UNOLS
REV. 5/76

CRUISE REPORT
SHIP UTIL[IZA]TION DATA

SHIP NAME R/V ROBERT D. CONRAD	OPERATING INST. Lamont-Doherty Geological Observatory	
CRUISE (LEG) NO. 21-02	DATES 10/2/77 - 11/9/77	
AREA OF OPERATIONS: Blake-Bahama Outer Ridge, Blake Plateau, Bahama Platform	PORT CALLS: PLACE	DATES
	Bermuda	10/2/77
	La Guaira, Venezuela	11/7/77 - 11/9/77
DAYS AT SEA 36	DAYS IN PORT 3	

PARTICIPATING PERSONNEL

CODE	NAME	TITLE	AFFILIATION
1.	G. Bryan	Chief Scientist	Lamont-Doherty
2.	R. Markl	Geophysicist	" "
3.	R. Sheridan	Geophysicist	" "
4.	H. Van Santford	E.T. - MCS	" "
5.	C. Gutierrez	E. T. MCS	" "

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)
MCS Survey of candidate IPOD Site in the Blake-Bahama Basin R. Houtz	NSF/IPOD	UC-NSF-C482-2, Scope "J"	All
MCS Study of Blake Outer Ridge & Plateau & Bahamas Platform G. Bryan	NSF	OCE 76-82326	All

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)

SIGNATURE George W. Bryan DATE 1/17/78
CHIEF SCIENTIST

(Continue personnel and project listings on reverse if additional space needed)

ATTACH PAGE SIZE CRUISE TRACK

COST ALLOCATION DATA

DAYS CHARGED	AGENCY OR ACTIVITY CHARGED	GRANT OR CONTRACT NO.
39 38	NSF	OCE 76-00060

SIGNATURE D E Hayes DATE 11 Jan 78
Institution Official

PARTICIPATING PERSONNEL (cont.)

6.	R. Rottier	E. T. -MCS	Lamont-Doherty
7.	D. Hutchinson	E. T.	" "
8.	W. Robertson	E. T.	" "
9.	D. Medlicott	Computer Tech.	" "
10.	R. Crimmins	Mech. Tech.	" "
11.	M. Iltzsche	Mech. Tech.	" "

D. Hayes

Lamont - Doherty Geological Observatory of Columbia University | *Palisades, N.Y. 10964*

Cable: LAMONT, Palisades, New York State

Telephone: Code 914, Elmwood 9-2900
Twx: 710-576-2653

CRUISE REPORT

Ship Name: Robert D. Conrad   Cruise No: 21-02

Departure: 2 October 1977 (Date) from Bermuda (Port)

Arrival: 6 November (Date) at La Guaira, Venezuela (Port)

Days at Sea: ~~36~~ 35   Days Foreign Port: ~~3~~ 4 (No. of days in arrival port)

Area of Operation:
Blake-Bahama Outer Ridge, Blake Plateau, Bahama Platform

Program Description:

Multichannel seismic survey

Sponsoring Agency: NSF and IPOD

Participants: (All L-DGO unless otherwise specified)

G. Bryan	Chief Scientist
R. Markl	Geophysicist
R. Sheridan	Geophysicist
H. Van Santford	E. T. - MCS
C. Gutierrez	E. T. - MCS
R. Rottier	E. T. - MCS
D. Hutchinson	E. T.
W. Robertson	E. T.
D. Medlicott	Computer Tech.
R. Crimmins	Mech. Tech.
M. Iltzsche	Mech. Tech.

All inquiries regarding cruise should be made to the chief scientist.

PROGRAM SUMMARY

The cruise consisted of three separate but interrelated multichannel seismic surveys: a survey of the Blake Outer Ridge, a survey of drill site 391 and its environs, and a survey of the Bahama Platform, including the southern end of the Blake Plateau. A total of about 4400 km of MCS data was obtained.

Blake Outer Ridge

The Blake Outer Ridge survey collected MCS data along the track shown in Fig. 1. Included are 5 transverse crossings of the ridge, a run along the ridge axis, and a line west of the axis, crossing the terraced region from the east-west feature to the Blake Plateau. The two northernmost crossings were designed to look for a possible basement protrusion of the Blake Plateau at the head of the ridge. The three crossings to the south, together with the axial line, will make possible stratigraphic correlation of the post Eocene sedimentary horizons along the length of the ridge. One of these crossings passes through DSDP holes 102, 103 and 104. This line will serve for regional extrapolation of these drilling results and is important for detailing the morphology of Reflector Y and the related unconformable internal bedding, features which are directly related to the gas-hydrate hypothesis. The track along the ridge axis is designed to show any transition, in the crestal zone, from northern regime to southern regime. The line connects with the GSI line which traverses the northern portion of the ridge crest. The line on the west flank of the ridge was designed to cross perpendicularly the topographic steps and unconformities where they are known to be well developed. The track from the Blake Outer Ridge to the IPOD site survey crosses the northern end of the Bahama Outer Ridge and ties both ridges to the drill site area.

Note: The dashed line on the west flank of the Blake ridge was originally scheduled for multichannel data, but a medical emergency necessitated retreiving the gear and steaming at 10 knots for Cape Fear (see Ship Operation).

Site 391 and Vicinity

The survey of site 391 and vicinity (Fig. 2) included the original site (A) but concentrated primarily on an alternative site (B) whose location relative to the magnetic anomalies is less ambiguous than that of the original site. A recent magnetic survey showed point A to be on a boundary between two anomalies while site B is centered on an anomaly (tentatively identified as M-28). A second alternative site (C), located on the Blake spur anomaly was also included in the survey. Orthogonal sonobuoy runs are centered on both B and C.

The overall track ties this area to the Blake Outer Ridge to the east, the Blake Plateau to the west, the Bahama platform to the southwest (through a short segment of FC2, Fig. 3), and the Bahama Outer Ridge to the southeast.

Blake Plateau - Bahama Platform

The Blake Plateau - Bahama Platform survey (Fig. 3) ties together wells located at Cape Canaveral, Palm Beach and Key Largo along the Florida coast and Great Isaacs #1 across the Florida Straits north of Bemini. A track through Northwest Providence Channel connects Palm Beach to drill site 98, which is then tied to site 391.

EQUIPMENT PERFORMANCE

Only equipment for underway measurements was used in this program; there is no performance report on station equipment. It should be noted however that considerable time and effort went into maintenance and repair of deck equipment for station work, particularly the core winch.

Multichannel Seismic Streamer

In Bermuda Charlie Windisch reported that the streamer seemed to tow well on his leg (21-01) until near the end of the leg when it came to the surface for no apparent reason.

On our leg the streamer towed well for the first 200 miles of MCS track (comprising the southernmost and northernmost ridge crossings and most of a third crossing) in smooth to moderate seas. Upon streaming initially, we had patched oil leaks in the forward stretch section and section 20. Oil was added to these sections and to section 15 which seemed excessively flat.

As we neared the end of the third crossing we began to experience strong highly variable currents. In a few more hours the after half of the streamer came to the surface while the forward half remained at a normal depth. A typical set of readings (fore to aft): 35, 30, 17, 4, 4, 1 feet (profile A in Fig. 4). Varying the speed did not improve the situation.

We retrieved the streamer and found three bad birds in the after half. In each case the motion of the wings was restricted by a faulty mechanical linkage. However in each case the restricted range of motion was toward the side of maximum depression rather than maximum elevation, which seems more consistent with excessive diving than with surfacing.

The birds were repaired, all set for 45 feet, and the gear streamed again. At 5 knots the after half of the streamer again went shallow (readings about as before). Increasing speed to 6 knots gave no improvement. We then decreased speed to about 3 knots, dropping the head to about 50 ft., the rest shallow.

After 15 minutes we went to 4 knots for 15 minutes, getting about 40 ft. on the first two meters, the rest shallow. We then went to 5 knots and after 10-15 minutes obtained a fair profile. Profile B shows the depth ranges over a three-hour period at 5 knots in moderate seas. The streamer remained reasonably stable for about 8 hours then surfaced again. It was coaxed back down as before for another 4 hours, after which it was brought in for reballasting.

There is apparently no record of prior ballasting so it was decided to inventory the ballast as found and to log any changes made on this leg. It is recommended that this practice be continued in the future. The ballast inventory is of course only half the problem: ideally one should also keep track of the quantity of oil in each section. When a leak develops there is no easy way to determine the quantity of oil lost, and we do not presently meter the oil added after a repair job. This severely limits the usefulness of ballasting records. Nonetheless such records are very helpful when adjustments are required.

Initial reballasting (Oct. 10) involved only the after half of the streamer through the first 12 active sections. As shown in the ballast table, 70 lbs of lead was added and was distributed to make the ballasting more uniform over the 12 sections. This gave the configuration, at 5 knots, labeled C in Fig. 4: the middle riding too shallow and the tail slightly deep. Stability was marginal to poor until we got clear of the Gulf Stream, when the configuration became quite stable. (Brackets around Profile C represent the spread of readings over a 4 hour period.)

The streamer remained stable for the next 2 1/2 days, giving good results in moderate seas. On the morning of Oct. 14 the seas began to build up somewhat and the streamer surfaced. After two hours of unsuccessful attempts to bring it down, it was brought aboard and the forward half was inventoried and reballasted. Sections 13, 14 and 15, near the middle, were found to be considerably lighter than the rest of the sections, as was section 18. These were all brought in line with the rest and five lbs was added near the head.

In subsequent trials in moderate to rough seas the streamer still could not stay down on any heading at any speed. The middle would surface and the tail was now riding slightly too deep. The gear was retrieved, 11 lbs was removed from the tail and 32 lbs distributed over sections 12, 13 and 14. The result was a streamer with negative buoyancy in the after half (the after half sank to over 100 feet at very low speeds) but which seemed quite stable at 5 knots in moderate to rough seas, running at a depth of about 45 feet. A typical set of readings is shown as profile D in Figure 4.

The streamer remained trouble-free for about 24 hours on a west-south-westerly course into seas which first moderated considerably then began building up again. On the afternoon of October 16 we turned to NNE, bringing the weather onto our port quarter. The eel surfaced and would not stay down under any combination of course and speed except heading into the weather, in which case it again was quite stable. On Oct. 17 we added 200 lbs, distributed as shown in the table. This made the streamer much too heavy - it would not stay above 100 ft. except at the head, which ran at 40 to 50ft. We then removed 100 lbs, as shown in the table, and got a stable configuration at about 50 ft. (profile E, Figure 4). There were no more ballasting adjustments during the leg. The streamer was somewhat negatively buyant but towed well on all headings in light to moderate seas at about 50 ft. On Oct. 24, crossing the Gulf Stream in rough following seas, the streamer ran somewhat shallower, in the range of 20 to 30 ft., but did not become unstable as it had before under similar circumstances.

The tail buoy was lost near the end of the leg. It was carrying a flasher but no radar reflector or radio transmitter.

The seismic system is very sensitive to noise from the ship's single side-band transmitter. Because this fact is not consistently reported there is some feeling that it is not consistently a problem. We tried to avoid it by scheduling transmissions during turns when possible and by keeping the transmission to a minimum. In one instance we circled back after transmission to rerun the affected segment of track. Perhaps more thought should be given to this problem.

Air Gun - Compressor System

The high pressure hose from the 4th stage of the aft compressor to the final cooler blew-out three times after only about 2 days of operation each time. After the last the hose was replaced by 3/8" high pressure steel tubing with a single loop about 6" in diameter. This ran without a problem for the rest of the leg. A similar unit was put on the forward compressor near the end of the leg when its hose blew out. (These units were made up in Bermuda to John Sindt's specifications, and they look like a good solution to the problem.)

On Oct. 24 a leak developed in the 4th stage cylinder head of the forward compressor, between the discharge valve assembly and its seat in the head. The seat was badly pitted and had to be milled down to effect temporary repairs. A new head was ordered and delivered to Roosevelt Roads.

On Oct. 28 the aft compressor went out with a broken crankshaft in the low pressure side. It was a V-shaped break in the connecting rod journal. Although the break was clear through, the two halves were held together by the connecting rods long enough to shut down before anything let fly. Some distortion of the connecting rods is very probable but the pistons and cylinders looked O.K. Spare parts were ordered for Venezuela. The leg was completed with one compressor and two guns.

Air guns performed very well. Toward the end of the leg the springs showed signs of fatigue and all were replaced.

Other Scientific Equipment

Computer - the PDP 11/20, after lengthy servicing in Bermuda, was never fully operational and deteriorated as time went on. Medlicott and Rottier tried very hard, without much success, to salvage something out of the system until about Oct. 24 when the system was shut down because of problems with fuel tank leaks into the room (see ship operations).

MCS Acquisition System - On the whole the equipment in the MCS van performed very well. This seems to be the result of a combination of good design and good watchstanders.

Some minor difficulties:

1. The power supply for the firing rate control and shot counter failed and was replaced by a spare which also failed. A huskier supply was borrowed from the dry lab and served without trouble for the rest of the leg.

2. The brake system on one of the magnetic tape drives began working erratically. The brake shoe showed considerable wear and was overdue for adjustment. The manual calls for adjustment every 400 hrs. Maintenance schedules should be established for the jobs which fall between daily maintenance and yearly overhaul.

3. The oscillograph sometimes leaked fluid because of some worn parts. Replacement parts were ordered.

SHIP OPERATIONS

Operation of the ship was excellent. Cooperation among all departments was apparent. Most conspicuous in its effect on the scientific program was the performance of the deck department in connection with the MCS work.

Some problems in ship operation which directly affected the scientific work are:

1. Medical emergency - While we were streaming the MCS streamer at the beginning of the leg an oiler developed signs of mental disturbance and jumped overboard from the 01 deck. We got a tethered ring buoy to him from the fantail and he was hauled aboard very quickly, before any decision was required regarding the partly streamed gear. The incident points up the need for established emergency procedures when such decisions are required.

The man subsequently locked himself in his room and his condition seemed to be worsening. It was therefore decided at the end of the first MCS line to retrieve the gear and proceed at 10 knots to Frying Pan Shoals Light, where the patient was transferred to a Coast Guard cutter. Time lost was about two days.

2. Two power failures (Oct. 22 and Oct. 23) were handled without any problems to the scientific equipment. In each case we circled back to close the gap left in the data.

3. Fuel seepage from under the deck tiles in the computer room was traced to a leak in the deck from #4 fuel tank below. The tank was emptied

and cleaned, and the leak repaired. All the deck tile was removed and it was found that the deck was pitted nearly through into the aft healing tank, which contained fuel at the time. This was also emptied, cleaned and repaired. The pits and holes were wash marks from a cutting torch apparently used in the shipyard to relocate the mounts for the computer.

RECOMMENDATIONS

1. Establish procedures for handling the MCS streamer in man-overboard emergencies. Include the case of the streamer only partway out; this is the most likely case to arise.

2. Provide an independent back-up hydraulic system for retrieval of the MCS streamer. Primary power should be from a hand-started diesel.

3. Consider carrying more compressor spares, particularly for the Falkland Plateau MCS work coming up.

4. Log all streamer ballast changes.

5. Investigate ways to minimize radio interference in the seismic system.

	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	~~25~~ S	S	TOTAL
DEPTH XDCR LOCAT.:	↓				↓					↓					↓					↓					↓			
BIRD LOCATIONS:	↓			↓			↓			↓			↓			↓			↓			↓			↓↓			
SECTIONS:	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	~~25~~ S	S	TOTAL
EMPTY WEIGHT (LBS)	200	346	369	349	370	345	352	348	371	369	365	371	367	349	375	352	348	349	346	350	352	348	351		372			
BALLAST (LBS) AS OF 10/2/77	21	18	19	22	23	21	20	20	20	19	17	16	16	13	16	18	26	24	17	24	24	26	27	24	21	22	37	570
10/10/77	7	7	6	4	1	3	3	4	5	7	9	7	7															70
	28	25	25	26	24	24	23	24	25	26	26	23	23	13	16	18	26	24	17	24	24	26	27	24	21	22	37	640
10/14/77														8	7	8			5						5			33
	28	25	25	26	24	24	23	24	25	26	26	23	23	21	23	26	26	24	22	24	24	26	27	24	26	22	37	673
10/15/77	-4	-4	-3										10	12	10				2									23
	24	21	22	26	24	24	23	24	25	26	26	23	33	33	33	26	26	24	24	24	24	26	27	24	26	22	37	696
10/17/77						4	4	4	6	6	6	6	8	6	10	16	16	16	16	16	16	16	16	8		4		200
	24	21	22	26	24	28	27	28	31	32	32	29	41	39	43	42	42	40	40	40	40	42	43	32	26	26	37	896
10/18/77						-2	-2	-2	-4	-4	-4	-4	-4	-4	-6	-8	-8	-8	-8	-8	-8	-8	-8					100
	24	21	22	26	24	26	25	26	27	28	28	25	37	35	37	34	34	32	32	32	32	34	35	32	26	26	37	796

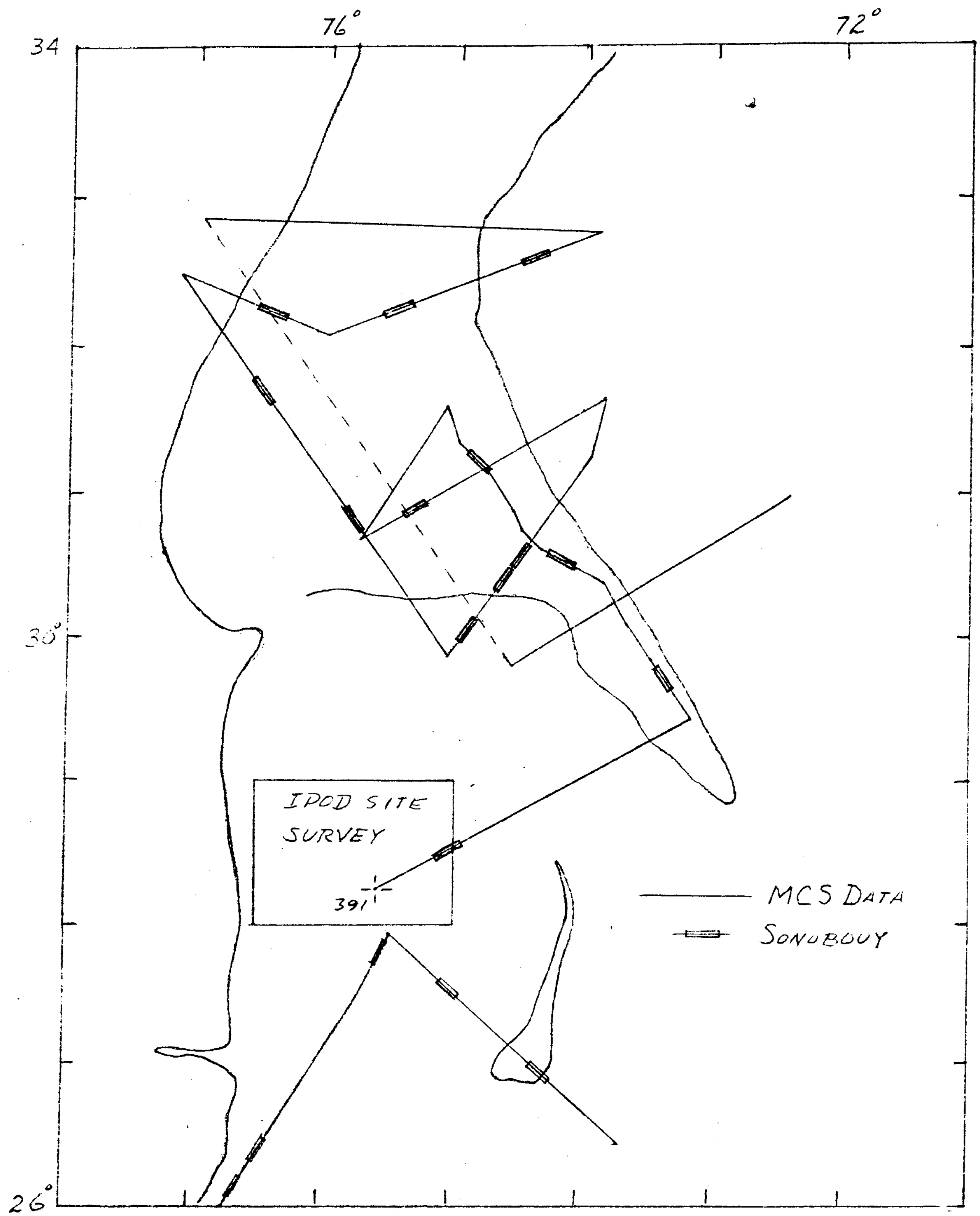


FIG. 1

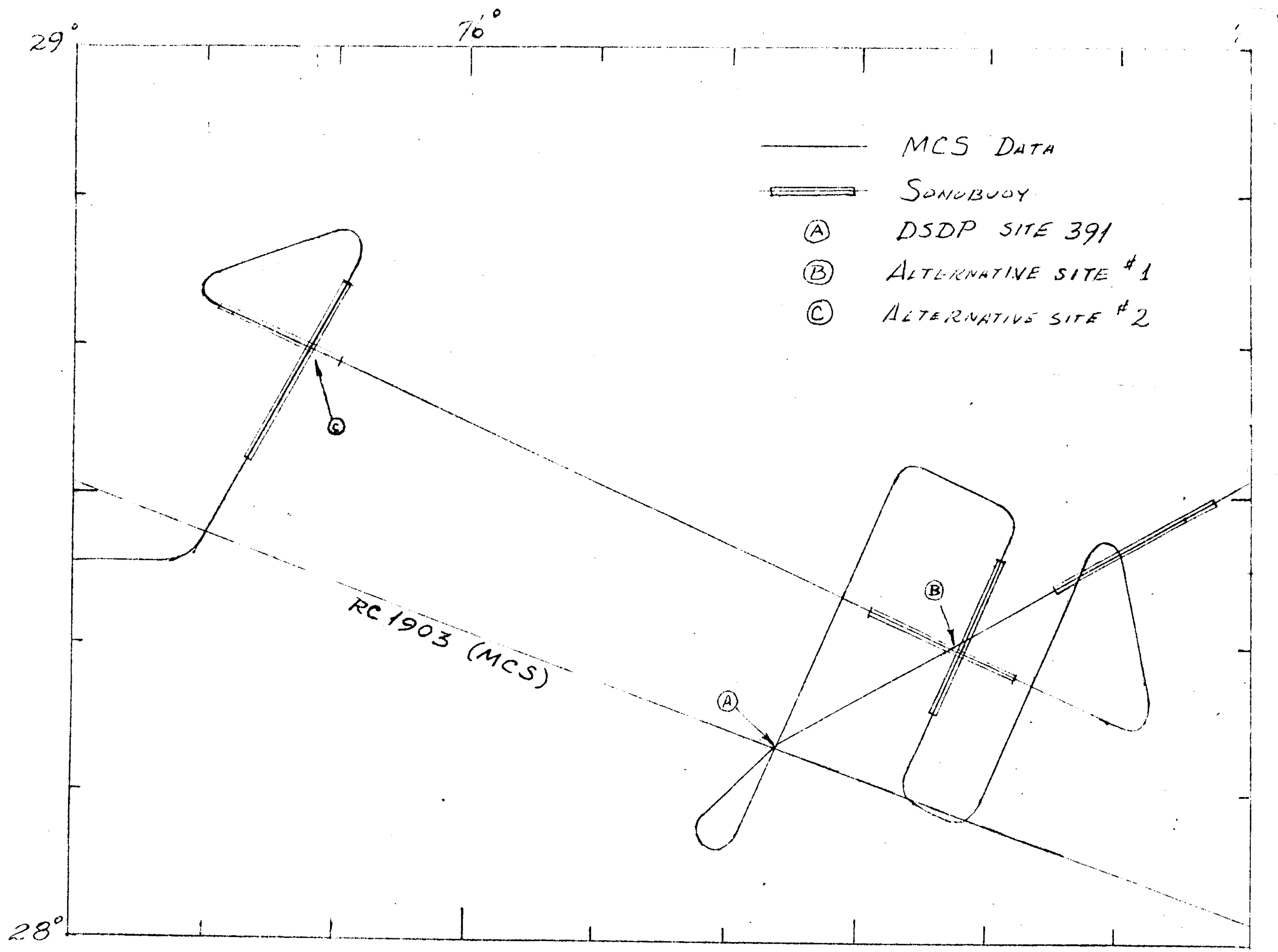
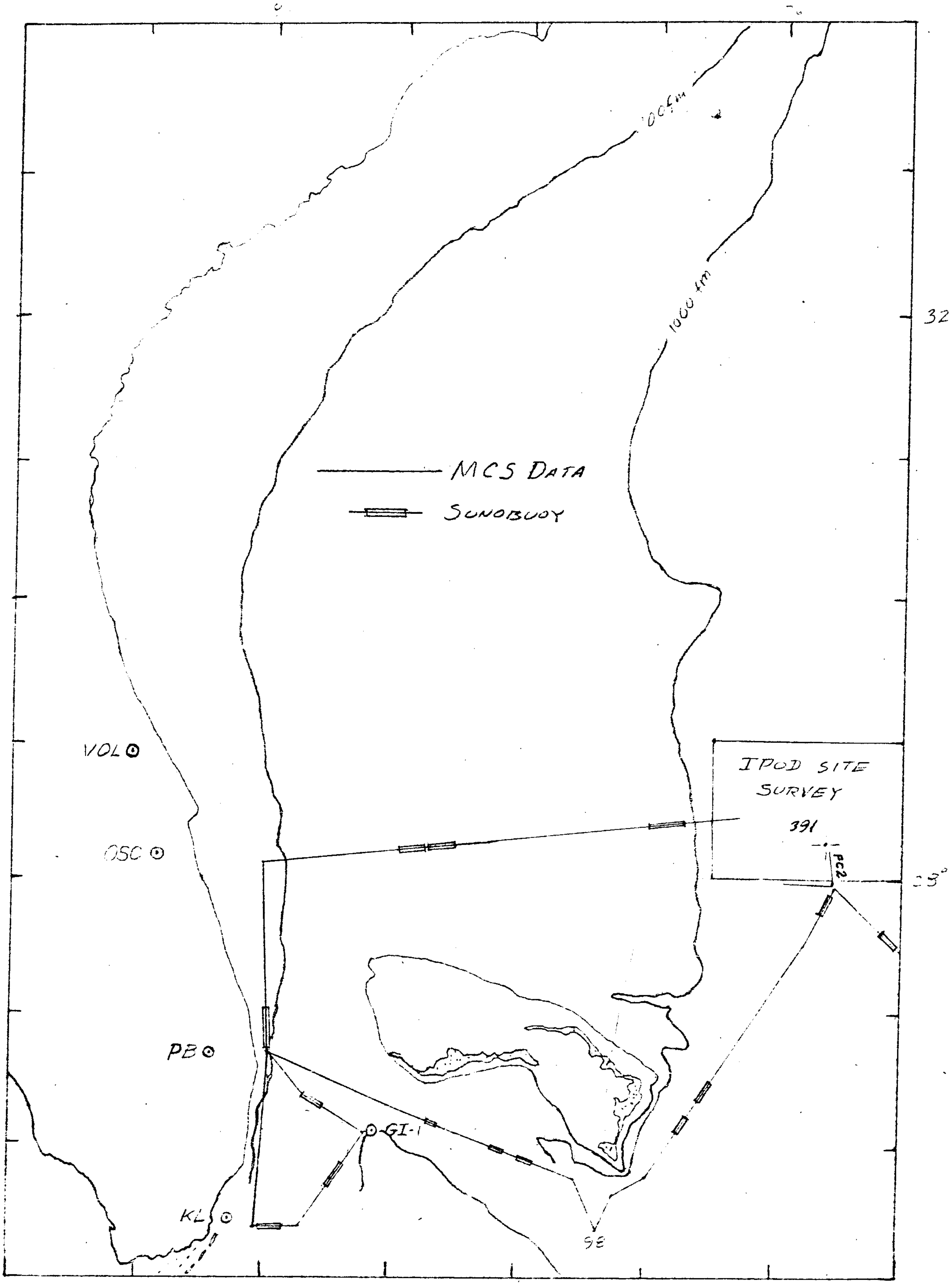

29°
70°
28°
MCS DATA
SONOBUOY
Ⓐ DSDP SITE 391
Ⓑ ALTERNATIVE SITE #1
Ⓒ ALTERNATIVE SITE #2
RC 1903 (MCS)
A
B
C

FIG. 2



100 fm
1000 fm
32°
MCS DATA
SONOBUOY
VOL
OSC
PB
IPOD SITE
SURVEY
391
PC2
GI-1
KL
98

FIG. 3

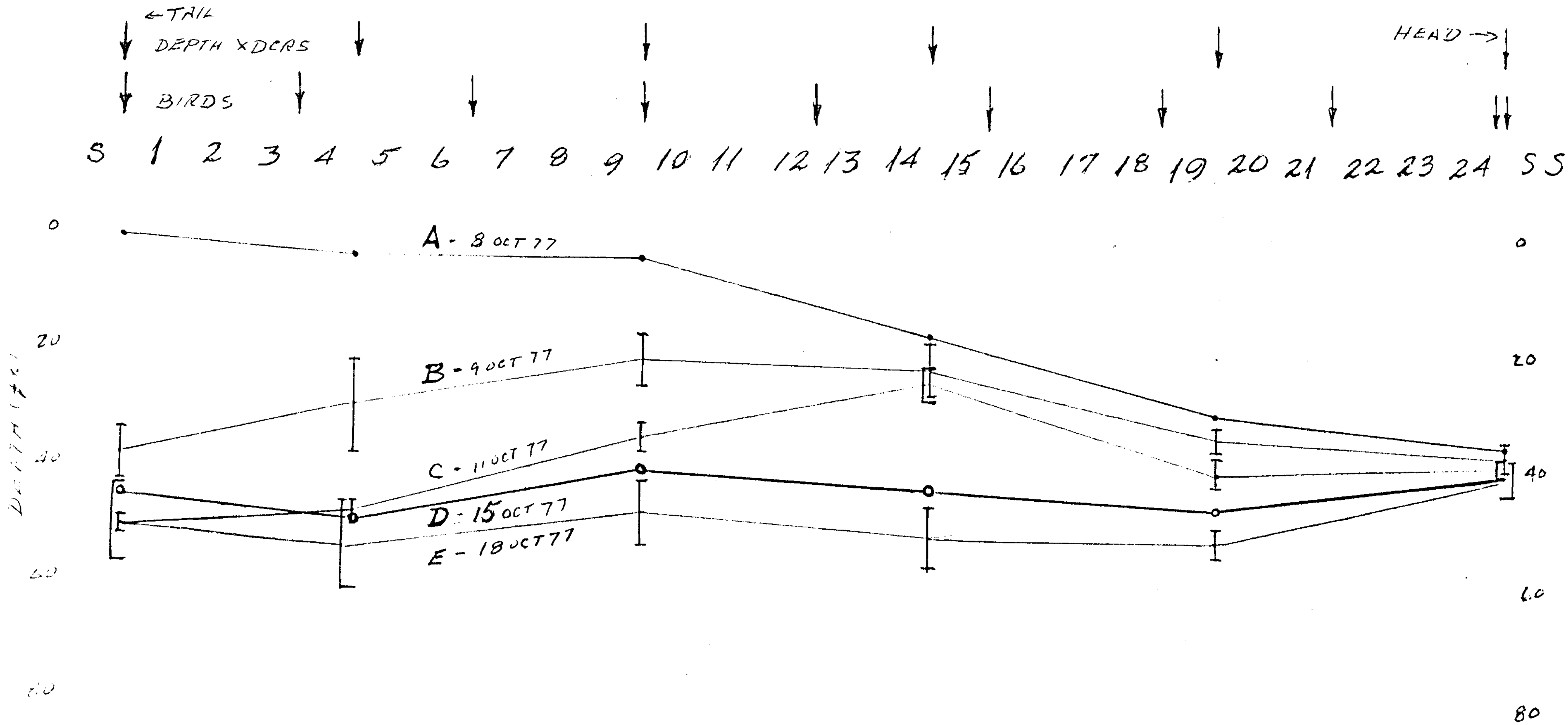
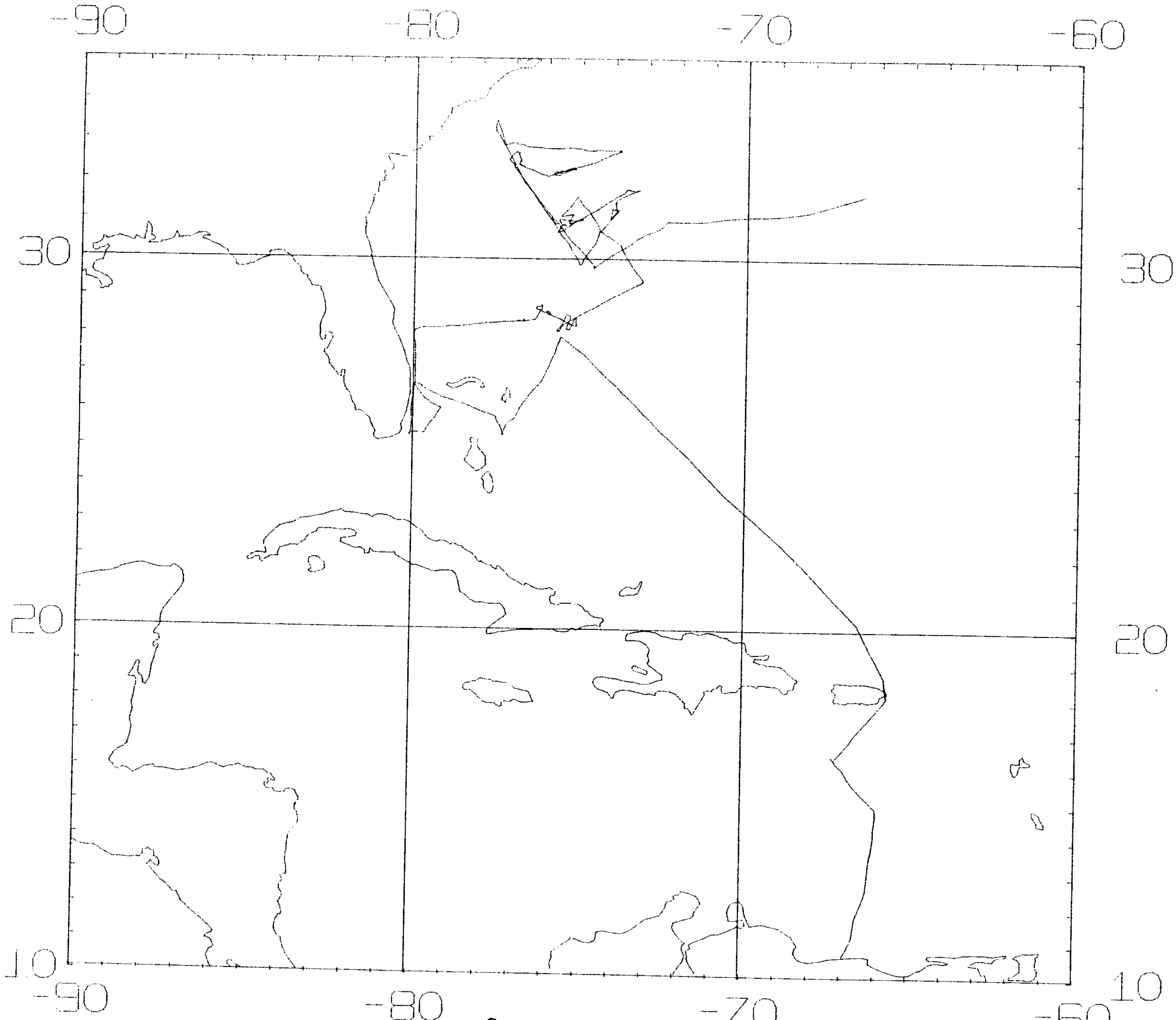

←TAIL
DEPTH XDCRS
BIRDS
HEAD →
S 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 SS
0
20
40
60
80
A - 8 OCT 77
B - 9 OCT 77
C - 11 OCT 77
D - 15 OCT 77
E - 18 OCT 77

FIG. 4



C 21-02