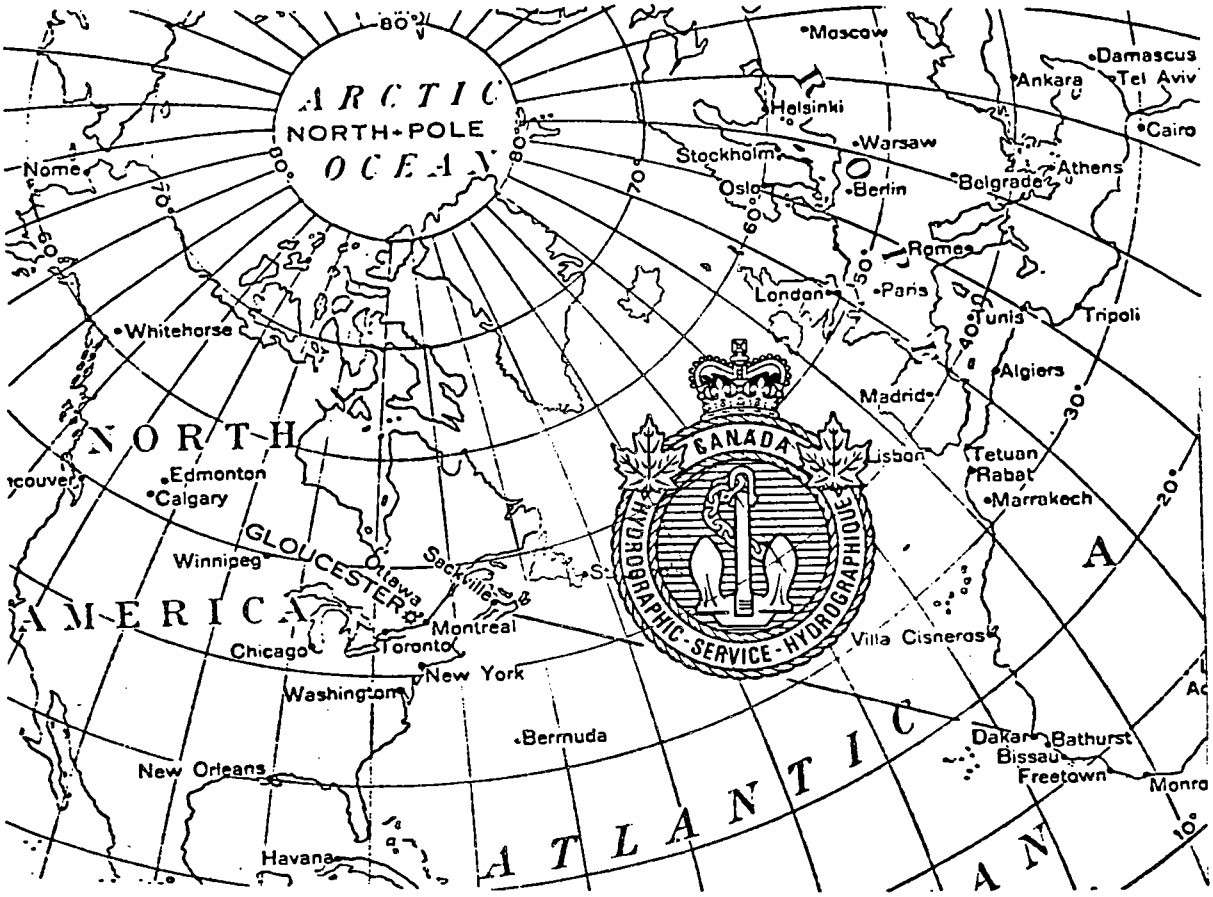
SENEGAL SURVEY

CSS BAFFIN CRUISE NO. 76-001

JANUARY 26 - APRIL 14, 1976

H.I.C. - R.A. MARSHALL



Senegal Survey

CANADIAN HYDROGRAPHIC SERVICE
CENTRAL REGION
OCEAN AND AQUATIC SCIENCES
FISHERIES AND MARINE SERVICE
DEPARTMENT OF THE ENVIRONMENT

FINAL FIELD REPORT
PERIOD OF OPERATION - JAN. 26 - APRIL 14, 1976

HYDROGRAPHER-IN-CHARGE - R. MARSHALL

SUMMARY

During February and March, 1976, the Canadian Hydrographic Service, in conjunction with the Atlantic Geoscience Centre and the Chemical Oceanographic Division, A.O.L., carried out a multi-parameter survey of the continental shelf and margin of Senegal and Gambia.

The survey, which was funded by the Canadian International Development Agency, was based on CSS BAFFIN. Highly sophisticated navigational, data logging and processing techniques were used.

SOMMAIRE

Durant les mois de février et mars 1976, le Service hydrographique du Canada, en conjonction avec le Centre de géoscience de l'Atlantique et la Division de l'océanographie chimique du Laboratoire océanographique de l'Atlantique, a effectué un relevé de la côte et la marge continentale de Sénégal et de Gambia.

L'office de ce relevé, fondé par l'Agence canadienne pour le développement internationale, fut basée à bord le CSS BAFFIN. Des techniques très sophistiquées furent utilisées pour controller la navigation, la collecte des données et le traitement de ces données.

Senegal Survey - Bathymetry, Magnetic and Gravity survey lines

Range-Range accuracy lobes with 30 & 50 metre measurement errors

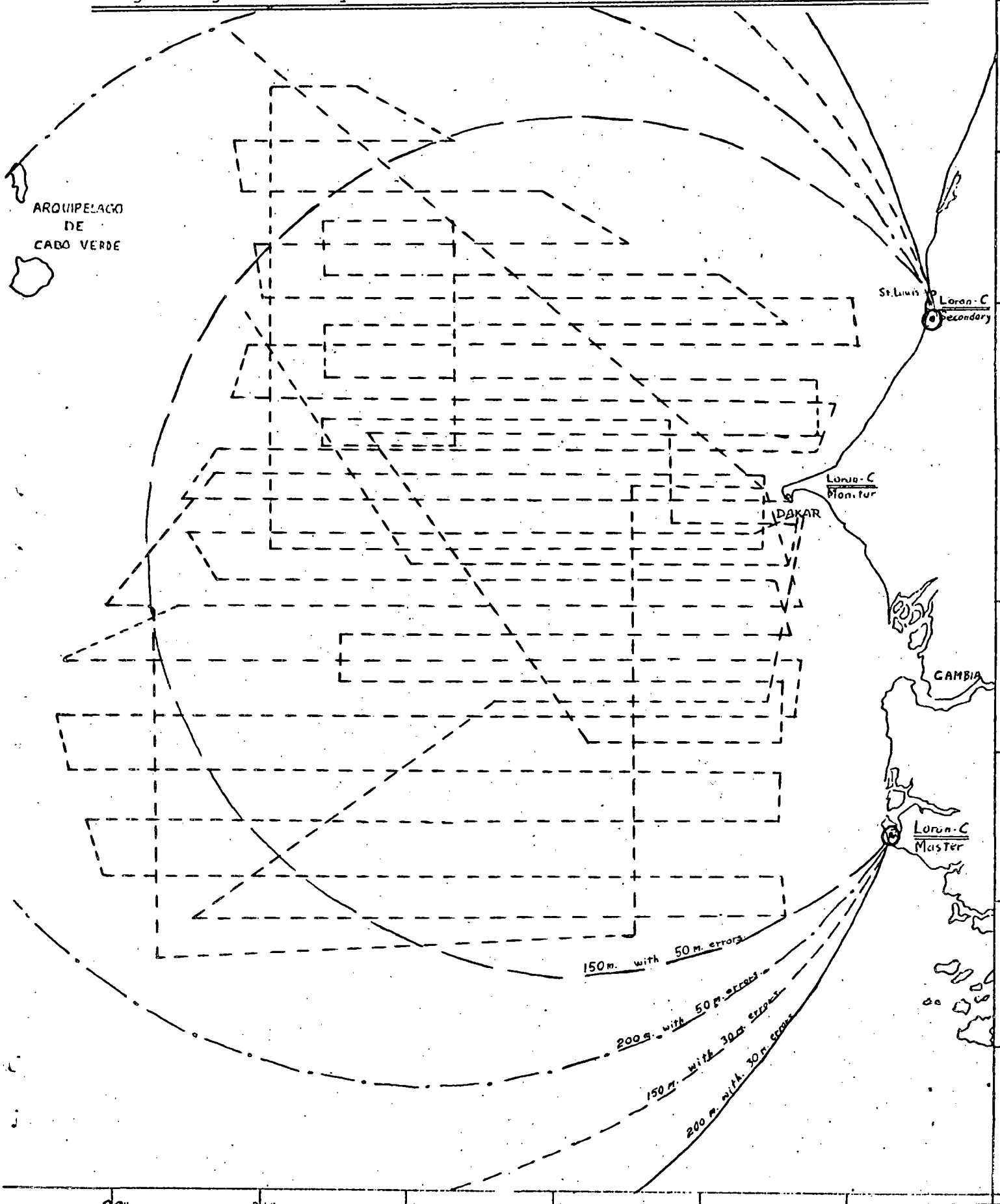


TABLE OF CONTENTS

SUMMARY	PAGE i
SURVEY AREA	PAGE ii
TABLE OF CONTENTS	PAGE iii
NARRATIVE	PAGE 1
CHRONOLOGY OF EVENTS	PAGE 5
LIST OF PERSONNEL	PAGE 9
NAVIGATION	PAGE 12
BATHYMETRY AND DATA PROCESSING	PAGE 20
GEOPHYSICS	PAGE 24
CHEMICAL OCEANOGRAPHY	PAGE 27
ORNITHOLOGY	PAGE 29
TRAINING	PAGE 30
TIDE GAUGES AND CURRENT METERS	PAGE 32
HORIZONTAL CONTROL	PAGE 34
HELICOPTER	PAGE 35
CSS BAFFIN	PAGE 36
WEATHER	PAGE 37
G.E.B.C.O.	PAGE 38
EQUIPMENT	PAGE 39
MISCELLANEOUS NOTES	PAGE 40
CONCLUSIONS AND RECOMMENDATIONS	PAGE 42
ACKNOWLEDGEMENTS	PAGE 43

APPENDIX A: STATISTICS
APPENDIX B: LIST OF MAJOR EQUIPMENT
APPENDIX C: PRESS RELEASES

NARRATIVE

Part III of the informal single negotiating text of the Third Conference on the Law of the Sea proposes that States: "... shall promote the development of the marine scientific and technological capacity of developing states ... , in consonance with their economies and needs, with regard to the exploration, exploitation, conservation and management of marine resources ... , with a view to accelerating the social and economical development of developing states ...

In order to achieve the above mentioned objectives, States shall endeavour to,

a) establish programs of technical co-operation for the effective transfer of all kinds of marine technology to developing states

b) undertake projects ... , and other forms of bilateral ..... co-operation."

In the spirt of Canada fulfilling this role, agreement was reached with Senegal and Gambia whereby Canada would conduct a multi-parameter survey of the continental shelves and margins of those countries so as to enable them to define the extent of their claims in accordance with whatever criteria are finally adopted by the Law of the Sea Conference.

Subsequently, the main responsibility for planning the project was given to Central Region, Hydrography Division. CSS BAFFIN was provisionally identified as a suitable survey vessel.

On July 9, 1975, a meeting chaired by the Dominion Hydrographer, was held in Ottawa, attended by interested groups from EM&R, CIDA, External Affairs and D.O.E. Agreement came from this meeting to send an advance mission to Senegal and Gambia to discuss the various aspects of the proposed survey with the appropriate officials.

This advance mission, consisting of:

Mr. John O'Shea - Canadian Hydrographic Service, H.Q.

Dr. W.J. van der Linden - Atlantic Geoscience Centre, B.I.O.

Mr. S.N. Tibbo - Fisheries Service,

was in Senegal from August 5-15th and submitted reports of their findings and recommendations to the Dominion Hydrographer on August 31, 1975.

Further meetings were held during September and after CIDA had confirmed funding, the project was given the go ahead on October 1st.

The "First Technical Co-Ordinating Meeting, Survey of the Continental Margin off Senegal and Gambia" chaired by the Dominion Hydrographer was held in Ottawa on the afternoon of October 1st. Representatives from H.Q., CHS; Central Region, CHS; Atlantic Geoscience Centre, BIO; Ship Division, A.O.L.; and, Chemical Oceanographic Division, A.O.L., attended and broad agreement was reached on the project.

A major concern at this time was the fact that BAFFIN was scheduled for refit from January 15 - March 15, 1976 which coincided with the proposed time of the survey. Ship Division, A.O.L. and D.S.S. finally arranged for BAFFIN to undergo her refit in Halifax from November 12, 1975 to January 16, 1976.

During early discussions (of the survey) we thought that the limits of the survey would be confined to the continental shelf and beyond to a depth of 2000 metres. This would have required positional coverage of a zone about 100 miles wide which could have been covered by our own Decca Lambda chain. However, EM&R specified limits of 300 miles offshore with positional accuracies to Canadian Offshore standards, i.e. ±200 metres. The only positioning system which could provide the required coverage was thought to be the Accufix Loran C system. This system would be interfaced with Central Region's own Integrated Satellite Navigation system to provide an extremely flexible and accurate navigational control over the entire survey area on a continuous 24 hour a day basis.

Accordingly, specifications were drawn up for such a system and submitted to D.S.S. for tendering. The proposal was for a "turn key" operation with the contractor being completely responsible for the operation and maintenance of a two station chain ready for operation when BAFFIN arrived.

Meetings at A.O.L. on November 5th and at CCIW on November 6th clarified many of the details concerning financial responsibility, equipment supplies, personnel availability, survey priorities, and schedule, etc.

From November 11-20th, Messrs. Marshall, O'Shea and Bryant were in Senegal selecting the sites for the 300 foot towers required for the Loran-C chain. Arrangements were made at this time for berthing space for BAFFIN in Dakar, fresh water supplies and stores. Discussions were held with local officials on the objectives of the survey, particularly the importance of training Senegalese personnel.

On December 12, 1975, a contract was awarded to ComDev Marine of Ottawa for the operation of the Loran-C chain. As time was getting short and the Agreement Between Canada and Senegal had not been signed, ComDev asked C.H.S. if we could send someone to Senegal to act as liaison between the contractor and Government officials. John O'Shea, CHS, H.Q., left for Senegal on January 7, 1976 to fulfill this role.

In early January, 1976, we began moving electronic and survey equipment from Burlington to Halifax for loading on BAFFIN. Central Region hydrographers and electronic technician arrived in Halifax on January 7th. As previously arranged, electronic technicians and other specialists began installing a multitude of equipment including a gravimeter, magnetometer winches, echo sounders, mini-computers, satellite navigation equipment and portable laboratories on BAFFIN. BAFFIN's refit was successfully completed on January 16th and everything was more or less ready by January 25th.

BAFFIN left the Bedford Institute on January 26th and after a day running equipment trials, finally cleared for Dakar early A.M. on the 27th. The voyage to Senegal lasted until February 8th and was used as a shakedown cruise during which all our equipment and systems were tested. Bathymetric, magnetic and gravity data were collected on a continuous basis. Prior to docking, we laid a standard U-shaped mooring containing 2 current meters and 1 tide gauge in 150 feet of water about 30 miles south of Dakar.

After a two-day stop in Dakar, we began the survey on February 11th. BAFFIN steamed on prearranged lines collecting bathymetry, magnetics and gravity on a continuous basis. An oceanographic station was occupied on a daily basis for about 1½ to 2 hours. Wildlife observations were made during daylight hours. Weather observations were recorded by the ship's officers every 6 hours and the results transmitted by radio to Dakar. This program,

interrupted by a visit to Dakar from March 5-8th, continued until March 18th. From March 18th to 28th, we towed a Huntec high resolution deep seismic system and a 40 cu. inch air gun over the near shore area. The current meter mooring was recovered on March 27th. BAFFIN was in port from March 28th to 30th when we sailed from Dakar. After a check line was run in the north part of the survey area, the Senegal survey was completed early on April 1st. BAFFIN headed for the Mid Atlantic Ridge and after two days running seismic lines over drill site no. 13, we headed for Halifax, arriving on April 14th in time for the Easter holidays.

CHRONOLOGY OF EVENTS

1975

July 9	Information meeting in Ottawa concerning proposed multi-parameter survey of Senegal Continental Margin.
July 28	Planning meeting in Ottawa to settle terms of reference for advance mission.
July 30	Planning meeting in Ottawa to discuss fisheries participation.
August 5-15	Advance mission of Messrs. O'Shea, van der Linden and Tibbo in Senegal to discuss proposed survey with Senegalese officials.
August 31	Reports from Advance Mission received at H.Q.
October 1	Operational meeting in Ottawa - Senegal Project given go ahead.
October 22	Requisition for Loran-C chain delivered to D.S.S.
November 5	Planning meeting at A.O.L.
November 6	Planning meeting at C.C.I.W.
November 11-20	Messrs. Marshall, O'Shea and Bryant in Senegal selecting Loran-C tower sites.
November 12	BAFFIN begins refit in Halifax shipyards.
November 21	Loran-C contract bidders conference in Ottawa.

December 12 — Contract awarded to ComDev Marine for the installation and operation of a mini Loran-C chain in Senegal.

1976

January 6 — Equipment trucked from Burlington to Halifax.

January 7 — Central Region hydrographic personnel arrive in Halifax.

January 9 — Commenced installing survey equipment on BAFFIN.

January 15 — Chemical Oceanographic Laboratory container and seismic compressor containers loaded on BAFFIN.

January 16 — BAFFIN moved from shipyard to B.I.O. under tow.
Refit completed.

January 19 — Gravimeter installed on BAFFIN.

January 22 — Huntec equipment loaded.

January 23 — A.G.C. laboratory container loaded.
Navigation and electronic equipment on line.
Helicopter on board.

January 26 — BAFFIN left B.I.O. Conducting equipment trials in vicinity of Halifax.

January 27 — BAFFIN cleared for Senegal.
Commenced underway measurements - gravity, magnetics and bathymetry.

February 1 — Running seismic line (40 inch air gun) over Mid Atlantic Ridge.

February 3 — Attempted run with air gun over Grosse Meteor Bank - ship rolling too much for good results.

February 7 — Tested oceanographic winch to 4000 metres.

February 8 A.M. — Moored tide gauge and two current meters south of Dakar.
P.M. — Alongside Naval Base, Dakar, Senegal.

February 10 — T.V., radio and newspaper interviews on BAFFIN.

February 11 — Loran-C chain operational.
Departed Dakar - Commenced survey.

February 20 — G. Macdonald and J. Cliff flown ashore with Doctor for medical attention in Dakar.

February 24 — Doctor picked up by helicopter from Dakar.

March 5 — Arrived Dakar - 1st phase of survey completed.
Geodetic personnel commence positioning Loran-C towers.

March 6 — Reception held on BAFFIN.

March 8 — Departed Dakar - resumed survey.

March 17 — Geodetic personnel returned to Canada.

March 18 — Completed bathymetric phase of survey.
Commenced seismic lines in near shore area.
G. Macdonald returned from sick leave.

March 21 — Canadian Ambassador to Senegal on board via helicopter, for short visit, while underway off Dakar.

March 26 — Completed chemical oceanographic program.

March 27 — Recovered current meters and tide gauge from mooring south of Dakar.

March 28	Completed nearshore seismic program. Arrived Dakar.
March 29	Completed positioning Loran-C towers.
March 30	Departed Dakar - running check lines.
April 1	Completed Senegal Survey - proceeding towards Mid Atlantic Ridge.
April 2	Loran-C chain shut down.
April 6	Commenced seismic lines over M.A.R.
April 9	Completed M.A.R. survey.
April 14	Arrived Halifax.

LIST OF PERSONNEL

CSS BAFFIN CRUISE NO. 76-001

R. Marshall	Hydrographer-in-Charge	CHS, Central Region	Jan. 7	April 15
G. Macdonald	Senior Assistant	CHS, Central Region	Jan. 25	Feb. 20
			March 18	April 14
J. Weller	Hydrographer	CHS, Central Region	Jan. 7	April 14
J. Gervais	Hydrographer	CHS, Central Region	Jan. 17	April 14
G. Thompson	Hydrographer	CHS, Central Region	Jan. 7	April 14
D. Pyatt	Electronic Technician	R&D, Central Region	Jan. 7	April 14
J. O'Shea	Training Officer	CHS, Ottawa	Feb. 9	March 30
G. Vezina	Electronic Technician	Engineering Services, AOL	Jan. 26	March 7
D. Winter	Electronic Technician	Engineering Services, AOL	March 7	April 14
A. Ruffman	Geoscientist	Contract to A.G.C.	Jan. 26	March 7
W. Zukauskas	Data Technician	Contract to A.G.C.	Jan. 26	April 14
D. Tulett	Instrument Technician	Contract to A.G.C.	Jan. 26	April 14
W. van der Linden	Senior Geophysicist	Atlantic Geoscience Centre	March 5	April 14
K. Manchester	Equipment Specialist	A.G.C.	March 18	March 30
T. Courtney	Electronic Technician	A.G.C.	March 18	April 14
G. Bika	Huntec Engineer	Contract to A.G.C.	March 18	March 30
T. Kerr	Huntec Engineer	Contract to A.G.C.	March 18	March 30
L. Johnson	Data Technician	A.G.C.	March 29	April 14
B. Inkpen	Instrument Technician	A.G.C.	Jan. 26	Feb. 9

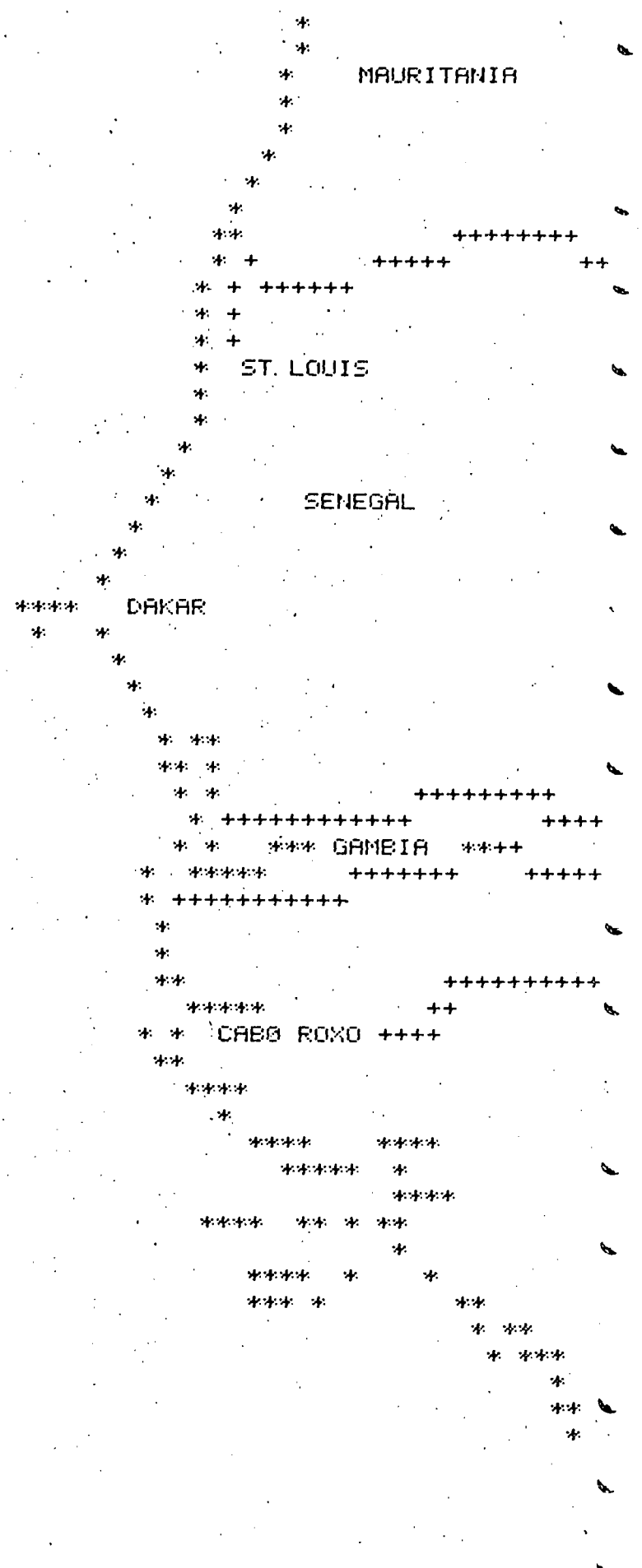
continued ....

LIST OF PERSONNEL - continued

T. Hollibaugh	Chemical Oceanographer	Contract to Chemical Oceanographic Div., A.O.L.	Jan. 26	March 30
R. Pocklington	Senior Chemical Oceanographer	Chem. Ocean. Div., A.O.L.	Feb. 9	Feb. 24
C. Cohrs	Assistant Technician	Contract	Jan. 26	April 14
R. DeCoste	Chemical Technician	Chem. Ocean. Div., A.O.L.	Feb. 9	March 30
R.G.B. Brown	Research Ornithologist	Can. Wildlife Service, B.I.O.	Jan. 26	March 6
A. Perley	Helicopter Pilot	M.O.T., Ottawa	Jan. 25	April 14
M. Takacs	Helicopter Engineer	M.O.T., Ottawa	Jan. 25	April 14
Matar Seck	Senegal Trainee	Dept. of Mines, Senegal	March 18	March 28
Amadou Diaw	Senegal Trainee	University of Dakar	March 21	March 28

Captain R. Gould, Master of CSS BAFFIN

Officers and Crew of CSS BAFFIN



BAFFIN
SENEGAL SURVEY
1976

NAVIGATION

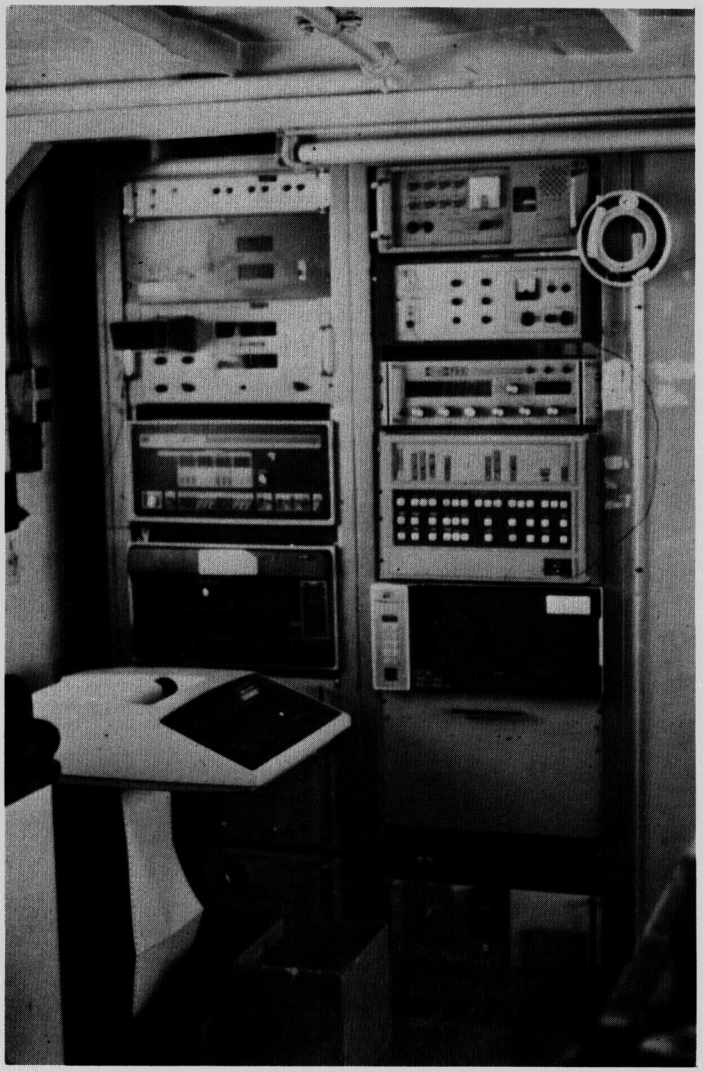
In order to achieve the required accuracy for the survey (±200 m), it was necessary to use an Integrated Satellite Navigation System interfaced with Loran-C. Central Region provided a Magnavox SatNav system previously used in Hudson Bay.

On December 12, 1975, we signed a contract with ComDev Marine of Ottawa for the operation and maintenance of an Accufix 2 range Loran-C chain.

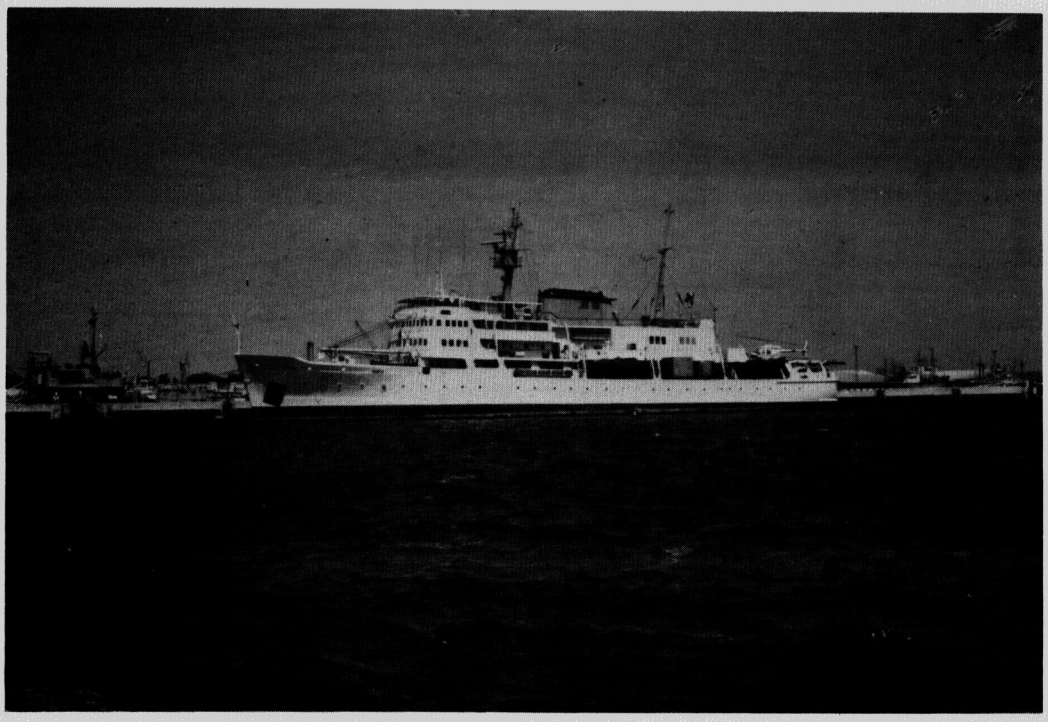
Because of the short time available before the chain had to be operational, ComDev shipped their equipment, including the two 300 foot tower sections, to Senegal by air. As the Secondary station site near St. Louis was fairly accessable, all gear was trucked north from Dakar. The Master site near the village of Diembering was well off the beaten track. Some equipment was trucked south via Ziguinchor and some was flown to Cap Skirring, by chartered DC-3. The 10 miles from Cap Skirring to Diembering presented quite a challenge as, at best, there is only a narrow track on which to drive vehicles. The final 1500 feet from the track to the site was over soft sand and 17 local men were required to haul in the heavy power generators and other heavy equipment.

The 300 foot tower at St. Louis was constructed from January 11-17, 1976 while construction of the Master tower began on January 23rd and was completed on February 3rd. Despite many difficulties, the chain was on the air and operational at 1300 hours on February 10, 1976.

A monitor was set up in Dakar and manned throughout the survey period by ComDev personnel. Adjustments to the chain timing were carried out, as and when required to maintain the tracking point at monitor to the desired value. Communications between Monitor, Master, Secondary and BAFFIN was maintained by S.S.B. radio-telephone. Any adjustments to the chain and other operational information could quickly be passed from monitor to BAFFIN on a 24 hour basis.



SAT NAV/LORAN C



BAFFIN

Apart from some initial teething problems, the chain was continuously on the air until April 2nd, when BAFFIN was heading back to Canada.

During December, 1975, the Navigation Group at A.O.L. had sent their Austron 5000 Loran-C receiver to Burlington so we could build an interface with our Sat Nav system. As we were unfamiliar with the Austron, Steve Grant from A.O.L. supplied us with working programs and gave us a crash course on the operation of the Austron.

From our departure from Halifax until near the Azores, we used the SatNav system with inputs from the East Coast Loran-C chain and then the North Atlantic chain. After we were out of range during the latter part of the trip, we used SatNav with gyro and manual speed inputs.

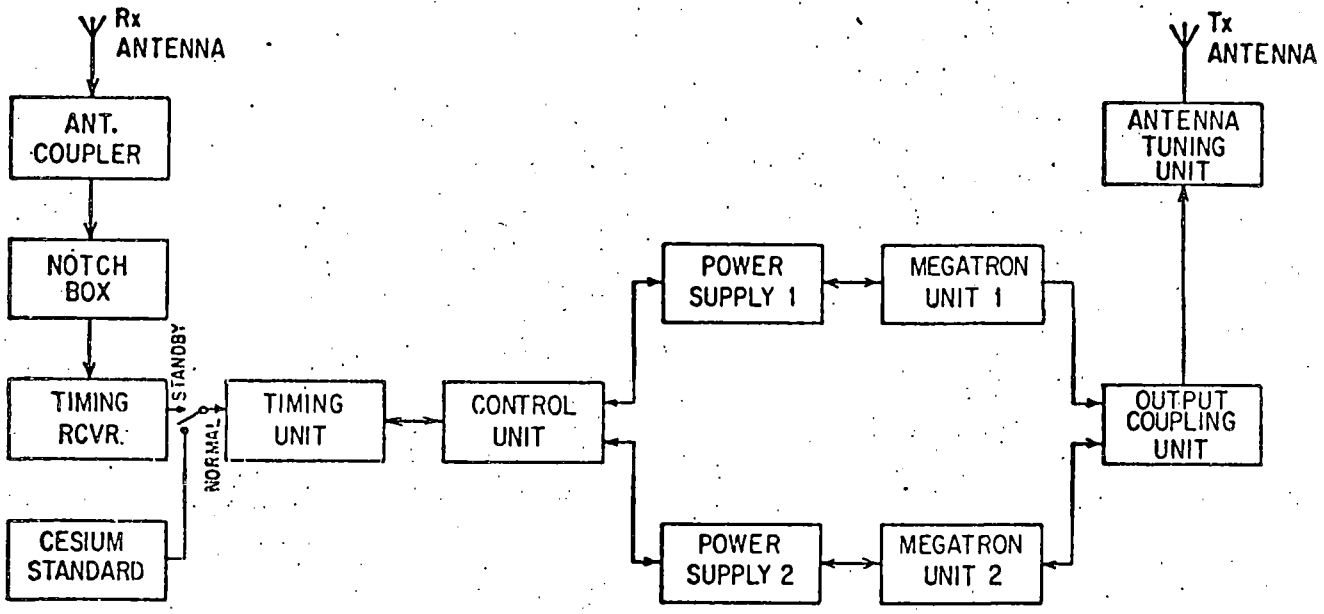
When BAFFIN left Dakar on February 11th, our complete navigation system was on line. However, for the first few days of the survey, we had some difficulty maintaining lock on the Loran signal due to excessive atmospheric noise levels at night, especially between 2300 and 0400 hours. Our Magnavox system uses the Loran-C as a velocity sensor so when we temporarily lost the signal, as we did on a few occasions, we reverted to manual input of speed and heading. After a few days, we were able to make some tuning and operating adjustments to the equipment and until the end of the survey the SatNav/Loran-C combination worked exceptionally well. We used the Loran signal throughout the survey area even at the extreme range of 720 kilometres from the Secondary station and 770 km from Master.

The SatNav equipment, Loran receiver, Biodal logger, gravimeter and magnetometer CRT readouts, and echo sounders were located in BAFFIN's plotting room immediately above and abaft the wheelhouse. This arrangement enabled one hydrographer, on normal sea watch, to monitor all equipment and con the ship along predetermined tracks.

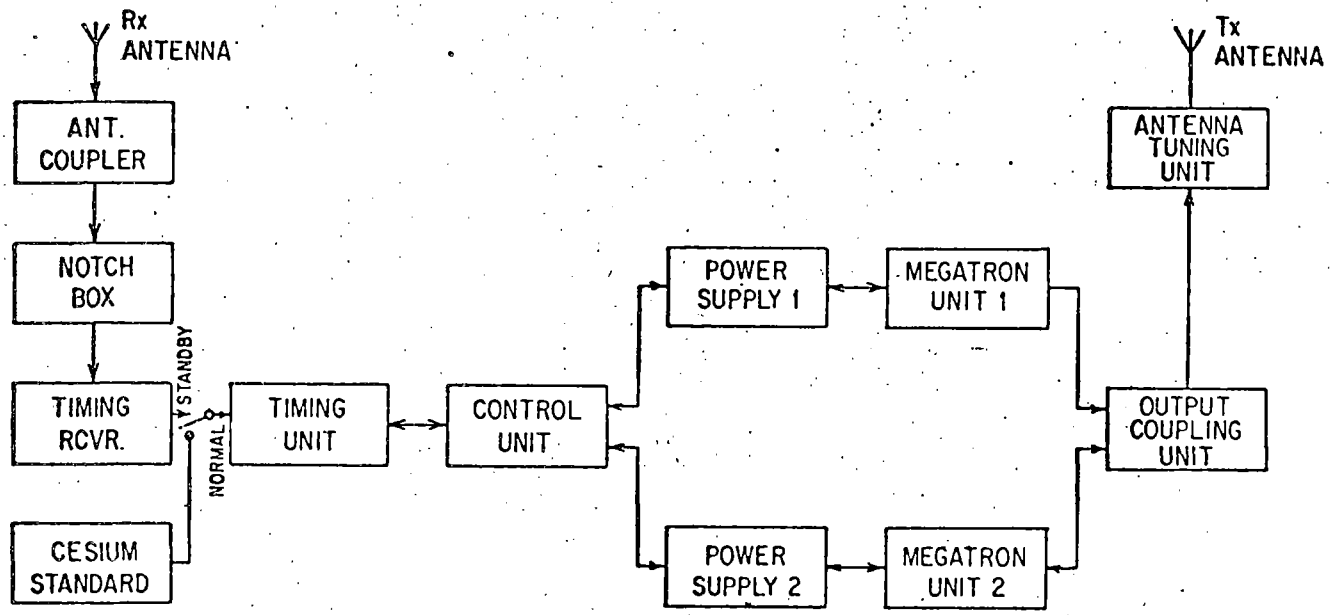
Ship's position, time, depths and Loran readings were automatically logged on mag. tape and displayed on a CRT and on a printout from a teletype terminal. A CRT display, showing position, depth, course to steer, distance off line, distance to go, etc. was located in the wheelhouse and kept the Officer of the Watch fully informed on the progress of the ship along the survey line. A similar display was set up in the seismic lab.

Voice communication between wheelhouse and plotting room as well as between plotting room and oceanographic lab. and seismic lab. was continuously available. The Officer of the Watch could instantly over-ride the survey navigation system when required for the safety of the ship.

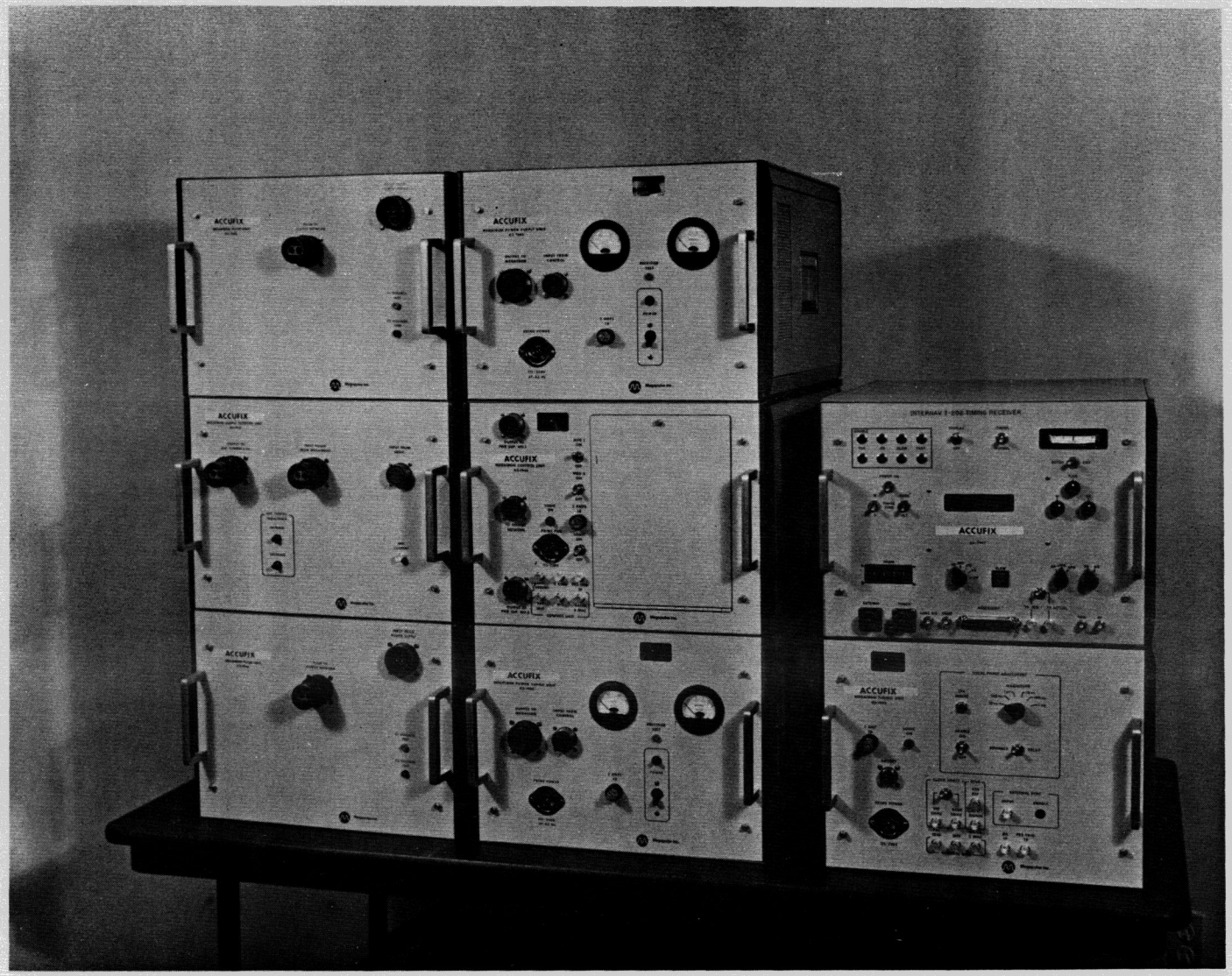
During the return trip from Dakar to Halifax, we tracked the Loran-C signal to a distance of 600 miles before the chain was taken off the air. We picked up the signal from Cape Race of the East Coast chain south of the Azores but it wasn't until mid-Atlantic that we were able to use the East Coast chain on a continuous basis.



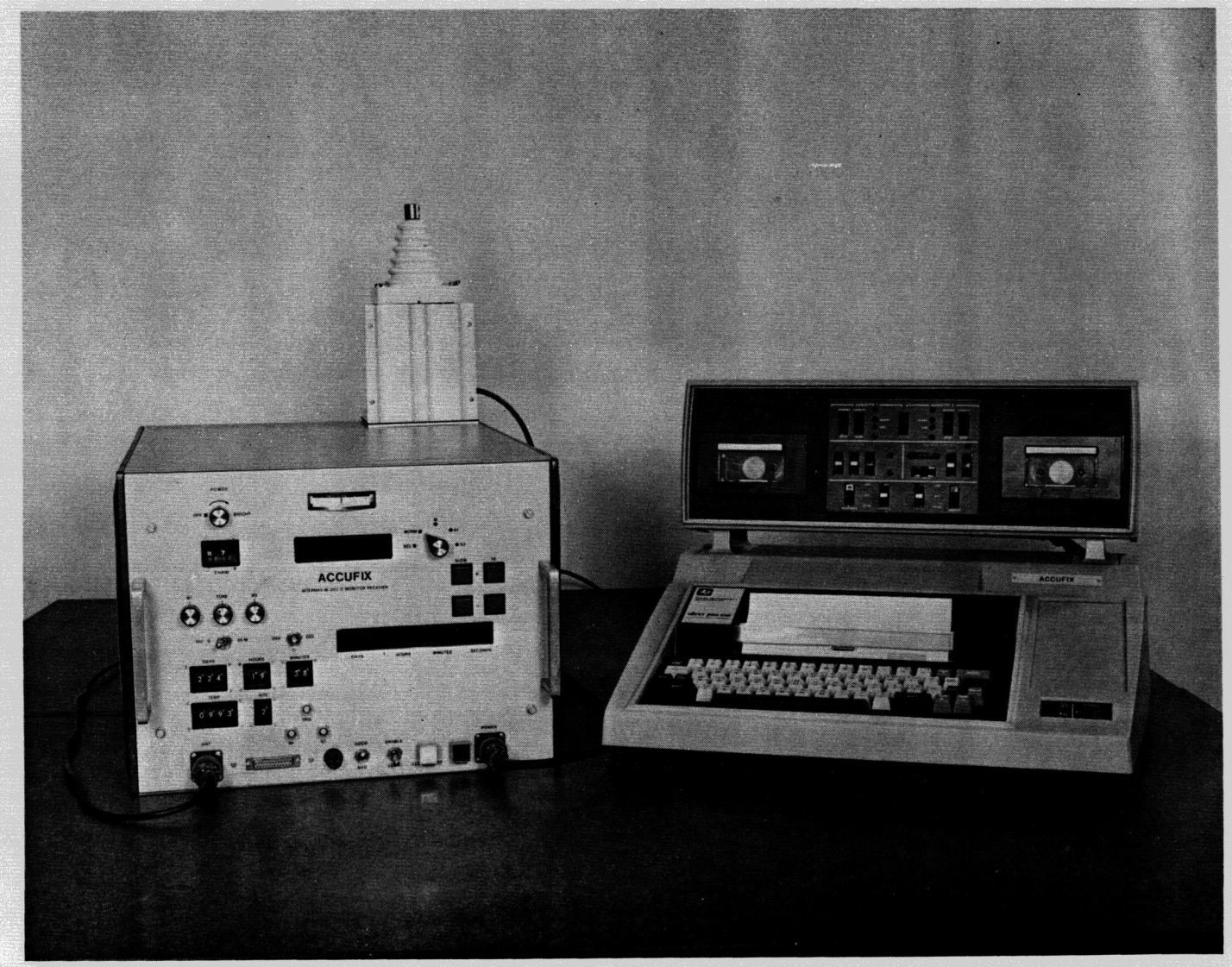
ACCUFIX TRANSMITTER-MASTER CONFIGURATION



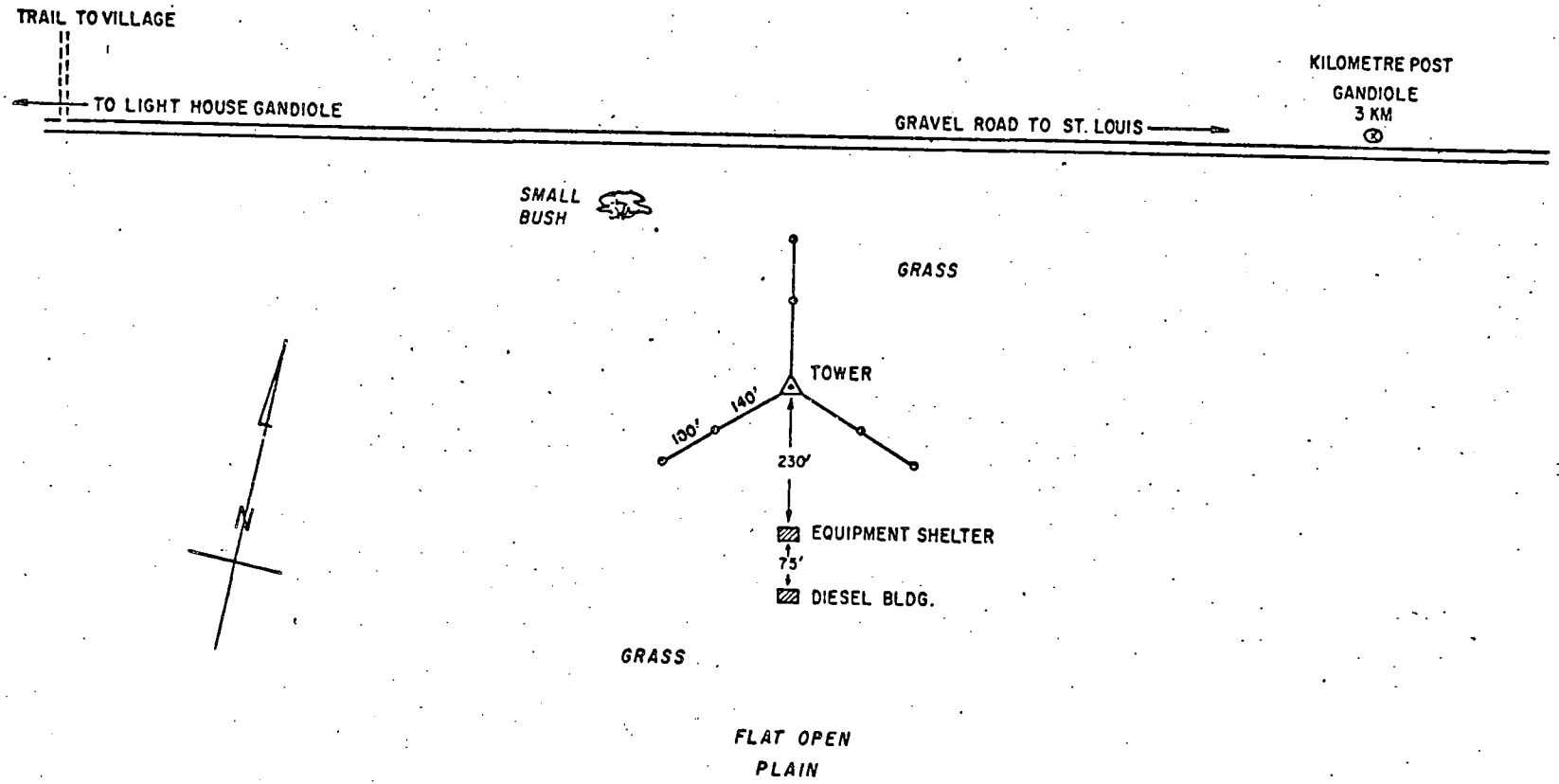
ACCUFIX TRANSMITTER-SLAVE CONFIGURATION



ACCUFIX TRANSMITTING EQUIPMENT

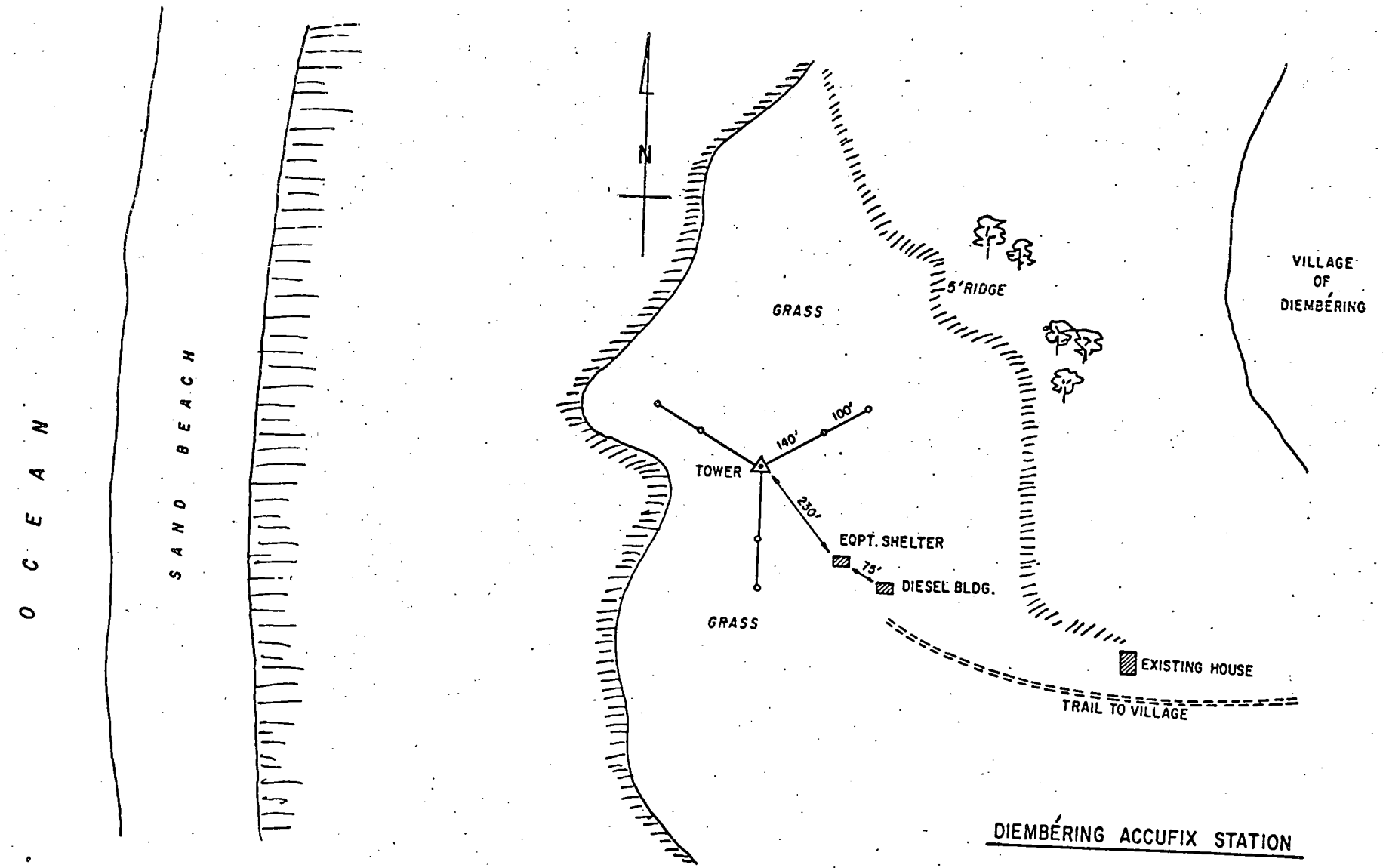


MONITOR SUB-SYSTEM M303



ST. LOUIS ACCUFIX STATION

APPROX. POS'N.
LAT. 15°54' N
LONG. 16°29' E

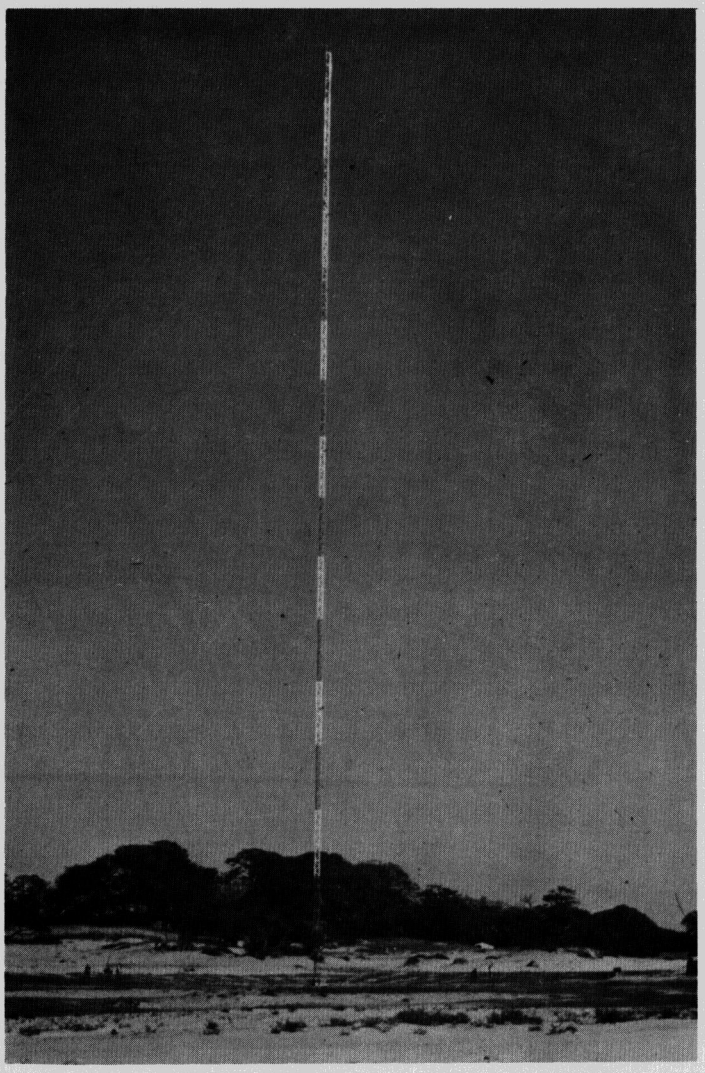


DIEMBÉRING ACCUFIX STATION

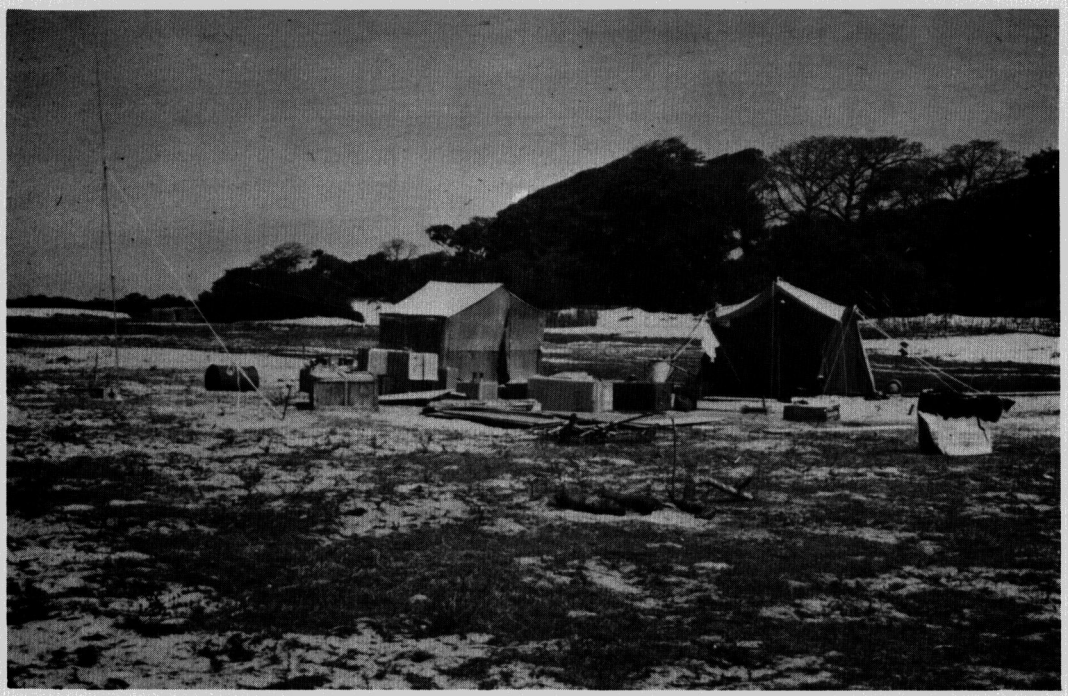
APPROX. POS'N.

LAT. 12°28'10" N

LONG. 16°47'30" E



LORAN TOWER - DIEMBERING



EQUIPMENT SHELTERS

BATHYMETRY AND DATA PROCESSING

Bathymetry was collected using a Raytheon deep sea sounding system consisting of:

Universal Graphic Recorder
PTR-105 transceiver
Correlation Echo Sounder Processor (C.E.S.P.)
Precision Depth Digitizer

Digitized depths were logged on the SatNav mag. tape. The analog record was constantly monitored by the Hydrographer of the Watch and annotated at regular intervals. Every 24 hours, the mag. tape was removed from the SatNav system in order to process the data.

This data, which was recorded once a minute, consisted of:

i) a position - latitude and longitude
ii) distance travelled since last satellite fix (computed from the Loran-C readings)
iii) the amount of the last update
iv) time of day
v) 12 depths

An Interdata Model 70 computer with a Disc Operating System (DOS) was used to process the bathymetry. Soundings were plotted on a Calcomp 563 drum plotter. In addition to the drum plotter, the computer was interfaced with:

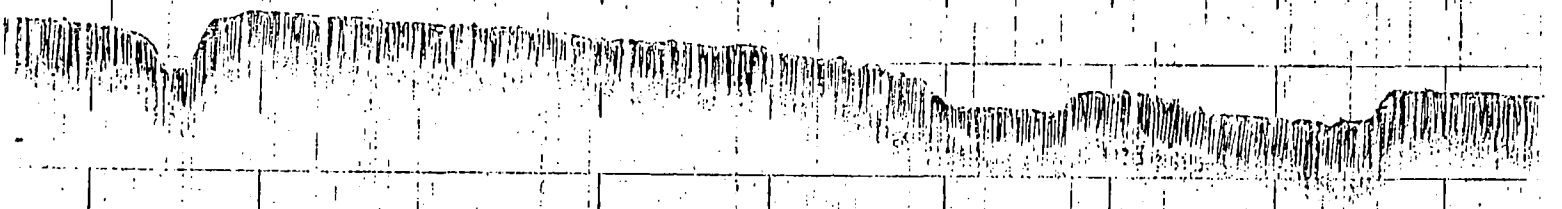
a) twin disc drives
b) twin 7 track magnetic tape drive
c) twin cartridge drives
d) high speed paper tape reader
e) Centronix line printer
f) ADDS CRT console

Processing software was based on programs previously developed for the 1975 Hudson Bay Survey and modified to handle a new data format.

Bathymetry was processed on a daily basis using the following programs:

PROGRAM NAME	DESCRIPTION	LANGUAGE
REBLOK	Reblocks mag. tapes written on the SatNav Logger. The output format is compatible with the Interdata processor.	Assembler
POSTPLOT	Using satellite updates recorded on the logger, recomputes the dead reckoning positions for each minute. Day, time, corrected Lat. and Long. and 12 depths are output for each minute.	Fortran
EDIT	Bad soundings or positions on the POSTPLOT file are corrected or deleted.	Fortran
BIODAL	Creates a position and depth file from edited POSTPLOT file. This was used by AGC personnel to process the gravity and magnetics.	Fortran
GEBCO	Soundings are selected every tenth of an inch at survey scale. A plot tape is written and the selected bathymetry is stored on mag. tape.	Fortran
SENPLT	Plots the GEBCO plot tape on the Calcomp plotter. Soundings on the plot are skewed 45 degrees to allow more soundings and less overplot.	Assembler

Normally, the next step would have been to use a sounding selection program called BOTREP. This is a routine which picks only the soundings necessary to define the bottom profile within a given tolerance. This file would have been used to produce all the final bathymetric products.

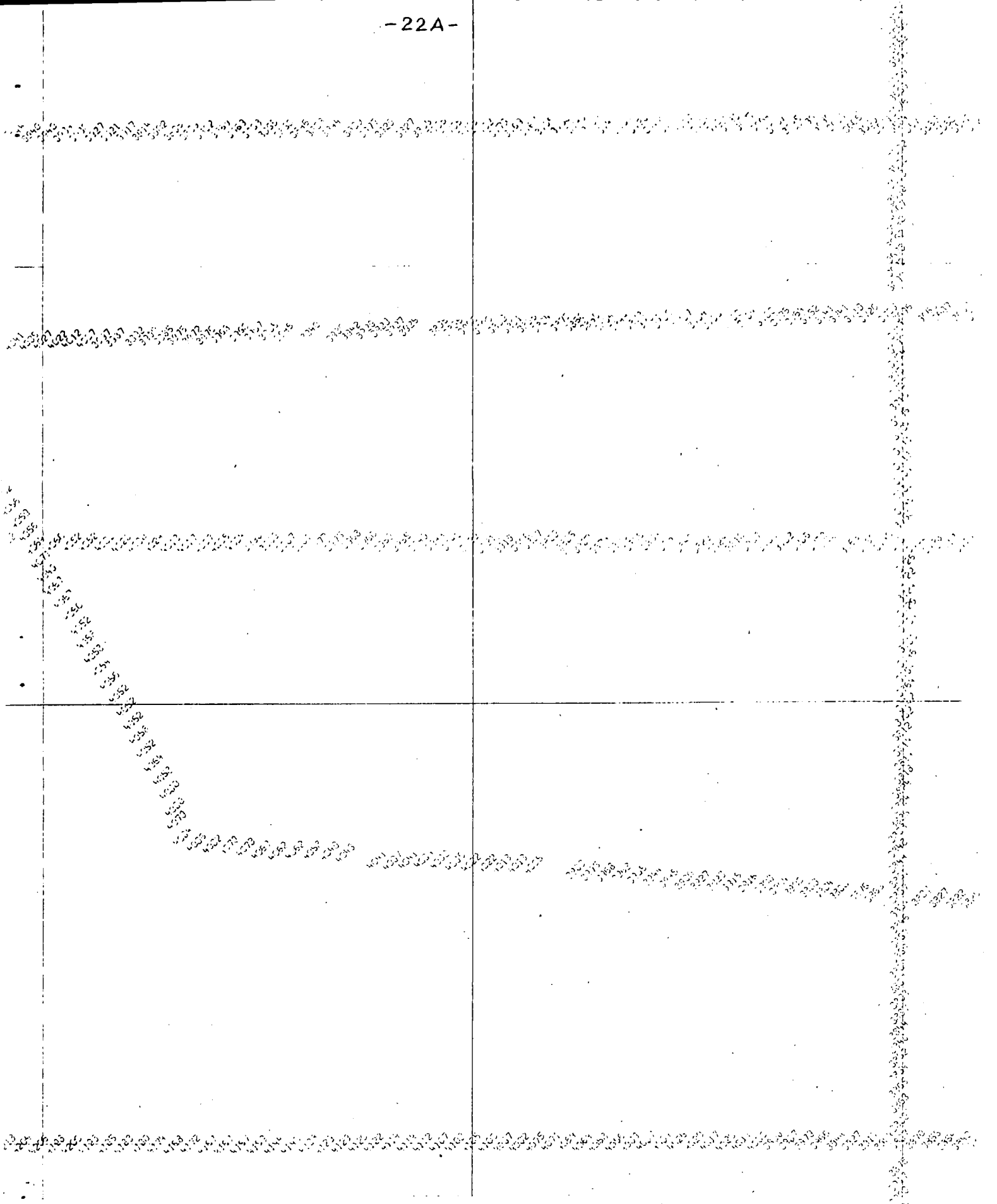


Typical sounding graph recorded by CSS Baffin in the Senegal offshore survey area. Depths of about 3500m to 3850m.

However, because of the great number of bad digitized soundings, due to BAFFIN's rolling and W.T. interference, we were unable to use this program. Soundings were chosen every tenth of an inch at a scale of 1:300,000. Since the bottom was generally flat outside of the physical continental shelf, this method satisfied our requirements. Deeps or shallows missed were manually added to the mag. tape file so that the bottom profile could be accurately redefined.

Seven preliminary field sheets have been plotted at a scale of 1:300,000 on the Calcomp plotter. These sheets, on plastic, have been submitted to Headquarters so that a start on contouring can be made. Permanent sheets will be plotted on a Gerber 22 flat-bed plotter for later submission.

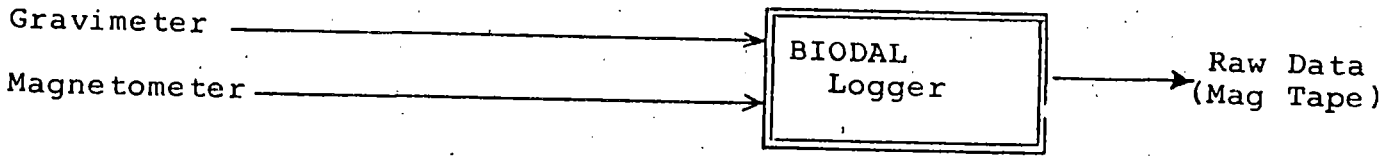
A sheet at a scale of 1:1,000,000 will be submitted for GEBCO requirements. Additional GEBCO sheets covering the voyage to and from Senegal will be submitted at a later date.



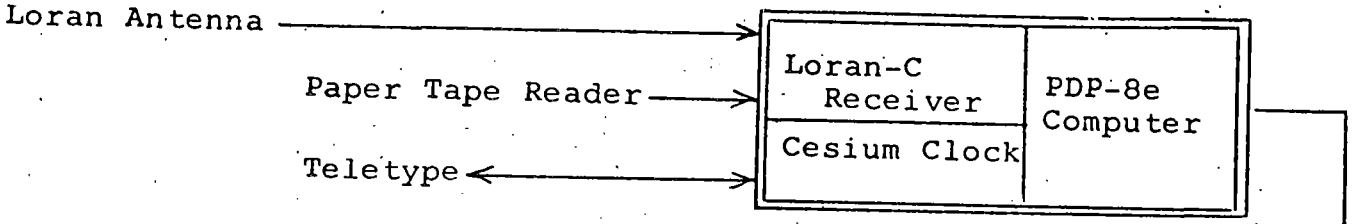
Part of a plot at 1:300,000 of the soundings obtained by CSS Baffin in the Senegal offshore survey area. Depths are shown in metres.

Senegal Offshore Survey, Data Logging and Positioning Systems

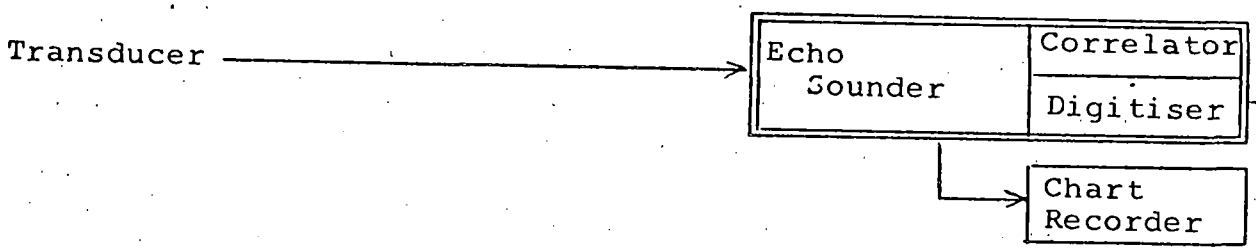
Geophysical Data System



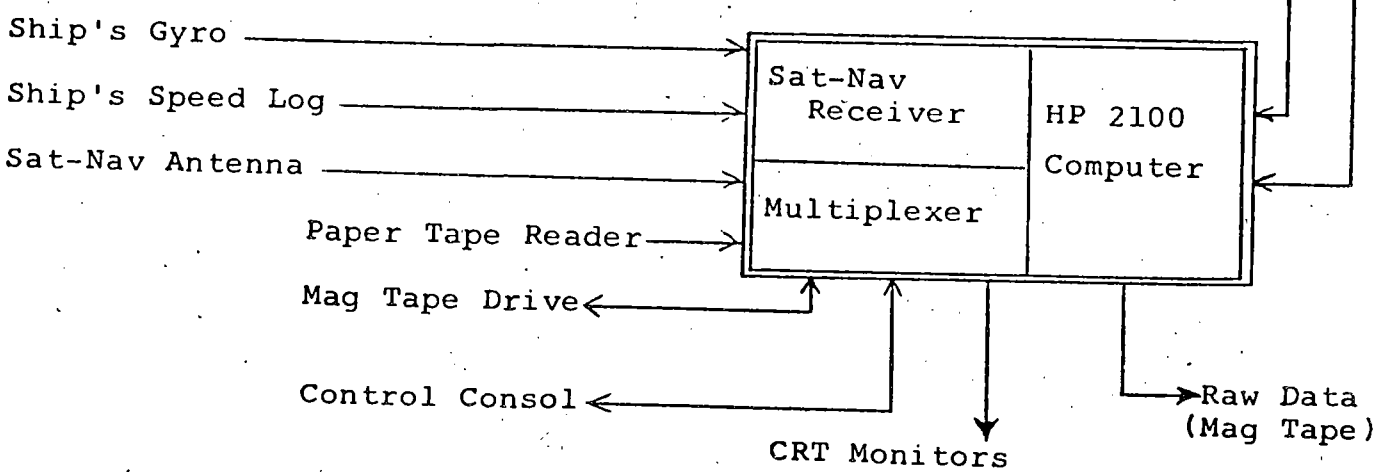
Loran-C Positioning System



Depth Sounder System



Integrated Navigation System



GEOPHYSICS

This program was under the direction of Dr. W. van der Linden. The objective was to provide data on the earth's magnetic and gravity field to assist the Senegalese and Gambian Governments in assessing the resource potential of their continental margin and to permit them to correlate the results of geophysical and geological surveys carried out by oil companies under license to them.

Gravity and magnetometer data was gathered on a continuous basis over the entire survey area. In addition, a 40 cu. inch air gun was operated over selected areas. From March 18-28th, in addition to the air gun, a high resolution deep towed seismic system (Huntec) was towed over the continental shelf areas, to provide information on the structure of the upper few tens of metres.

The area around the Dakar peninsula, the shelf zones north of Dakar and south of Gambia showed accoustically hard bottom with poor or no penetration of signal. The central shelf and the entire upper slope down to about 2000 m provided the best conditions encountered for deploying the Huntec system and showed penetrations into well stratified folded sequences up to about 50 m.

The air gun records showed, in general, a remarkably uniform, well stratified thick sequence of sediments over the whole region.

In the survey area, the gravity field was found to be monotonously flat with the only anomalies over the shelf break, Cayar Seamount, the Dakar Region and the salt domes of Cassamance. In general, the magnetic quiet zone was found to cover most of the survey area.

Gravity and magnetic data were automatically logged on BAFFIN using the BIODAL system. Data was processed on board using an HP-2100 computer.

Data reduction will be carried out by A.G.C. and maps will be produced showing: i) total magnetic field contour

ii) magnetic anomaly contour

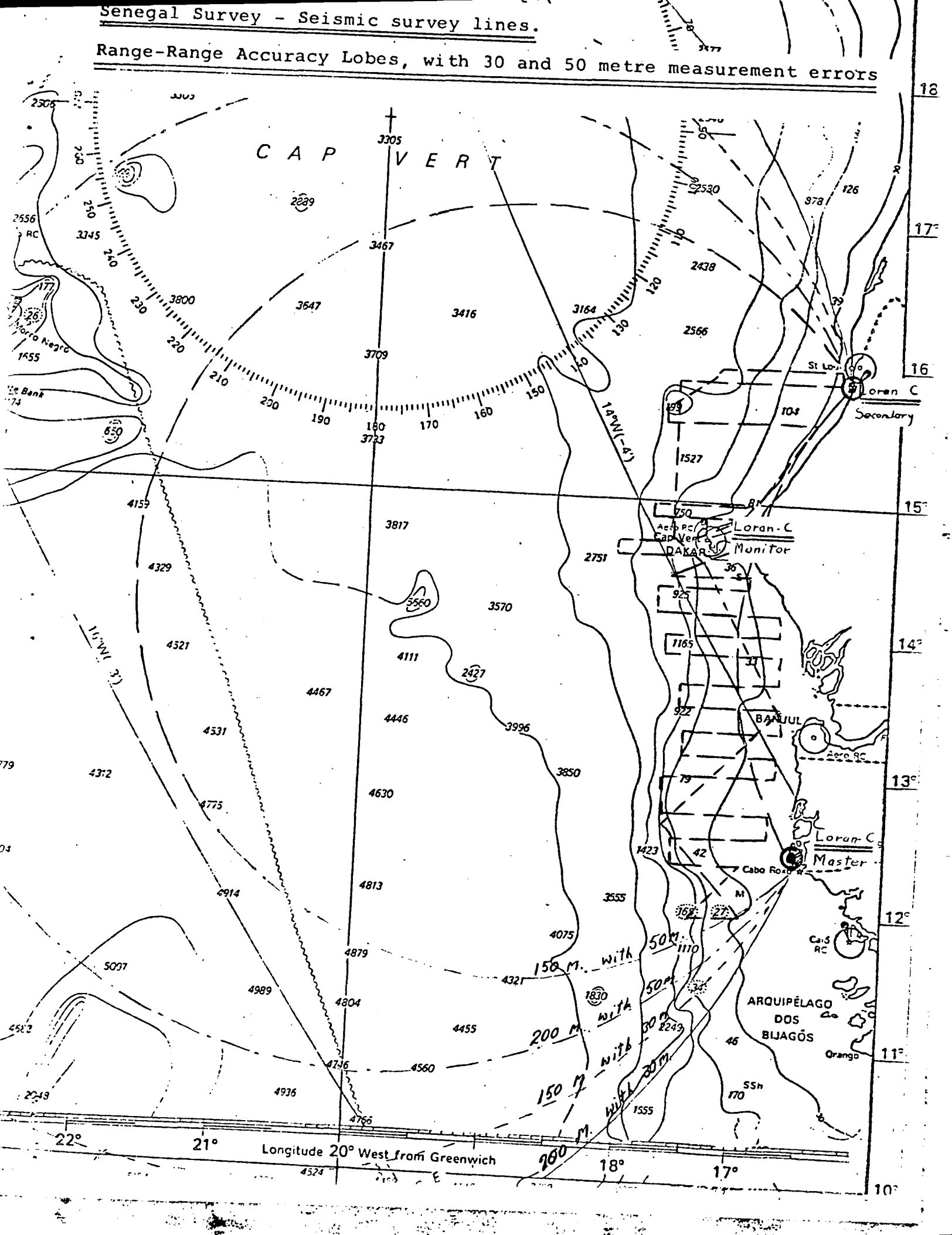
iii) free air gravity anomaly contour

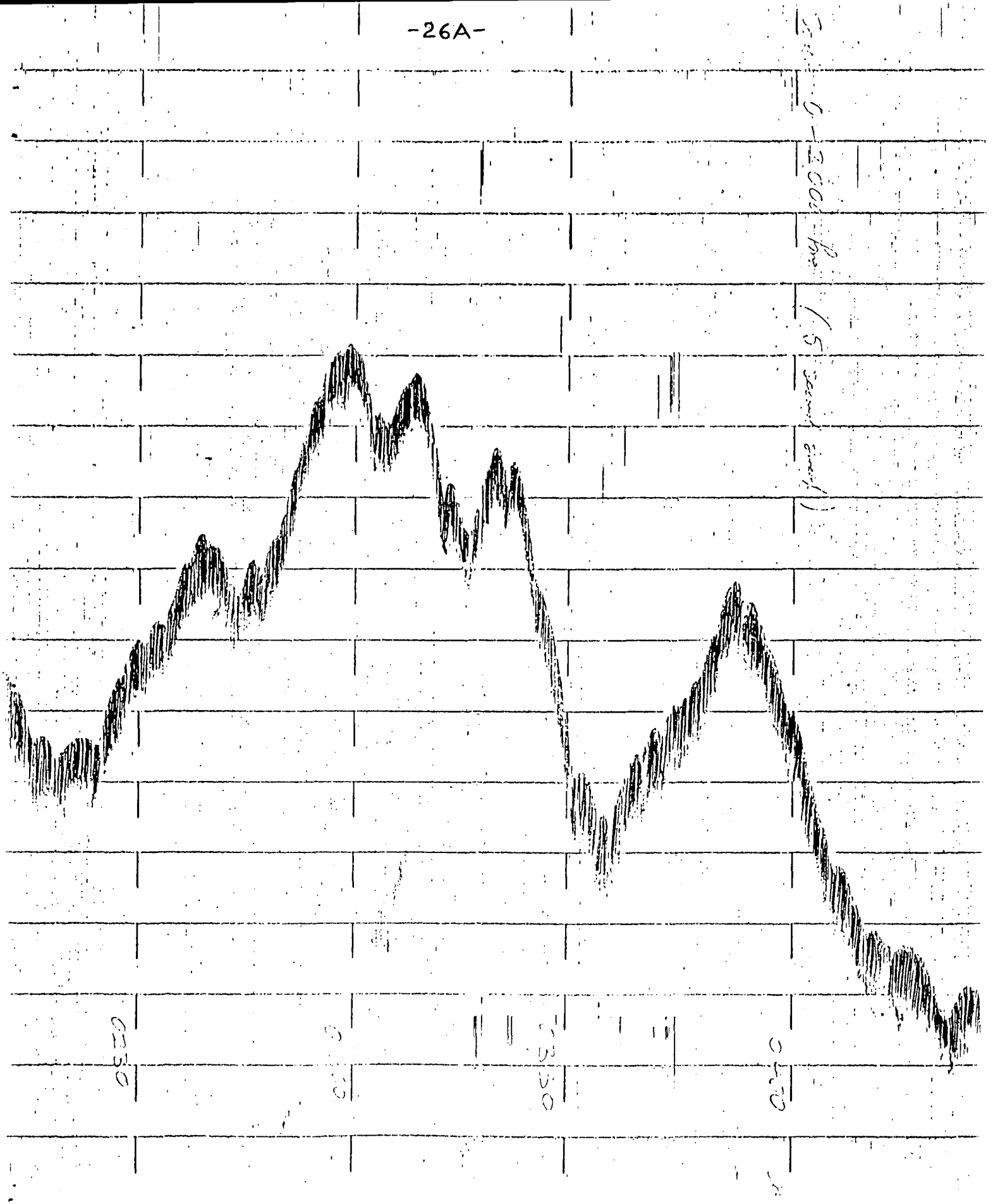
iv) Bouguer gravity anomaly contour

During the return trip to Halifax, we spent 2 days running lines over the Mid Atlantic Ridge in the vicinity of drilling site no. 13. Bathymetry, gravity and magnetic data was collected and we successfully towed a 40 cu. inch air gun at speeds up to 10½ knots.

Senegal Survey - Seismic survey lines.

Range-Range Accuracy Lobes, with 30 and 50 metre measurement errors





Soundings by CSS Baffin over Mid Atlantic Ridge area.
Peak of 2183 m in Lat 36 25 N, Lon 33 24 W.

CHEMICAL OCEANOGRAPHY

Under the guidance of Dr. R. Pocklington, this program was set up to sample the distribution of temperature, salinity, oxygen, dissolved and particulate oil, dissolved and particulate organic matter and oxygen isotope ratios on the Continental Margin of Senegal and Gambia.

During the passage from Halifax to Dakar and return, oil tows and X BT profiles were made on a daily basis.

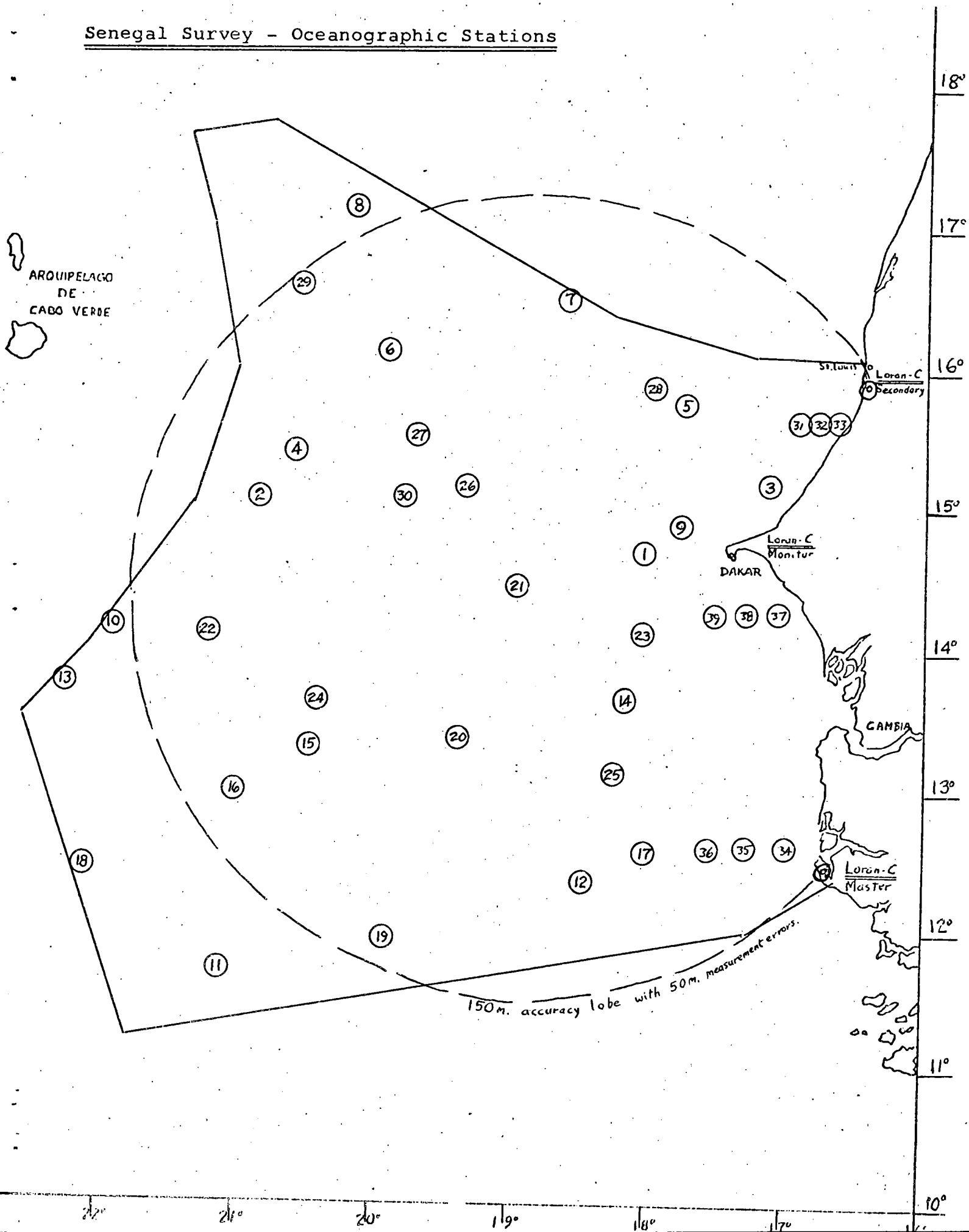
Thirty-nine (39) oceanographic stations were occupied in the survey area from February 11th to March 27th. Station depths ranged from 25 to 4500 metres and time on station varied from 45 minutes to 4 hours.

The analysis for temperature, oxygen concentration, salinity, phosphate and silicate concentrations and particulate C.H.N. were performed on board BAFFIN. Raw data from these analysis was transmitted by W.T. on a regular basis to AOL in a similar format to that of weather observations. Other samples were returned to AOL for analysis at the end of the cruise.

From an initial analysis of data it seems that there is a continuous zone of upwelling water overlying the continental shelf and slope off Senegal and Gambia. The zone of upwelling is much wider south of Cape Vert than to the north with cooler nutrient rich water occuring seaward to a distance of approximately 90 miles from the coast (beyond the 1000 m contour) as opposed to 40 miles in the northern part of the survey area.

A data report complete with maps and charts is presently being prepared by Dr. Pocklington and will be submitted to the Dominion Hydrographer by mid-June, 1976.

Senegal Survey - Oceanographic Stations



ORNITHOLOGY

Dr. R.G.B. Brown of the Canadian Wildlife Service carried out a program of observations from January 26 to March 6, 1976. His observations covered the survey area and has allowed quantitative mapping of sea birds, flying fish and dolphin distributions. A chart of surface temperatures was prepared and the biological distributions were interpreted in terms of the various temperature zones. The importance of the offshore upwelling system to sea birds and other animals was investigated. Surface tows were made for oil particles and plankton and samples were frozen for laboratory analysis.

Dr. Brown will submit a full report on his investigations to the Dominion Hydrographer for inclusion in the final reports to C.I.D.A.

TRAINING

Objectives of the cruise included:

i) to demonstrate the willingness of the Canadian government to transfer the techniques and results of high technology marine sciences to the Governments of Senegal and Gambia.

ii) to provide work experience and training to such officers as may be selected by the Governments of Senegal and Gambia in the conduct of modern multi-parameter surveys and associated programs in physical oceanography.

The advance mission to Senegal and subsequent meetings with Senegalese officials stressed the importance we gave to conducting a training program for up to 4 Senegalese and 2 Gambians.

John O'Shea, CHS Headquarters, was named as Training Officer. In conjunction with AGC and Ocean Chemical Division, he drew up a training program. In order to carry out inshore training, if required, we took two hydrographic launches on BAFFIN. These launches were rigged up for standard surveying and equipped with Edo echo sounders, MF and VHF radios, and radar. In addition, we were equipped with standard survey instruments, including theodolites, sextants, levels, etc.

We were prepared to give instruction (in the French language) in the following fields:

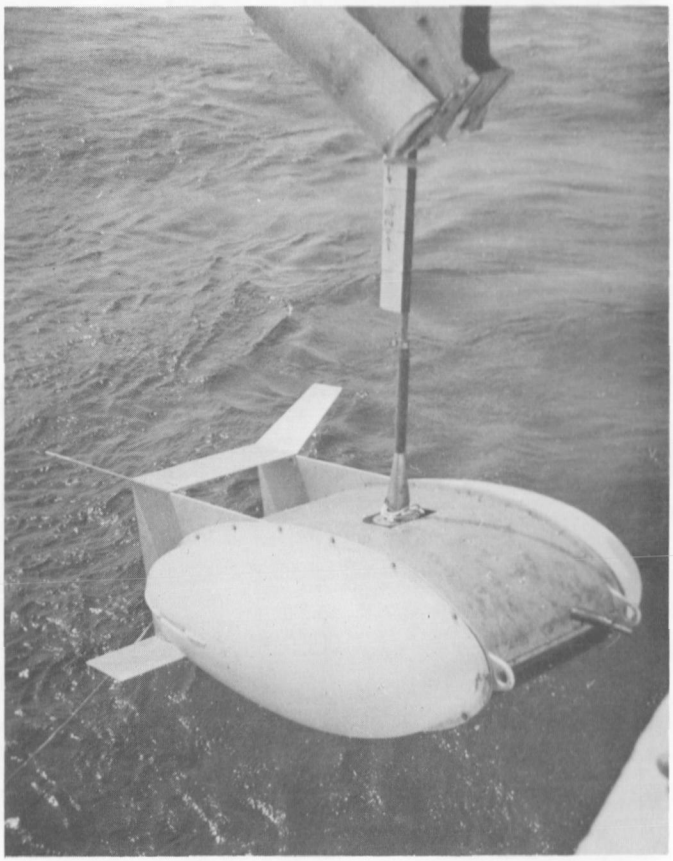
i) Survey General
ii) Hydrography
iii) Tides & Water Levels
iv) Geodesy and Projections
v) Computer Utilization
vi) Radio Aids to Navigation
vii) Geophysics
viii) Oceanography

When BAFFIN arrived in Dakar on February 8th, we were informed by the Canadian Embassy that Senegal had not yet identified any trainees. In fact, it was not until March 18th that M. Matar Seck, from the Senegal Bureau of Mines, joined the cruise. M. Amadou Diaw, a 4th year geography student from the University of Dakar, reported to BAFFIN on March 21st.

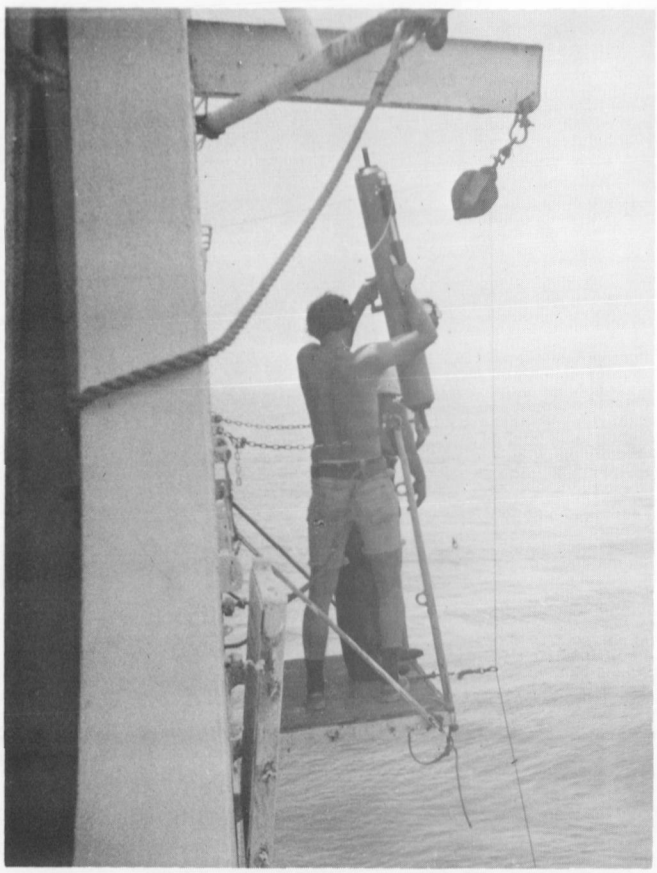
During the final week of the cruise, the two trainees were exposed to all aspects of the BAFFIN operation. They were briefed on the purpose of the mission and spent considerable time observing navigational, seismic and oceanographic operations.

Informal discussions were arranged with the Senior Geophysicst and Senior Oceanographer as well as with Senior Hydrographic staff. Although the time was short, we feel they might have picked up some general knowledge of an offshore multiparameter survey. However, how useful this might be to them in their future careers is open to question. The whole concept of training foreign students during a survey of limited length must be seriously reconsidered so as to avoid our lack of success.

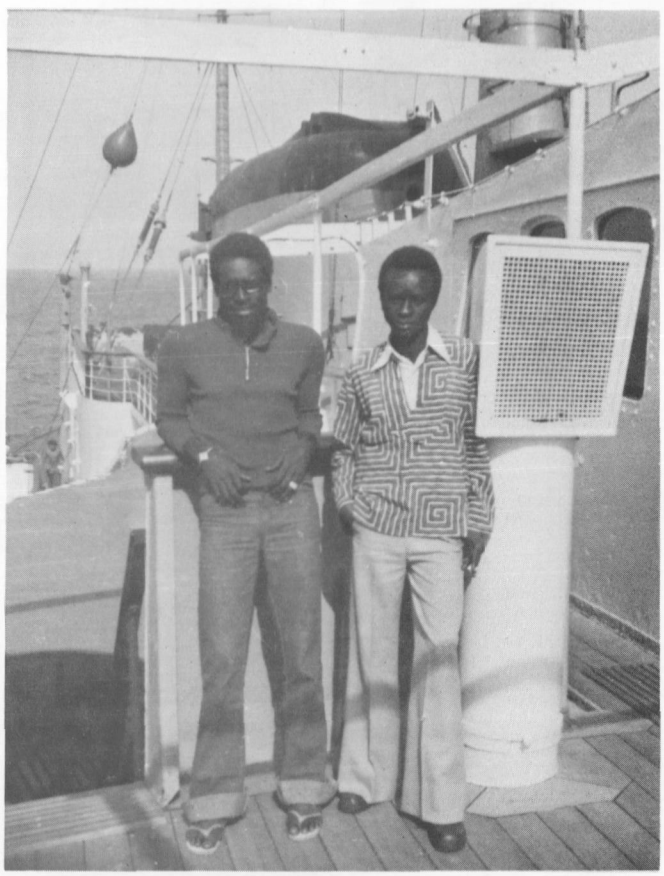
Mr. Malik John of Gambia, who had been invited and who had accepted an invitation to participate in the cruise, had to call off at the last minute because of his official duties.



HUNTEC FISH



OCEAN STATION



TRAINEES

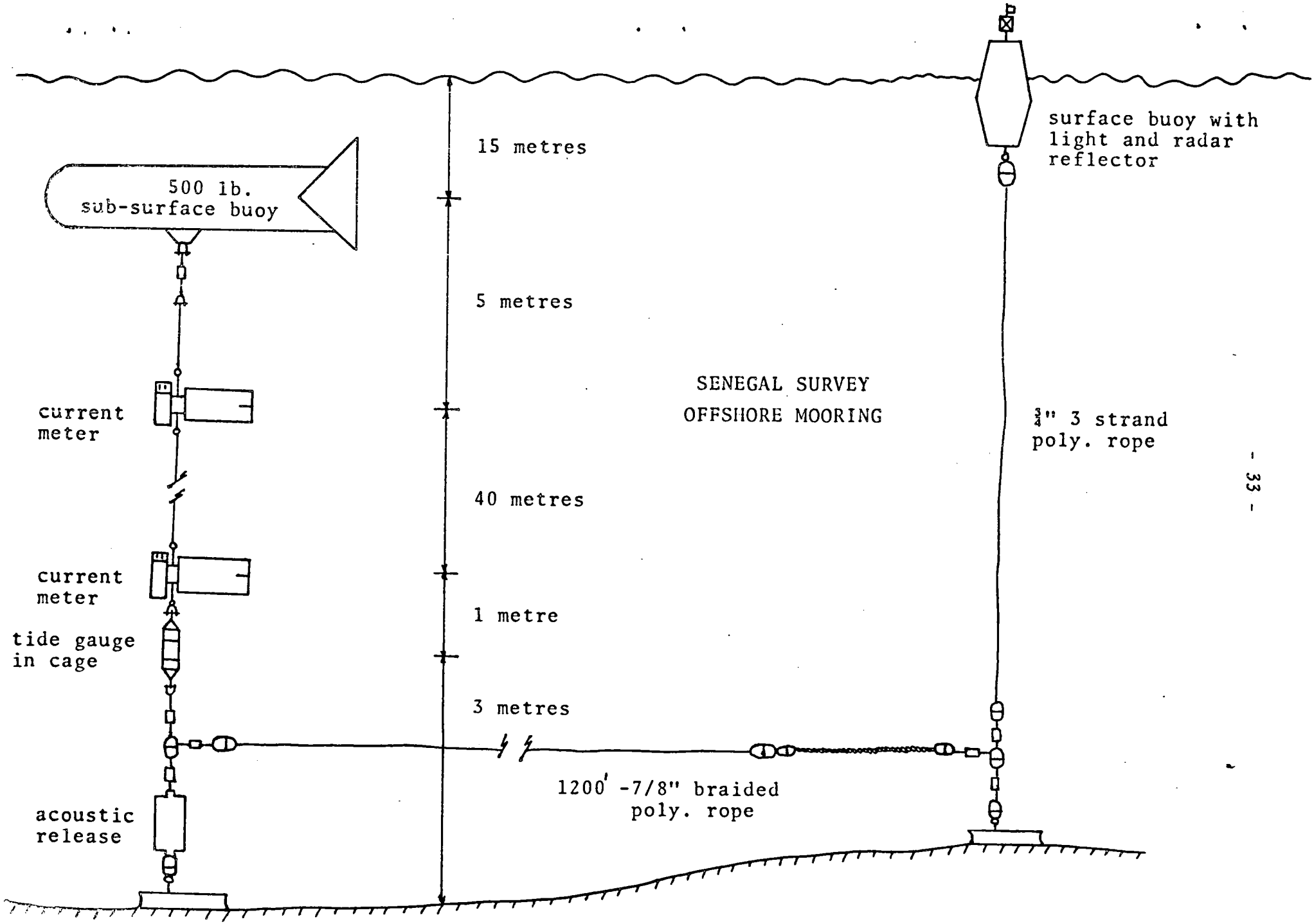
TIDE GAUGES AND CURRENT METERS

The advance mission to Senegal found that the permanent tide gauge at Dakar, originally operated by the French, was no longer in working order and could not be repaired. We established a standard C.H.S. Ottboro gauge at the Naval Base in Senegal. At the end of the cruise, this gauge was handed over to the Commandant of the Senegalese Navy. A junior naval officer was given training in the operation and maintenance of the gauge.

On February 8th, we laid a standard U-shaped mooring with two (2) Aanderaa current meters and one (1) Aanderaa tide gauge in 210 feet of water, about 30 miles south of Dakar. This mooring was recovered on March 27th. As the surface buoy was missing, presumably cut adrift by a passing ship, we had to trigger the acoustic release.

Both current meters were still working and seemed in good shape. The tide gauge had stopped and may only have worked for a couple of weeks. Hardware from the mooring was in excellent shape except for two (2) nicropress sleeves which showed extreme deterioration.

Data from these instruments will be worked up by the Tidal Section at Central Region and will be submitted to the Dominion Hydrographer for inclusion with the final reports to C.I.D.A.


surface buoy with light and radar reflector
15 metres
500 lb. sub-surface buoy
5 metres
SENEGAL SURVEY
OFFSHORE MOORING
current meter
¾" 3 strand poly. rope
40 metres
current meter
1 metre
tide gauge in cage
3 metres
1200' -7/8" braided poly. rope
acoustic release

HORIZONTAL CONTROL

Geodetic Survey of Canada agreed to send a team to Senegal to position the Loran-C towers using their portable Doppler Satellite receivers.

On March 5th, Vern Doucette and two assistants arrived in Dakar from Ottawa. During the following 10 days, they occupied Doppler stations close to the Loran-C towers at St. Louis and Cap Skirring and at the Monitor station in Dakar. Because the towers were "live", they had to occupy stations about 75 metres from the bases. The tower at Cap Skirring was tied into the Doppler station by azimuth and distance.

On March 29th, hydrographic personnel from BAFFIN flew to St. Louis by helicopter and tied in this tower to the doppler station by sun azimuth and measured distance.

Positions and descriptions of the towers and reference markers will be included in the final report to C.I.D.A.

HELICOPTER

A Jet Ranger helicopter was carried on BAFFIN throughout the cruise for the following reasons:

a) in case of major component failure at the Loran-C shore stations, the helicopter could quickly fly in spare parts;

b) transfer personnel from ship/shore so that BAFFIN need not waste time going alongside;

c) to help in positioning the Loran-C tower at St. Louis; and,

d) to show the flag; it was important to have as "large" a Canadian presence as possible.

As things turned out, we flew the helicopter for 16 hours during the trip. Although this was only a small number of hours, the helicopter actually saved three (3) days of survey time.

BAFFIN

BAFFIN proved an excellent vessel for the survey. The Master, Officers and Crew gave exceptional support and their interest and co-operation contributed directly to our success. Food on board was of a very high standard and our accommodations were well maintained. As we spent 73 days at sea out of a survey time of 80 days, the importance of the above items can not be over-emphasized.

As with other large vessels with flush mounted sounder transducers, we had some difficulty digitizing soundings. The analogue sounding records were fairly good all the time. However, as soon as BAFFIN began to pitch and roll, the quality of the digitized soundings began to deteriorate. We found that by having the flume tanks in operation we could get better results. We also found that in deep water, in moderate sea conditions, we got better results when steaming at 11½-12 knots. At slower speeds - 10 knots or less - under the same weather conditions, BAFFIN seemed to wallow and we recorded many bad depths due to aeration. In good weather, we obtained excellent data in depths of 2600 fathoms.

WEATHER

Weather conditions during the survey, although not ideal, did not cause any disruption of our program. Available literature led us to expect northeast trade winds of about 15-20 knots. Except for two days, we consistently experienced winds from north by west to northnortheast at speeds of between 25 and 30 knots. The resultant northerly swells caused BAFFIN to roll, heavily at times, as most of our lines were run in an east-west direction.

On one occasion (100 miles off shore) we passed through a sand storm. We estimated that 0.7 tons of Sahara red sand landed on our upperworks. Only a trace of rain was experienced from February 1st to April 1st.

Weather observations were made every six hours by the ship's officers and transmitted to Dakar Radio.

G.E.B.C.O.

During the passage from Halifax to Dakar and return, bathymetry was collected for inclusion on the various G.E.B.C.O. sheets. Depths recorded confirmed existing information except in position Lat. 25°48'N, Long 26°09'W where we found a depth of 1722 metres which was several hundred metres shallower than shown on the existing G.E.B.C.O. sheet. Two (2) reported shoals off the south coast of Senegal were sought without success. We towed a 40 in. air gun over the reported positions but the seismic record gave no indication of any shoaling.

Seamount found by CSS Baffin in Lat 25 48 N, Lon 26 09 W.
Peak of 1722 m (possible side echo of 1540 m) in depths of 5200 m.

EQUIPMENT

BAFFIN was equipped with a vast range of electronic equipment, including:

a) satellite navigation system
b) Loran-C positioning system
c) data logging systems
d) PDP-8 and HP2100 computers plus peripherals
e) deep sea echo sounding system
f) deep towed seismic system
g) magnetometers
h) gravimeter

Despite the variety and complexity of the equipment, we had no major breakdown. We recorded no downtime of survey activities due to electronic or mechanical failure. A great deal of the credit for this must go to the technicians from Central Region and A.O.L. who installed the equipment and maintained it throughout the cruise.

On a non-continuing type of survey such as the Senegal cruise, it is vitally important to carry a sufficient amount of spares. This may add to the initial expense of the survey but is well worth it when faced with completing a project within a given number of days.

MISCELLANEOUS NOTES

Staff members had complete medicals before the start of the cruise. On the advice of Health and Welfare, immunization was given against smallpox, polio T.A.B.T., yellow fever and cholera. In addition, anti-malaria pills were issued to all on board BAFFIN.

To facilitate travel for those joining the ship in Dakar and in case of an emergency flight back to Canada, all staff were issued with Departmental Special Passports. No trouble was experienced travelling in or out of Senegal.

Co-operation from the Canadian Embassy in Dakar was excellent. Everyone from the Ambassador down, seemed genuinely interested in our project and more than willing to help in any way possible.

On March 10th, great excitement was generated on BAFFIN when a bright comet was "discovered" by the morning '4-8' watch. On subsequent mornings, half the ship's company seemed to be on the upper deck gazing skyward. In our enthusiasm, we sent off a message to the Smithsonian Astrophysical Observatory documenting our find. Much to our disappointment, however, we discovered much later from an old newspaper, that our comet actually belonged to someone else. In fact, we seemed to be the only people who didn't know about it. Suffice to say, it was a magnificent sight.

T.V., radio and newspaper interviews were held on board BAFFIN with reporters from Dakar. John O'Shea carried off a T.V. interview in French with great aplomb. We ended up with a 5 minute spot on Dakar television and a few paragraphs in the local newspapers.

On March 6th, while in Dakar, BAFFIN played host for a cocktail party with over 100 guests. Many Senegalese officials, the Canadian Ambassador to Senegal, Embassy Staff, Officers from a visiting Nigerian warship and many others attended. Tours of the ship were arranged and the ship's crew seemed to relish their role as unofficial ambassadors from Canada.

Of four (4) large passenger ships we saw in and around Dakar, three (3) were Russian. In addition, there were dozens of Russian trawlers in Senegal waters; many were using Dakar for drydocking, recreation and for changing crews. About the only type of Russian ship we didn't see was an oil tanker.

CONCLUSIONS AND RECOMMENDATIONS

All the objectives of the cruise, with the exception of the training program, were met. Although perhaps not operationally desirable, we found that it is possible to run an ongoing underway program (bathymetry, etc.) in conjunction with an on station program. With understanding between the different disciplines, a great deal of data can be gathered.

It was disappointing when the training program failed to materialize. I believe we didn't give the Senegalese enough time to react to our proposals. I'm not sure how, but better planning in this area is required for future projects.

From the time we got the go-ahead for the survey until BAFFIN sailed from Halifax was just over 3½ months. This was a pretty tight schedule and did not allow for even minor disasters, especially as BAFFIN was due for a two month refit. A five month lead time for operational planning should be the target.

It is imperative that complete agreement on the program be reached among the different participating agencies. All objectives should be clearly identified before the survey begins. Greater consideration should be given to the question of who should produce and in what format, the final charts, maps and data reports. This type of survey tends to become an "extra", and at the end of the cruise many participants quickly get reinvolved in their regular duties with consequently little time to work up their data. I think the Dominion Hydrographer's Office can play an important role in this area by assembling a final data package for presentation to C.I.D.A.

ACKNOWLEDGEMENTS

A project of this size and complexity could not be organized and carried out in such a short time without the help and co-operation of a great many people.

I should like to thank the various groups at A.O.L., A.G.C., Headquarters and Central Region who provided assistance and advice.

Captain R. Gould, the officers and crew of the BAFFIN gave excellent support to the survey and their interest and co-operation contributed directly to our success.

Finally, my thanks to all the survey staff on BAFFIN, who, although representing different agencies and interested in a variety of disciplines, worked well together towards the successful conclusion of the cruise.

R. Marshall
Hydrographer-in-Charge
Senegal Survey
Burlington, May 18, 1976

APPENDIX A

- STATISTICS -

STATISTICS *SENEGAL SURVEY* *JANUARY 27 - APRIL 14, 1976*

	N. Miles	Kilometres
Total Steamed		
* Bathymetry	15,904	29,454
* Gravity	15,426	28,568
* Magnetics	15,426	28,568
Air Gun	4,190	7,760
Deep Towed Seismic Profiler	1,200	2,222
Ocean Stations	39	
Depths sampled	492	
Total samples taken	4,468	
Oil tows	77	
X B'ts	75	

* - in survey area 9600 n. miles 17,779 kilometres

Total operational days - Jan. 26 - April 14, inclusive	80
Days in port - Dakar	7

APPENDIX B

- LIST OF MAJOR EQUIPMENT -

MAJOR EQUIPMENT

SHIP

CSS BAFFIN - operated by Ship Branch, D.O.E.

gross tonnage	- 3460
length O/A	- 285 feet
draft	- 18½ feet
speed	- 10½ knots
compliment	- 90

HELICOPTER

one Jet Ranger

NAVIGATION

1 Magnavox Integrated Satellite Navigation System with inputs from Loran-C, ship's gyro plus spare HP2100 computer

1 Austron 5000 Loran-C receiver and spare PDP-8/e computer and spare HP 506 Cesium beam frequency standard

BATHYMETRY

2 Raytheon Universal Graphic Recorder

2 PTR-105 transceiver

1 Correlation echo sounder processor (C.E.S.P.)

1 Precision depth digitizer (P.D.D.)

GRAVITY

1 Askania gravity meter and recorder

1 Anschutz gravity platform

MAGNETICS

1 Barringer magnetometer system
3 Magnetometer fish
1 Magnetometer winch

DATA LOGGING

1 Biodal logging system with paper punch and mag. tape recorders

SEISMIC

1 K-98 Rix compressor
1 BI-44 Rix compressor
2 Model 1500 Bolt air guns
3 Model 600B Bolt air guns
1 Huntec Hydrosonde Deep Towed Seismic System
2 Seismic Engineering hydrophone eels

OCEANOGRAPHIC

1 C.H.N. analyser
1 Autosale salinometer
1 Beckman Spectrophotometer
2 Expendable B.T. launchers
30 Niskin bottles (12 l)
2 oil tow rigs
24 reversing thermometer mounts
1 oxygen titration rig
1 oil extraction rig

DATA PROCESSING

1 Interdata Computer - Model 70 - 64K bytes - 2 disc/2 tape drives
1 H.P. 2100 Computer - 2 tape drives - 1 disc drive
2 Calcomp drum plotters

APPENDIX C

- PRESS RELEASES -

COMMUNIQUE (issued by Canadian Embassy 7/2/76 to Senegal news media

Coopération canado-sénégalaise

Le "Baffin", l'un des principaux navires de recherche océanographique du Canada arrivera à Dakar le 8 février et croisera aux larges des côtes sénégalaises pendant les mois de février et mars.

Le Canada et le Sénégal ont en effet convenu d'un programme de recherche visant à doter le Sénégal de cartes bathymétriques et topographiques de ses fonds marins. Dans le cadre de ce programme le Baffin effectuera divers relevés hydrographiques au cours desquels il recueillera des données sur la géologie superficielle, le magnétisme et le champ de gravité terrestre. Les données recueillies permettront au Sénégal de mieux évaluer les ressources potentielles de sa marge continentale et ainsi de contrôler les résultats des recherches géophysiques et géologiques entreprises soit par des sociétés publiques ou par des sociétés privées en territoire marin sénégalais. Trois Sénégalais se verront offrir la possibilité de participer à titre de stagiaires aux opérations de cette mission scientifique.

D'une longueur de 95 mètres, déplaçant 3,700 tonnes, avec un équipage de soixante-dix hommes le "Baffin" est mû par deux hélices qu'entraînent des moteurs diesels. Capable d'une entière autonomie pour la durée d'une saison de travaux dans l'Arctique, il possède un rayon d'action de 14,000 milles marins sans ravitaillement. Bien que renforcé contre les glaces et suffisamment puissant pour évoluer facilement dans les eaux de l'Arctique, le Baffin a aussi participé à des levés hydrographiques de vastes secteurs des grands bancs de pêche de la côte est du Canada ainsi que dans les eaux tropicales de la mer des Antilles. Il est doté des instruments de navigation les plus récents, y compris des radars et écho-sondeurs de grande précision, des appareils de radionavigation à courte et longue portée, et de deux ordinateurs. Il possède en outre une grande chambre de cartes très moderne, une salle de construction graphique, un laboratoire photographique et un laboratoire océanographique. Le Baffin est secondé dans ses travaux par un hélicoptère qui a sa base sur le pont arrière.

Afin d'effectuer ce relevé océanographique deux tours de signalisation de position, hautes de 100 mètres, furent élevées à Gandiole et à Diembering par des techniciens canadiens arrivés au Sénégal le 6 janvier dernier. De concert avec un système de navigation par satellite, ces tours permettront au Baffin de déterminer par triangulation sa position exacte.

PAGE I

9/02/76

Dakar Newspaper.

Navire canadien de recherche océanographe

LE BAFFIN

mouille dans le port de Dakar

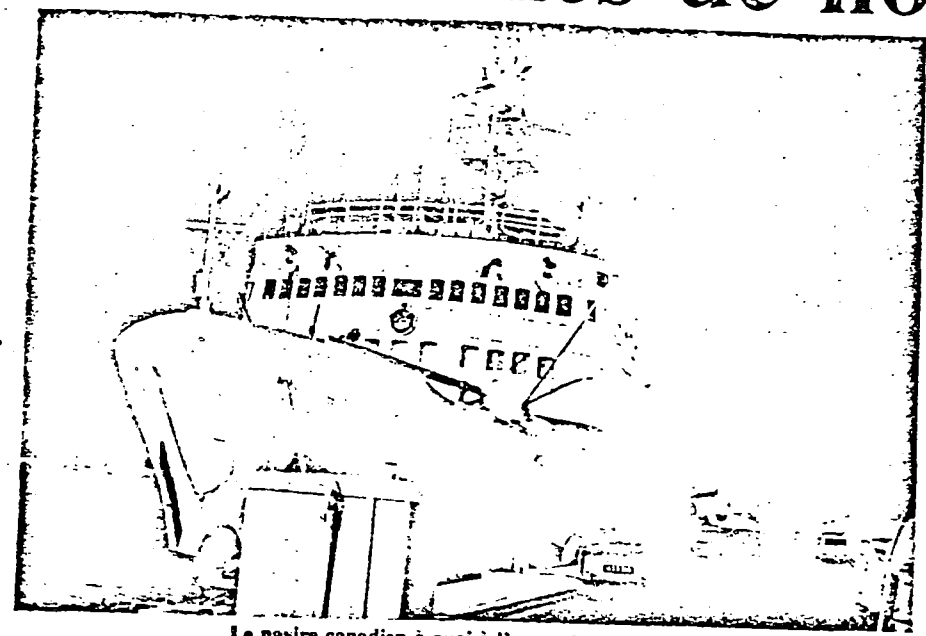
DAKAR, (AFP) - Le «Baffin» l'un des principaux navires de recherche océanographique du Canada, est arrivé à Dakar hier dimanche et croisera au large des côtes sénégalaises pendant les mois de février et mars.

Le Canada et le Sénégal ont, en effet, convenu d'un programme de recherche visant à doter le Sénégal de cartes bathymétriques et topographiques de ses fonds marins. Dans le cadre de ce programme, le «Baffin» effectuera divers relevés hydrographiques au cours desquelles il recueillera des données sur la géologie superficielle, le magnétisme et le champ de gravité terrestre. Ces données permettront au Sénégal de mieux évaluer les ressources potentielles de sa marge continentale, et ainsi de contrôler les résultats des recherches géophysiques et géologiques entreprises soit par des sociétés publiques, soit par des sociétés privées, en territoire marin sénégalais. Trois Sénégalais se verront offrir la possibilité de participer à titre de stagiaires aux opérations de cette mission scientifique.

Le «Baffin» va faire l'inventaire des richesses naturelles de nos côtes

Nous avons visité le «Baffin», un navire hydrographique canadien qui vient travailler dans nos eaux et qui est présentement à quai à l'Arsenal. Ce navire est considéré comme «l'un des plus modernes du monde» en matière de levées et de recherches hydrographiques. C'est à MM. Gabriel Lussard, de l'ambassade diplomatique du Canada, John O'Shea, hydrographe par ailleurs chargé de l'étude d'un projet de formation de spécialistes sénégalais et Marshall, hydrographe en chef qu'il reviendra de nous recevoir amicalement à bord.

Nous avons déjà signalé l'arrivée de ce navire de recherches. Nos interlocuteurs nous feront la genèse des faits qui ont conduit à la présente mission du «Baffin». Tous faits qui soulignent l'excellence des rapports de coopération qui existent entre notre pays et le Canada.



Le navire canadien à quai à l'arsenal de Dakar

Cartes de fonds

En effet, il faut remonter aux différentes conférences internationales sur le droit de la mer, et notamment celles de Caracas et de Genève, pour bien comprendre comment le navire-hydrographe est là. Une parfaite entente entre experts sénégalais et canadien après ces conférences a conduit à la venue à Dakar d'une mission composée notamment de MM. Lapointe, Leneau et Crosby, tous responsables à un très haut niveau dans le secteur des services canadiens s'occupant de pêches et d'océanographie. M. Crosby, pour sa part, est de réputation mondiale et bien connu sur le plan mondial comme spécialiste de travaux servant à définir le plateau continental.

Cette mission canadienne a alors rencontré des experts sénégalais, notamment MM. Cissé, ambassadeur qui dirigeait à Genève la délégation sénégalaise, Doudou Diop et Sylla, des Affaires étrangères, le Lt. Guèye, etc....

D'un entretien que ces experts auront avec le Premier ministre M. Abdou Diouf, il ressortira le constat de la nécessité pour le Sénégal d'avoir des cartes des fonds marins au dessus de ses eaux territoriales.

La mission canadienne soumettra la requête à Ottawa qui n'a pas hésité à donner son accord. Accord qui, du reste, va se concrétiser par une autre mission arrivée au Sénégal en août 1975 et qui comprenait déjà M. O'Shea que nous avons retrouvé hier. C'est sur leur rapport aux autorités canadiennes que va être définie la mission précise du «Baffin».

Ce sera d'abord les cartes de nos fonds marins, cartes d'une utilisation certaines d'autant qu'elles vont être faites essentiellement pour compléter les données existantes dans ce domaine. Il s'agira aussi de répertorier de la façon la plus exhaustive possible toutes les richesses naturelles que recèlent nos fonds tout comme on se penchera sur les mouvements des courants, du plancton, des poissons et même sur les migrations des oiseaux marins, en rapport direct avec le déplacement du poisson. D'ailleurs un orthinologue est attaché à la mission canadienne et il profitera de l'occasion pour s'intéresser au Parc de Djoudj où l'on sait qu'il y a une extraordinaire concentration d'oiseaux -ce qui, soit dit entre parenthèses, nous attire et continuera à nous attirer d'inombrables touristes.

Différentes autres missions, plus techniques reviendront pour préparer le terrain. Aujourd'hui tout est en place. Il y a notamment deux tours de signalisation, haute chacune de 100 mètres, l'une aux environs de Saint-Louis, non loin de Gandiol, l'autre à Diembéring en Casamance. Elles permettent au navire hydrographe de pouvoir, à chaque instant, déterminer sa position avec une rigueur admirable. Le navire est par ailleurs en rapport avec certains satellites pour le même motif. Les deux systèmes combinés, lui permettront de connaître sa position à 200 mètres près sur 400 km de route. Ceci se passe de commentaire !

Ce qu'il faut surtout retenir est que les tours ont été construites et equipées dans un délai extrêmement court. Les techniciens canadiens qui en étaient charges sont arrivés au Sénégal en janvier et ils sont déjà repartis laissant des tours opérationnelles. C'est tout dire.

L'électronique est pleinement mise à contribution pour que le travail du «Baffin» se fasse rapidement et sans bavure. Rapidement et c'est encore là un signe des bons rapports qui existent entre le Sénégal et le Canada-parce que le «Baffin» est par définition «conçu spécialement pour résister aux conditions rigoureuses de l'Arctique» dans lequel il travaille d'ordinaire et où il a effectué nombre de missions importantes depuis sa construction qui date de 1956.

En ce moment, au Canada, c'est le plein hiver et les eaux de l'Arctique sont prises par les glaces. C'est donc l'époque habituelle pour le «Baffin» des réparations à quai. Mais, cette année, pour qu'elle puisse effectuer sa mission sénégalaise, la remise en ordre a été menée tambour battant. Le navire n'en devra pas moins être de retour au Canada pour la mi-avril.

A l'avant-garde

L'essentiel est que d'ici là il aura fait de l'excellent travail sur nos côtes. Nous en sommes persuadé après avoir visité ses différentes installations techniques - bourrées d'instruments électroniques sophistiqués mais tous à la pointe du progrès dans ce domaine. Le système général de repérage -en liaison avec les tours, nous a été donné comme absolument d'avant-garde qui n'aurait que deux ans d'existence. Il n'y aurait à ce jour que huit ou neuf tours du même genre dans le monde.

Demain si par exemple une compagnie pétrolière prenait contact avec les autorités sénégalaises pour un permis de recherches off shore, les bases d'un travail plus approfondi existeraient déjà. Mais il ne faut pas oublier que se sont toutes nos richesses naturelles du fonds de la mer qui sont concernées.

Autre chose à retenir, les cartes des fonds qui vont être établies restent pour partie du domaine international tandis que tout ce qui aura directement trait à nos richesses ne pourra être communiqué à qui que ce soit qu'avec l'autorisation du Sénégal, ou de la Gambie pour la partie qui la concerne directement.

Papa Amet DIOP

"Unofficial" Translation from Dakar Newspaper
February 12, 1976

THE BAFFIN IS GOING TO DO AN INVENTORY OF OUR COASTAL NATURAL RICHES

Yesterday we visited the BAFFIN, a Canadian Hydrographic Ship which has come to work in our waters and is presently at the wharf in the Arsenal.

This ship is considered to be one of the world's most modern in the field of surveys and hydrographic research.

Mr. Gabriel Lessard, of the Canadian Embassy at Dakar, Mr. J. O'Shea, responsible for a training programme for Senegalese specialists and Mr. R. Marshall, Hydrographer-in-Chief, cordially received us on board.

We have already reported on the arrival of this research ship. Our reporters will give us an account of the events which led to the present mission of the BAFFIN. All the events underline the excellence of the terms of co-operation which exist between our country and Canada.

BATHYMETRIC CHARTS

In fact, it is necessary to go back to different international conferences on the Law of the Sea and especially those of Caracas and Geneva to really understand why the hydrographic ship is here. A good understanding between Senegalese and Canadian experts after these conferences led to the arrival in Dakar of a mission comprised notably of Messrs. Lapoint, Lebeau and Crosby, all very high-ranking officials of the Canadian Services involved with fisheries and oceanography. Mr. Crosby has a world wide reputation and is well known on the world scene as a specialist in work aimed at defining the continental shelf.

This Canadian mission met Senegalese experts, notably M. Cisse, the Ambassador who was directing the Senegalese delegation at Geneva, Doudou Diop and Sylla, of Foreign Affairs, Lt. Gueye, etc.....

As a result of a meeting between the experts, and the Prime Minister M. Abdou Diouf, it was realized that Senegal needed to have charts showing depths of its territorial waters.

The Canadian Mission submitted the request to Ottawa who did not hesitate in agreeing. The agreement was made more concrete by another mission which arrived in Senegal in August, 1975 and which included Mr. O'Shea whom we met again yesterday. It was with their report to the Canadian authorities that the precise objectives of the BAFFIN mission were defined.

There will be first, charts showing our marine depths - charts which will be made essentially to complement existing data in this field. There will also be the question of listing in the most thorough manner possible the natural riches which our depths conceal, it will deal with the movement of currents, plankton, fish and even the migrations of sea birds, in direct relation with the movement of fish.

Moreover, an ornithologist is attached to the Canadian mission and he will take advantage of the occasion to visit Parc de Djoudjou where there is an extraordinary concentration of birds which, it may be said, brings us and will continue to bring us numerous tourists.

Various other missions have come to prepare the way. Today all is ready.

Notably, there are 2 signal towers, each 100 metres in height: one outside St. Louis, not far from Gandiole and the other at Diembering in the Casamance. They permit a hydrographic ship to determine, at every instant, its position, with extreme accuracy. The ship, moreover, monitors certain satellites for the same purpose. The combination of the two systems permits it to know its position to 200 metres nearly 400 kms away. This passes all comment. (That's really something!!)

One ought to consider that the towers were built and equipped in a very short time. The Canadian technicians responsible for it, arrived in Senegal in January and they have already left, leaving the towers operational. That says enough.

The electronics are put to full use so that the BAFFIN can work rapidly and without a hitch rapidly, and it is again an indication of the good relations which exist between Senegal and Canada because the BAFFIN is basically designed to resist the rigorous conditions of the Arctic where it works ordinarily and where it has carried out numerous missions since its construction in 1956.

In Canada, at this time, it is mid-winter and the Arctic waters are ice infested. It is, therefore, the usual time for BAFFIN to undergo repairs at dockside. But this year, so that she could carry out the Senegalese mission, the refit was managed very quickly (local expression). The ship will have to return to Canada by mid-April.

The main point is that excellent work will be done of our coast. We are sure of it after our visit to the different technical installations full of sophisticated electronic instruments and all up to date in this field.

The general system of positioning in liaison with the towers has given us as an advanced guard ? absolutely that which has been in existence only two years. There are at this time only 8 or 9 such towers in existence in the world.

Tomorrow, for example, if an oil company contacts Senegalese authorities for an offshore research permit, the base data useful for more detailed study will exist. But one should remember that it is our natural resources from the sea which are affected.

Another thing to remember, the depth charts which will be made, will be part of the international domaine whereas those which will directly affect our wealth cannot be given to anyone except with the approval of the Senegal or Gambia for the part which concerns it directly.

NEW COMET

discovered on Baffin by Mr. Smith & John O'Shea just before sunrise of 10 March.

To see: check area above eastern horizon about 0530 each morning. Will appear as fuzzy, bright star with a tail pointing upward.

Brightest comet seen in last 10 years.

Environment Canada
RADIOCOMMUNICATIONS

MAR 11 1976

GB CSS BAFFIN/CGCL NR 6 CK 95 DHROD LLPD 11 0930GMT

CENTRAL BUREAU FOR ASTRONOMICAL TELEGRAMS SMITHSONIAN ASTROPHYSICAL OBSERVATORY
60 GARDEN STREET CAMBRIDGE MASSUCHUSETTS USA

QUOTE REPORT DISCOVERY BY BRUCE SMITH AND JOHN O SHEA OF BRIGHT COMET AT 0530 GMT OF 1976 MARCH 10 STOP ROUGH POSITION IS 20 HOURS 18 MINUTES AND PLUS 10 DEGREES AT 0600 GMT OF 1976 MARCH 11 STOP MAGNITUDE ABOUT 2 STOP TAIL LENGTH ABOUT 10 DEGREES STOP OBSERVERS AT 13 DEGREES 35 MINUTES NORTH LAT 20 DEGREES 30 MINUTES WEST LONG ON CANADIAN HYDROGRAPHIC SURVEY SHIP BAFFIN UNQUOTE
W P ZUKAUSKAS

R GOULD MASTER CANADIAN HYDROGRAPHIC SURVEY SHIP BAFFIN

NEWS OF COMET

Extract of Halifax Chronicle-Herald of March 3, 1976 (Wednesday).

Smith must mak

LONDON (UPI) — Foreign Secretary James Callaghan said Tuesday Rhodesian Premier Ian Smith must make "the mental leap" of accepting rule by the former colony's black African majority to prevent a bloodbath of whites by blacks.

"If he will only make the mental leap that is necessary, then he can save not only his own reputation but the future of the Europeans," Callaghan said in a statement to parliament.

"But so far there is nothing in his record to indicate he is willing t
said. "L
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Person had to be up early to see comet

NEW YORK (AP) — A new comet came into view from Earth early Monday but to see it a person had to be up an hour before sunrise, before sunlight overwhelmed the comet's image.

It is named Comet West, after its discoverer Richard West. It was visible by looking east, low on the horizon.

Astronomers can't promise how bright it will be, or how long a tail it will have. There's hope it may be the brightest since Comet Bennett in 1970, says Dr. Mark Chartrand of the Hayden Planetarium here.

Monday morning was the first good chance to see Comet West with the naked eye. Today and Wednesday, about an hour before sunrise, should be even better, comet experts say.

It should be visible all over North America, starting low on the horizon, then rising higher, but becoming fainter as it does.

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Halifax, N.S.

NOTICE

PUBLIC MEET

to discuss and receive Briefs
YOUNG PERSONS IN CONFLICT W
(A Report of the Solicitor General
on Proposals for new legis
to replace the Juvenile Delinq