CRUISE REPORT MW8909

R/V Moana Wave

SeaMARC II and Single Channel Seismic Survey of the
Swan Fault Zone, Northern Caribbean

July 26, 1989 through August 26, 1989

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Dr. Gonzalo Cruz, University of Honduras
Dr. Raymond Wright, Petroleum Corporation of Jamaica

INTRODUCTION

The cruise departed aboard the R/V Moana Wave from San Juan, Puerto Rico at 0815 EST on Wednesday, July 26, and arrived in Montego Bay, Jamaica, at 1230 EST on Saturday, August 26. The cruise was extremely successful because of calm weather and no major equipment problems.

The cruise was designated "Swan Islands Transform Survey - MW8909". Because we operated ahead of schedule, we actually mapped areas well to the east of the Swan Island Transform in the vicinity of western Jamaica.

The scientific party included the following:

Dr. Paul Mann, UTIG (Chief Scientist)
Dr. Eric Rosencrantz, UTIG (Co-chief scientist)
Dr. Bernard Mercier de Lépinay, Univ. Nice-Sophia Antipolis (Research Scientist)
Eric Calais, Univ. Nice-Sophia Antipolis (Ph.D. Aspirant)
Stacey A. Tyburski, UT Department of Geological Sciences (M.A. Aspirant)
David DeBalko, UT Department of Geological Sciences (M.A. Aspirant)
David Grote, UT Department of Marine Studies (Ph.D. Aspirant)
Cynthia Goszewski, UT Department of Geological Sciences (Ph.D. Aspirant)
Michael Kozuch, Peace Corps-Honduras (Geophysicist and unofficial observer for Honduran Ministry of Mines and Hydrocarbons)

The HIG SeaMARC party included:

Dr. Thomas Reed, SeaMARC party chief
Joel Erickson, SeaMARC Engineer
Les Kajiwara, Data Technician
Gail Yamada, Data Technician

The HIG technical assistance group (TAG) included:

Mike Simpson, Electronics Technician
Steve Poulos, Programmer
Dave Gravatt, Deck Technician
Wil Hervig, Electronics Technician

The captain was Robert Hayes and the chief engineer was Lew Skelton. The crew was unusually large (11) because additional crewmen were painting and carrying out other maintenance at sea. All cruise participants arrived on time and without incident to Puerto Rico.

This report provides an overview of the scientific objectives of the cruise, some preliminary results, a brief description of geophysical tools used, our evaluation of the ship operation, a plan for working up the data, and a plan to keep the coastal states informed of our results.. Appendices include:

Appendix 1: Summary of cruise statistics

Appendix 2: Description of seismic tapes

Appendix 3: List of data logs and data from MW8909

Appendix 4: EOS abstract and cruise results submitted to Fall AGU meeting

Appendix 5: Cruise narrative

OBJECTIVES

The Northern Caribbean Plate Boundary Zone (NCPBZ) provides a unique arrangement of tectonic and sedimentary problems which are readily solved by combining sidescan reflection, single-channel and multi-channel reflection data. Questions outlined in our original proposal included:

1. How does the large-offset Swan Islands Fault Zone terminate in Central America?
2. How is interplate motion distributed on faults between Jamaica and Honduras?
3. How does the presence of continental versus oceanic basement control style and morphology of strike-slip-related structures within the NCPBZ?
4. Does the Swan Islands Fault Zone exhibit "leaky" features typical of other oceanic transforms?
5. How precisely can the direction of interplate slip and associated stresses be interpreted from observed faults, folds, and fault-related basins within the NCPBZ? Does the orientation of secondary folds and faults suggest the high

shear strength concept of "classic" wrench tectonics or a recently proposed concept of low shear strength strike-slip faults?

Other questions listed below were developed during pre-cruise preparation and after seeing raw data during the cruise:

1. Apparently drowned coral reefs on the Nicaraguan Rise were particularly prominent on the sidescan images; some were observed as deep as 1700m. Was "drowning" accomplished by large-scale eustatic changes in sea level by vertical tectonic movements? Drowned reefs were also observed by Droxler, and others on the Rice University cruise to the Nicaraguan Rise in 1988.
2. Several fault-controlled channels were mapped along the southern edge of the Cayman Trough. What type of faults bound the channels and what is their relation to the Swan Transform? Are these structures similar to onland grabens in Central America, like the Guatemala City graben?
3. Prior to the cruise, we obtained a Seabeam bathymetric map of the Mid-Cayman Spreading Center through Dr. Terry Edgar (USGS). How does sidescan bathymetry compare with Seabeam bathymetry?
4. Fault surveys were conducted in two populated coastal areas with long historical records of destructive earthquakes (Motagua Valley, Guatemala; Montego Bay Jamaica). Can submarine earthquake scarps be confidently identified offshore near these areas and can they be correlated to historical earthquakes?

OPERATIONAL OBJECTIVES

The primary objective of MW8909 was to acquire SeaMARC II sidescan and SCS data from the Swan Islands Fault Zone (Fig. 1). A flowchart showing the operation of the

SeaMARC system is shown in Figure 2. Our final area of sidescan coverage was ~90,000 km^2.

For the SCS work, a small airgun sound source (40 in^3) and a 100 m long streamer were deployed. A flowchart summarizing the SCS source, receiver and processing array is shown in Figure 3. As streamer noise progressively increased near the Swan Islands, we briefly experimented with a 120 in^3 airgun. When the noise problem was identified in the streamer, we went back to the 40 in^3 airgun.

OPERATIONAL RESULTS

A map showing our sidescan and SCS coverage is given as Figure 1. Data gaps in SCS and SeaMARC data are indicated. Appendix 1 ("Cruise Statistics") provides a summary of the amounts of data collected by the various techniques and illustrates the small percentages of downtime for the SCS and SeaMARC system. A complete description of all seismic tapes is given in Appendix 2. Appendix 3 provides an overall inventory of the various kinds of data logs generated during the cruise.

PRELIMINARY SCIENTIFIC RESULTS

1. Distribution of throughgoing strike-slip faults. The Swan Fault Zone was mapped from its intersection with the Mid-Cayman Spreading Center to its entry into the Motagua Valley of Guatemala/Honduras. It is a remarkably linear and continuous fault, in contrast to the segmented eastern end of the Oriente Fault Zone, south of Cuba, as mapped by Mercier de Lépinay, Renard, and Calais during the SeaCarib II cruise south of Cuba in 1987. SeaMARC mapping established its trace to the south of the Swan Islands rather than to the north as proposed by previous workers. Slip is concentrated along the fault except for splaying near the Swan Island restraining bend and near the Motagua Valley. There is no obvious along-strike change in character of the fault as it extends from oceanic-island arc crustal types in the east to continental crustal-types in the west. Because no pull-apart

structures were identified along its trace, the fault is apparently not "leaky" as are many large-offset oceanic transforms. The arcuate and linear trace of the fault suggests that is follows a small circle of rotation about the North America-Caribbean pole of rotation.

A second major fault system ("West Jamaica Fault System") was mapped between the Mid-Cayman Spreading Center and Jamaica. This system appears to be the splayed continuation of the Duanvale-Plantain Garden System of Jamaica. These faults merge in the vicinity of the MCSC and suggest the presence of a FFR triple point at the southern end of the MCSC. Fault splaying, both in the case of the Swan Islands and Jamaica area, may be related to the presence of restraining bend segments, although more work needs to be done to make this correlation with certainty.

2. Termination of the Swan Fault. Sidescan mapping of the Honduran borderland did not reveal active faults between the Swan Fault Zone and prominent lineaments known from satellite imagery of Honduras. This suggests that these faults are largely inactive and do not play a major role in transform fault termination as originally proposed. We plan field studies in January, 1990, in northern Honduras to further explore this question.

3. Stress field along a major strike-slip fault. Sidescan mapping suggests large numbers of oblique folds along the Swan Fault Zone. Based on this observation and the data from the French SeaCarib II cruise in 1987, it appears that folds form at ~30-45° to the fault and then rotate quickly into parallelism with the fault. This supports the model of "classic" wrench tectonics for strike-slip deformation.

SHIP EVALUATION AND SUGGESTIONS

We were impressed with the overall operation of the ship and SeaMARC operation. The crew was friendly and the ship was clean and well maintained. Captain Hayes and the bridge staff did an excellent job of navigating us through often poorly charted waters. The galley staff (Paul Delmacio and Rey Ramos) did an outstanding job of preparing meals and

snacks for the 32-day period. The TAG group was particularly helpful in assisting us with setting-up watchers (only 4 of our 9 scientific party had previous sea experience).

Although the lab areas are spacious, we feel that a few simple refinements could considerably improve the use of this space. These and other suggestions are listed below.

1. The plotting table area could be enlarged and centralized at one location. This could eliminate numerous trips walking back and forth to compare charts.
2. Better lighting is needed above all plotting and work tables.
3. The wet lab could be temporarily modified to better accommodate the needs of a "dry" scientific party. For example, a raised tabletop could make map work easier on the back. Stools would be helpful. Also, insofar as the wet lab is the major thoroughfare to the rear deck, installing a moveable partition could help in reducing the constant disturbance of opening and closing doors.
4. Despite the fact that the SeaMARC rack is temporary, we suggest that it be moved to a more central location out of the passage way and mounted on a pedestal. Moreover, all the small, worn scraps of paper marking switches should be replaced with easier-to-read, permanent labels.
5. Navigation should be plotted automatically using the CALCOMP plotter, which is presently out of order.
6. We were unable to locate any of the "athletic equipment" mentioned on p. 45 of the Ship User's Manual. Exercise bike, rowing machine and weights would have been nice.
7. There was no back-up streamer. We were fortunate that the streamer lasted until the end of the cruise. In the meantime, it was noisy and required frequent maintenance.
8. A detailed list of office supplies available to the oncoming science party would be helpful.

REPORTS TO COASTAL STATES

We operated with permission within the EEZ's of three coastal states: Jamaica, Honduras, and the Cayman Islands. We were granted clearance from all three countries without the condition of having observers on board. A late request from Honduras to put Dr. Arturo Cruz (University of Honduras) and a Honduran naval officer onboard as observers arrived after we had already left Puerto Rico and could not be accommodated. Michael Kozuch, a Peace Corps volunteer working as a geophysicist in the Ministry of Hydrocarbons, served as an unofficial observer from Honduras and has agreed to act as our link to the Ministry of Hydrocarbons and the University of Honduras.

Dr. Raymond Wright of the Petroleum Corporation of Jamaica will be our contact in Jamaica. Dr. Wright had sent us some unpublished bathymetric charts around Jamaica to help with the preparation for the cruise.

We have had no contact with the government of the Cayman Islands.

Our plan for keeping geologists and officials in Honduras and Jamaica up-to-date on our results is as follows:

1. Send the cruise report to the Ministry of Hydrocarbons and to Dr. Arturo Cruz through APO mail to Kozuch. When available send one set of 8 x 10 photographic prints of the SeaMARC mosaics of the Honduran EEZ. All other data described in the cruise report will be available on request.
2. Send the cruise report by regular mail to Dr. Raymond Wright. When available, send one set of 8 x 10 photographic prints of the SeaMARC mosaics of the Jamaican EEZ. All other data described in the cruise report will be available on request. It should be pointed out that our SeaMARC data from Walton Basin area off of western Jamaica have not been processed and mosaiced. This should be ready by January, 1990. When available, we will send these prints to Dr. Wright.

PLAN FOR WORKING UP DATA

We have divided up the data into five categories: 1) structural data from SeaMARC mosaics; 2) sedimentological data from SeaMARC mosaics; 3) SCS data; 4) gravity and magnetics data; and 5) integration of cruise data into existing geologic and geophysical data (especially existing UTIG MCS lines).

Mann will be responsible for categories 1, 2, and 5, while Rosencrantz will be responsible for categories 3, 4, and 5. Several UT graduate students, who played an important role in the success of MW8909, will continue to work on the data which they helped to collect:

1. Stacey Tyburski: Master's thesis on categories 1, 3, and 5.
2. David DeBalko: Master's thesis on categories 2 and 3.
3. David Grote: partial requirements of Ph.D. thesis using category 2.

Theses, abstracts, and papers resulting from this data will be forwarded to the Ministry of Hydrocarbons in Honduras and to Dr. Wright in Jamaica as they become available.

Any requests for additional data or inquiries about the status of data processing should be sent to Paul Mann:

Univesity of Texas Institute for Geophysics
8701 Mopac Boulevard
Austin, TX 78759-8345

Phone: 512-471-0452
Fax: 512-471-8844
Telemail: UTIG.AUSTIN (Omnet)
Telex: 910-874-1380 UTIG AUS

Appendix 1: Summary of Cruise Statistics - MW8909

1. Duration of entire cruise: 31 days, 0 hours, 40 minutes (32 days planned).
2. Total distance covered during cruise: 5922 nm (10,860 km).
3. Duration of SeaMARC II survey: 29 days, 2 hours, 4 minutes (28 days planned).
4. Total distance covered during SeaMARC II survey: 5655 nm (10,372 km).
5. Total area survey by SeaMARC II: 55,772.5 miles^2 (89,753 km^2).
6. Average ship speed during SeaMARC II survey: 8 knots.
7. Time of first deployment of SeaMARC II: July 28, 1989, 2100 GMT.
8. Time of final recovery of SeaMARC II: August 26, 1989, 1130 GMT.
9. Percent of downtime of SeaMARC II system: 0%.
10. Duration of transits during cruise: 2 day, 0 hours, 40 minutes.
11. Total distance covered during transits: 267 nm (488 km).
12. Average ship speed during transits: 10 knots
13. Total distance covered during single channel seismic survey: 3780 nm (7102 km)
14. Amount of planned seismic survey lost because of streamer problem: 163 nm (290 km)
15. Percent of downtime of seismic system: 4% (~20 hours of 535 hours).
16. Survey lines affected by loss of seismic system: 27, 28, 29, and 97.
17. Total distance coverage with magnetometer: 5690 nm (10,435 km).
18. Total distance coverage with gravimeter: 5890 nm (10,800 km).
19. Total distance coverage with 3.5 Khz: 5890 nm (10,800 km).
20. U.S. state whose area most closely matches size of area mapped with SeaMARC II: Wisconsin.

Appendix 2: Description of Seismic Tapes - MW8909

Reel Number	Tape Number	Shotpoint Numbers	Survey Line Number
1	30228	1 - 4805	1 - 2
2	30229	4806 - 9583	2 - 4
3	30230	9584 - 12646	4 - 5
4	30231	12647 - 17479	5 - 6
5	30232	17480 - 22285	6 - 8
6	30233	22286 - 27107	8 - 12
7	30234	27108 - 31907	12
8	30235	31908 - 36748	1 - 14
9	30236	36749 - 41542	14 - 15
10	30237	41550 - 51204	15 - 17
11	30238	46350 - 51204	17 - 20
12	30239	51205 - 56012	20 - 21
13	30240	56013 - 60858	22
14	30241	60859 - 65690	21 - 22
15	30242	65691 - 69557	22 - 23
16	*30243	69558 - 70255	23 - 25
17	30244	70255 - 76361	25
18	30245	76362 - 82560	25 - Transit
19	30246	82561 - 88709	Transit - 34
20	30247	88710 - 94158	34 - 36
21	30248	94159 - 100292	36 - 37
22	30249	100319 - 100643	37 - 39
23	30250	100644 - 111490	39 - 41
24	30251	111491 - 117573	41 - 42
25	+30252	1 - 6133	42 - 44

(Continued on next page.)

*At shotpoint number 69711 on tape 30243, the records were changed from 4 second records to 3 second records.

+Shotpoint numbers were reset at the beginning of this tape, 30252, because shotpoint numbers were too large to be fully displayed on screen.

Appendix 2: Description of Seismic Tapes - MW8909, continued

Reel Number	Tape Number	Shotpoint Numbers	Survey Line Number
26	30253	6134 - 12267	45 - 46
27	30254	12315 - 18400	46 - 49
28	30255	18401 - 24533	49 - 53
29	30256	24534 - 30667	53 - 56
30	30257	30668 - 34007	57 - 59
31	30258	34019 - 40151	59 - 62
32	30259	40152 - 46292	62 - 68
33	30260	46292 - 50316	68 - 73
34	30261	50318 - 56456	73 - 77
35	30262	56457 - 58870	78 - 80
36	30263	58871 - 60776	80 - 82
37	30264	60777 - 64727	97

Appendix 3: List of Data Logs and Data from MW8909

1. UTIG Lab Notebook (Preliminary geologic interpretations, rationale for waypoint selection, description of major equipment problems, etc.) UTIG has the only copy. The cruise narrative (Appendix 4) was abstracted from this notebook and the A-log.

2. Electronics Lab Watch Notebook ("A-log") (Course changes, Transit satellite fixes, wind direction and speed, gyro direction, gravity, magnetics, water depth, description of major events.) HIG and UTIG have copies. The cruise statistics (Appendix 3) was abstracted from this notebook. Paper copies of 3.5 bathymetry were shipped to HIG following the cruise to be microfilmed and archived. The paper copies will then be returned to UTIG.

3. Notebook with SeaMARC sonograph and corresponding SeaMARC color bathymetry (2 volumes) HIG and UTIG have copies. SeaMARC tapes are stored at HIG; one tape was taken to UTIG as a sample.

4. Log of single channel seismic data (Tape inventory, shot numbers, lines, etc.) All tapes are stored at UTIG.

5. SeaMARC II Lab Watch Log (115 p.) (Towfish altitude, gain, ship speed, etc.) Copy made for UTIG; original at HIG.

6. Thermocline Sheets (Water temperature profile.) All sheets at UTIG.

7. 35 SeaMARC II mosaics of survey area on corrected navigation and with uncorrected overlay of color bathymetry. These were hand carried to UTIG where each of the 35 mosaics was photographed on a black and white 8 x 10 negative from which 8 x 10 prints can be made.

Appendix 4: Abstract submitted to Fall AGU Meeting 1989

SeaMARC II Survey of the North America-Caribbean Plate Boundary Zone Between Western Jamaica and Eastern Guatemala

Paul Mann and Eric Rosencrantz (Both at: Institute for Geophysics, University of Texas at Austin, Austin, TX 78759; 512-471-6156)
Stacey A Tyburski (Department of Geological Sciences, University of Texas at Austin, Austin, TX 78713; 512-471-0438)
Bernard Mercier de Lepinay and Eric Calais (Institut de Géodynamique, Université de Nice-Sophia Antipolis, Nice, France 06560)

The North America-Caribbean Plate Boundary Zone consists of two large-offset (~1100 km), left-lateral transforms (Swan, Oriente Fault Zones) separated by a short-spreading ridge (Mid-Cayman Spreading Center-MCSC). In August of 1989, we conducted a comprehensive survey of the Swan Fault Zone using SeaMARC sidescan sonar, gravity, magnetics, 3.5 KHz and digital single channel reflection techniques. Preliminary results based on 57 crossings of the Swan Fault Zone over a distance of 700 km include the following: 1) The Swan Fault Zone is a remarkably linear feature which is continuous from the MCSC intersection to Guatemala, where it extends onshore as the Motagua Fault Zone. 2) Fault splaying is typically associated with right-stepping push-up structures, such as those mapped west of the Swan Islands and east of the Bay Islands; push-ups are characterized by elevated seafloor topography and active foldbelts. Existing MCS seismic data reveal that the edges of the push-up blocks are defined by miniature accretionary wedges. 3) Mapping along the Honduran borderland reveals that active faults do not connect the Swan Fault Zone with prominent faults known from satellite mapping of Honduras. This observation suggests that many of the Honduran faults are presently inactive and do not play a major role in terminating offset along the Swan Fault Zone. 4) A second, major strike-slip system was mapped for 400 km east of the MCSC, to Jamaica. This fault system appears to be the splayed continuation of several strike-slip faults known from onland mapping in Jamaica; at least 3-4 linear faults form a 100 km wide zone of active deformation west of Jamaica and merge into a single fault west of the MCSC. This single trace joins the southern tip of the MCSC, indicating that this intersection is an unstable FFR triple junction.

1. 1989 Fall Meeting

2. 000267799

3. (a) Paul Mann
Institute for Geophysics
The University of Texas at Austin
8701 Mopac Boulevard
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(b) 512-471-6156

4. T

5. a) 8150 Plate Boundary Structures and Processes
b) 8110 Continental Tectonics

6. poster session

7. 0%

8. $50 check enclosed

9. C

10.

11. No

Appendix 5: Cruise Narrative (all times GMT)

July 25, 1989 (206 Julian calendar)

1200-2000 UTIG scientific party arrives on schedule in San Juan, Puerto Rico to join R/V Moana Wave (Mann, Rosencrantz, Tyburski, DeBalko, Mercier de Lepinay, and Calais from Austin, Texas; Grote and Goszewski from British Virgin Islands; Kozuch from Honduras). Taxi driver sent by ship agent Jaime Silva picked us up at airport as prearranged. HIG scientific party already on board by 1200. UTIG party assigned unoccupied berths.

July 26 (207J)

0015 Depart on schedule from San Juan harbor to transit to survey start point south of Jamaica at 16°10'W, 76°30'W (transit route: north of Puerto Rico, through Mona Passage, south of Hispaniola).
0200 Fire drill and abandon ship drill.
0230 Introduction of UTIG and HIG scientific parties.
0300 UTIG watch schedule posted.
1200 Begin organized UTIG watch schedule for training purposes: 0-4 and 12-16 (Mann, Mercier de Lepinay, Kozuch); 4-8 and 16-20 (Tyburski, Calais, DeBalko); 8-12 and 20-24 (Rosencrantz, Grote, Goszewski).

July 27 (208J)

1604 Begin recording 3.5 kHz bathymetry and gravity.
1710 Deploy SCS streamer and magnetometer. Test of 40 in^3 airgun at 1500 psi and newly purchased magnetometer.
1754 Magnetometer pulled for repair.
1813 Streamer and airgun pulled for repair.
1831 Older magnetometer, gun, and streamer deployed to test.
2307 Older magnetometer, gun, and streamer working okay and retrieved.
2309 Received cable through HIG concerning observers: "Honduras requests that "if possible" a Honduran naval officer and Dr. Gonzalo Cruz (Physics Department, University of Honduras) be permitted to accompany the vessel during its voyage. If not inconvenient, persons could board at any Honduran port of call." We responded that we could not comply because we could lose up to 30% of our survey. We also pointed out that the Honduran government had previously given us clearance without observers in June, 1989. We promised to send full documentation of results and meet personally with interested Honduran geologists during our trip to Honduras in January, 1990.

July 28 (209J)

1030 All gravimeter readings from 0715 July 27 found to be in error. Gravimeter corrected; readings okay.
1831 Tom Reed requests that SeaMARC be deployed earlier than we planned to begin shakedown leg. New deployment point is 16°25', 75°30'W. Purpose of shakedown leg is to make sure SeaMARC is operational and watches are trained. Also will provide recon data on the Nicaraguan Rise.
1904-2100 Drogue, SeaMARC, depressor in water and operating.

July 29 (210J)

0030	Magnavox navigator and ship's gyro out of sync. Bridge brought bow around to calibrate.
0743	Very rapid shallowing at uncharted high well to the SE of Pedro Bank; SeaMARC lost bottom; course changed to steer farther south to southern edge of Pedro Bank. New waypoint is 16°30'N, 79°00'W.
1318	Changed course to avoid a charted shallow area and to reduce transit time caused by first detour. New waypoint is 16°38'N, 79°06'W.

July 30 (211J)

0007	Begin survey of large meandering canyon on north edge of Nicaraguan Rise. Our course is approximately parallel to canyon axis.
0053-0130	Fault escarpments along southern edge of Cayman Trough; bottom lost on SeaMARC.
0210	Colors of SeaMARC bathymetry on ACT plotter are washed out; reported to Tom Reed.
0419	Line 1 lengthened to include proposed site of ODP drilling of Mid-Cayman Spreading Center (MCSC).
0710	Colors of SeaMARC bathymetry improved by flushing ACT plotter.
0724	40 in^3 gun and streamer deployed.
0753	Gun pulled for repairs.
0850	Gun deployed.
0902	SCS and MASSCOMP operational (40 in^3, 2000 psi, 10 sec rep). Starting log of seismic information.
1338	Surveying active part of MCSC.

July 31 (212J)

0116	Ship lost rudder control and dead in water because a cable snagged on rudder. SeaMARC cable kinked as ship slowed and towfish sank. Cable reeled in to leave kink on spool.
0120	Regained rudder control and speed up to 8 kts. No damage to electronics in SeaMARC cable.
1321	Shortened survey lines slightly to north to decrease MCSC coverage; continue mapping faults along the southern wall of Cayman Trough to south.
2220	MASSCOMP crashed.
2245	MASSCOMP rebooted and running.

August 1 (213J)

0631	Gun losing pressure.
0635	Gun retrieved.
0650	Gun deployed.
0942	MASSCOMP crashed (A2D module). No shots recorded from 0942- to 0950. Restarted.
1151	SeaMARC bathymetry plotter down for repairs.
1332	No faults observed on Line 7 across northern Nicaraguan Rise. Faulting confined to slope and base of slope.
1344	Encountered drowned reefs at 1100 m depth. We plan to continue mapping this reef trend to west for tectonic and sea level significance. This ridge extends westward to Bay Islands, Honduras.

August 2 (214J)

0153	Continuing to map entire transform valley to north and reef trend to south. Establishing that the zone of faulting is quite narrow.
0800-0904	SeaMARC having difficulty tracking bottom on steep slopes of Cayman Trough.
1720	Approximately every other shot not on appearing on oscilloscope or Raytheon recorders.
1734	Pulled gun; ruptured seal.
1745	Gun deployed.

August 3 (215J)

0306	Survey lines extended north in Cayman Trough to check if young sediments onlap or are faulted against NS basement ridges of oceanic crust.
0914	Gun retrieved with blown seal; gun in.

August 4 (216J)

1339	NNE faults observed controlling canyons on north slope of Nicaraguan Rise; similar to onland grabens in Central America.

August 5 (217J)

0301	Surveyed meandering channel on slope of Nicaraguan Rise.
1211	Active fold mapped at base of slope.
1600-1730	Frequent crashes of ACT plotter.
1750	Changed guns; ruptured seal.

August 6 (218J)

0351	Discussion with Tom Reed and Eric Rosencrantz on best way to swath-map steep scarp on eastern side of Swan Islands block. My feeling was to continue present map pattern even if it meant data loss because of bottom tracking problems. This was suggested because most of the structures were at the base of the slope.
1446	Fault splaying noted east of Swan Island restraining bend.
1520	Changed guns; ruptured seal.
1800-1900	Stopped MASSCOMP at end of Line 23 to change recording parameters (record length reduced from 4 to 3 seconds). This was done to attempt to reduce the frequent A2D crashes on MASSCOMP. Also noted during playback that the data was either not being recorded or printed correctly. Printer reset to print 3 sec of data.

August 7 (219J)

0014	Maintenance leg planned during deadhead across northern edge of Swan Island; this was requested by Tom Reed for preventative maintenance on towfish at approximate halfway point of cruise.
0014	Active fold mapped at base of slope.

August 8 (220J)

1541 Changed waypoints 54 and 55 to avoid a shallow bank shown on navigation chart (569 m). Captain reports that ship's radar shows Swan Island 2 NM east of its location on our bathymetric chart.

2310 Streamer pulled at beginning of Line 28 because of noise problem. Possibly a bad connection. MASSCOMP paused.

August 9 (221J)

0100 Lost 3.5 kHz for 10 minutes. Was inadvertently switched off during streamer repair.

0138 Waypoints 56 and 57 revised to avoid shallow banks.

0545 Gun and streamer still out of water for repairs.

1004 EOL 29; begin turn east to deadhead across north side of Swan Island; SeaMARC depressor pulled at 6 kts. to check SeaMARC connections for potential problems. Pulled magnetometer. Seismics still down. Only 3.5 kHz operating.

1106 SeaMARC connections okay; depressor redeployed.

1115 Magnetometer redeployed and checked out okay.

1118 SeaMARC operational and speed increase to 8 kts.

1150 Streamer and gun deployed; no trace on recorders 2 and 3.

2349 Seismic records still very noisy despite maintenance. Problem is in the streamer which is old and probably needs another tape job. No backup streamer on board. Eric Rosencrantz thinks most of the noise can be processed out.

August 10 (222J)

0312 No clear evidence seen for active deformation at base of slope north of Swan Island.

0633 Problem in SeaMARC bottom detect for 10 minutes; swath width decreased. Rack problem?

0910 Streamer still noisy. Pulled streamer on turn to retape boots. Streamer shows no visible damage. Retaping has no effect on noise problem.

August 11 (223J)

0339 Established that all deformation active south of Swan Island.

1234 3-in-1 Magnavox navigator not accepting satellite fixes. We were relying on 2-in-1 which is less finicky. 3-in-1 reinitialized and accepting fixes.

1540 Push-up compressional bend along Swan Fault.

1854 Passed over uncharted shallow ridge.

0030 Mass wasting features and in situ reefs noted on Bay Islands Ridge. Drowned reef at depth of 1600-1800 m. Does the reef rise in depth to Bay Islands? Separate reef trend to south at depths of 1400 m is named "Explorer Tablemount Ridge". Both ridges are believed to mark inactive, strike-slip faults based on existing UTIG MCS lines.

August 12 (224J)

1917 SeaMARC ACT plotters changed to improve fading colors on bathymetry.

2348 Reduced speed to 6 kts. to pull streamer and check why data quality is progressively deteriorating. Audio check of different sections of streamer on back deck. No oil leaks seen.

0042 Streamer back in water but no change in data quality.

0128 Steve Poulos suggests going to a larger airgun (120 in^3) to improve signal to noise ratio.

0345 Surficial structure of Swan Island accretionary wedge established.

August 13 (225J)

1200 Eric Rosencrantz recommends switching the 40 in^3 gun for a 120 in^3 gun either at the end of the line or when it fails--whichever comes first. Advantages would be to improve signal to noise ratio and allow deeper penetration into thicker sedimented areas of Cayman Trough.

1435 Base of slope possibly faulted although seismics are bad. Ripples on SeaMARC appear to be folds parallel to the base of the slope. Could black "smudges" on SeaMARC be mud volcanos on accretionary wedge?

1510 120 in^3 gun in water.

1531 Seismics up.

0031 Steve notes that when power is off to the streamer there is no noise. Therefore, problem is probably the preamps at head of the streamer.

0000 Visual comparison of 40 and 120 in^3 guns results show that 120 in^3 gun show that 120 offers no advantages because: 1) can see basement equally as well with 40; and 2) 40 has no water bottom multiple.

0036 Replace 120 in^3 gun with 40 in^3 gun. Preamp in streamer replaced with old part.

0112 Streamer out; seismics up.

0151 New preamp failed after 2 minutes. Very weak signal coming through with high gain settings. Temporarily recording in this mode until the preamp on streamer can be replaced.

August 14 (226J)

0439 Streamer back in water with new preamp.

0506 ACT plotter only giving sporadic event markers--rebooted. 9 minute data gap.

0522 ACT crashed again.

0559 ACT crashed again.

0605 ACT crashed again.

1115 Paper jam on gravimeter printer--turned off.

1337 Wil Hervig is taking apart old preamp to see what the problem was; seismics still look noisy.

2012 Turned at 210° off of Line 45; encountered uncharted high at 750 m; turned off to 270°.

0317 3 reef levels mapped on Bay Islands Ridge at 1150-1050 m depth. Ridge peaked at 970 m.

August 15 (227J)

0416 Reading of towfish heading off; problem not solved because this heading not recorded.

1145 Small, closely spaced faults visible on Line 47 on 3.5 kHz records; seems to correspond with graben structure seen at the base of slope on MCS-CT line. Water depth 4850. Could mounds be recent volcanics?

1938 First sighting of Bay Islands (Guanaja).

August 16 (228J)

0745 Falco logger down for 5 minutes.

0800 Streamer quality continuing to deteriorate.

1518 Noisy seismics. Preamp problem again?

1525 Ship speed slowed to 6 kts. to check speed effect on streamer noise. Better returns off reflectors are seen but increase in noise. Cause of noise unclear.

1634 Repeated failures of ACT plotter. Data gap of 30 minutes.

1641 ACT plotters switched to improve color bathymetry.

August 17 (228J)

1537 Goals for Puerto Cortes area in Gulf of Honduras: 1) identify Motagua fault extension--1976 rupture?; 2) identify Chalmelecon Fault extension; 3) identify normal faults related to Yojoa graben; 4) identify slumps related to historical earthquakes.

1652 Full sweep seismic Raytheon down.

1715 MASSCOMP crashes because of sync problem in A2D module. Rebooted.

1755 Seismic Raytheon back up.

1803 MASSCOMP back up.

0318 I discussed plan with Tom Reed to cross shallow Tela Straits. He wants to take both fish and depressor out and foresees 1 hour at each end. No maintenance time needed for towfish or connections.

August 19 (229J)

0400 Plan for Tela Basin: 3 lines parallel to long axis of basin using SeaMARC and seismics. The extremely localized 9 m deep bank in the center of the basin may be either a recent volcano with a reef on top or a mistake on the chart. The southernmost line will pick up Texaco MCS Line 77-1 and follow it out the eastern end of the basin. This line may be tied to other industry lines and wells on the shelf to the south.

1319 Slow to 4 kts. Tom Reed decided pull only depressor and not towfish contrary to previous plan.

1346 Depressor on board.

1605 SeaMARC party informed of deploy point at next turn.

1614 Made turn; slowed to 4 kts. to deploy SeaMARC.

1630 Depressor deployed.

1635 Gun and streamer deployed.

1640 Towfish at depth; SeaMARC recording.

1659 Seismics up.

1934 Seismics looking much better partly because of decreased water depth in Tela Basin (~1400 m); possible volcanic flows seens on seafloor south of Roatan.

0338 Line extended to include 9 m bank in sidescan swath; no sign of shallowing to bank; either mislocated or mistake on chart.

August 20 (230J)

1220 Received FTBREAK, FPDONE, and FDONE error messages on the MASSCOMP. System rebooted. Problem was that MASSCOMP was not receiving a timing pulse from SeaMARC. Problem solved by switching the airgun time pulse to manual mode.

1408 Lines laid out for "Camerón Basin" to the east of "Tela Basin" (area named after Punta Camerón on the Honduran coast).

1436 Possible volcanic flows on EW fissures. Similar to those seen on line south of Roatan in Tela Basin.

1740 Rep rate problem between SeaMARC and MASSCOMP worked out.

August 21 (231J)

2218 EOL 82 and begin recovery of SeaMARC and SCS in order to transit to Jamaica.

0321 Towfish on board; full stop to retrieve drogue.

0331 Magnetometer deployed; speed to 10 kts. to begin transit to Jamaica; begin one person 2 hour watches for transit: 4-6 (Debalko); 6-8 (Calais); 8-10 (Grote); 10-12 (Kozuch); and 12-14 (Lepinay). Only systems operating on transit are 3.5 kHz, gravity, and magnetics. No plotting sheets kept. Transit satellite fixes plotted on navigation charts.

Routine transit to next study area near western Jamaica.

0322 Approaching start point for SeaMARC survey near western Jamaica. Slow to 4 kts. to deploy drogue.

0337 SeaMARC in water; ground fault light on rack at lower intensity. Leak in towfish?

0357 Depressor in water.

August 22 (232J)

0415 Start survey at waypoint 157.

0725 Bottom tracking problems because of incorrect sweep on 3.5 kHz. Lack of seismic Raytheon makes depth estimates difficult when 3.5 loses steep slopes.

2338 Depth of depressor and fish lowered from 60-65 m to 90 m because of increased speed of ship (10 kts.) without seismics.

0025 Bottom tracking problem may be worse because of increased ship speed.

August 23 (233J)

Routine survey.

August 24 (234J)

1321 Seismics deployed without problems on turn between Lines 96 and 97. Speed reduced to 8 kts. Goal was to have two long seismic lines to tie with Droxler's study on Walton Basin.

1810 No signal from seismics.

1826 Streamer brought in for repairs.

1950 Steamer problem was short in preamp; redeployed seismics.

2150 Lost seismic signal. Problem with electronics. Decided seismics were not worth the delays. Pulled seismics for good. Return to 10 kts. with SeaMARC only.

August 25 (235J)

0441	ETA to end point near Montego Bay is 2323, August 26.

August 26 (236J)

1207	Turned off final Line 107 and slowed to 6 kts. to bring in SeaMARC. Begin transit to Montego Bay with ETA of 1600.
1300-1600	Unable to contact Montego Bay pilot by radio.
1630	Enter Montego Bay harbor without pilot. Dock without incident. Take on customs agents.

University of Hawaii at Manoa

Hawaii Institute of Geophysics
2525 Correa Road • Honolulu, Hawaii 96822
Cable Address: UNIHAW

PRELIMINARY
RESEARCH CRUISE REPORT

SHIP NAME:
RV Moana Wave

OPERATING INSTITUTION:
Univ. of Hawaii at Manoa

CLEARANCES COUNTRIES:
Jamaica, Cayman Islands, Honduras

DATES:
7/26/89 -- 8/26/89

PROJECT TITLE(S):
Swan Island Transform Fault Survey (MW8909)

PORT CALLS:
San Juan, Puerto Rico
Montego Bay, Jamaica

FOREIGN PARTICIPANTS:
Bernard Mercier de Lepinay and Eric Calais (Univ. of Nice, France)

SENIOR SCIENTISTS:
Paul Mann and Eric Rosencrantz (Univ. of Texas at Austin)

DESCRIPTION OF SCIENTIFIC PROGRAM: (Brief)
SeaMARC II and SCS survey of strike-slip fault systems along the southern margin of the Cayman Trough.

OBSERVATIONS AND SAMPLES COLLECTED: (TYPE, LOCATION, CUSTODIAN)
SCS, gravity, magnetics, 3.5 Khz data catalogued by HIG with microfilm copies to UTIG; SeaMARC II mosaics stored at UTIG; SeaMARC tapes at HIG; SCS tapes at UTIG.

INFORMATION ADDRESS:
Ms. Patricia Ganey-Curry, Data Archives, UTIG, 8701 Mopac Boulevard, Austin, TX 78759
512-471-0408

POST-CRUISE OBLIGATIONS SCHEDULE:

	PRODUCT	DUE - MONTH YEAR
1.	Cruise report including detailed track map showing data coverage to State Dept., Dr. Raymond Wright (Petroleum Corporation of Jamaica) and Jose Lanza (Ministry of Petroleum and Mining, Honduras)	9/89
2.	Set of 8x10 photographic prints of SeaMARC mosaics of Jamaican EEZ to Wright, Honduran EEZ to Lanza.	10/89
3.	All other data described in the cruise report is available upon request.	Upon request

Appendix 7: Ship Utilization Data for UNOLS

UNOLS
Rev. 4/83

SHIP NAME RV Moana Wave	OPERATING INST. Univ. Hawaii
CRUISE (LEG) NO. MW8909	DATES 7/26/89 -- 8/26/89
AREA OF OPERATIONS: Southern Cayman Trough, Caribbean Sea	PORT CALLS: PLACE: San Juan, PUERTO RICO; Montego Bay, JAMAICA — DATES: 7/26/89; 8/26/89
DAYS AT SEA: 31 — DAYS IN PORT: 0	

PARTICIPATING PERSONNEL

CODE	NAME	TITLE	AFFILIATION
1.	Paul Mann,	Research Associate,	Univ. Texas Inst. Geophys.
2.	Eric Rosencrantz,	Research Scientist,	Univ. Texas Inst. Geophys.
3.	Thomas Reed,	Research Associate,	Univ. Hawaii Inst. Geophy
4.			

Use Reverse If Additional Space Required.

WAS RESEARCH CONDUCTED IN FOREIGN WATERS? YES COUNTRY: HONDURAS, JAMAICA, CAYMAN ISLANDS

PRIMARY PROJECTS (those which govern the principal operations, area and movements of the ship)

PROJECT TITLE AND PRINCIPAL INVESTIGATOR	SPONSORING ACTIVITY	GRANT OR CONTRACT NUMBER	PARTICIPATING PERSONNEL (AS CODED ABOVE)
Paul Mann, Eric Rosencrantz, co-P.I.'s SeaMARC II and seismic reflection study of strike-slip tectonics along the NW Margin of the Caribbean Plate.	NSF	OCE-8811310	1, 2, 3
DISCIPLINE			

24

ANCILLARY PROJECTS (which are accomplished on a not-to-interfere basis and contribute to the overall effectiveness of the cruise)

PROJECT TITLE AND PRINCIPAL INVESTIGATOR	SPONSORING ACTIVITY	GRANT OR CONTRACT NUMBER	PARTICIPATING PERSONNEL (AS CODED ABOVE)
None			

SIGNATURE Paul Mann DATE 9/28/89
CHIEF SCIENTIST

TOTAL SCIENTISTS 4 TOTAL TECHNICIANS 4
TOTAL GRAD STUDENTS 5 TOTAL STUDENTS/OBSERVERS 6

ATTACH PAGE SIZE CRUISE TRACK (attached)

COST ALLOCATION DATA

DAYS CHARGED	AGENCY OR ACTIVITY CHARGED	GRANT OR CONTRACT NO
32	NSF	OCE-8811310

SIGNATURE Paul Mann DATE 10/2/89

Appendix 8: UNOLS Research Vessel Cruise Assesment

UNOLS Office, WB-15
School of Oceanography
University of Washington
SEATTLE, WA 98195

PI/SIC Paul Mann	SHIP RV Moana Wave
PI/SIC INSTITUTION Univ. of Texas Inst Geophysics	General Type of Work and Procedures Employed. SeaMARC II, SCS, 3.5 Khz, gravity magnetics
AREA OF OPERATIONS Northwestern Caribbean Sea	
Cruise, Expedition, and Leg #, and/or Project Name Swan Transform Fault Survey, MW8909	
Dates of Cruise 7/26/89 -- 8/26/89	Was cruise successful in terms of your scientific project? Please circle best choice. (FULLY-) PARTIALLY- MARGINALLY- SUCCESSFUL UNSUCCESSFUL
Days Total 31 days 0 hours 4 minutes	
Days Transit 2 days and 4 minutes	
Days Stations 0	
Days Underway Surveying 29 days 2 hours 40 minutes	

What ship did you request if not this one? _____

Were you given adequate advance information by the operating institution concerning equipment and technician services provided? NO/YES

Work lost because of weather: days 0 stations _____

Work lost because of ship, ship's equipment or ship's personnel: days 0 stations _____

Work lost because of scientific equipment: days 2 stations _____

Factors adversely affecting cruise success (include percentage estimate if possible). Please circle equipment used.

Main engine	0	Crane or A-Frame	0
Electric power	0	Winches	0
Officers & Crew	0	Computers	0
Ship's technicians	0	Other electronics	0
Pre-cruise liaison	0	Other (specify)	streamer

Comments, details of problems, suggestions, and praise, if appropriate, for both successful and unsuccessful cruises. Use other side and additional pages as ncessary.

Streamer failure caused us to lose 160nm (290km) of SCS data. This was 4% of our total SCS coverage.

These evaluations are an attempt to assist ship users, operating institutions, and funding agencies to improve the quality of research vessel operations. Copies will be sent to UNOLS Advisory Council and the operating institutions only, but summarized edited data will be sent to all UNOLS members and associate members and funding agencies. Please fill out as completely and frankly as possible.

Revised 2/82

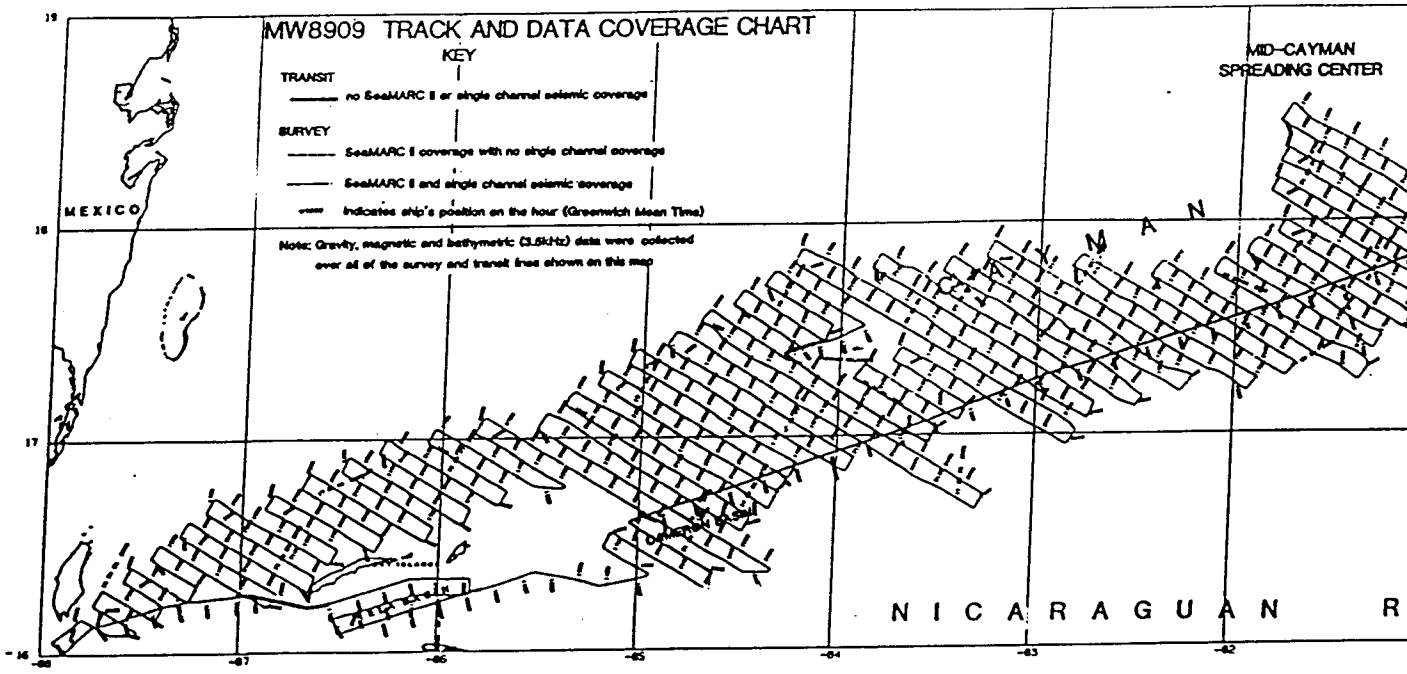
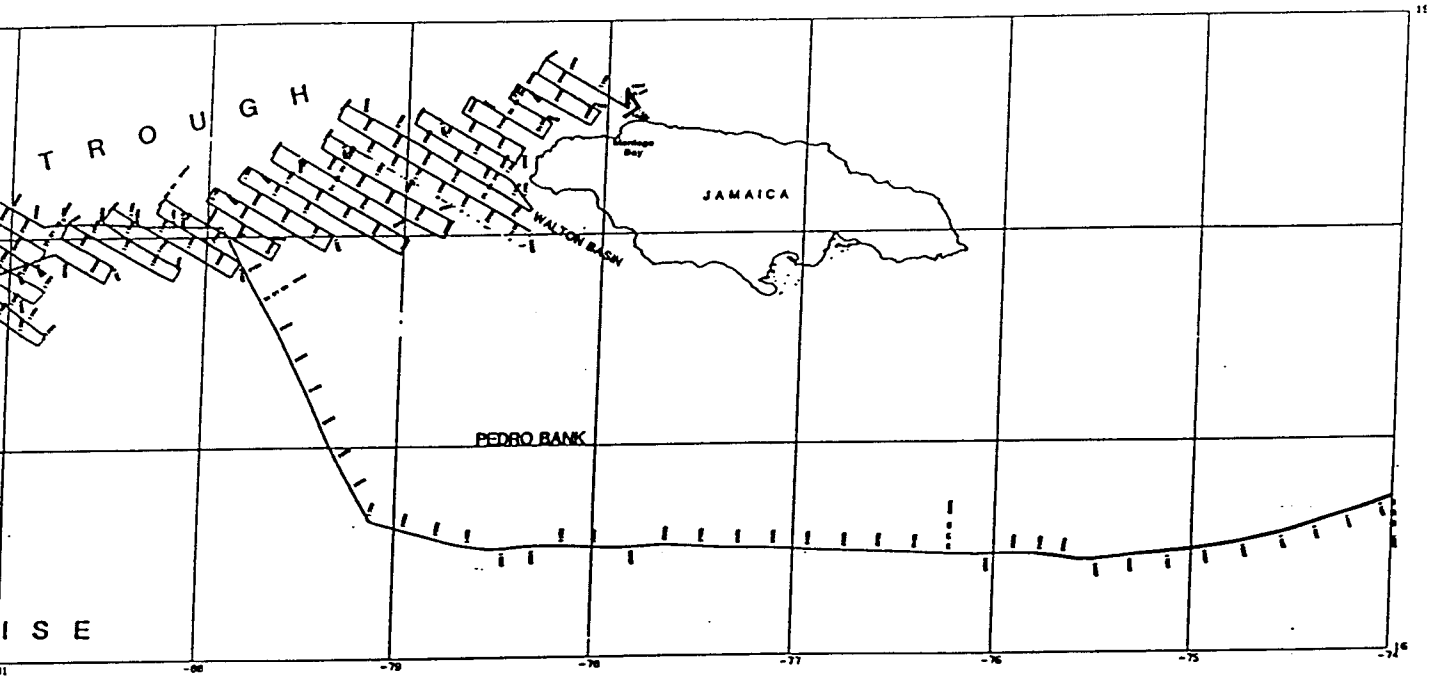


Figure 1: MW8909 Track with data co



erage chart.

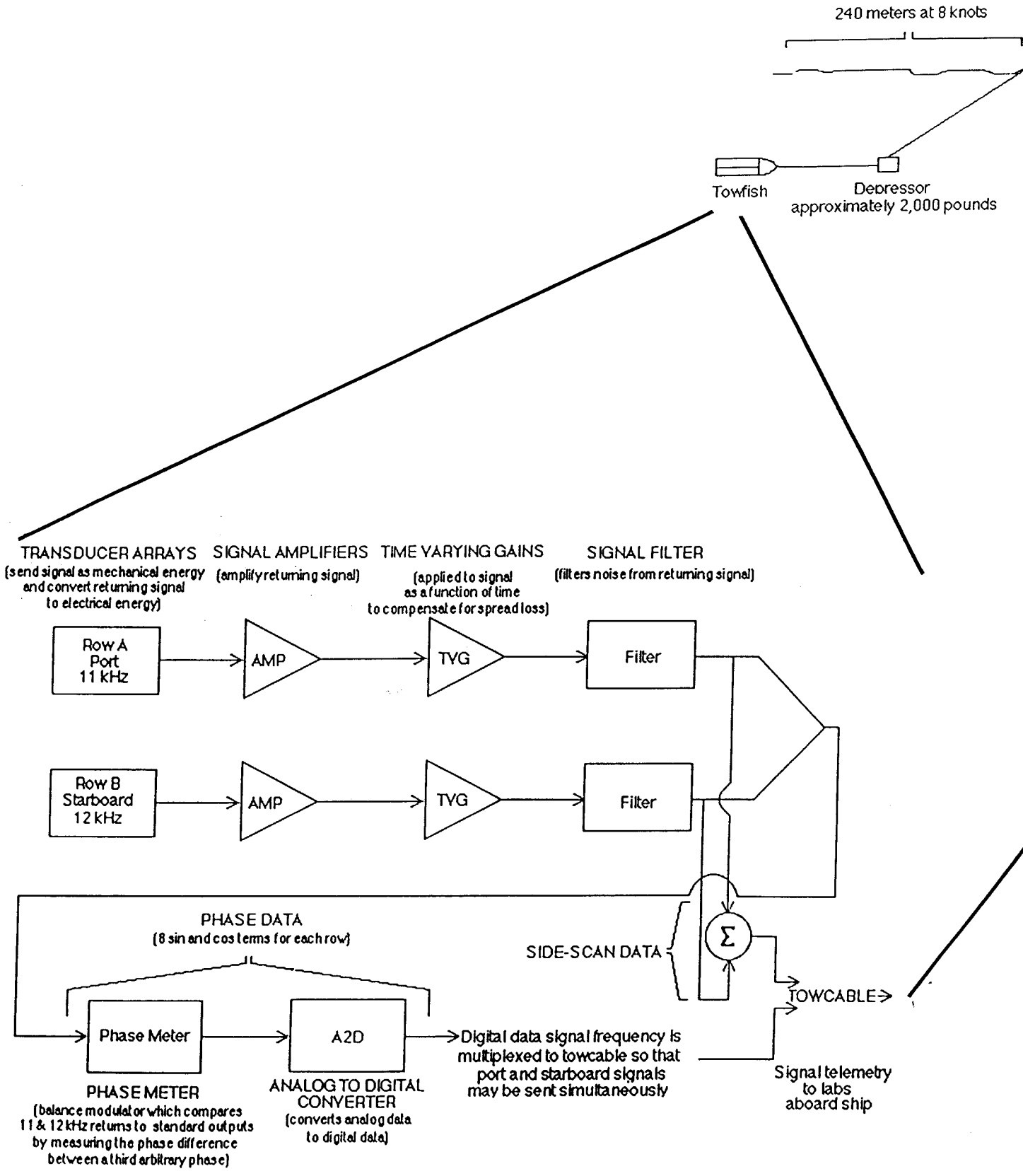
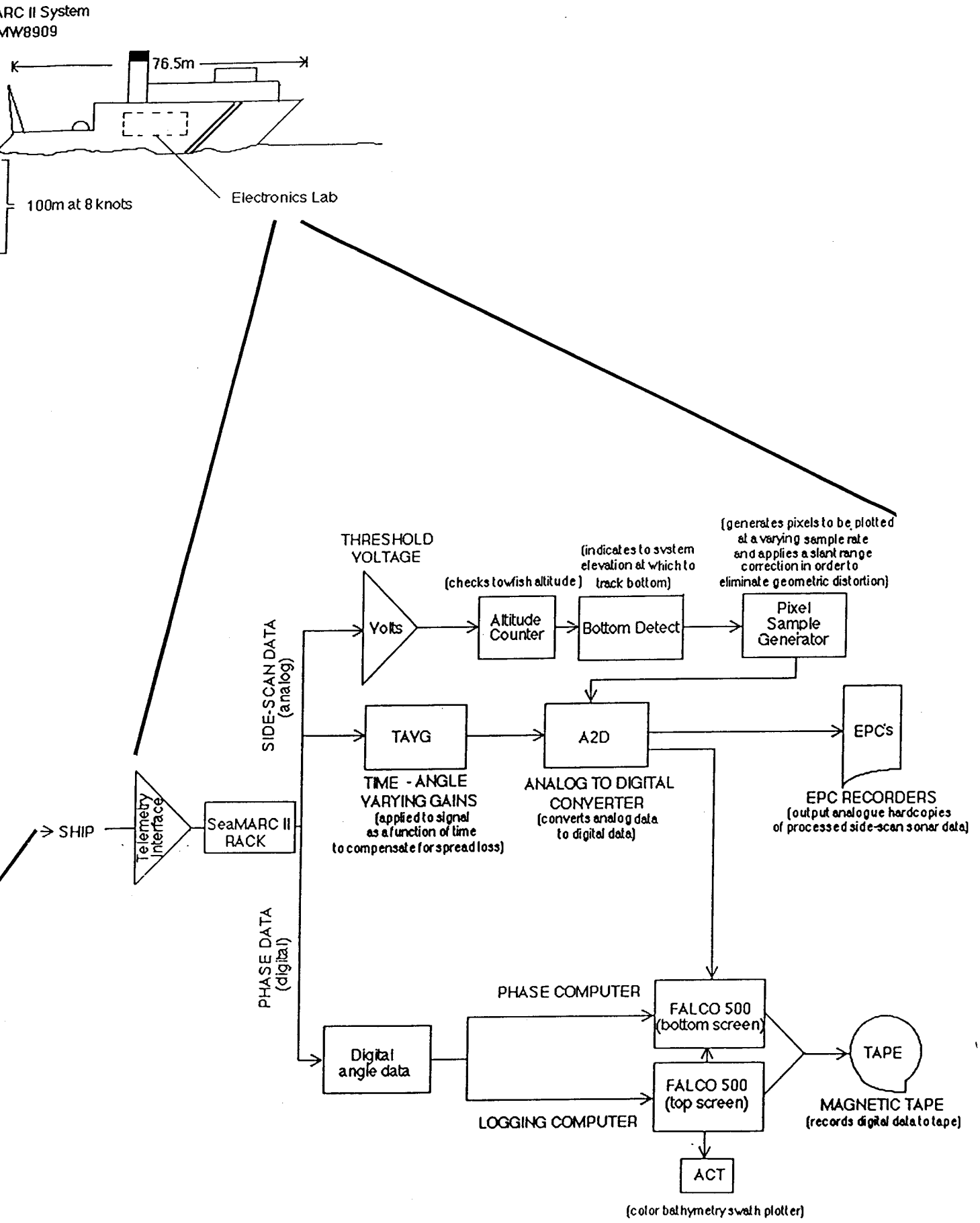
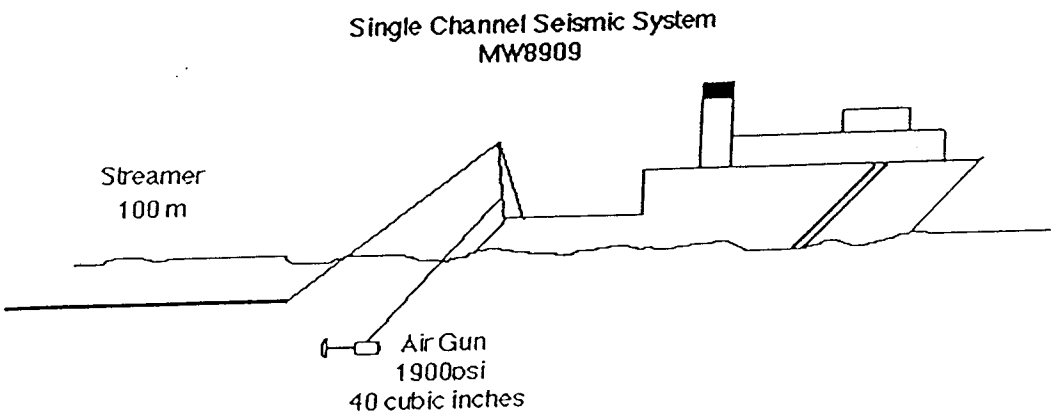


Figure 2: SeaMARC II side



27B

can sonar system used during MW8909.



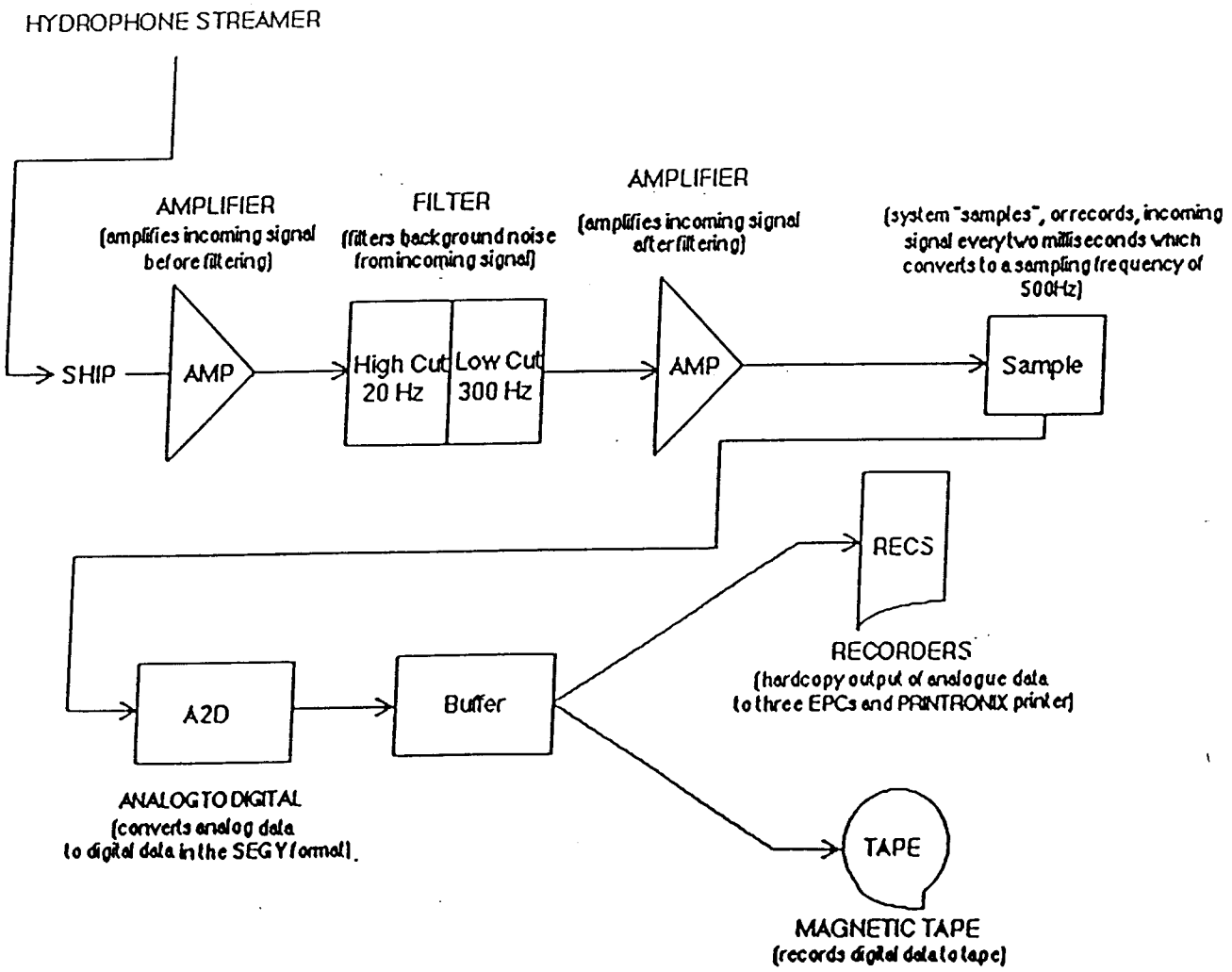


Figure 3: Single channel seismic system used during MW8909.