THE CANADIAN HYDROGRAPHIC CONFERENCE 1989

MARCH 6 to 10, 1989
PAN PACIFIC HOTEL
VANCOUVER, BRITISH COLUMBIA, CANADA

DISCOVERY '89

"A Moment from Captain Vancouver's Voyage of Discovery" by John M. Horton C.S.M.A. F.C.A

CANADIAN HYDROGRAPHIC CONFERENCE '89

VANCOUVER, B.C., CANADA

MARCH 6TH - 10TH, 1989

"DISCOVERY '89"

CONFERENCE PROGRAM

CONFERENCE PROGRAM INDEX

CHAIRMAN'S MESSAGE

On behalf of the Conference sponsors, it is a great privilege to welcome you to the **Canadian Hydrographic Conference "Discovery '89".**

We think of this Conference as a "curtain raiser" for the upcoming celebrations in 1992. These will mark the 200th Anniversary of the Voyage of Captain George Vancouver in his ship "Discovery" to the Canadian West Coast in 1792. By courtesy of the "Discovery Re-Enactment Society", their replica of the "Elizabeth Bonaventure" (Captain Vancouver's Survey Yawl) will be displayed on board the "John P. Tully".

There is a similarity between organizing a Conference and making gourmet soup. In this case the soup pot was simmering for 2-1/2 years while we added a little bit of this and a dash of that. The end result is unique in some aspects; it is not just another in an interminable series of Conferences that fill the calendar.

The National Ocean Service, NOAA and the Canadian Hydrographic Service have demonstrated very solid support for the technical program. Their participation has enhanced the quality of the technical papers. The "emerging states forum" features delegates from developing countries. We have not previously had the opportunity to learn at first hand what are the hydrographic issues facing them. The ever popular Electronic Chart Workshop will examine the needs of the user and focus on training. This approach is long overdue, especially for the West Coast.

You will be made welcome when visiting NOAA's Survey Ship "Rainier" and the Canadian Survey Ship "John P. Tully". Tours and demonstrations will be arranged during Conference hours.

The exhibitors make a major contribution to the success of the Conference and deserve your support. You will have ample time to visit the exhibits and attend the demonstrations.

Bus tours are an effective way of seeing the city highlights when time is limited. For shopping forays, I recommend using the "Sea Bus" and "Sky Train" - both only a minute or two from the Pan Pacific Hotel.

With best wishes for an enjoyable stay;

Gordon Murray
Chairman

DISCOVERY '89!

CALENDAR OF EVENTS

MONDAY, MARCH 6th

16:00 - 20:00 hrs. Registration

19:00 - 21:00 hrs. **Ice-breaker Reception**
at: the Centre Board Club

TUESDAY, MARCH 7th

07:30 - 18:00 hrs. Registration

08:30 - 10:00 **Introduction and welcome to delegates** by City and Federal Government officials and the Honorable Jack Davis,Minister of Energy, Mines and Petroleum Resources - **Crystal Ballroom**

Historical Sketch: R.W. Sandilands, CHS
Keynote Address: Rear Admiral Alfredo Civetta, Director, IHB

10:00 hrs. **Official Opening of Exhibit Area**
Vancouver Trade & Convention Centre.

10:30 - 12:00 Morning technical session - Crystal Ballroom
"Changing Conditions and User Requirements"
Session Chairperson:
Rear Admiral Wesley V. Hull, Director, Charting Geodetic Services, NOAA

13:30 - 15:00 Afternoon technical session - Crystal Ballroom
"Hydrography- The Next Decade"
Session Chairperson:
George MacDonald, CHS

15:30 - 17:00 Afternoon technical session - Crystal Ballroom
"Progress With New Survey Technologies"
Session Chairperson:
A. D. (Tony) O'Connor
Regional Director, CHS

18:00 - 20:00 "POSH" Beer Social
in Exhibit Area.

WEDNESDAY, MARCH 8th

07:30 - 18:00 Registration

08:30 - 10:00 Morning technical session - Crystal Ballroom
"Data Management"
Session Chairperson:
Commodore J.L.A. Van Aalst, Hydrographer
Royal Netherlands Navy

10:30 - 12:00 Morning technical session - Crystal Ballroom
"Electronic Chart"
Session Chairperson:
Robert Lyall, Offshore Systems Ltd.

12:00 - 14:00 **"Discovery" Luncheon,**
Pavilion "A"
Luncheon Speaker: Dr. A.D. Booth

14:30 - 16:00 **"Emerging States Forum"** - Crystal Ballroom
Session Chairperson: Mr. T.D.W. McCulloch

16:15 **C.H.A. General Meeting - Gazebo I & II**

THURSDAY, MARCH 9th

07:30 - 18:00 Registration

08:30 - 10:00 Morning technical session - Crystal Ballroom
"Cartography"
Session Chairperson:
W. S. Crowther, CHS

10:30 - 12:00 Morning technical session - Crystal Ballroom
"Positioning"
Session Chairperson:
Barry M. Lusk, President
Canadian Hydrographic Assoc.

13:30 - 15:00 Afternoon technical session - Crystal Ballroom
"Hydrographic Surveys
- Advancing The Art"
Session Chairperson:
Rear Admiral S. R. Petersen
Director, Pacific Marine Centre

13:30 - 15:00 Afternoon technical session - Crystal Ballroom
"Tidal Instrument Development"
Gail Gabel,
Aanderaa Instruments Ltd.

18:00 **Cocktails - No-Host Bar** - Pavilion "A"

19:00 **"Capt George Vancouver Dinner"** - Pavilion "A"

FRIDAY, MARCH 10th

08:00 - 11:45 **"Electronic Chart Workshop"** - Pavilion "C"
Chairperson: Mr. Neil Anderson

ACKNOWLEDGEMENTS

The Conference Committee is grateful for the support received from the following:

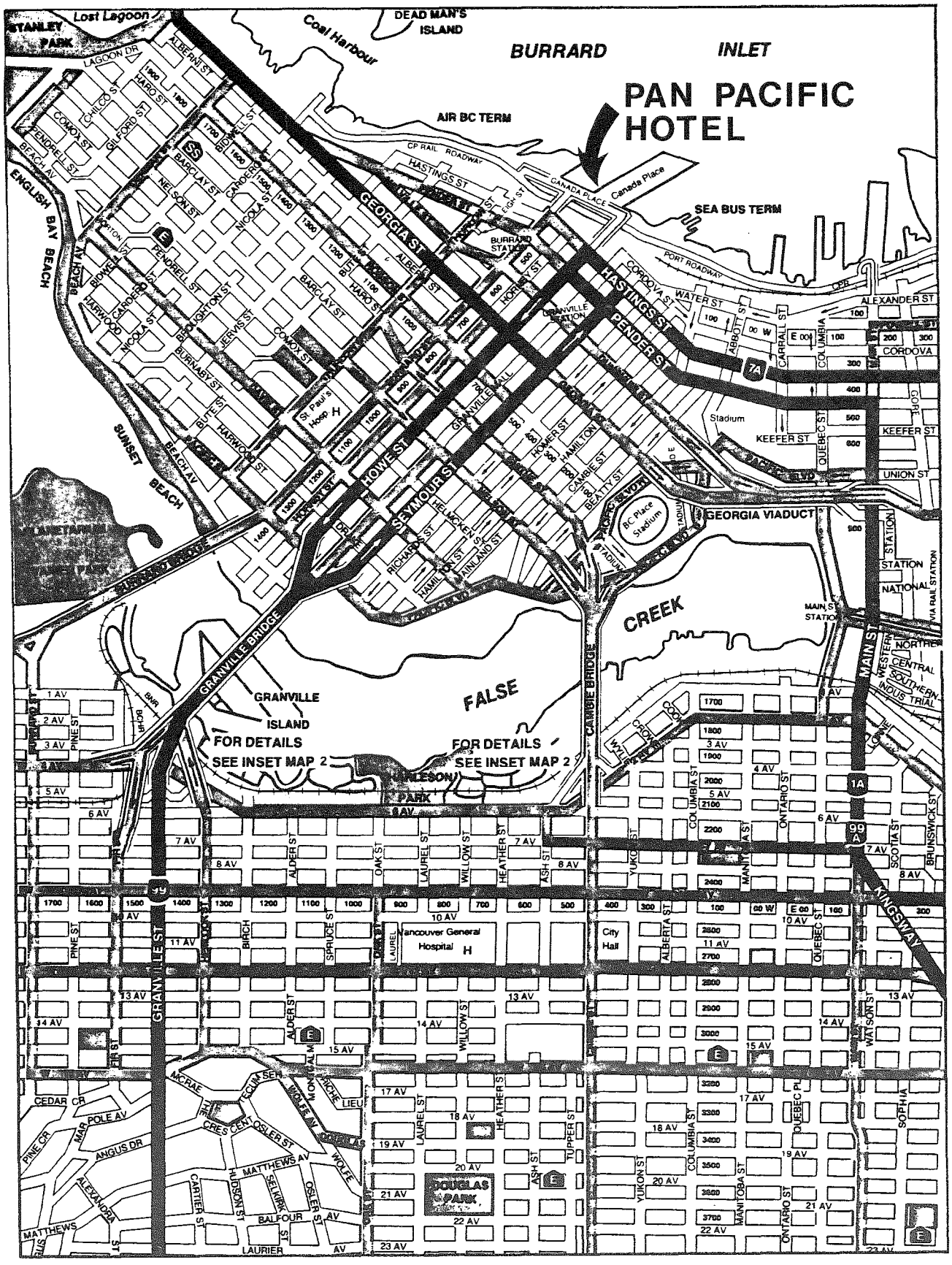
The Province of British Columbia
Department of Fisheries and Oceans
National Ocean Service, NOAA
Vancouver Port Corporation
Canadian Hydrographic Association
Canadian Hydrographic Service
Canadian Coast Guard
Public Works Canada
Aanderaa Instruments Ltd.
Mesotech Systems Ltd.
British Columbia Ferry Corporation
Atek Hydrographic Surveys Ltd.
Murray & Associates
Aplin & Martin Engineering Ltd.
Triton Consultants Ltd.
Meridian Control Service Ltd.
Northwest Hydrographic Surveys Ltd.
Terra Surveys Ltd.
Corporation of Land Surveyors of B.C.
Canadian Institute of Surveying & Mapping, Victoria Branch
Dillingham Construction Ltd.
Fraser River Pile and Dredge Ltd.
Canadian International Development Agency

CONFERENCE COMMITTEE, MARCH 1989

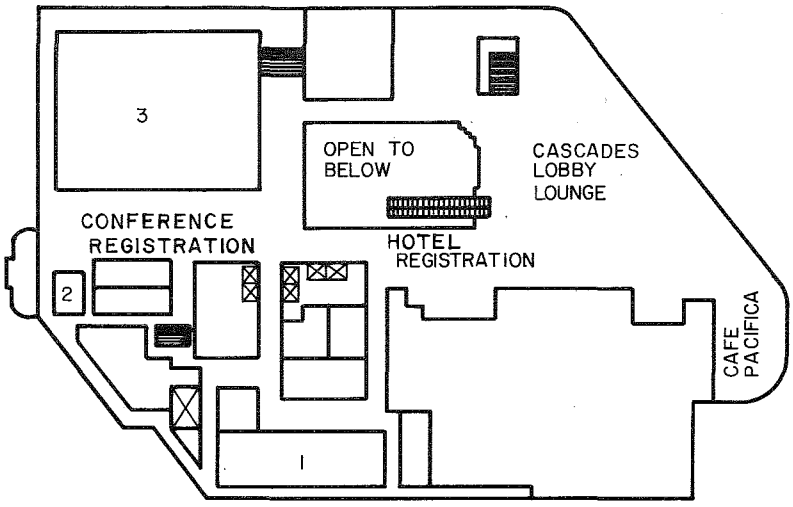
1.	**Chairman**	Gordon Murray, B.C.L.S. (Retired)
2.	**Exhibits**	Carl Christensson, Mesotech
3.	**Finance**	Eric Kaardal, Murray Assoc.
4.	**Fisheries and Oceans**	Anthony O'Connor, CHS Director, Hydrography
5.	**Honorary Chairman**	Michael Bolton Hydrographic Consultant
6.	**NOAA and Hydrographic Society**	Pamela Chelgrin - Koterba, N O A A
7.	**Publicity**	Michael Tarbotton, Triton Consultants Ltd. Reg Labinsky, Meridian Control Service Ltd.
8.	**Registration**	Warren Williams & Allen Cadenhead, Public Works Canada
9.	**Small Business**	Gail Gabel, Aanderaa Instruments
10.	**Social Events**	Alex Fakidis, Public Works Canada
11.	**Special Events**	Michael Slater, Northwest Hydrographic Surveys Ltd.
12.	**Technical Program**	Richard Bryant, Canadian Coast Guard
13.	**Treasurer**	Judy Johansen, Aplin & Martin Engineering Ltd.
14.	**Visiting Ships**	Alex Raymond, Canadian Hydrographic Service
15.	**Electronic Chart Workshop**	Robert Lyall, Offshore Surveys and Positioning Services Ltd.

Conference Committee 1987, 1988
Thomas Richards, NOAA; Paul Sawyer, Sandwell Swan Wooster

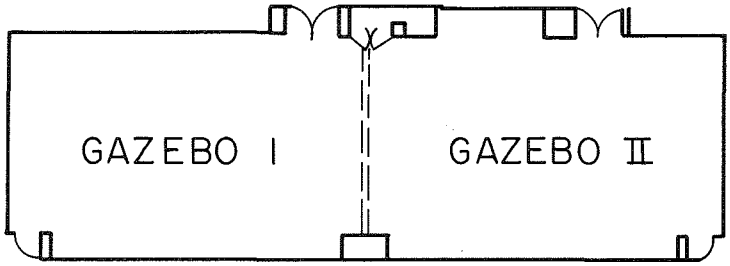
DOWNTOWN VANCOUVER MAP



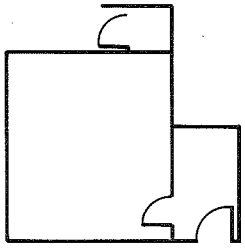
PAN PACIFIC HOTEL - FLOOR PLAN



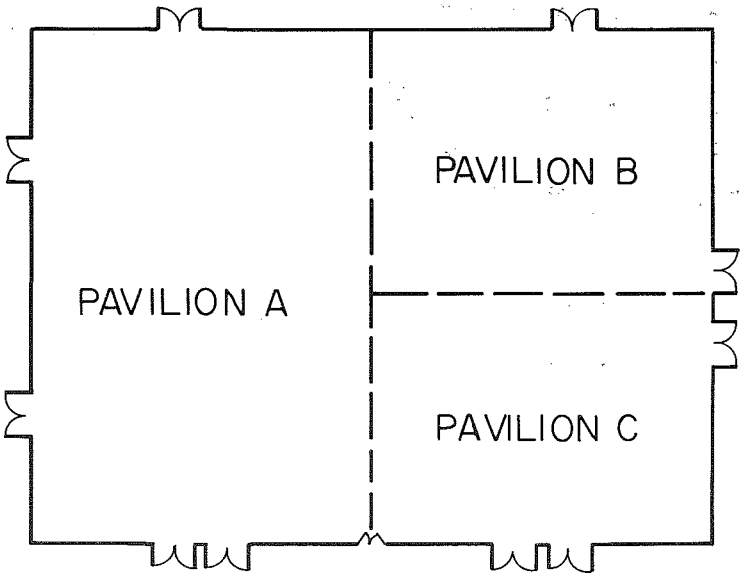
HOTEL LOBBY LEVEL



1. THE GAZEBO

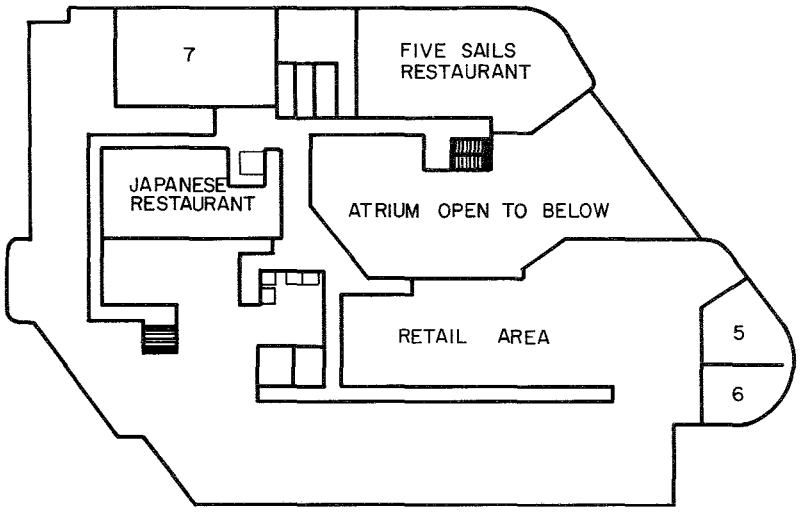


2. THE BOARD ROOM

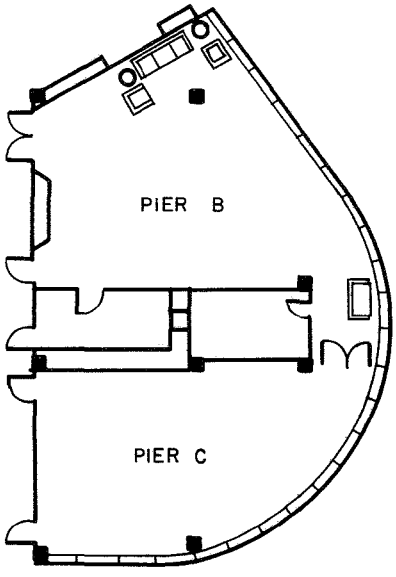


3. THE CRYSTAL PAVILION

PAN PACIFIC HOTEL - FLOOR PLAN



HOTEL RESTAURANT LEVEL



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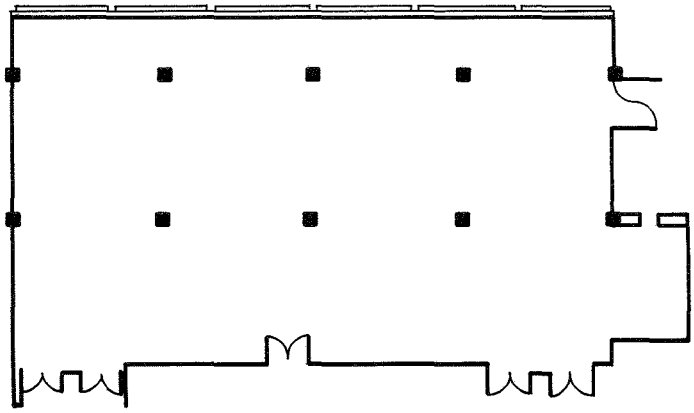
6. PIER C



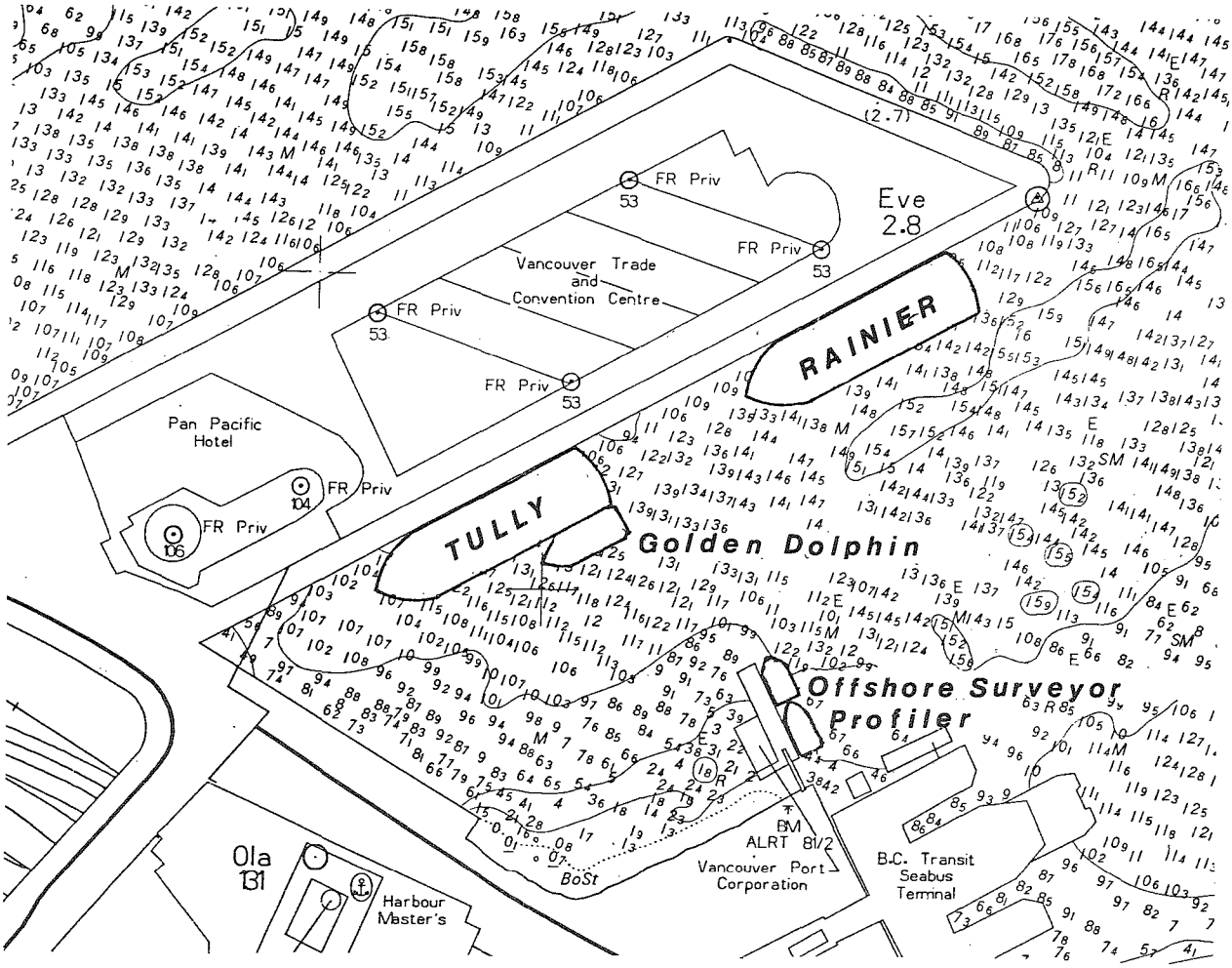
7. CENTREBOARD CLUB

VISITING SHIPS

VESSEL	LOCATION
NOAA SHIP RAINIER	Convention Centre Wharf
CHS JOHN P. TULLY	Convention Centre Wharf
GOLDEN DOLPHIN	Convention Centre Wharf
PROFILER	Vancouver Port Corp. Float
OFFSHORE SURVEYOR	Vancouver Port Corp. Float
ELIZABETH BONAVENTURE	Onboard the JOHN P. TULLY

TOUR SCHEDULE

Tuesday, March 7	1400-1600 Hrs
Wednesday, March 8	0900-1100 Hrs 1400-1600 Hrs
Thursday, March 9	0900-1100 Hrs 1400-1600 Hrs



SOCIAL EVENTS

There are several social events planned for the week of the Conference:

ICE BREAKER RECEPTION

Monday, March 6th — 19:00 - 21:00 hrs.
PAN PACIFIC HOTEL — CENTRE BOARD CLUB

There will be an informal reception at the Centre Board Club for participants after they have completed registration. Hors-d'oevres will be served.

"POSH" BEER SOCIAL

Tuesday, March 7th — 18:00 - 20:00 hrs.
VANCOUVER TRADE & CONVENTION CENTRE — EXHIBIT AREA

Following the technical sessions on Tuesday, all Conference participants are encouraged to attend the "Posh" Beer Social. Beer will be served in a complimentary souvenir mug.

"DISCOVERY" LUNCHEON

Wednesday, March 8th — 12:00 - 14:00 hrs.
PAN PACIFIC HOTEL — PAVILION " A"

The "Discovery" Luncheon will be held following the morning technical session on Wednesday. A delicious lunch with wine will be served and Dr. Don Booth, the renowned computer pioneer, will address the participants.

"CAPTAIN GEORGE VANCOUVER" DINNER

Thursday, March 9th
PAN PACIFIC HOTEL — PAVILION "A"

Cocktails (No host bar)	18:00 - 19:00 hrs.
Dinner	19:00 - 21:00 hrs.
Entertainment	21:00 - 23:00 hrs.

This highlight of the social events, will include an outstanding buffet dinner. Live entertainment will be featured for dancing and listening pleasure.

ACCOMPANYING PERSONS

The Pan Pacific Hotel is located in downtown Vancouver with ready access to shopping centres, markets, theaters, restaurants and magnificent parks.

Accompanying persons (or delegates if they wish) can be assisted by **Conference tour consultants which will be available at the registration desk daily: March 7th - March 9th from 7:30 to 11:30 hrs.** This service will be provided by the Lady Vancouver Club whose members will provide an overview of local attractions and assist with personal itineraries.

VISITOR'S GUIDE

Visitor's guide packages will be available to all conference participants and accompanying persons at the registration desk. These packages will include maps and brochures of local attractions. Be sure to pick one up.

Wednesday, March 8th

CONFERENCE LUNCHEON
Luncheon Speaker:
Dr. Donald Booth, D. Sc. Ph.D. P. Eng.

Dr. Booth was born in Surrey, England, educated at the University of London (B.Sc.- 1st Class Honours); University of Birmingham (Ph.D.) and the University of London (D. Sc.).

Chairman of the Board, Autonetics Research Associates, since 1978, President of Lakehead University 1972 - 78; numerous visiting professorships; Director of Computer Project and Head of Department of Numerical Automation, University of London; Head of Department of Electrical Engineering, University of Saskatchewan, 1962; Member of Council of N.R.C. since 1975; numerous awards and fellowships.

Dr. Booth is the author of **"Automatic Digital Calculators"** (1953) and **"Numerical Methods"** (1955); also over 300 Scientific Papers; inventor of the Magnetic Storage Drum for computers; basic patents on multi-core magnetic storage.

Awarded **Centennial Medal in 1967** and other honours.

Dr. Booth had remained involved in the activities of many British and Canadian Engineering organizations, particularly those on Vancouver Island where he has his home.

DISCOVERY '89 ELECTRONIC CHART WORKSHOP

The Electronic Chart Workshop will be held on **Friday, March 10th, from 0800 hours to 1145 hours.** The Workshop will be held at the Pan Pacific Hotel, Pavilion "C".

The main topic of the Workshop will be the Electronic Chart Display and Information System (ECDIS) and the user community. The objective of the Workshop is to examine the present status and the future of the Electronic Chart. This will be accomplished by panel discussions, contributions from invited speakers and open discussion among the participants. Participants will be able to have specific issues or concerns addressed by the expert panel.

WORKSHOP SCHEDULE

Time (hrs)	Event
0800	Chairman's Introduction
0815 - 0930	Panel Presentations
0930 - 0945	Coffee/Snack
0945 - 1145	Questionnaire - Response/Open Discussion

WORKSHOP PANEL

Mr. Neil Anderson (Chairman), Canadian Hydrographic Service

Mr. J.C. Braconnier, Pacific Marine Training Institute

Captain John L Hammer III, Qubit North America

Mr. John Kydd, Marinus Cartographic

Mr. Barry Ridgewell, Offshore Systems Ltd.

Mr. Oyvind Stene, Norwegian Hydrographic Service

Mr. Neil Anderson spent eight years as a field hydrographer specializing in Arctic Hydrography. He then moved into Hydrographic Technology Development, initially working on hydrographic surveying systems, followed by the application and implementation of computer technology in the charting process. His formal education is in surveying and computer mathematics. Presently he is Director of Planning and Development for the Canadian Hydrographic Service, coordinating R & D programs including those related to the development, production and distribution of Electronic Charts.

Mr. J.C. Braconnier served over twenty-eight years in the Canadian Navy. During active service, he obtained a B.Sc. in Electrical Engineering. His extensive experience and training in operations led to his appointment as Deputy Director of the Naval Reserve and ultimately to the command of HMCS Annapolis. Retiring in October 1981, he took the position of Vice Principal/Registrar at the Pacific Marine Training Institute (PMTI). Presently, he is the Principal of PMTI and actively supports the Electronic Chart for the marine environment through education.

Captain John L. Hammer III, after graduating from the U.S. Naval Academy, served in destroyers before transferring to the hydrographic and oceanographic community. He has served with the Royal Navy Hydrographic Department, commanded two USN oceanographic (hydrographic surveying) units, and finished his Navy career as Deputy Director of the Defence Mapping Agency Hydrographic/Topographic Centre. His interest in Electronic Charts began in 1982 and he has been an active participant in ECDIS meetings and specification-writing activities since. He now works as Market Development Manager for Qubit North America, Inc.

Mr. Don Kydd has a background in computers and surveying and international experience in the marine industry. His interests in ECDIS have grown from a relationship with the Canadian Hydrographic Service as well as working with several private companies involved in the Electronic Chart industry. Recently, he has become President of Marinus Cartographic where he offers his services as an expert consultant.

Mr. Barry Ridgewell served over twenty-three years in the Canadian Navy. His extensive experience with diving and submersibles ultimately led to his appointment as Section Head in the Directorate of Naval Requirements of National Defence Headquarters. During the last five years in the Navy, he was also the Chairman of the Canadian Standards Association, Main Committee on Diving and Caisson Systems during which time he coordinated the drafting of three new standards. Since 1984 he has been Vice-President of R & D at Offshore Systems Ltd. and working towards ECDIS standards for the marine environment.

Mr. Oyvind Stene has a background education in Civil Engineering, photogrammetry and geodesy. He is a committee member of the International Hydrographic Organization (IHO) on ECDIS and a member of the IHO/IMO Harmonization Group on ECDIS. He is responsible within the IHO-COE for the further development of Electronic Chart Bases (ECDB). Presently he is Director of the Norwegian Hydrographic Service.

COMMERCIAL PRESENTATIONS

A room (Gazebo I) has been made available for exhibitors and other firms wishing to make technical presentations on their products. This room is available concurrent with the technical sessions on Wednesday, March 8th and Thursday, March 9th, 1989.

The following list of presentations is subject to additions and changes. A notice will be posted giving a current schedule.

Wednesday, March 8th

1030 — KRUPP ATLAS ELECTRONIK
Reinhold Schreiber & Kae Breman
"Atlas Deso 25 and Atlas Fansweep"

~~1430~~ cancelled — OFFSHORE SYSTEMS LIMITED
Helmut Lanziner
"Shipboard Integrated Navigation & Display System"

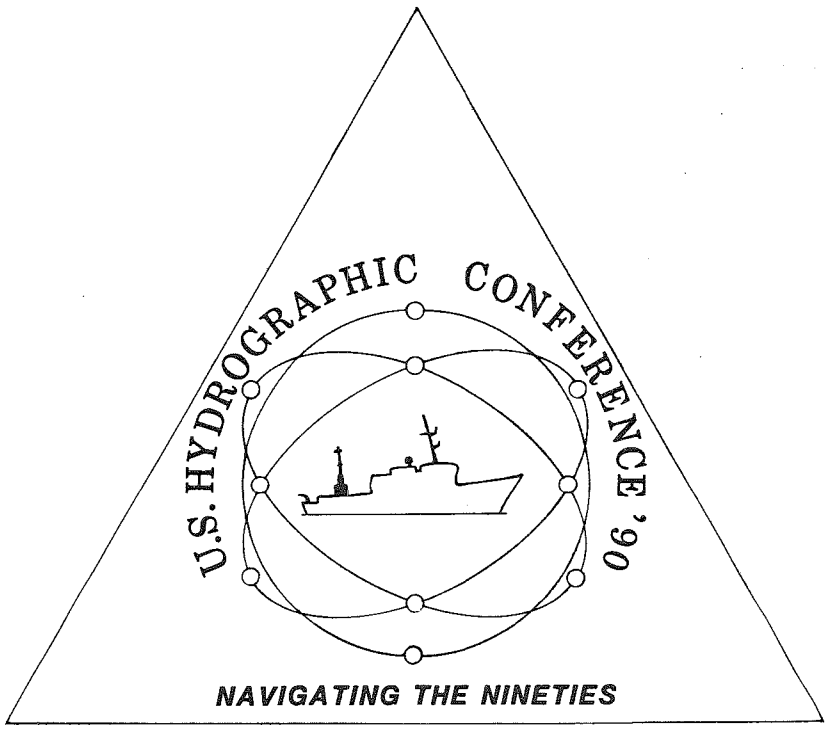
~~1515~~ 14:30 — SIMRAD
Dr. Freddy Pohner and Ben Molbach
"Advances in Hydrographic Instrumentation"

Thursday, March 9th

0915 — QUBIT NORTH AMERICA INC.
John L. Hammer III and Wayne R. Hoyle
"Integrated Navigation & Positioning in the GPS Era"

1030 ~~1530~~ — OFFSHORE SYSTEMS LTD.
Helmut Lanziner
"Radar Positioning"

Announcing....



MAY 1-4, 1990

OMNI INTERNATIONAL HOTEL

Norfolk, Virginia, U.S.A.

FOR FURTHER INFORMATION, CALL:
LCDR DEAN SMEHIL 804-441-6439
OR WRITE: U.S. HYDROGRAPHIC CONFERENCE '90,
P.O. BOX 177, NORFOLK, VIRGINIA 23501, U.S.A.

SPONSORED BY:

NATIONAL OCEAN SERVICE

The Hydrographic Society

TECHNICAL PROGRAM INDEX

Wednesday, March 8th, 1989

14:30 - 16:00 **EMERGING STATES FORUM**

P.48 T.D.W. McCulloch - Chairman
Invited papers will deal with hydrographic issues related to developing countries.

Thursday, March 9th, 1989

08:30 - 10:00 **CARTOGRAPHY**

P.50 Cartographic Generalization - Intelligence or Intuition?
B. Beale, CHS, Burlington, Ontario

P.52 U.S. Trends Toward Standardized & Internationally Recognized Nautical Chart Symbology.
W. E. Frey, NOS, NOAA, Rockville, Maryland

P.54 Print-On-Demand
D. Vachon, CHS, Ottawa, Ontario

10:30 - 12:00 **POSITIONING**

P.56 Communication Link Trials for Hydrographic Differential GPS Operation
J.M. Tranquilla, H. Boudreau, A Bell & B.G Colpitts, University of New Brunswick, Fredericton, N.B.

P.58 Status and Future of Relative Kinematic GPS Positioning
S.R. DeLoach, U.S. Army Engineer, Fort Belvoir, Virginia

P.60 Integrated Syledis Positioning and Communication
J. Green, Hi-Flight Engineering Ltd., R. Sutherland, Canadian Engineering Surveys Ltd. and H. Stewart, Gulf Canada Resources Ltd., Calgary, Alberta

13:30 - 15:00 **HYDROGRAPHIC SURVEYS - ADVANCING THE ART**

P.62 Toss The Probe In Lieu of the Bar
E.F. Thompson & D.G. Pugh, CHS, Burlington, Ontario

P.64 Productivity Increases Involving an NOS Hydrographic Field Party
D.J. Hill, R. Mihailov & F. Diaz, NOAA, Seattle, Washington

P.66 Discovery of the S.S. Cambridge
P. Lacroix, Quester Tangent Corporation, Sidney, B.C.
C. Stuart, Master, M.V. "Blue Nabilla"

15:30 - 17:00 **TIDAL INSTRUMENT DEVELOPMENT**

P.68 The Development of a Permanent Tide Gauge for Remote Areas
C. T. O'Reilly, G. Steeves & S.T. Grant, CHS, Dartmouth, N.S.

P.70 Digital Tide Gauge - New Orientations
P. Kielland and P. Hally, CHS, Quebec

P.72 The Low Power Tide Gauge - A New Tool For Hydrography
F.E. Stephenson, CHS, Sidney, B.C. & D.D. Silver, Revlis Electronics Ltd., Sidey, B.C.

INTEGRATING HYDROGRAPHIC DATA FOR OTHER SCIENCES

The ocean areas around the United States face a number of problems and opportunities in which mapping and charting efforts play a vital role. The traditional role of maintaining safety of navigation is an aspect that cannot be overlooked. However, other demands are becoming ever more important. The mission of NOAA's National Ocean Service is to conduct surveys and to provide charts and related information, not only for the safe navigation of marine and air commerce, but also to provide basic data for engineering and scientific purposes, and for other commercial and industrial needs. State-of-the-art technology not only insures a better product for the navigator, but also produces data that are increasingly valuable to scientists, engineers, planners and decision-makers.

The stresses of civilization are showing in the coastal areas around the United States as the majority of the country's population is now living within 50 miles of a seashore. Greenhouse gases cause sea level rise and ground water withdrawal causes regional subsidence. Together these accelerate erosion and landloss. Response can range from stabilization and replenishment efforts to retreat but there is an increasing realization that natural processes must be understood and allowed to function as much as possible. Survey data are vital ingredients in the information needed to make these, and other decisions. For example, management of coastal fisheries can be aided by survey data which indicates "live bottom" areas of greatest productivity. Similarly, the design of dredging projects to maintain and improve port access can be aided by an understanding of sediment dynamics based on survey data.

There is a similar array of demands for survey data in the offshore regions around the United States. High resolution bathymetric surveys of the Exclusive Economic Zone (EEZ) are unveiling unexpected sea floor features and proving invaluable to researchers. These data were instrumental in the discovery of the first hydrothermal field found in the EEZ and of biological communities supported by seeps in deep-sea canyons. Fishermen have eagerly sought more accurate, detailed bathymetric maps. Oil and gas exploration, the search for marine minerals, and consideration of waste disposal options are other efforts that are expected to benefit from the new survey data.

Hydrographers today must meet the needs not only of navigators but also a variety of others who seek to understand, manage and use ocean resources. The increasingly sophisticated tools available to them must be used to meet a broadening range of requirements.

CHANGING CONDITIONS AND USER REQUIREMENTS

Rear Admiral Wesley V. Hull
Director, Charting and Geodetic Services, NOAA

Tuesday, March 7, 1989

10:30 - 12:00

INTEGRATING HYDROGRAPHIC DATA FOR OTHER SCIENCES

Thomas J. Maginnis
Assistant Administrator, Ocean Services
and Coastal Zone Management, NOAA

Captain C. Andreasen
Chief, Nautical Charting Division, NOS, NOAA

PRESENTED BY:

Captain Andreasen attended the University of Illinois and holds a degree in Civil Engineering. He was commissioned as an officer in the NOAA Corps in March 1963 and has held a variety of sea and shore positions. These have included Chief of mobile gravity and geodetic astronomy parties, Chief of the U.S. Exclusive Economic Zone mapping project, and Commanding Officer of the NOAA Ships "RUDE", "HECK", "DAVIDSON" and "FAIRWEATHER". At present, he is Chief, Nautical Charting Division in the Office of Charting and Geodetic Services, National Ocean Service.

NOTES:

TRENDS IN SHIP TRANSPORT AND PORT DEVELOPMENT

The paper presents a review of the historical trends in the waterborne trade of resource commodities, in both a regional and international context, and assesses the implication of these trends on the physical development of port facilities.

The principal impact is the increase in physical dimensions of shipping involved in the transportation of these resource commodities, the most recent regional impact being in the size of ships in the dry bulk and forest products trades.

Case studies for development of physical port facilities required to accommodate these ships are reviewed. The physical design parameters influencing terminal site selection are reviewed both for greenfield and existing port or terminal facilities.

The development for modern terminals, or rehabilitation of existing port facilities, has a substantial impact on national and regional economic growth. Physical facilities have a high capital cost, and location is generally determined on the basis of hydrographic and climate data. Survey information of bathymetry, tidal influences, and wave climate is critical in the evaluation of project feasibility and in the selection of sites for physical facilities. Post construction surveys of marine structures, access dredging and the location of aids to navigation is essential for the safety of shipping.

CHANGING CONDITIONS AND USER REQUIREMENTS

Rear Admiral Wesley V. Hull
Director, Charting and Geodetic Services, NOAA

Tuesday, March 7, 1989

10:30 - 12:00

TRENDS IN SHIP TRANSPORT AND PORT DEVELOPMENT

C.J. Anderson
Sandwell Swan Wooster

T.D. Smyth
Sandwell Swan Wooster

G. Lang, P. Eng.
Manager, Marine Services
Sandwell Swan Wooster

PRESENTED BY:

Mr. Anderson is a master mariner and holds a B.Sc. in Maritime Studies. He has 15 years experience as a consultant in the evaluation and planning of physical port facilities for both regional and international projects.

NOTES:

HYDROGRAPHIC REQUIREMENTS DURING POLAR 8 OPERATIONS IN ARCTIC WATERS

The Polar 8 Icebreaker will operate in a number of Arctic regions that until now have been inaccessible to ships, or only rarely transitted by icebreakers in the past. Existing hydrographic information on many of these areas ranges from none to minimal, or generally not up to modern charting standards. For example, in some areas, the depth and true nature of the sea floor is still not known; in others, the only available data are British Admiralty spot soundings with poor positional accuracy, random track soundings of variable quality, or accurately positioned spot soundings taken through ice at intervals of 2 to 20 kilometers. In the approximately 25% of Arctic waters where controlled surveys have been completed, the data are limited to mostly well-positioned continuous profile soundings along trading routes, or in areas of petroleum industry exploration and production activity. Personnel aboard icebreakers and ice-breaking supply boats, and those aboard bulk carriers, tankers and dry cargo vessels with or without an ice class, rely on this information during the current Arctic navigation season. However, even in these relatively well-documented waters, uncharted shoals and foul ground continue to be reported. Lastly, for reasons unrelated to shipping, reconnaissance soundings have been obtained during geophysical and other scientific work in the Arctic. These data include, for example, those collected over the Lomonosov Ridge, over the Alpha Ridge, and along the continental margin off the Arctic Archipelago.

Hydrographic requirements during Polar 8 operations in Arctic waters will be described in our paper. This icebreaker will be the highest conventionally-powered ice-breaking ship in the world when it is built and commissioned in the 1990's. The vessel will be highly ice-capable, and has been designed to carry out a variety of Arctic operations on a year-round basis for extended periods of time. These operations will be guided by normal maritime practise, the ship's mission profile, and in the case of water depths, by the 20 metre contour. The contour will be a safe operating threshold for the ship. The variability in hydrographic coverage referred to above poses many possible problems for Polar 8, as does, to a lesser extent, the varying quality and amount of tide and current data. Deficiencies in present-day coverage will be discussed, relative to possible Polar 8 operating areas at different times of the year. Attention will be paid to Parry Channel, other straits and passages in the Arctic Islands, the Southern Coastal Waterway, Nares Strait and the Arctic Ocean. Hydrographic data in some of these waters will need to be collected for planning purposes and other reasons before the ship begins to operate in the 1990's. There will also be an on-going requirement for data collection once operations begin, in support of new missions, or transits to and from new locations.

Various ways of meeting operational requirements for hydrographic information in the future will be described in our paper. Both existing and new types of technology developed for Arctic surveys by the Canadian Hydrographic Service will be reviewed. The following types of approaches, for example, could be employed: conventional (open water) survey methods, spot soundings through ice using helicopter-mounted systems, autonomous under-ice systems, airborne laser profiling systems, and airborne electromagnetic systems. In addition, the ship itself could become a platform for collecting hydrographic data in some of the waters where coverage does not now exist, or cannot be reasonably and cost-effectively collected by other means in the future. These data could be collected during dedicated (scientific) missions, or on an opportunity basis during other types of Polar 8 operations. Different aspects of planning and staging this work aboard the ship will be discussed in our paper as well.

CHANGING CONDITIONS AND USER REQUIREMENTS

Rear Admiral Wesley V. Hull
Director, Charting and Geodetic Services, NOAA

Tuesday, March 7, 1989

10:30 - 12:00

HYDROGRAPHIC REQUIREMENTS DURING POLAR 8 OPERATIONS IN ARCTIC WATERS

Mr. M.G. Lowings
President
Polar Sea Research Ltd.

Mr. M.A. Cameron
Senior Physical Scientist
Norland Science
& Engineering Ltd.

Mr. J. Keen
Planning Officer
Canadian Hydrographic Service

Capt. D.H. Johns
Manager,
Arctic Operations
Canadian Coast Guard

PRESENTED BY:

Mr. Lowings is an Arctic oceanographer and northern regions specialist. He has been involved in documenting and interpreting the effects of the ocean, ice and marine weather environments on various types of Arctic operations for the last eight years. He is President and Senior Consultant with Polar Sea Research Ltd., an innovative Arctic and cold regions consulting firm providing services to clients in Canada, the United States and northern Europe from its offices in Lethbridge, Alberta, Canada. His current professional interests include site and routing access during Polar 8 operations at different times of the year, an inventory and assessment of ice-capable ships in the Canadian fleet, and Arctic database development.

NOTES:

SYSTEM DEVELOPMENT IN CHANGING ECONOMIC, POLITICAL AND TECHNOLOGICAL ENVIRONMENTS

Despite its specialization, the world of hydrography does not exist in a vacuum. Political and economic forces throughout the globe have an effect, however small, on the way in which we carry out our business. The same market forces which set the retail price of gasoline at the local pump govern the feasibility of arctic pipelines or northern shipping routes. We in Canada have seen our work plans migrate North, then South, drift Offshore, then Inshore, pushed and pulled by on-again/off-again pressures for offshore and frontier oil exploration. The impact of these changes on long term charting programs can be unfortunate as these programs generally require extensive lead times, are by nature laden with inertia, leading sometimes to completed projects which are no longer needed. We have extensive experience in charting areas which never achieved their predicted strategic importance.

Fortunately, we live in an era when technology is introducing solutions almost as quickly as it introduces problems. Swath sonar, acoustic sweeping, lidar bathymetry and through-ice profiling are technologies rapidly reaching maturity. Each has a tremendous positive impact on the productivity of the organization. Faster and cheaper computers are allowing us to use more sophisticated approaches to data processing and, in certain sectors, we are now seeing real improvements in quality as well as quantity. More data does not necessarily translate into better charts, but steady progress in the fields of Geographic Information Systems, data base management and interactive compilation is showing light at the end of the tunnel. On the other hand, we have also had some experience with developing equipment which either didn't work or didn't do what it was expected to do.

Development by its nature is a risky business. Not every project will deliver as expected. For example, Artificial Intelligence may provide us with the true breakthroughs needed to synthesize good cartography from the preponderance of new data delivered by modern sensors. But pursuing it with any vigor may also prove to be an expensive failure. We need a method which will help us determine what developments are likely to pay off and now we can measure the result. Does an improvement in the manufacturing process come at the cost of a decreased product value, leading in the end to an overall net loss? Where does management technology fit in? How do you compare improvements in the organization's management to those on the process side?

Priority management issues like these have been the focus of much recent management literature but the focus has always been restricted to optimizing an enterprise committed to sustained growth and return on investment. There is little information for those who must optimize the operation of agencies committed to zero growth. These issues require careful thought and the answers may only come through a mix of both quantitative (e.g. process modelling, simulations, etc.) and more qualitative (e.g. Opportunity Audits, Task Forces, etc.) approaches in others. The goal is the development of a framework within which programs can be evaluated and development priorities set in a manner that allows for the flexibility needed for short term response yet provides the technical guidance necessary for the steady growth of the hydrographic industry as a whole.

SYSTEM DEVELOPMENT IN CHANGING ECONOMIC, POLITICAL AND TECHNOLOGICAL ENVIRONMENTS

M. J. Casey
Chief, Hydrographic Development

PRESENTED BY:

Mr. Casey is Chief of Hydrographic Development for the Canadian Hydrographic Service and Chairman of the CHS Development Planning and Priorities Committee. His responsibility areas include directing the research programs into the Global Positioning System (GPS), Computer Networking via satellite, the LARSEN Airborne Laser Sounder and Geostatistics. He has worked for CHS since 1971 in a variety of positions including Hydrographer in Charge (HIC) of field surveys. He has a BSc in Mathematics from McMaster University.

NOTES:

PROSPECTS FOR HYDROGRAPHIC POSITIONING IN THE 90'S*

The 90's will witness the full deployment of the satellite-based **Global Positioning System (GPS)**. The major features of this powerful system, which have a profound impact on all oceanographic-related positioning and navigation aspects, are described.

The capability of the system in terms of coverage, availability, accuracy, reliability and integrity is presented. The time transfer capability of GPS and the potential impact on Loran-C is discussed. Current user equipment characteristics and capabilities are summarized. The results of extensive shipborne and airborne tests, conducted in Canada during the 80's for hydrographic applications, are reviewed. Issues such as the effect of **Selective Availability** on user accuracy degradation and possible counter-measures such as the proposed EMR's **Active Control System** are discussed. User equipment trends such as RF component miniaturization, multi-antenna receivers for the determination of attitude components and integrated GPS-INS systems for velocity estimation are presented. The potential of GPS to provide decimetre level accuracy for shipborne hydrographic surveying is discussed. The possible inter-operability of GPS with Loran-C and other space-based systems such as GLONASS and various geosynchronous RDSS is discussed.

HYDROGRAPHY - THE NEXT DECADE

Mr. George MacDonald
Canadian Hydrographic Service

Tuesday, March 7, 1989 **13:30 - 15:00**

PROSPECTS FOR HYDROGRAPHIC POSITIONING IN THE 90'S*

Gerard Lachapelle
Department of Surveying Engineering
The University of Calgary

PRESENTED BY:

Professor **Gerard Lachapelle** has been with the Department of Surveying of the University of Calgary since early 1988. He is involved in teaching and research in areas such as hydrography, navigation and geodetic positioning. He studied geodetic sciences at Laval University, Quebec (BSc, 1971), the University of Oxford (MSc, 1972), the University of Helsinki (LPh, 1973), and the Technical University at Graz (Dr. techn, 1975). He has 15 years of government and industrial research experience and has been working with the Global Positioning System since 1980. He is active with many Canadian and international scientific and professional associations. He is former president of the Canadian Institute of Surveying and Mapping and a former executive of the International Association of Geodesy.

NOTES:

DIRECTIONS IN THE DEVELOPMENT OF SONAR SURVEY SYSTEMS

With the introduction of multi-beam and multi-transducer survey systems into regular service during the 1980s, hydrographers, for the first time, began to get quantitative information about the majority of the sea floor areas that they were surveying. These systems still are not the standard tools of the hydrographer --- they are not suitable for much of the water depths that have to be surveyed, or reasonable for the sea conditions that are encountered or the platforms that are used. However, there are solid prospects for that to change in the near future. Laser systems, or some other non-acoustic technique, will likely be the standard of the future for water shallower than 10 or 20 meters. From 10 meters to full ocean depths, developments and improvements in sonar technology promise to provide the capability for complete, high-resolution bottom coverage, and to do so more efficiently than any current equipment. Data produced by these new generation systems should make possible better charts as well as providing data for many other applications.

Multi-beam systems are being extended to cover swaths of three or four times the water depth. Interferometric systems can cover even wider swaths. Both can be made to provide information on bottom composition through backscatter imagery. Both types of systems are being made smaller and more portable. Hybrid systems may exploit the strengths of both. Multi-system systems, akin to multi-transducer systems, are possible. Sector-scanning, correlation, and other signal processing techniques may offer advantages. Digital, perhaps adaptive, beamforming offers other potential. Computer processing power is evolving as fast as the volume of data from survey systems is increasing. Optical disks are being developed to provide adequate storage. New hardware and software are being developed to manipulate, analyze and display the massive amounts of data produced.

It is not just Buck Rogers fantasy to think of robot vehicles capable of going to sea with these sensors and using artificial intelligence to complete the survey, record and analyze the data and report back. For the near future, however, the challenge will be to develop systems which are accurate, reliable, efficient, and manage data well. They must meet the international accuracy standards. They must perform properly at sea with a minimum of anomalies and downtime. They must provide complete survey coverage with efficiency sufficient to justify their cost. They must provide real-time and near-real-time information necessary to ensure the quality of the survey. Some innovative concepts have emerged to meet these requirements. The hydrographic community needs to encourage more.

DIRECTIONS IN THE DEVELOPMENT OF SONAR SURVEY SYSTEMS

Donald Pryor
Office of Charting and Geodetic Services
NOAA, National Ocean Services

PRESENTED BY:

Donald Pryor is responsible for systems planning and technical advice to the Director of NOAA's Office of Charting and Geodetic Services. He has been involved in the development of sonar survey and data processing systems since joining NOAA in 1978. He came to NOAA with ten years experience in a Navy laboratory doing research and development of underwater ordnance. He worked in NOAA's Engineering Development Office from 1978 until 1983 on a variety of projects involving acoustics and electronics. After joining the Director's staff in 1983, he served as manager of the Exclusive Economic Zone survey project during its start-up phase.

Mr. Pryor is a graduate of the Massachusetts Institute of Technology and the University of Maryland with degrees in electrical engineering. He is a member of the Hydrographic Society, Marine Technology Society, American Geophysical Union, and the Institute of Electrical and Electronics Engineers.

NOTES:

ADVANCES IN TERRAIN AND COASTAL MAPPING

USING

THE LARSEN 500 SCANNING LASER SYSTEM

The Larsen 500 Scanning Laser Bathymeter has been used for collecting hydrographic charting data since 1985 in regions of Canada's Arctic, Pacific Coast, and the Gulf of St. Lawrence. Operational strategies were envisioned for the Larsen 500 during its development and have been refined over the past four years of production surveys.

The Larsen 500 has proved the most effective operating as an autonomous survey vehicle. To achieve this autonomy, data sets from video and photogrammetric cameras are employed to complement the laser bathymeter.

This paper details the evolution of the system's hardware, software, and operational techniques that have been adopted and expanded to gather the hydrographic data set required for coastal charting.

PROGRESS WITH NEW SURVEY TECHNOLOGIES

Mr. D.A. (Tony) O'Connor
Regional Director,
Canadian Hydrographic Service

Tuesday, March 7, 1989

15:30 - 17:00

ADVANCES IN TERRAIN AND COASTAL MAPPING USING THE LARSEN 500 SCANNING LASER SYSTEM

J. A. Vosburgh
Terra Surveys Limited
Sidney, B.C.

PRESENTED BY:

Jim Vosburgh joined the Canadian Hydrographic Service in 1969 on the Pacific Coast following graduation from the British Columbia Institute of Technology in Survey Technology. Field surveys throughout Canada and the Arctic, staff training, and development projects were among the many tasks undertaken in the following fifteen years within the C.H.S. In 1984, Jim left the C.H.S. to join Terra Survey's marine division in Sidney, B.C. where his primary duty has been the co-ordination of the Larsen 500 airborne remote sensing program.

NOTES:

The Ocean Mapping Section (OMS) of the National Ocean Service (NOS) is responsible for mapping the United States coastal waters and Exclusive Economic Zone (EEZ). Since 1984, four NOS ships equipped with multi-beam survey systems have surveyed over 100,000 linear nautical miles covering approximately 50,000 square nautical miles of the U.S. EEZ.

ADVANCES IN DATA ACQUISITION In 1988, NOAA Ship "MT. MITCHELL" increased productivity significantly by using the STARFIX commercial satellite navigation system. The ship achieved this after losing one month of production due to numerous problems with their medium frequency positioning system. A next generation of multi-beam data acquisition and processing systems is scheduled for use in early 1989. The Sea Beam acquisition software was developed by the University of Rhode Island SEA BEAM Development Centre. NOS also plans to adapt this software to its new HYDROCHART II - based Intermediate Depth Swath Survey System to standardize data formats and handling for all five swath mapping ships. A new PC-based computer program, VELOCITY, standardizes the determination of sound velocity tables derived from different CTD and sound velocimeter sensors. The program selects the most significant data points to define the sound velocity curve based on changes in depth and crosstrack position. VELOCITY also performs comparisons of CTD data to routine XBT observations or historical temperature and salinity data from NOAA's National Oceanographic Data Centre. OMS has become more aware of the possible generation of errors in position resulting from incorrect gyrocompass information. NOAA Ship "SURVEYOR" has compared gyrocompass readings against observed bearings to natural ranges in port and sun azimuths at sea. The results from these comparisons showed that gyrocompass drift stayed within one degree. OMS personnel prepared a revised manual of procedures to conduct Sea Beam system evaluation tests called Patch Tests. The manual explains the source of system errors and detailed graphical procedures to determine these errors. The new procedures use standardized, cell-protected spreadsheet software to calculate patch test correctors.

ADVANCES IN DATA PROCESSING Program VAXCOP merges Sea Beam data files with navigation data and selects representative soundings for gridding and contouring data and producing legible point plots. Though most of the algorithms used in VAXCOP are from it's predecessor, the Combined Off-line Program (COP), VAXCOP is much faster. VAXCOP can process 24 hours of data in 12 minutes. COP would require several hours to process the same data. Storage of both hard copy and digital multi-beam data has become a major problem. Magnetic tapes are highly susceptible to degradation and loss of data. In addition, a large amount of space is required to store hard copy data from line scan recorders, sound velocity printouts and computations, survey reports, and other documents which must be retained. To alleviate this storage problem, the OMS has obtained a Write Once Read Many (WORM) disk reader/recorder. Because worm disks are expensive and can be written to only once per disk, the data needs of potential users must be thoroughly addressed to determine what type of data are archived onto WORMs.

ADVANCES IN DATA PRESENTATION Gridded multi-beam data have been used to refine 100-fathom contours on small scale (less than 1:100,000-scale) nautical charts off Oregon. Although some noise appears in the contours, the results are more accurate in deeper water than contours derived from existing conventional hydrographic survey data. Multi-beam data are used to create various products such as standard 1:100,000- scale contour maps, color-filled rasterized images, nested profiles, slope maps and isometric (3-dimensional) plots. By vertically exaggerating isometric plots, considerably more detail can be shown of an area's morphology.

CONCLUSIONS The use of multi-beam systems to systematically map the EEZ has resulted in an evolutionary understanding of system capabilities, error sources and limitations. The Ocean Mapping Section is continuously evolving to incorporate new developments in the acquisition, processing and presentation of multi-beam data.

PROGRESS WITH NEW SURVEY TECHNOLOGIES	Mr. A.D. (Tony) O'Connor Regional Director, Canadian Hydrographic Service
Tuesday, March 7, 1989	15:30 - 17:00

ADVANCES IN THE ACQUISITION, PROCESSING AND PRESENTATION OF MULTI-BEAM SURVEY DATA

Lt. Bruce F. Hillard, NOAA
and
Ltjg. Patricia D. Lynch, NOAA
National Oceanic and Atmospheric Administration
National Ocean Service (NOS), Ocean Mapping Section

PRESENTED BY:

Lt. Bruce Hillard began his career in the NOAA Corps as a junior officer aboard the NOAA Ship "RAINIER" conducting hydrographic surveys. At the Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida, he worked as a research oceanographer in the Sediment Dynamics program of the Marine Geological and Geophysics Laboratory. From 1982 to 1984 he attended the Naval Postgraduate School in Monterey, California, obtaining an M.S. in Hydrographic Sciences. Upon graduation, he was assigned as Field Operations Officer aboard NOAA Ship "DAVIDSON", conducting multi-beam surveys of the U.S. Exclusive Economic Zone. For one year he served as Manager of the NOS Hydrographic Data Base at the National Geophysical Data Centre in Boulder, Colorado. At present, Lt. Hillard and Ltjg. Lynch are members of NOS's Ocean Mapping Section.

NOTES:

APPLIED PHOTOBATHYMETRY, LOOE KEY

- A CASE STUDY

In 1919, the U.S. Coast and Geodetic Survey, forerunner to National Ocean Services (NOS), first experimented with the use of aerial photographs to locate submerged rocks and coral heads. However, it was not until 1958, with the introduction of color aerial film emulsions, that the first successful photobathymetry project was undertaken near San Juan, Puerto Rico. Natural color film emulsions have excellent clear water penetration characteristics. Depths exceeding 20 meters have been distinguished in Caribbean waters.

Looe Key is a small coral reef lying 20 nautical miles east of Key West and 6 nautical miles south of Big Pine Key. The reef area is a National Marine Sanctuary. It is considered to be the most spectacular reef in the Lower Keys. To assist in the development of management plans for the sanctuary and to support the Nautical Charting Program at NOS, the Nautical Charting Division of NOS was requested to produce bathymetric and seabed characteristic maps of the Looe Key area. The extreme shallowness of numerous coral peaks near the core of the reef would present a real danger to hydrographic survey ships, and to the reef itself, with a conventional hydrographic survey. Therefore, the portion of the sanctuary inaccessible to hydrographic survey ships would be surveyed photogrammetrically. Final map products would be compiled from merging hydrographic and photogrammetric data.

The Looe Key mapping project represents NOS' most ambitious photobathymetric survey to date. Since Looe Key is well offshore and the area to be mapped lies almost entirely submerged, unique methods and procedures were developed to conduct the photogrammetric survey. Temporary platforms, which would be visible on aerial photographs, were erected to provide horizontal and vertical controls for stereomodels. Stereomodel compilation was accomplished using NOS' Integrated Data Photogrammetric Facility (IDPF). IDPF utilizes analytical stereoviewers, computer graphics, and data base management technologies. Software routines developed by NOS personnel for IDPF compensate for the image displacement which occurs when light rays reflected from the seabed are bent at the air/water interface.

The photogrammetric survey would be the initial phase of the project conducted. Aerial photography was obtained at two scales; 1:15,000 and 1:5,000. Areas where seabed could not be distinguished on aerial photographs would be subject to hydrographic survey. Map products were produced at two scales; 1:10,000 and 1:2,500. The 1:10,000 maps cover most of the sanctuary area, approximately 5.3 square nautical miles. The large scale 1:2,500 maps cover the Core Area consisting of the prominent Fore Reef and shallow Reef Flat (approximately one square nautical mile). For each map scale, bathymetric and seabed characteristic data was collected. Depth measurements were collected at over 3000 discrete points for the 1:10,000 map and more than 5,000 points for the 1:2,500 map. Bottom texture, such as coral, sand, sea grass, etc., were delineated from the project photos for each map scale. Draft copies of the bathymetric and seabed texture maps were then supplied to the hydrographic survey party, which then filled in all data holidays from the photogrammetric survey. Final map products generated consisted of seabed texture map with discrete point depths and depth curve overlays for each scale.

Excellent agreement was obtained in the merging of hydrographic and photogrammetric data. The Looe Key mapping project demonstrated that in clear water areas photgrammetric bathymetry is an effective and versatile complement to conventional hydrographic surveys.

PROGRESS WITH NEW SURVEY TECHNOLOGIES

Mr. A.D. (Tony) O'Connor
Regional Director,
Canadian Hydrographic Service

Tuesday, March 7, 1989 **15:30 - 17:00**

APPLIED PHOTOBATHYMETRY, LOOE KEY

- A CASE STUDY

Ted Doyle
NOAA, National Ocean Service

PRESENTED BY:

Ted Doyle is a cartographer in the Photogrammetry Branch, National Ocean Service, NOAA. Mr. Doyle received his Bachelor of Science degree in Geography from the University of Maryland in 1981. He has worked in the Photogrammetry Branch for the past 7 years.

NOTES:

DEVELOPMENT OF A DIGITAL BATHYMETRIC MODEL FOR THE FRASER RIVER VANCOUVER, BRITISH COLUMBIA

The Waterways Development Group of the Canadian Coast Guard (CCG), Western Region, has the responsibility to develop and maintain main navigational channels in Western Canada. The Marine and Civil Engineering Division of Public Works Canada (PWC), as a service agent to CCG, has the responsibility to provide hydrographic and engineering surveys to assist in the management of the CCG dredging program. Together, these two agencies have identified a need to improve the management of dredging activities for which they are responsible on the lower reaches of the Fraser River.

The Fraser River drains 250,000 km^2 of south central British Columbia into Georgia Strait at Vancouver, B.C. The major deep sea channel, with a maximum draft of 10.7 m, extends 34 km along the South Arm of the river to New Westminster/Surrey. The second major channel, in the North Arm, extends from Point Grey between Vancouver and Richmond, and runs 31 km to join the South Arm at New Westminster. These two channels and associated secondary channels are the main waterborne transportation links serving the industrial and commercial users on the river.

In the Fraser River, an average of 3.3 million m^3 of sand annually forms deposits requiring dredging within the main navigation channels in a complex dynamic process. The effective management of a dredging program to plan and execute the removal of the deposited sand requires the manipulation of large volumes of survey data and detailed volume calculations.

The key requirement is to adopt a data management scheme that could robustly and accurately manipulate bathymetric surveys taken at different times, constantly update information to show the current status of the river, but still allow comparisons with previous surveys of the same area. Thus, the system is required to store and retrieve the geographic and bathymetric information; perform engineering and related computations; and, combine and display data on-screen and in hard copy formats.

Additionally, the existing Canadian Coast Guard **AVADEPTH** program (an **AVA**ilable **DEPTH** prediction function for the existing Fraser River Deep Sea Channel) will be integrated into the DBM.

After analysis of all user requirements, and review of available systems through a proposal call, a geographic information system (GIS) package called Terrasoft was chosen as the platform on which to build the customized dredging data and graphics display functions. Initially, the system will utilize time dependent data in a static manner. Future developments may include synthesis of dynamic models of sedimentation, flow velocities, salt wedge intrusion, tidal variations, etc.

DATA MANAGEMENT

Commodore J.L.A. Van Aalst
Hydrographer,
Royal Netherlands Navy

Wednesday, March 8, 1989

08:30 - 10:00

DEVELOPMENT OF A DIGITAL BATHYMETRIC MODEL FOR THE FRASER RIVER VANCOUVER, BRITISH COLUMBIA

Fred Stepchuk, B.Sc., P. Eng.
Regional Waterways Engineer
Waterways Development, Western Region
Canadian Coast Guard

PRESENTED BY:

Fred Stepchuk, a 1970 graduate from the University of Alberta, worked extensively in the municipal engineering and water resource areas as a consultant between 1970 and 1982. After a brief return to university to study Computing Science, Mr. Stepchuk joined Public Works Canada in 1984 with assignments in Edmonton, Alberta and Whitehorse, Yukon.

In 1987, Mr. Stepchuk accepted his current position with Coast Guard where he is responsible for the development and implementation of processes and systems to aid in the management and monitoring of the regional waterways development program.

NOTES:

DATA BASE NEEDS OF NAVIGATORS AND DREDGE MASTERS

The navigator needs to know where the hazards are and how much confidence he can have that all these have been identified.

The dredging master gets paid for producing a channel to a particular depth. He does not get paid for excess material being taken out and may not be compensated for removing the results of resiltation while dredging.

If the navigator requires too large a safety margin, the dredging costs can escalate. Safety margins are in a way measurement uncertainty factors. If the tolerance on the post dredging survey is uncertain, a greater quantity may need to be removed and this in turn may de-stabilize the channel. Quality control in survey may ensure better safety at less overall cost.

DATA MANAGEMENT

Commodore J.L.A. Van Aalst
Hydrographer,
Royal Netherlands Navy

Wednesday, March 8, 1989

08:30 - 10:00

DATA BASE NEEDS OF NAVIGATORS AND DREDGE MASTERS

Dr. R.L. Cloet, B.A., Ph.D., F.R.G.S., F.G.S.
Bathymetrics Limited
United Kingdom

PRESENTED BY:

Dr. Cloet

NOTES:

THE CHS INFORMATION SYSTEM - "ASSEMBLING THE PIECES"

The concept of a Canadian Hydrographic Service (CHS) information system that would provide users with validated data was developed in 1985. Originally, it was unconstrained by technical or financial limitations and identified primarily the data sources required for the compilation of nautical charts.

The concept was refined through prototyping and pilot projects until a design was developed that incorporated the constraints imposed by the available technology as well as those of a limited budget for development and operation of such a system.

This paper will review the concept and design phases and then outline the plans for the implementation phase. Because of the constraint of implementing the design using existing resources, a four phased approach is proposed for implementation:

1. Manage the existing data in CHS.
Develop a directory to all data sources that will provide an index of all source data, the location of the data, a summary of the data sets and indicate where the data sets have been incorporated into products. This can also include systems to manage digital field data tapes and digital chart files and can be done with existing resources.

2. Build data bases for data sets not now in data bases.
Develop data bases for data sets that are not presently in a data base management system. The directory of source data will serve as the index to the availability of the different data types and a product management system will be developed to record the products of CHS, cross reference the sources incorporated into each product as well as the processes involved in the production, distribution and maintenance of these products.

One of the first data bases to be built will be the bathymetric data base which will contain soundings, dangers, bottom samples, etc. It will be complemented by the topographic data base which will also contain shoreline data. Because of the importance of water level data to these data sets, that data base will be assigned a high priority.

3. Interface data bases within CHS
The interfacing of data bases within CHS will have begun with the directory of sources and the product management system. The choice of oracle as the data base management system for the Department of Fisheries and Oceans simplifies the technical interfacing of data bases within CHS. Thus, the emphasis will be placed on defining the data contents so that data are stored and linked logically. The mechanics of the interface will be considered and implemented later.

4. Interface to external data bases.
This will be a more difficult phase since it will require negotiation with other departments for access to their data and the technical connections between different data base systems. It will also involve setting interchange standards for data output by the CHS information system and access criteria for users external to CHS.

As the pieces of the CHS information system are assembled, the technical feasibility of networking the data bases into an information system will be addressed as well as the organizational and financial support required to implement and operate such a system. These latter issues will only be identified since the solutions are complex and indeed may prove to be a greater challenge than the technical networking of data bases into the information systems of the information age.

DATA MANAGEMENT

Commodore J.L.A. Van Aalst
Hydrographer,
Royal Netherlands Navy

Wednesday, March 8, 1989 **08:30 - 10:00**

THE CHS INFORMATION SYSTEM - "ASSEMBLING THE PIECES"

Colin Bromfield
Programmer

J. Richard MacDougall
Data Base Engineer

Donald Vachon
Head, System Development

PRESENTED BY:

Dick MacDougall is a hydrographer, a Canada Lands Surveyor, a New Brunswick Land Surveyor and a Professional Engineer in the province of Ontario. He is a graduate of the surveying engineering program with the University of New Brunswick and has been with the Canadian Hydrographic Service since 1970. During that time he has been a hydrographer, hydrographer-in-charge of the Winter Arctic Surveys, and since 1985 he has headed up the CHS Data Base Development Project.

NOTES:

THE NORTH SEA PROJECT

The North Sea Project was initiated in June, 1987 by the Norwegian Hydrographic Service and the Royal Danish Administration of Navigation and Hydrography. Six other countries surrounding the North Sea joined the project. The Canadian Hydrographic Service contributes with the "Electronic Chart Testbed" equipment. Finland and the USA were present as observers.

ORGANIZATION The project which was jointly led by Norway and Denmark was supported by the IHO Committee on ECDIS. The venture was principally funded by Norway, which also provided management and logistical support. National project managers were appointed by the member nations to assist with domestic arrangements.

OBJECTIVES The aim of the project was to assess practical measures and co-operation required to establish an electronic chart data base (ECDB), to test ECDB contents applicability for electronic chart display systems (ECDIS's) and to evaluate methods of electronic navigational chart (ENC) updating. The project would also attempt to demonstrate and analyze potential usefulness of ENC in the future.

DIGITAL CHARTS Each nation digitised a domestic harbour together with its approaches, i.e., Zeebrugge, Esbjerg, Dunkerque, Cuxhaven, Europoort, Stavanger, Gothenburg and Harwich. Digitisation of inter-connecting offshore areas was provided either by the respective nations or Norway. Altogether 30 national nautical charts have been either completely or partially digitised as a result of this project.

DATA EXCHANGE FORMAT The CEDD format should have been used as a standard, however some of the participating nations couldn't meet this requirement. Subsequently, all digital data were supplied to the ECDB in the different nations' own formats.

ELECTRONIC CHART DATA BASE The ECDB is built upon the TECHRA Image Server, a data base management system based on the relational model and oriented towards efficient and secure handling of large data volumes in a multi-user and networking environment. Digital charts from the national Hydrographic Offices are converted, and divided into cells, before insertion in the ECDB. The chart cell system is built in accordance with the IHO Committee on ECDIS recommendations. Chart corrections and changes are stored on cells too, but in a separate part of the ECDB. These corrections update the ECDB when output is demanded, they are also utilized when a new, updated ECDB version is created. Additional information like list of lights, sailing directions and information related to the chart cells, e.g., references, history and changes are stored in the Administrative section. Digital chart cells for specific areas in desired scale are created on demand. The resulting data output is created on the basis of the ECDB and the ECDB corrections, and supplied to the ECDIS producers in the internal Norwegian standard format.

UPDATING Chart corrections was transmitted from the ECDB in Norway to an equal and unchanged ECDB version aboard the vessel. The INMARSAT Enhanced Group Call (EGC) carrier at Eik Coast Earth Station was used.

ELECTRONIC CHART DISPLAY SYSTEM The IHO Committee on ECDIS, together with the national project managers, provided addresses of system manufacturers who were invited to participate. Some of the manufacturers attended the "Sea Trials and Demonstration".

ELECTRONIC CHART

Mr. Rob Lyall
Offshore Systems Ltd.

Wednesday, March 8, 1989 **10:30 - 12:00**

THE NORTH SEA PROJECT

O. Stene
Director,
Hydrographic Service
Norway

A. Kyrkjeeide
Hydrographic Service
Norway

PRESENTED BY:

Mr. Stene is the Director of the Norwegian Hydrographic Service. His formal educational background is in Civil Engineering, with specialization in Photogrammetry and Geodesy. He is a member of the IHO - Committee on ECDIS {Electronic Chart Display and Information System} and is also a member of the IHO/IMO Harmonization Group on ECDIS. He is responsible within IHO - COE for the further development of Electronic Chart Data Bases (ECDB).

NOTES:

A NAUTICAL INFORMATION SYSTEM FOR SMALL CRAFT

For many years the Netherlands Hydrographic Service has been deeply concerned about the use of unauthorized digital chart data for small craft.

It is well known that the number of systems for this attractive market segment is still growing and that manufacturers generate their own data. Assuming that the responsibility for an H.O. does not stop with the use of official charts by the professional user, but that "all ships should carry adequate charts", we looked for a solution to this problem.

Firstly, we concentrated on a solution within the Netherlands. Discussions followed with potential small craft users, manufacturers, the Netherlands Tourist Association and a producer of digital land information, the firm Tele Atlas.

This resulted in the philosophy that a system for this purpose should be able to be used for:
- at home planning,
- en route navigation and
- in port information.

The chart information should be prepared c.f. guidelines and under the supervision of the Hydrographer. (As much as possible the guidelines should be in conformance with the IHO specs for ECDIS.)

The paper described the testbed model as it has been developed to present. (The testbed will be executed in the second half of this year.)

The paper deals with:
- the content of the system (what features should be included),
- the organization of the project, and
- the financial aspects, etc.

In its ideal form the project should be executed internationally. It should be developed parallel to the ECDIS, which is still looked at as a long term project.

REMARKS

1. The paper does not deal with the technical aspects, but; concentrates more on the organization problems for HO's (to serve the small craft market) to find a formula in which the effort for HO's is minimized while control of the quality of data is maintained.

2. The situation in the Netherlands is at the moment such that the greater part of our income comes from the sale of small craft charts.

3. Although there is no solid juridical basis in the Netherlands for small craft vessels to carry "adequate charts", the HO has already made available, for numerous years, a series of Hydrographic Charts for small craft that are considered to have the same status as the "normal" charts.

ELECTRONIC CHART

Mr. Rob Lyall
Offshore Systems Ltd.

Wednesday, March 8, 1989

10:30 - 12:00

A NAUTICAL INFORMATION SYSTEM FOR SMALL CRAFT

Berend Buis
Deputy Hydrographer (Cartography)
Hydrographic Service of the Royal Netherlands Navy,
The Hague

PRESENTED BY:

Mr. Buis has been active within the Netherlands Hydrographic Service (Royal Netherlands Navy) for over 25 years. He started as a survey officer for a period of about 6 years and then switched within the Service from military to civil. He was involved from the beginning (1967) in the development of hydrographic logging and the processing of data for oceanography and cartography. For four years Mr. Buis acted as special assistant for nautical and international affairs. In March of 1988 Mr. Buis was appointed Deputy, Hydrography.

NOTES:

ELECTRONIC CHARTING AND SATELLITE COMMUNICATIONS

Operators of EC systems are currently faced with navigating with a sub-standard product. Low cost systems which can manipulate chart data at the resolution of paper charts are not yet with us. Nevertheless, technological forecasters call for the kind of inexpensive, high speed, memory rich processors to be available at the same time as inexpensive, accurate and easy-to-use global positioning. Similarly, inexpensive media which carry massive amounts of modifiable data will be available at consumer prices within the same time-frame. One by one the enabling technologies are lining up to provide land, air and marine operators with a quantum leap in navigation/guidance system capability. Prudent planners are busy with the task of preparing both users and suppliers with the kind of systems and information bases necessary to bring this new order to life. Standardization of symbology, data base creation and information dissemination systems are major tasks currently being pursued. For a country like Canada, with a huge frontier area and its cities and ports scattered across the world's second largest country, information dissemination in particular is a problem. Canada's rich history in developing communication systems: from Alexander Graham Bell's experiments in Brantford to ANIK I, the world's first civilian telecommunication satellite, testify to how such difficulties can be overcome.

Data communications by satellite can offer solutions to the difficult yet important task of providing mariners with the most up-to-date information for the area in which they are about to pass. While this is a daunting problem for any HO to face, the problem is expanded many-fold given the Canadian geography and the unique decentralized nature of the CHS.

International Datacasting Corporation, in conjunction with the Canadian Hydrographic Service, is currently developing such a system. Testing is scheduled to begin in the first quarter of 1989. The two-part satellite based system consists of a dedicated high-speed section for data collection from remote sites and a broadcast section to service Print-On-Demand-Stations (PODS). The POD station can access the central database whenever required, thereby providing absolutely current information distribution. Both inbound and outbound satellite channels operate at a speed of 512 Kilo-bits per second. In addition to this, the PODS utilize a cost effective telephone line backhaul, operating at 1200 bits per second.

As the EC databases grow larger, so too will the need for cost- effective, high-speed delivery of the revolutionary Electronic Chart.

ELECTRONIC CHARTING AND SATELLITE COMMUNICATIONS

James I. MacCuaig
Systems Engineering Representative
International Datacasting Corp.

PRESENTED BY:

Mr. MacCuaig is the InterLAN Network Product Manager at International Datacasting Corporation (IDC) in Ottawa, Canada. Over the last 16 months, Mr. MacCuaig has been involved in the specification and implementation of a unique hybrid two-way satellite network designed for the collection and dissemination of digital nautical charts. This hybrid data broadcast network involves the use of multiple 512KB/S carriers utilizing Band-Edge technology with TDMA techniques managing access to the inbound carrier for remote data collection sites. Mr. MacCuaig is a graduate of the University of Ottawa's Bachelor of Applied Science Program with a degree in Electrical Engineering.

NOTES:

EMERGING STATES FORUM

T. D. W. Mc Culloch

Wednesday, March 8, 1989 **14:30 - 16:00**

This session is devoted to presentations and discussion related to hydrographic issues in developing countries. The session has been planned by the Chairman, Mr. Tom McCulloch, to achieve wide participation from delegates from these countries and at the same time increase the awareness of others to issues, challenges and opportunities for hydrographic activity in these states. The program could change as a result of travel or other unforeseen difficulties.

PAPERS:

1. FIG Working Group 418 and the Joint IHO/FIG

   - Technical Assistance Coordinating Committee
   - T.W.D. McCulloch - Canada

2. The Trinidad Experience

   - F.L. Charles,
     Officer-In-Charge, Hydrographic Unit
     Trinidad and Tobago

3. Malaysia and Hydrography

   - Kok Fook Sans

4. The Jamaican Experience

   - Noel Francis,
     Assistant Director, Survey Department
     Jamaica

5. An Appropriate Response to Technology Transfer

   - M. Casey, CHS, Canada
   - J. Watt, Questor-Tangent, Canada

NATIONAL REPORTS:

Short summaries of issues and activities will be presented by representatives from the following countries:

1. GUYANA	Choo See Nam
2. SOLOMON ISLANDS	Nabura Tekaai
3. FIJI	Deepak Kumar
4. TONGA	Etueni Topou
5. BARBADOS	Michael Griffiths

DISCUSSION:

Time will be reserved for questions from the floor and discussions of the presentations.

NOTES:

CARTOGRAPHIC GENERALIZATION -INTELLIGENCE OR INTUITION?

Within Hydrographic Offices throughout the world, Nautical Chart and Field Sheet data are routinely generalized as Cartographers create derived Nautical Chart products from larger scale source documents. While this was a necessary evil in the era of manual drafting (the data had to be re-compiled/generalized each time a chart was manually drafted) the promise of digital mapping was to provide portrayal flexibility and the ability to re-use information for many different products. However, the generalization of digital data must still be performed when a Cartographer reduces the scale of chart features, such as depth contours and soundings. This necessarily involves a significant amount of time being devoted to re-compiling and editing digital files to portray the information at smaller scales.

The capability to automate or semi-automate portions of cartographic generalization will liberate Cartographers from re-compiling much of the chart information and therefore increase cartographic productivity for both conventional paper chart products derived from digital information and for electronic navigation chart data. By minimizing the subjective and time-consuming process of chart generalization/re-compilation by Cartographers, subsequent re-digitization and editing would be significantly reduced. Further gains will be made by standardizing how chart features are selected and when chart symbology should be altered.

Within the context of creating Electronic Navigation Charts the benefits would be substantial. The International Hydrographic Organization (IHO) Electronic Chart Display and Information System (ECDIS) Draft Specification states that six different scale ranges are desirable for ENC coverage requiring chart areas to be re-compiled and generalized six different times. This task would be in addition to the production of paper charts (i.e., for some time, an electronic charting publication capability will be developed as Hydrographic Offices are still keeping pace with their commitments to produce paper charts). In order to minimize the impact of producing two similar but distinct publications (paper and electronic chart) we must develop and test software and methodologies which all enable Hydrographic offices to meet demands for increasing productivity. In a small but critical way, automated or semi-automated generalization capabilities will allow the Hydrographic Offices to sustain both activities and fulfill the promise which digital charting offers.

CARTOGRAPHIC GENERALIZATION - INTELLIGENCE OR INTUITION?

B. Beale
Canadian Hydrographic Service
Burlington, Ontario

PRESENTED BY:

After graduating from the University of Glasgow in 1977, **Brent Beale** joined the Canadian Hydrographic Service as a Marine Cartographer. In 1983 he became Supervisor of the Chart Maintenance and Computer-Assisted Cartography Units. He became Head of Cartographic Research and Development in 1987 at the CHS Central and Arctic Region office in Burlington, Ontario.

NOTES:

U.S. TREND TOWARD STANDARDIZED AND INTERNATIONALLY RECOGNIZED NAUTICAL CHART SYMBOLOGY

Efforts at NOS to achieve standardization of product have been a continuous process for many years. When two or more national or international organizations participate in a project to produce a common product, standardization becomes even more important. Since the National Ocean Service (NOS) and the Canadian Hydrographic Service (CHS) agreed to a cooperative plan to produce charts of the boundary waters between the United States and Canada, a concerted effort to achieve standardization between the two agencies was undertaken. Although time consuming, this proved to be an extremely worthwhile effort. To approach this in a systematic and logical manner, six volumes comprising the "Chart Specifications of the IHO" were reviewed and compared to the symbology then in use at NOS and at CHS. Agreement was attained on a substantial number of specifications. Of all the specifications where agreement between NOS and CHS had been attained, over eighty percent were in agreement also with the "Chart Specifications of the IHO."

In 1986, although standardization was not the primary purpose, NOS produced an experimental chart, incorporating a number of standard and non-standard features. This chart was made available to a number of users with a request for comments. Responses received as a result of this effort were clear on the preferences of the users on at least two thirds of the features incorporated into the chart. The encouraging factor was that the features which were endorsed were for the most part already standard practice within NOS.

A common reference source in the hydrographic community is Chart No. 1, "Symbols and Abbreviations". The U.S. Chart No. 1 contains symbols and abbreviations approved for use on nautical charts produced by the United States. This publication remained unchanged for several decades. However, with the recent production of Chart INT 1 by the Deutsches Hydrographisches Institut in 1987, the U.S. version was re-examined with a view toward standardization of the format to agree with the Chart INT 1 produced in Germany. It was decided that the U.S. Chart No. 1 would be revised and re-formatted based on Chart INT 1. This task is underway at the present time.

Another standardization effort was undertaken to develop a format in which digital chart data could be exchanged between international hydrographic offices. This format was developed by the IHO Committee on Exchange of Digital Data (CEDD) and is referred to as the CEDD format. Both NOS and CHS are developing software to convert their internal digital data formats to the CEDD format and vice-versa.

Introducing change on nautical charts is a slow and deliberate process. Over the years, mariners have become comfortable with the format of the graphic product which has been produced and with the reliability of this product. Today, however, things are changing rapidly and charting agencies may be at a point where significant change of product is necessary. Thus, we are preparing to implement some of the accepted features of the experimental charts. The use of the pictorial symbols for buoys is among one of the primary and most notable changes. Another significant change, at least to NOS, is the gradual introduction of metric units.

CARTOGRAPHY

Mr. W.S. (Seth) Crowther
Canadian Hydrographic Service

Thursday, March 9, 1989

08:30 - 10:00

U.S. TREND TOWARD STANDARDIZED AND INTERNATIONALLY RECOGNIZED NAUTICAL CHART SYMBOLOGY

W. Erich Frey
Cartographer
Mapping and Charting Branch
National Ocean Service, NOAA

PRESENTED BY:

Mr. Frey has been with the National Ocean Service and its predecessors since 1969 where he has been involved in the production of nautical charts. In recent years he has been assigned to the Chart Planning and Technology Group where he became involved with establishing or revising nautical chart standards, policies, and procedures. This included the review of NOS and CHS symbologies and their comparison to the "Chart Specifications of the IHO". Mr. Frey has provided considerable support to NOS efforts with the IHO and with CHS. Although the name of the group was changed in 1988 to "External and Cooperative Affairs Group" to reflect our involvement and cooperation with other agencies and organizations such as the CHS, his duties remain unchanged for the most part.

NOTES:

PRINT - ON - DEMAND

This paper reviews the status of the Print-On-Demand (POD) project, as well as the many other applications for electrostatic technology, within the CHS.

Print-On-Demand focuses on printing full color, ready-to-use charts in minutes, from an up-to-date chart information base. The other applications for electrostatic technology vary from the generation of photo-positives and negatives, to the production of color proofs and chart patches. The objectives of this effort are a reduction in processing time, a provision to end-users of timely feedback and an overall reduction in costs. Results to date will be summarized. The status of color-banded plotting (by depth ranges) will also be reviewed.

This paper also relates the benefits of this technology through real world experiences and identifies the requirements to effectively introduce this technology to the rest of the organization.

CARTOGRAPHY

Mr. W.S. (Seth) Crowther
Canadian Hydrographic Service

Thursday, March 9, 1989 **08:30 - 10:00**

PRINT - ON - DEMAND

Donald Vachon
Head, Systems Engineering
CHS Headquarters, Ottawa

PRESENTED BY:

Don Vachon is Head of Systems Engineering at CHS Headquarters in Ottawa.

He graduated as an Electrical Engineer in 1979 and has been with the CHS ever since. His main duties are in coordinating development projects and advising on technology.

NOTES:

COMMUNICATION LINK TRIALS
FOR HYDROGRAPHIC DIFFERENTIAL GPS OPERATION

This paper describes a series of communication trials conducted off the coast of Nova Scotia during the summer of 1988.

These tests were designed to investigate the reliability and performance criteria of a differential GPS link for hydrographic applications. A simulated correction message was transmitted over the link from a base station at Halifax to a hydrographic launch which travelled along the coastal region between Halifax and Canso.

Two data rates (75 bps and 300 bps), two frequencies (2000 kHz, 4000 kHz) and three transmitting antenna configurations (85 ft. whip, 40 ft. mast, 26 ft. whip) were tested during the trial period which included day, night and sunset time periods under fog, clear, light and heavy rain conditions. The hydrographic launch receivers logged transmitted messages, signal to noise ratio, time references and LORAN positioning information.

In preparation for this series of tests, the coastal region had been logged on computer files to provide total land and water path segment lengths from the transmitter site to any point along the launch path which was intentionally selected to include harbour entrances, headlands and as wide a variety of land-water path conditions as possible. A computer program has been developed to analyze bit and message error rates and to provide correlation with other channel and path variables.

POSITIONING

Mr. Barry M. Lusk
President,
Canadian Hydrographic Assoc.

Thursday, March 9, 1989

10:30 - 12:00

COMMUNICATION LINK TRIALS FOR HYDROGRAPHIC DIFFERENTIAL GPS OPERATION

J. M. Tranquilla

H. Boudreau

A. Bell

B. G. Colpitts

PRESENTED BY:

Dr. Tranquilla obtained his PhD in electrical engineering at the University of Toronto. He is currently Professor of Electrical Engineering at the University of New Brunswick and Director of the Radiating Systems Research Laboratory. He has been very active in antenna and propagation research for over ten years, particularly related to radio and satellite-based positioning and navigation systems such as GPS. He is consultant to several Canadian and U.S. companies and government agencies in antenna and GPS development and has been actively involved in the development of hydrographic applications of differential GPS. He is a Registered Professional Engineer in the province of New Brunswick and is a member of several professional organizations.

NOTES:

STATUS AND FUTURE
OF RELATIVE KINEMATIC GPS POSITIONING

The U.S. Army Corps of Engineers spends approximately $450 million annually dredging the Nation's ports, harbors and waterways. An additional $40 million is spent performing hydrographic surveys supporting the planning, engineering and design phases of this effort. It is a well recognized fact that hydrographic surveying and vessel positioning is an essential engineering function in preparing for and administering dredging projects. Presently, dredges and hydrographic survey vessels are horizontally positioned with systems that electronically measure multiple ranges or ranges and angles from previously established control points on shore. Most of these systems require the vessel to occupy a calibration point installed near the job site each work day to "initialize" the system. Furthermore, they all require establishing a series of receiver/transmitters on control stations on shore. Maintaining these control stations, moving receiver/transmitters about, and performing the calibration process is extremely expensive and labor intensive. In addition, all dredging and survey operations are vertically referenced to the vessel performing the work. This reference is generally related to a tide or river gage to reduce the depth readings to some datum, for instance mean low water (MLW). This method assumes that water surface elevations at the gage site accurately represent the surface elevations at the survey site. However, this is not the case and the surface elevations vary significantly between the gage and the survey site. Offshore tide gages have been introduced as a means to produce mathematical models of the surface characteristics of a body of water. However, these are expensive to install, operate and maintain. Furthermore, the models produced are limited in accuracy by various tidal characteristics, and meteorological, oceanographic, and hydrological effects. Current technology does not allow surveyors to accurately and efficiently define the datum at a job site.

A system requiring no on-site calibration and only one reference station would significantly increase the efficiency and productivity of the Corps hydrographic surveyor. If this system could simultaneously provide sufficient vertical accuracy it could also serve as a means to rectify the tidal datum. For such a system to be accepted by the community it would have to provide a horizontal positioning accuracy of about 2 meters, and a vertical accuracy of about 1 decimeter with time tags to correlate positions with other on-board sensors.

With the deployment of the Navigation Satellite Timing and Ranging (NAVSTAR) Global Positioning System (GPS), a possibility for kinematic positioning system meeting these requirements has materialized. Positions of a moving antenna relative to a stationary point, meeting the above criteria are possible using GPS.

This paper discusses several alternatives for meeting the demands of hydrographic surveyors with accuracies to the meter level and the decimeter level. An examination of the kinematic GPS technology from conception to existing systems is presented. This includes both code and carrier tracking concepts resulting in meter level and decimeter level accuracies respectively. Ongoing research and development activities are also discussed as they are perceived to lead to production level hydrographic positioning systems within the next few years.

POSITIONING	Mr. Barry M. Lusk President, Canadian Hydrographic Assoc.
Thursday, March 9, 1989	10:30 - 12:00

STATUS AND FUTURE OF RELATIVE KINEMATIC GPS POSITIONING

Stephen R. DeLoach, P.E., L.S
Civil Engineer
Engineer Topographic Laboratories
Corps of Engineers, U.S. Army
Fort Belvoir, Virginia

PRESENTED BY:

Stephen R. DeLoach is a Civil Engineering graduate of Virginia Polytechnic Institute and State University. In addition to fulfilling requirements for a degree in engineering, he also completed studies in Surveying Specialization.

He worked with the Tennessee Valley Authority from 1978 to 1980. Since 1980 he has been with the Corps of Engineers, first in the Survey Section, Norfolk District, and presently the Precise Survey Branch, Engineer Topographic Laboratories. He is licensed as a Professional Engineer and Land Surveyor in the State of Virginia. He is a member of ACSM, ASCE, the Institute of Navigation and the Instrument Subcommittee of the Federal Geodetic Control Committee.

NOTES:

INTEGRATED SYLEDIS POSITIONING AND COMMUNICATION

Traditionally hydrographic surveying and positioning was carried out as a specialized function that was used at a later time in conjunction with other data to evaluate and make decisions on numerous functions, such as navigation, marine construction, project planning and environmental impact studies.

In Canada's arctic areas, the limited operating season and great potential combined to necessitate real time surveying, processing, transmission, distribution and presentation for immediate evaluation and decision. This capability combined to maximize the exploration effort within the time constrains and available investment capital.

To enable this coordination of information gathering, processing and distribution into one efficient system the redundant capacity of the Syledis positioning system, linking all operating entities in the areas, is being utilized to do double duty of both positioning all users of the system and distributing this current information on the position of the users to all other users for group interaction and ease of coordination. Message service would also be available between users.

Mr. Green has engineered the present capabilities of the CES modified Syledis system and will describe in detail the evolutionary process and the technical accomplishments required to meet the added communications capability.

POSITIONING

Mr. Barry M. Lusk
President,
Canadian Hydrographic Association

Thursday, March 9 1989 **10:30 - 12:00**

INTEGRATED SYLEDIS POSITIONING AND COMMUNICATION

Mr. Hugh Stewart, B.Sc.
Gulf Canada Resources Ltd.

Mr. Joe Green, B. Sc.
Hi-Flight Engineering Ltd

Mr. D. Rae Sutherland, B.Sc.
Canadian Engineering Services

PRESENTED BY:

Mr. Stewart was born in Geneva, Switzerland and educated in Britain where he attended Winchester college, the University of Nottingham and finally the University of Southampton where he received his Master of Philosophy in engineering. Until 1980, Mr. Stewart worked on numerous offshore projects in the Middle East and the North Sea. In 1981, he joined with Gulf Canada Resources Ltd. to assist them with their Arctic Beaufort Sea exploration and drilling operations where he is still presently employed as Base Superintendent.

NOTES:

TOSS THE PROBE IN LIEU OF THE BAR!

All measurements are subject to errors.

The professional Hydrographic surveyor realizes that, unlike his/her land-based counterpart, the dynamics of sea-borne operations, present a very complex situation. While operating in this environment we strive to derive a precise X, Y, (position) and perhaps most important, Z (depth). The probable cause for errors in the X, Y, will be left to others.

The "Z component", the object of this paper, will be reviewed, the standard barchecking techniques critiqued, and the impact of digital versus analogue sounding file (data) examined. Data for this paper is based on field values and methods, obtained during the 1988 Hudson Bay survey, conducted by the Canadian Hydrographic Service.

Corrections to a depth which is ultimately displayed for use on a navigation chart, historically have been made by adjusting the stylus speed and transmission point of the analogue acoustic depth sounder; to portray what is thought to be the average propagation conditions present at the time of data collection. While this technique was, and still is acceptable, the limit of "permissible" error is decreasing. Factors which influence and call for an improved methodology are deep draft vessels, utilizing all the water available in the navigation channels, at the maximum allowable speed; and a "resource" requirement, where the collection of ancillary data is used by other disciplines to offset surveying costs, i.e., a multi-disciplinary approach to collect oceanographic data simultaneous with hydrography.

Computers allow for some margin of decrease in the amount of time required for processing of sound data, (though some may question this statement). Their major "forte", is however, the ability to apply a multitude of corrections to a digital data file. Such as the multitude of corrections which we must make to the "Z component" in order to arrive at a precise depth. By collecting the actual physical parameters of the watercolumn, digitally; this task can be accomplished.

The 1988 Canadian Hydrographic Service field survey party operating in Hudson Bay, undertook to determine the field feasibility of using a "velocity probe profiler" to correct the digitally collected sounding file as compared to the conventional barchecking technique. Applied Microsystems (SVP-16) velocimeters were deployed from the mother ship and two 34-foot survey launches to collect the velocity data.

Three beneficial results were immediately perceived:

(1) the collection of the "digital" barcheck was applauded by the launch crews as simpler, safer and less time consuming;

(2) the collected file portrayed actual, not assumed, velocity values of the watercolumn;

(3) the input of the digital velocity file into the processing package for data reduction was not subject to operator interpretation; (though data editing was available if required).

HYDROGRAPHIC SURVEYS - ADVANCING THE ART

Rear Admiral S.R. Petersen
Director,
Pacific Marine Centre, NOAA

Thursday, March 9, 1989

13:30 - 15:00

TOSS THE PROBE IN LIEU OF THE BAR!

Mr. Edward Thompson
Hydrographer-In-Charge
Canadian Hydrographic Service
Central & Arctic Region

Mr. David Pugh
Hydrographer-In-Charge
Canadian Hydrographic Service
Central & Arctic Region

PRESENTED BY:

Mr. **Robert (Bob) Covey** is a Hydrographer with the Canadian Hydrographic Service, Central & Arctic Region.

He graduated from Algonquin College of Applied Arts & Technology , Ottawa, Ontario with a Civil Technology Diploma. He has been attached to surveys in the Great Lakes Region and Hudson Bay and is currently assigned to the St. Lawrence River Survey.

NOTES:

PRODUCTIVITY INCREASES INVOLVING AN NOS HYDROGRAPHIC FIELD PARTY

INTRODUCTION During the 1988 survey of Carquinez Strait, California, the Nautical Chart Branch undertook an experiment to increase the productivity of the hydrographic field party. Surveying and office processing were conducted simultaneously. The twofold objective of reducing the amount of time and resources required to complete the survey while increasing the data quality was met.

SURVEYING Soundings and position data are periodically forwarded to the office during the survey. This transfer uses a telephone link and computer communications software. As the data is processed in the office the hydrographer conducts additional surveying. Data returned to the hydrographer are either computer listings or plotted soundings and positions. The hydrographer edits the documents and returns them to the office by overnight mail where the revisions are keyed into the master computer file. Near the end of the survey the hydrographer transmits a draft of his survey report which is checked for accuracy and then returned for signature.

OFFICE PROCESSING From survey parameters the cartographer manually compiles a plotting sheet consisting of shoreline maps mosaicked together and trimmed to fit the survey area. Soundings, received via the telephone link are reduced, plotted and listed by the office mainframe computer. Data quality is checked and the plots are annotated with questions, recommendations and requests for clarification. Plots and listings are returned to the hydrographer by overnight mail, edited and returned to the office for the completion of the cycle. The process repeats several times until the survey is complete.

ANALYSIS Some of the major benefits include the following:

- The traditional relationship of surveying followed by office processing has been changed to permit simultaneous rather than sequential work accomplishment.
- Quality control has been enhanced with the addition of more powerful office computer resources and cartographic personnel functioning interactively during data acquisition.
- The use of the slower, less capable, field computer for processing has been minimized.

Photo reduction of customized plot sheets containing shoreline and other topographic features eliminates a significant amount of repetitive cartographic drafting while retaining the quality of the original plot.

- The hydrographer's manual editing of office formatted data listings eliminates time consuming reformatting of field data.

CONCLUSIONS The modification of traditional sequential procedures is an effective productivity improvement under certain conditions. Field processing procedures must be relatively inefficient and the hydrographer must be responsible for a high quality, finished hydrographic map. On the other hand, the supporting office must have available superior computing resources, together with qualified cartographic personnel, to conduct quality checks. Finally, there must be an efficient and timely means of transferring data and products between field and office.

HYDROGRAPHIC SURVEYS - ADVANCING THE ART

Rear Admiral S.R. Petersen
Director,
Pacific Marine Centre, NOAA

Thursday, March 9, 1989

13:30 - 15:00

PRODUCTIVITY INCREASES INVOLVING AN NOS HYDROGRAPHIC FIELD PARTY

Dennis J. Hill
Chief, Hydrographic Section
NOAA-Pacific Marine Centre

Robert N. Mihailov
Cartographic Technician
NOAA-Pacific Marine Cntr.

Lt. Frederico "Fred" R. Diaz
Officer-In-Charge
Pacific Hydrographic Party

PRESENTED BY:

Following a military enlistment, **Dennis Hill** graduated from Portland State University in 1972, with a B.S. degree in geography. Subsequently employed by CH2M-Hill, the National Park Service and NOAA in the cartographic field. Early NOAA experiences include hydrographic survey review, nautical charting source document analysis, and survey planning. Most recent work has been as a supervisory cartographer responsible for west coast cartographic data processing and map compilation.

NOTES:

DISCOVERY OF THE S.S. CAMBRIDGE

Early in 1940 the German raider PASSAT, a captured Norwegian tanker originally named STORSTAD laid mines off the Tasmanian and Victorian coasts of Australia. The mines later destroyed two vessels in less than twenty-four hours. These were the United States Vessel CITY OF RAYVILLE which sank near Cape Otway, and the 10,855 ton British steamer CAMBRIDGE, lost off Wilson's Promontory. Prior to 1988, several searches had failed to locate the S.S. CAMBRIDGE.

The National Safety Council of Australia, NSCA, was established in 1927 to promote community safety and provide emergency services. In 1985 the Council commissioned the M.V. Blue Nabilla to provide diver training and marine emergency response services. A subsea search system was added to the vessel's equipment in early 1988 as part of the Council's on-going commitment to provide Australia with increased marine emergency response capabilities.

The subsea search system's primary use was to facilitate search operations to locate aircraft, downed at sea, in the waters of the Australian Continental Shelf. Once the object of the search is located, the system must then provide an accurate position to allow close examination or recovery of the contact by divers, submersibles, or ROVs. The NSCA requirements were that the system be readily configurable to whatever vessel and positioning system type that is available at the time of an emergency. The operational environment and sonar technologies require that precise navigation and positioning techniques be used with efficient survey management tools to ensure that a comprehensive and complete subsea search mission is rapidly and effectively carried out. The search methodology must respond to highly variable weather and sea conditions which may force the delay of the search for extended periods. The system incorporates equipment for search management and precise navigation and positioning of the vessel, towfish and targets on the sea floor. A Trimble GPS receiver, a Ferranti acoustic positioning system, and a Klein side scan sonar and target processing system are integrated in the NSCA system using the Quester Tangent ISAH navigation and survey management system. The system installed aboard the M.V. Blue Nabilla was designed to locate and to position objects on the sea floor with a relative accuracy of better than 10 meters.

During May of 1988, the NSCA Blue Nabilla was on patrol near Wilson's Promontory in the Bass Strait conducting the final night of training and commissioning of the subsea search system. The NSCA ship's company were standing watches on the search system when the sonar operator reported a large contact on both sides of the side scan towfish. The vessel made five passes over the target before the GPS satellite positioning window was lost and the Blue Nabilla returned to its base at Port Welshpool. The contact, a wreck, was in one piece with details of the superstructure as well as the hole left by the mine clearly visible in the side scan records. After forty-eight years the S.S. CAMBRIDGE had been discovered in sixty-seven meters of water in the Bass Strait.

Since the discovery on the twenty-first of May, 1988, the S.S. CAMBRIDGE has been declared a Historical Wreck. The National Safety Council of Australia and the Victorian Historical Society have agreed to conduct a detailed survey of the CAMBRIDGE Wreck Site with the M.V. Blue Nabilla and the NSCA subsea search system.

HYDROGRAPHIC SURVEYS - ADVANCING THE ART

Rear Admiral S.R. Petersen,
Director,
Pacific Marine Centre, NOAA

Thursday, March 9, 1989

13:30 - 15:00

DISCOVERY OF THE S.S. CAMBRIDGE

Paul R. Lacroix, B. Sc.
Vice President
Quester Tangent Corporation

Charles Stuart
Capt. M.V. Blue Nabilla
National Safety Council
of Australia

PRESENTED BY:

Mr. Lacroix, a Vice President of Quester Tangent Corporation, has been directly involved in the design of three generations of hydrographic data logger, navigation and survey management systems including the **ISAH** System. Mr. Lacroix has applied his background in mathematics, real time computing systems and field experience in survey techniques to the specification, design, implementation, installation and commissioning of automated marine systems for other ten years. Mr. Lacroix is a member, and a past member of the executive, of the Pacific Region of the Canadian Hydrographic Association.

Captain Charles Stuart is an officer with the Victoria Division of the National Safety Council of Australia. He is Master of the NSCA emergency response ship the M.V. Blue Nabilla. As the Senior Systems Officer, he is responsible for the nav-com, diving submersible, ROV, hyperbaric chamber and the Subsea Search Systems.

NOTES:

THE DEVELOPMENT OF A PERMANENT TIDE GAUGE FOR REMOTE AREAS

Accurate long-term sea level information is essential to a large number of scientific and engineering disciplines. Oceanographers studying large scale water movements and more recently, worldwide phenomena such as the ocean's response to the "Greenhouse Effect" require this information on a global basis. Geodesists need long-term sea level data to determine the relationship between sea level variation, earth tides and the shape of the earth. Land and marine surveyors require information to establish national vertical control networks and hydrographic datums. Continuous tidal data is critical for the publication and maintenance of Tide Tables for shipping and navigation.

Traditionally, measurement of long-term water levels has been obtained through the use of analogue gauges and stilling wells. This approach has been impractical and prohibitively expensive for use in remote Arctic areas; mainly due to the extreme winter conditions and the brutal forces of the sea-ice interface. Bottom pressure gauges have had some limited success, but suffer from the fact that they record the total of water and atmospheric pressure variations. In-situ barometric data are required to allow precise water level calculations to centimeter accuracy.

During 1986/1987, a digital Arctic barometer was designed and built at Bedford Institute of Oceanography. This instrument was self-recording and could survive extreme cold temperatures while operating for periods in excess of one year. In August 1987, one such unit was deployed along with two Aanderaa submersible pressure gauges, at Nain, Labrador. In August 1988, after successful recovery, data from all three instruments were processed. The barometer had functioned flawlessly, and although one of the two submersibles had failed prematurely, a complete year of water levels was obtained. (This underlines the benefits of redundant data collection). A few areas of weakness were identified which included the need of a more precise calibration technique and an improved mooring package for recovery.

The ultimate goal of collecting water level data from remote sites includes real-time access capability. A modified Arctic barometer will be constructed for use in 1989/90, which in addition to measuring air pressures, will also store water pressures transmitted from the submersible gauges. Data will then be relayed to the outside world via an Argos satellite link. A break-away wire will allow real time data communication between the submersibles and shore units, at least until the winter freeze-up. Development of an underwater unit to relay submersible data to shore using EM transmission through the sea bottom will begin in the later part of 1989 or early 1990. A completely functional Arctic water measurement station, including year-round communication, is possible as early as 1991.

TIDAL INSTRUMENT DEVELOPMENT

Ms. Gail Gabel
Aanderaa Instruments Ltd.

Thursday, March 9 1989 **15:30 - 17:00**

THE DEVELOPMENT OF A PERMANENT TIDE GAUGE FOR REMOTE AREAS

C. T. O'Reilly,
Tidal Officer
Canadian Hydrographic Service

S.T. Grant
Regional Tidal Officer
Canadian Hydrographic Service

G.D. Steeves
Head, Systems Engineering
Bedford Institute of Oceanography

PRESENTED BY:

C. T. O'Reilly graduated in 1975 with a B.Sc. (Honors) in Geology and Physics from Dalhousie University, Halifax, N.S. He worked for three years in exploration geophysics for Texaco (Canada) and Union Oil in Alberta. In 1978, he joined the Canadian Hydrographic Service where he has been working in the Tides, Currents and Water Levels Section to the present. He is a past Vice-President of the Atlantic Branch of the Canadian Hydrographic Association.

NOTES:

DIGITAL TIDE GAUGE - NEW ORIENTATIONS

This paper deals with the development and testing of a new Canadian digital tide gauge. This gauge was designed primarily to fulfill the needs of the Permanent Tide Gauge Network (PTGN), however; it can also be configured for temporary gauging on hydrographic surveys.

This development exercise began in 1985 after Quebec Region determined that the useful life-span of it's float gauges along the St. Lawrence River was nearing an end. Ice damage and silting were causing significant reliability problems. Perhaps even more pressing was the need to acquire data digitally and have it available in real time. A market search at that time didn't reveal any commercial gauges that were considered adequate for replacing the permanent gauges. It was decided that the time was ripe for developing a more flexible, redundant and low cost solution than that afforded by float gauges. With this goal in mind, development staff in Quebec Region established a set of design criteria for a "next generation" digital tide gauge.

The principal design criteria deemed necessary were as follows:

Redundant Sensors: This criteria reflects the conservative design philosophy needed if a new gauge technology is to satisfy permanent gauging requirements. It was decided at an early stage that, no matter how reliable or accurate a particular logger or sensor might appear to be, the only true guarantee of accuracy and reliability would be to obtain redundant water level measurements. Optimal redundancy is provided by at least three independent sensing channels. While this triple redundancy criteria effectively triples the cost of hardware it was decided that the extra cost was warranted due to the higher accuracy and reliability it imparts to the acquired data.

No Stilling Well or Gauge-house Required: Since the construction costs for a stilling well and gauge house are high ($20-30K), it was decided that the replacement gauge must be able to employ signal averaging to eliminate the need for the stilling well. Furthermore, the logger hardware must be completely weather-tight and the system must consume very little power. The added cost of employing redundant sensors could thus be offset by eliminating the need for supporting structures.

Flexible Architecture: The logger hardware must have a sufficient number of data channels to log a variety of different sensors. This would allow the tide gauge to log or telemeter other environmental data such as wind speed, wave height, air temperature, etc. Such hardware flexibility would also permit a minimal (single sensor) configuration to be deployed as a temporary tide gauge on hydrographic surveys. The hardware flexibility must be complimented by a very friendly user interface so that a variety of personnel can install and use it.

The above general design criteria were transmitted to a local electronics development firm (Ocean Communications Ltd. of Rimouski). This company embarked on the development of a tide gauge known as the Telemar. After three years of prototype development, a final version was delivered to CHS Quebec Region in May of 1988. CHS performed tests on this gauge in May and June using an analog Ottboro gauge as a reference. These tests indicated that the accuracy obtainable from a stilling well gauge could be met or surpassed by the Telemar. Further testing is continuing using the more accurate TATS digital float gauge as a reference. These test results give more conclusive proof that the Telemar gauge is suitable for deployment in the PTGN.

TIDAL INSTRUMENT DEVELOPMENT

Ms. Gail Gabel
Aanderaa Instruments Ltd.

Thursday, March 9, 1989

15:30 - 17:00

DIGITAL TIDE GAUGE - NEW ORIENTATIONS

Peter Kielland, B. Sc., C.L.S.
Development Officer
CHS, Quebec Region

Patrick Hally, P. Eng.
Head of Development
CHS, Quebec Region

PRESENTED BY:

Mr. Hally graduated in 1977 from L'Ecole Polytechnique de L'Universite de Montreal as a Civil Engineer. He joined the newly formed Quebec Region of the Canadian Hydrographic Service in 1978. After four years of field work he became Head of the Development Section in Quebec Region, the post he presently occupies. Mr. Hally has been involved in many hydrographic development projects over the years. This work included SATRADHY (the Quebec Region field processing system), the CHS Data Base Management System, swath sounding acquisition and digital tide gauges.

NOTES:

THE LOW POWER TIDE GAUGE- A NEW TOOL FOR HYDROGRAPHY

For a number of years it has been recognized that there is a need for an improved tide gauge for use in hydrographic surveys. Discussions in late 1984 at the Institute of Ocean Sciences led to the development of a pressure actuated instrument, the low power tide gauge, to satisfy the requirements of hydrographic and tidal surveys. The primary design requirements were that the instrument be rugged, waterproof, require no external power, and have sufficient internal memory to hold five months of data. The first of two prototype instruments was completed in August 1985, and after lab tests for temperature sensitivity and ruggedness, field testing was carried out over a period of six months. Since that time the instruments have been used successfully on three Pacific Coast surveys and two surveys in the Beaufort Sea. A total of 441 days of data were collected in support of these surveys.

In 1987, the rights to manufacture and market the low power tide gauge were acquired by Revlis Electronics Ltd. of Sidney, B.C. Using the experience gained form the prototypes, a new version, the model 874, was designed and manufactured. The model 874 has a number of hardware and software improvements incorporated into it, notably four times the internal memory of the prototypes and the option to either fill memory and stop logging, or fill memory then overwrite the oldest data. The low power tide gauge internally provides for two years of unattended collection of fifteen minute time series tidal records. The instrument is fitted with two electrical interfaces that permit data recovery; a field rugged HP-IL interface is provided to permit data extraction at the field site using a common HP-75 or HP-71B hand-held computer and an RS-232 interface is provided for either data extraction using a laptop computer or remote transmission of data using a telemetry link.

The low power tide gauge operates using a conventional pneumatic system, either closed or gas-purge, to convey sea floor pressure to a differential Parascientific pressure sensor internal to the shore situated instrument. The pneumatic system is suited to hydrographic surveys and temporary gauging applications as it eliminates the requirement to construct costly support structures such as stilling wells or tide gauge platforms in the vicinity under study. The underwater components are inexpensive, can be quickly and easily installed in almost any location, and are highly resistant to fouling.

The differential Parascientific pressure sensor permits atmospheric pressure variations to be automatically removed from the sea floor pressure measurement and provides an integral temperature sensor that is used to compensate the pressure measurement for ambient temperature variations. The effect of pressure fluctuations due to swells and wave action is also reduced by averaging the sea floor pressure over a time interval of four minutes. A nominal accuracy of one millibar, approximately one centimeter of sea water, has been achieved over the temperature range of -40 to +50 degrees using the temperature compensated Parascientific sensor in conjunction with a highly stable measurement time base.

The Canadian Hydrographic Service, Pacific Region, has acquired two model 874 instruments for use on hydrographic surveys. These instruments are expected to extend the range of practical tide gauge installations, providing vertical control for hydrographic surveys with improved accuracy and in an improved format. In addition to hydrographic survey applications, the model 874 also has the potential to be used for water level measurement at permanent gauging stations and for hydrometric surveys on lakes and rivers.

TIDAL INSTRUMENT DEVELOPMENT

Ms. Gail Gabel
Aanderaa Instruments Ltd.

Thursday, March 9, 1989 **15:30 - 17:00**

THE LOW POWER TIDE GAUGE-
A NEW TOOL FOR HYDROGRAPHY

F.E. Stephenson
Regional Tidal Officer
Institute of Ocean Sciences

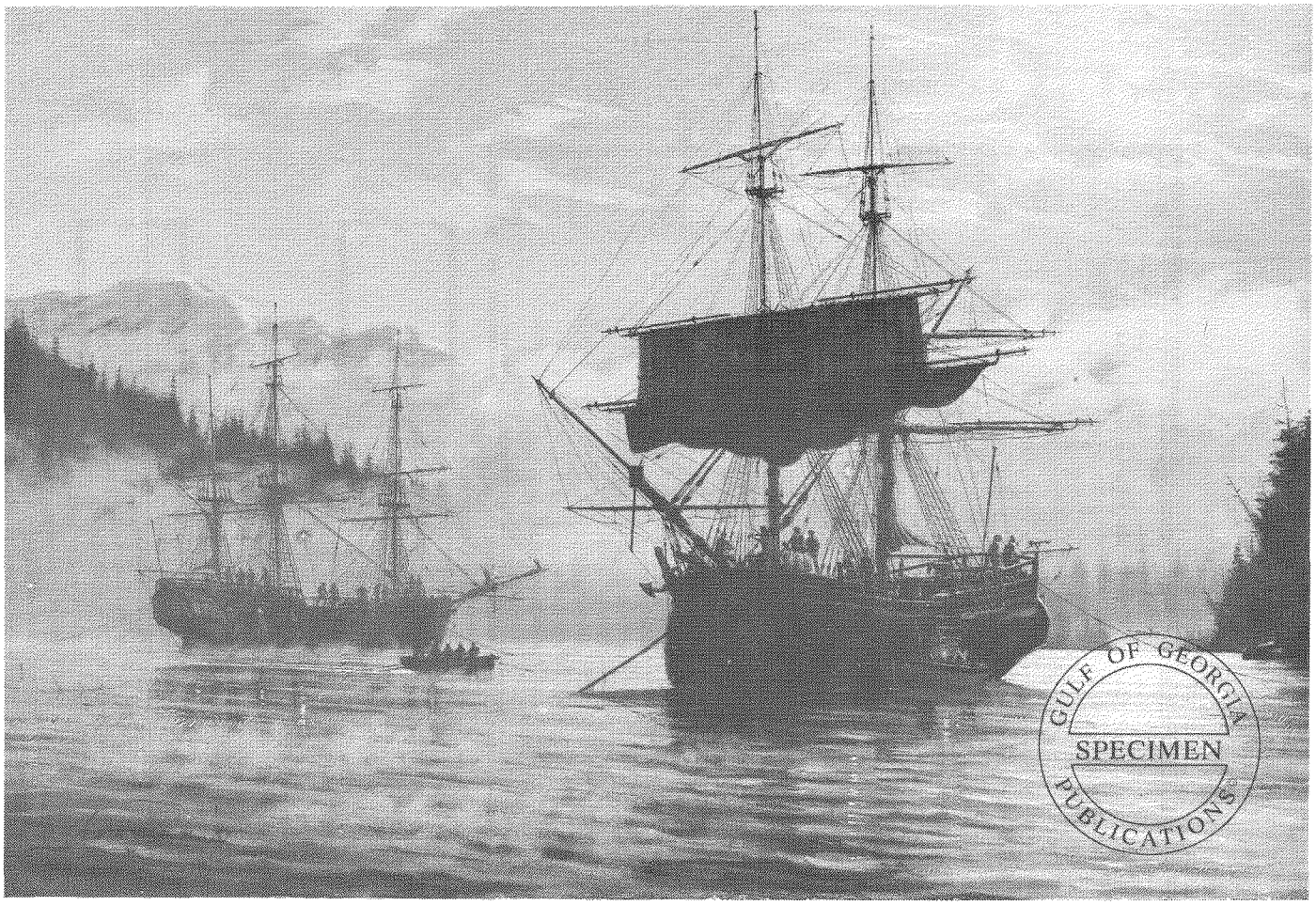
D.D. Silver
President
Revlis Electronic Ltd.

PRESENTED BY:

Fred Stephenson graduated from the University of Victoria in 1972 with a BSc in Physics and joined the Canadian Hydrographic Service as a field technician in the Tides and Currents Section. Since 1980 he has been the Regional Tidal Officer in Pacific Region. In his 17 years with the CHS he has conducted many tidal surveys on the Pacific coast and in the Western Arctic, as well as water level measurements in support of hydrographic surveys on the Mackenzie River. During the course of these surveys he has worked with water level instrumentation of almost every type. His experience in tidal surveys and tidal instrumentation is both varied and extensive.

NOTES:

A Moment from Capt. Vancouver's Voyage of Discovery



"CHANTY TIME" Image Size 20″×30″ **JOHN M. HORTON, Pres. C.S.M.A., F.C.A.**

Historical Note: In 1792 Captain George Vancouver explored the dangerous and unknown coastline of what was to become British Columbia. The charts he created were so accurate that they compare well with todays charts, even more outstanding when you remember that most of the work was done from the small ship's boats. Danger lay everywhere in the uncharted waters, illustrated by the fact that both 'Discovery' and 'Chatham' grounded on rocks within 24 hours of each other.

This fine limited edition print is from an original oil painting by John M. Horton, C.S.M.A., F.C.A. and depicts the crews relaxing in the evening on the upper decks of Vancouver's ships after several days of toil repairing the vessels in Restoration Cove.

Men gather on the foc'sle of 'Chatham' to sing a chanty led by the fiddler, while the 'watch' checks the boats and Captain Broughton relaxes over the taffrail with one of his junior officers.

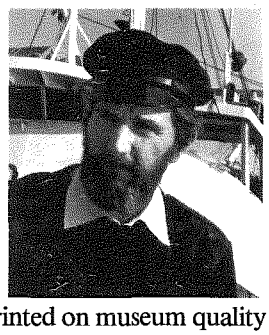


Photo by Jim Harrison

About the Artist: John Horton has enjoyed a love affair with the sea since boyhood. At an early age he entered the Royal Navy and served in the Pacific, Atlantic and finally in the British Fishery Protection Squadron in the Arctic.

John continues to have a close relationship with the fishing industry which he loves.

His work can be found in major collections around the world. He is often described as a 'Mariner's Artist' because of his technical accuracy, attention to detail, and his natural feeling for the sea. Horton enjoys a keen sense of history and leans more and more towards his special passion . . . recreating moments in B.C.'s Maritime past.

Living aboard his vessel 'Artist's Life', he is continually immersed in the atmosphere of the sea and that mood come through on his canvas.

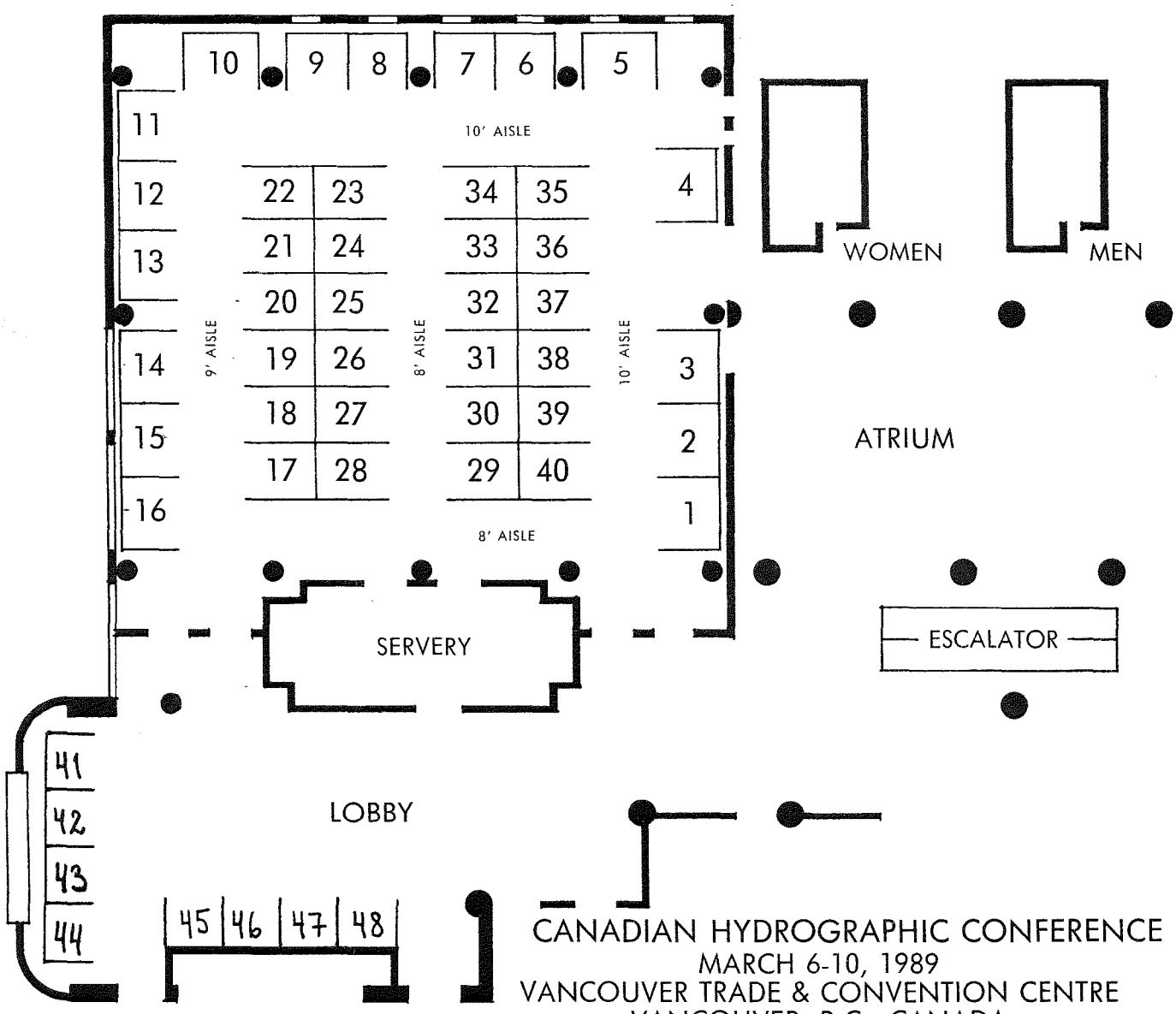
This Print is offered in a limited edition of 450. Printed on museum quality acid free paper, signed and numbered by the artist.

Meet the artist at Conference Booth 41 for a special print signing.

GULF OF GEORGIA GALLERIES

Heritage Court 5 - 3500 Moncton Street
Steveston, B.C., Canada V7E 3A2

(604) 271-3883



EXHIBITOR'S AREA PLAN

CANADIAN HYDROGRAPHIC CONFERENCE

Vancouver, March 6 - 10, 1989

EXHIBITORS

BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
29	Gail Gabel AANDERAA INSTRUMENTS LTD. 560 Alpha Street Victoria, BC V8Z 1B2 Tel: (604) 386-7783 Fax: (604) 386-5461	Oceanographic and environmental monitoring instruments including Aanderaa, Sea Tech, Nautronix instruments, and International Vessel leasing
21/22	Tony J. Mason BY TOWN MARINE LTD. P.O. Box 11397 Station "H" Ottawa, ON K2H 7V1 Tel: (613) 820-6910 Fax: (613) 726-0266	Navigation, Data Acquisition, & Tide Monitoring System
42	Barry Lusk CANADIAN HYDROGRAPHIC ASSOC. 9860 West Saanich Rd. Sidney, BC V8L 4B2 Tel: (604) 356-6373 Fax: (604) 356-6390	Small self contained display - T.V. - VCR Advertising this Association
45/46	A.D. (Tony) O'Connor CANADIAN HYDROGRAPHIC SERVICE 9860 W. Saanich Rd. Sidney, BC V8L 4B2 Tel: (604) 356-6347 Fax: (604) 356-6390	
3	Bo Skapski CANSEL SURVEY EQUIPMENT 4040 Graveley St. Burnaby, BC V5C 3T6 Tel: (604) 299-5794 Fax: (604) 299-1998	Electronic Distance Measuring Systems, Computer Hardware & Software

BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
39/40	Andrew S. Bogle JOHN E. CHANCE & ASSOC. INC. 200 Dulles Drive Lafayette, LA 70506 Tel: (318) 237-1300 Fax: (318) 237-1300 Ext 143	Starfix Satellite Positioning System & differential GPS Services
10	Pat C. Sanders COASTAL OCEANOGRAPHICS R R #3, Box 406 2 Salted Lane Durham, CT 06422 Tel: (203) 349-3800 Fax: (203) 349-8021	Hydrographic Data Collection & Processing Software & Equipment: ECPAC - Electronic Chart System
20	Theresa Lowe/Robert Smith Lester Myricks, SDSVP Exhibits Coordinator DEFENSE MAPPING AGENCY Washington, DC 20315-0030 Tel: (202) 227-1045 Fax: (301) 227-2463	ARC Digitized Raster Graphic Equipment
19	Paul Igo E G & G MARINE PRODUCTS 217 Middlesex Turnpike Burlington, MA 01803 Tel: (617) 270-9100 Fax: (617) 270-9724	Model 260 Side Scan Sonar with Colour Video Display
4	Ruby Jones/R.M. Butler, Jr. ENDECO INC. 13 Atlantis Drive Marion, MA 02738-1448 Tel: (508) 748-0366 Fax: (508) 748-2543	Oceanographic-Current Meters Wave Buoys-Water Level Recorders-D.O. Sensors-Towed Underwater System-Telemetry
25	Wayne J. Sula GENERAL INSTRUMENT CORP. 33 Southwest Park Westwood, MA 02090 Tel: (617) 326-7815 Fax: (617) 326-7831	

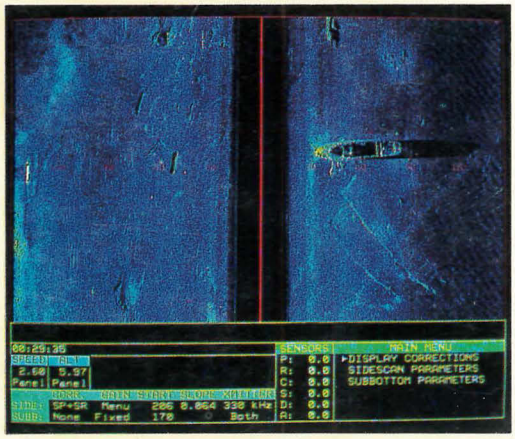
BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
37/38	Robert T. Ragsdale GEODIMETER OF CANADA LTD. 41 Horner Ave. #5 Toronto, ON M8Z 4X4 Tel: (416) 252-4691 Fax: (416) 252-8635	Geodimeter Hydrographic Systems
41	John M. Horten CSMA FCA GULF OF GEORGIA GALLERIES #5 - 3500 Moncton St. Steveston, BC V7E 3A2 Tel: (604) 271-3883 or 275-0228 Fax: N/A	Marine Art Display featuring John M. Horten
5	James Ferguson INTERNATIONAL SUBMARINE ENGINEERING 1734 Broadway Street Port Coquitlam, BC V3C 2M8 Tel: (604) 942-5223 Fax (604) 942-7577	
30	H.R. Zeller LASER PLOT INC. 48 Sword St. Quburn, MA 01501 Tel: (508) 757-2831 Fax: (508) 757-1424	
35/36	D.P. Mahony/John Blair THE MCELHANNEY GROUP LTD. 200 - 1166 Alberni St. Vancouver, BC V6E 3Z3 Tel: (604) 683-8521 Fax: (604) 683-4350	Marine Surveys, Navigation & Positioning, Geodetic Surveys
26/27	R.K. McMillan MCQUEST MARINE (Racal Decca Canada Ltd. & Klein Associates Inc.) 489 Enfield Road Burlington, ON L7T 2X5 Tel: (416) 639-0931 Fax: (416) 639-0934	Racal QX - 4, Racal Microfix System, Racal Hyperfix System, Racal Colour Radar, Seabird Seacat CTD, Klein 595 Recorder

BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
1/2	Steinar Gregersen/ Carl Christensson MESOTECH SYSTEMS LTD./ SIMRAD A/S 2830 Huntington Place Port Coquitlam, BC V3C 4T3 Tel: (604) 464-8144 Fax: (604) 941-5423	UCM 40 Current Meter, 971 Sonar System, 971-6 2nd Axis Drive, EA300P Portable Depth Sounder
23	Meg Moore NOAA, NATIONAL OCEAN SERVICE C & GS, N/CG241 WSC-1 Rm 408 6001 Executive Boulevard Rockville, MD 20852 Tel: (301) 443-8752 Fax: (301) 443-8701	Samples of Nautical Charting, Aeronautical Charting & Geodetic Materials
34	W.A. Perry OCEAN DATA EQUIPMENT CORP. 473 Pleasant Street P.O. Box 2557 Fall River, MA 02721 Tel: (508) 679-5284 Fax: (508) 672-9780	Digital Echo Sounders, Oceanographic & Bathymetry Equipment
18	Bryan Apsey ODOM HYDROGRAPHIC SYSTEMS, INC. 8178 G.S.R.I. Avenue Baton Rouge, LA 70820 Tel: (504) 769-3051 Fax: (504) 766-5122	Echo Sounder, Velocity Probe, Bottom Discrimination, Range-Azimuth Positioning
28	Robert Lyall/Keith Dunn OFFSHORE SYSTEMS LTD. 1974 Spicer Road North Vancouver, BC V7H 1A2 Tel: (604) 929-7961 Fax: (604) 929-3260	Electronic Chart Display & Information Systems (ECDIS), Radar Positioning
24	Bill Matvichuck OPTECH INC. 701 Petrolia Road Downsview, ON M3T 2B6 Tel: (416) 661-5904 Fax: (416) 661-4168	Airborne Underwater Laser Radar Equipment Posters

BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
16	Wayne R. Hoyle QUIBIT CANADA LTD. Suite 812 Cogswell Tower Scotia Square Halifax, NS B3J 3K1 Tel: (902) 422-9570 Fax: (902) 422-1737	TRAC/CHART V - Integrated Navigation & Hydrographic Surveying Charting System
8/9	John V. Watt QUESTER TANGENT CORP. 99-9865 W. Saanich Rd. Sidney, BC V8L 3S1 Tel: (604) 656-6677 Fax: (604) 656-0800	ISAH - The Integrated System for Automated Hydrography
14/15	Richard Carpenter RC MARINE ELECTRONICS LTD. 214th Right Ave. Dartmouth, NS B3B 1R6 Tel: (902) 468-2405 Fax: (902) 469-9194	Electronic Acoustical Equipment
6	Donald D. Silver REVLIS ELECTRONICS LTD. 8632 Llewellyn Place Sidney, BC V8L 1G7 Tel: (604) 656-8745 Fax: (604) 655-3113	Model 874 Low Power Tide Guage & SAIL SYSTEM 8700 Hydrographic Survey Support Equipment
12	Hy Pollack/Wayne M. Ross ROSS LABORATORIES INC. 3138 Fairview Ave. E. Seattle, WA 98102 Tel: (206) 324-3950 Fax: (206) 329-0250	Automated Depth Survey Systems, Portable Survey Recorders
31/32/33	H.D. Tolten/C.A. Greatrex SURNAV CORP. 1000-38 Antares Dr. Nepean, ON K2E 7V2 Tel: (613) 723-1830 Fax: (613) 723-0786	Microwave & UHF Trisponder System, GPS Geodetic & Nav. Receivers, Div. of Trimble Nav. GPS Software Products, Laser Positioning & Precision Bathymetric Systems, Nav. Data Processors, Tidal Senors & Survey Echo Sounders

BOOTH #	EXHIBITOR	DESCRIPTION OF EQUIPMENT OR SERVICES TO BE DISPLAYED
13	Timothy D. Kelley SWATH OCEAN SYSTEMS 979 G Street Chula Vista, CA 92011 Tel: (619) 426-2179 Fax: (619) 426-2196	Hydrographic Survey Instruments
11	Trevor Illingworth/Philip Goy TECHNICAL SURVEY SERVICES Wedgwood Road Bicester, Oxon 0X6 7UL United Kingdom Tel: (869) 248111 Fax: (869) 244781	Hydrographic Survey, Science Swath Ships of exceptionally stable sea keeping ability
47	Don Davis TELEFIX CANADA INC. Unit 5, 155 West Beaver Creek Rd. Richmond Hill, ON L4B 1E1 Tel: (416) 889-9534 Fax: (416) 889-9552	TELLUROMETER Distance Measuring Equipment/Airlink Communication Equipment
17	F.J. Quinn TERRA SURVEYS LTD. 1962 Mills Road, R R #2 Sidney, BC V8L 3S1 Tel: (604) 656-0931 Fax: (604) 656-4604	Airborne & Conventional Hydrographic Services
7	Mr. Rick Nyarady/Dr. S.E. Masry UNIVERSAL SYSTEMS LTD. 270 Rookwood Avenue P.O. Box 3391, Station B Fredericton, NB E3A 5H2 Tel: (506) 458-8533 Fax: (506) 459-3849	CARIS - Computer assisted mapping/charting software and geographic information system software
43	Isabel Coelho VANCOUVER PORT CORPORATION 1900 Granville Square 200 Granville Street Vancouver, BC V6C 2P9 Tel: (604) 666-3226 Fax: (604) 666-8916	8' x 10' Static Display

NO OTHER SIDE SCAN SONAR COMES CLOSE



Monitor displays sidescan data, sub-bottom data, time, sensor status and menu information.

Model 972 SIDE SCAN Sonar features:

- Display resolution 1280 x 1024 x 128
- Undistorted side scan displays with the water column removed and corrected for slant range and towfish speed
- Available simultaneous side scanning and sub-bottom profiling
- Available towfish sensors: speed, roll, pitch, compass, depth and altitude

MESOTECH SYSTEMS LTD

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SIMRAD

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Division of Mesotech Systems Ltd
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Fax: (902) 468-2217