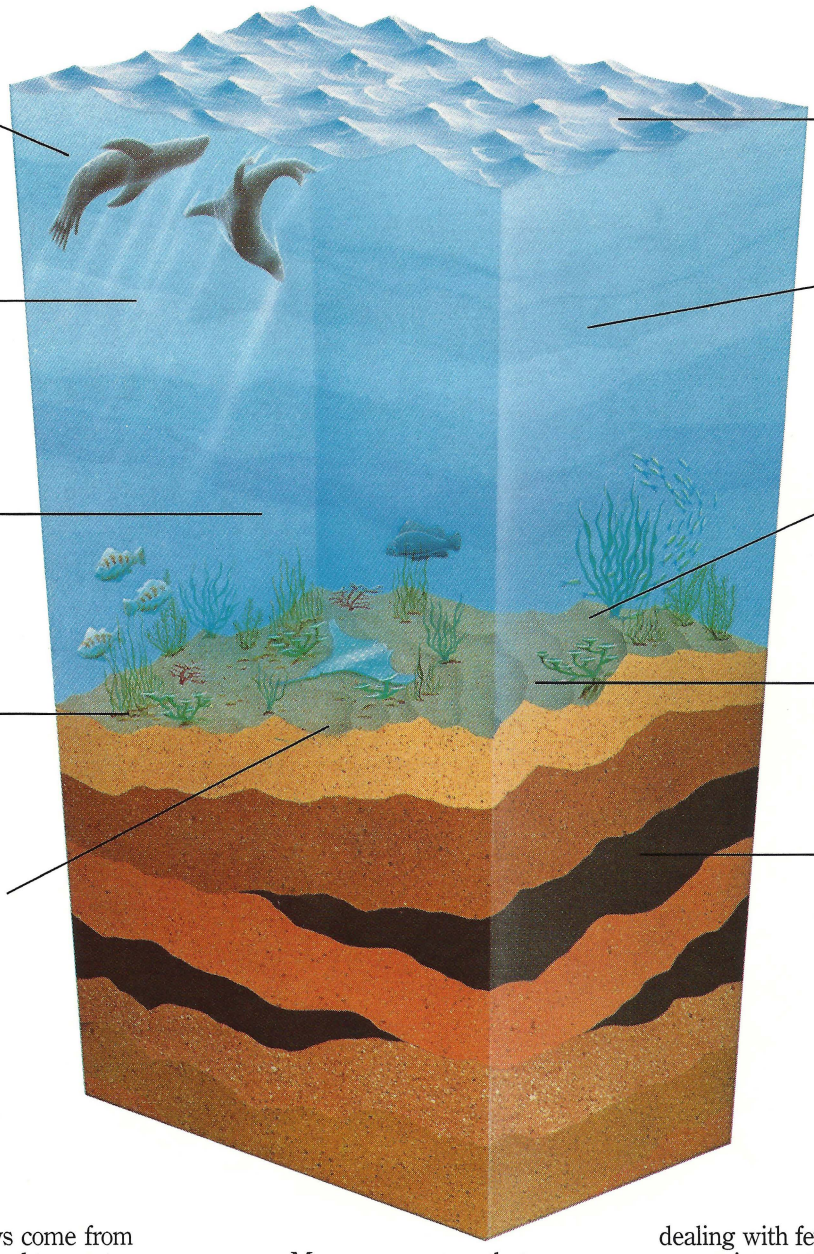

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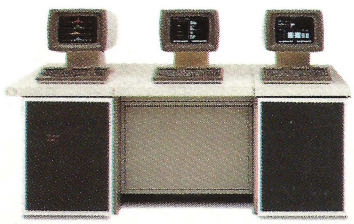

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