91614 copy

INSTITUTE FOR GEOPHYSICS
THE UNIVERSITY OF TEXAS AT AUSTIN

8701 Mopac Boulevard · Austin, Texas 78759-8345 · (512) 471-6156 · Telex: 910-874-1380 UTIG AUS

M E M O R A N D U M

DATE: January 28, 1991

TO: Dr. Arthur E. Maxwell

FROM: Jan Garmany, Seiichi Nagihara and Yosio Nakamura

SUBJECT: Cruise Report, Student Cruise XIV

UTIG Student Cruise No. 14 took place from 8 to 13 of January 1991 in the Gulf of Mexico on board *R/V Gyre*. The objectives of the cruise were (1) to test newly developed ocean-bottom seismographs, (2) to acquire seismic and heat-flow data relevant to deep structure of salt domes, and (3) to expose students to pioneering geophysical measurement technology and to give students experience in marine data acquisition in general.

Some relevant technical details of the experiments conducted during the cruise are as follows:

Experiment Site:	Area bounded by 26°55'N, 27°20'N, 95°00'W and 95°35'W
Experiments Conducted:	Multichannel Seismic (MCS), Ocean-Bottom Seismographs (OBS), Heat Flow, Magnetic
Equipment Used:	
Air Gun	1 429 in^3
Compressors	2 100 CFM, rented from Ardco
Streamer	1 4-channel, 25 m
OBS's	2 UTIG Donoho OBS's upgraded with high-density tape drive (Stations 1 and 3)
	1 UTIG C-44 3-channel OBS with QADC-2 (Station 2)
	1 UTIG C-44 4-channel OBS with QADC-3 (Station 4)
Heat Flow Probes	1 UTIG multi-outrigger-bow heat-flow probe
Magnetometer	Supplied by Texas A&M
Data Logger	Masscomp and Macintosh II

We sailed from Galveston about 12 hours later than originally planned because of a cold front that had just passed the area. The weather condition throughout the cruise, however, was relatively good for the time of the year, with steady 3- to 5-foot seas and some light rain early in the cruise. All experiment went without any major problems, and we were able to complete the cruise in 5 days (out of the 6-day allocation).

Overall, the cruise was quite successful. We collected multichannel seismic data along 26 lines over and around the salt domes within the area; all four OBS's returned with useful data (details later); we

made heat-flow measurements at 7 locations on the smaller of the two salt domes in the area; and we collected supplementary magnetic data along most of the seismic lines.

Captain Mark Bowen and his crew were quite competent and helpful in all respects. As usual, Bill Behrens had all of the students very well organized to take charge of the ship's navigation for various experiments.

The scientific party consisted of the following:

Jan Garmany	Co-chief scientist, OBS operation
Seiichi Nagihara	Co-chief scientist, heat-flow operation
Yosio Nakamura	Co-chief scientist, OBS operation
Bill Behrens	Student supervision, navigation, streamer, magnetometer and heat-flow operations
Ken Griffiths	Technical support, electronics
Archie Roberts	Technical support, heat-flow and air-gun operations
Eddie Wheeler	Technical support, heat-flow operation
Mark Wiederspahn	Technical support, data acquisition, OBS and heat-flow operations
Gery Billish	Technical support, air-gun operation
Lila Beckley	Graduate student
Cindy Goszewski	Graduate student
Dan Lizarralde	Graduate student
Jinyong Oh	Graduate student
Dan Olson	Graduate student
Ran Zhou	Graduate student
Khib Kugler	Undergraduate student
Ray Newby	Undergraduate student
Annette Peloquin	Undergraduate student
Desmond Rolf	Texas A&M
Dave Barrows	Texas A&M
R V Pittman	Texas A&M

A chronological narrative follows, with all times given in local Central Standard Time (CST), which is 6 hours behind UTC.

Saturday, January 5 - Monday, January 7

Members of the scientific party arrived at Galveston to prepare for the cruise

Tuesday, January 8

02:00 - 06:30	Turned on OBS's and closed up spheres
08:00	Departed from Galveston dock
13:00 - 13:13	Safety instructions
13:26 - 13:54	Air-gun test
23:05	Arrived at the test site

*** See Table 1 for details of activities at the test site ***

Saturday, January 12

15:07	Experiments completed, started sailing back to Galveston

Sunday, January 13

08:00	Returned to Galveston port

Summary of OBS performance

One of the main objectives of the cruise was to test the newly developed OBS's. The cruise was quite successful in achieving useful results.

The two old OBS's upgraded with higher capacity tape drives, deployed at stations 1 and 3, performed as expected. Because of the limited memory capacity (72K bytes), the data on these units must be transferred to the tape drive at short intervals, consuming tape drive motor power at a very high rate. The units lasted for 19 hours and 17 hours, respectively, for stations 1 and 3, before the tape motor power was exhausted. Both units recorded full 3-component seismic data for these durations.

A new OBS deployed at station 4 recorded 4 channels of data (3-component geophone and a hydrophone) for the entire 36-hour duration of the test. A minor problem, however, has been discovered: the recorded time information was occasionally late by exactly 0.3 second. It appears to be caused by a defective real-time clock chip on the microprocessor board. All three seismic channels recorded excellent data, but the hydrophone channel appears to be weak, possibly caused by a slight leakage of current at the feed-through of this high-impedance input.

Another new OBS deployed at station 2 may also have recorded full 36 hours of data. However, we have been unable to read past the first 2 and 3/4 hours of the recorded data because of a tape medium error in reading, suspected to be caused by a physically damaged tape. Seismic signals on all channels of this 3-component unit appear excellent.

The recorded signals at far distances, however, were often masked by strong signals from what appear to be shots from another seismic vessel in the area. Although we did not notice any other seismic vessels in the area during the experiment, and the MCS monitor record did not show any signs of interfering seismic signals, there apparently was another ship shooting air guns in the area. The problem is especially severe because we were using a relatively small air gun for this experiment.

Summery of heat-flow experiment

Objectives of the heat-flow measurements on this cruise were: (1) to test the integrity of the operating software of the heat-flow probe and (2) to augment our previous heat flow survey over the salt structure by collecting more data along the seismic lines.

We made two lowerings and occupied seven stations in total. Two stations were taken during the first lowering in the northern edge of the salt structure. The other five were taken during the second lowering near a seismic line in the south.

The sea state was bad for the heat-flow operation. Especially, the strong southward current of more than 3 knots made the station work very difficult. Despite the crew's maneuvering effort to keep stations, the ship drifted constantly with two- to three-knot speed. The steep wire angle from the stern indicated that the probe was several hundred meters behind the ship. A pinger was attached 75 m above the probe, but its bottom return signal hardly showed up in the EPC recorder in such condition. Because of these difficulties, the probe did not penetrate successfully at two of the seven stations.

We obtained good quality thermal gradient data at the five successful stations. However, we still had problems of misfiring heat pulses and were not able to collect in-situ thermal conductivity data. The misfiring is apparently a software problem. We were very disappointed because we had tested this software before the cruise rather extensively. A more complete software test is currently in progress.

Table 1. Activities at the Test Site

Time*	Location**	MCS / Air Gun	OBS	Heat Flow	Magnetic
8/23:14	27°02.4'N,95°10.0'W		St 1 deployed		
8/23:34	27°02.0'N 95°08.7'W		St 2 deployed		
8/23:53	27°00.6'N 95°07.1'W		St 3 deployed		
9/00:18	27°00.0'N 95°05.7'W		St 4 deployed		
9/01:34	26°57.1'N 95°02.9'W	Start line A			
9/03:31	26°58.8'N 95°08.5'W	End line A			
		Start line B			
9/04:00	26°58.9'N 95°05.8'W		Start recording		
9/04:13	26°59.2'N 95°04.7'W	Start line 1			
9/04:50	27°01.3'N 95°07.7'W	) 49.315 km			Start recording
9/09:05	27°14.7'N 95°29.0'W	End line 1			
9/09:16	27°15.2'N 95°28.8'W	Stop shooting) 0.981			
9/09:47	27°15.3'N 95°26.5'W	Resume shooting			
9/09:48	27°15.3'N 95°26.5'W	Start line 2) 16.103 km			
9/11:42	27°08.8'N 95°33.0'W	End line 2) 1.293			
9/11:52	27°08.1'N 95°33.0'W	Start line 3) 26.609			
9/14:40	27°19.4'N 95°23.0'W	End line 3) 1.007			
9/14:50	27°19.5'N 95°22.4'W	Start line 4) 9.690			
9/15:52	27°15.0'N 95°25.3'W	Stop shooting			
9/16:47	27°12.3'N 95°27.3'W	Resume shooting) 10.465			
9/17:55	27°07.7'N 95°31.0'W	End line 4) 2.231			
9/18:15	27°07.0'N 95°29.9'W	Start line 5) 25.089			
9/20:55	27°18.2'N 95°21.3'W	End line 5			
9/20:57	27°18.3'N 95°21.1'W	1.740	St 3 out of power		
9/21:10	27°17.9'N 95°20.3'W	Start line 6) 1.357			
9/21:43	27°15.9'N 95°21.7'W	Stop shooting			
9/21:47	27°15.8'N 95°21.9'W	Resume shooting			
9/22:57	27°11.9'N 95°24.4'W	) 21.969	St 1 out of power		
10/00:25	27°06.1'N 95°29.6'W	End line 6			
10/00:28	27°05.9'N 95°29.6'W	Stop shooting) 0.369			
10/00:34	27°05.4'N 95°29.5'W	Resume shooting			
10/00:49	27°05.6'N 95°28.4'W	Start line 7) 1.855			
10/03:51	27°18.6'N 95°18.2'W	End line 7) 29.327			

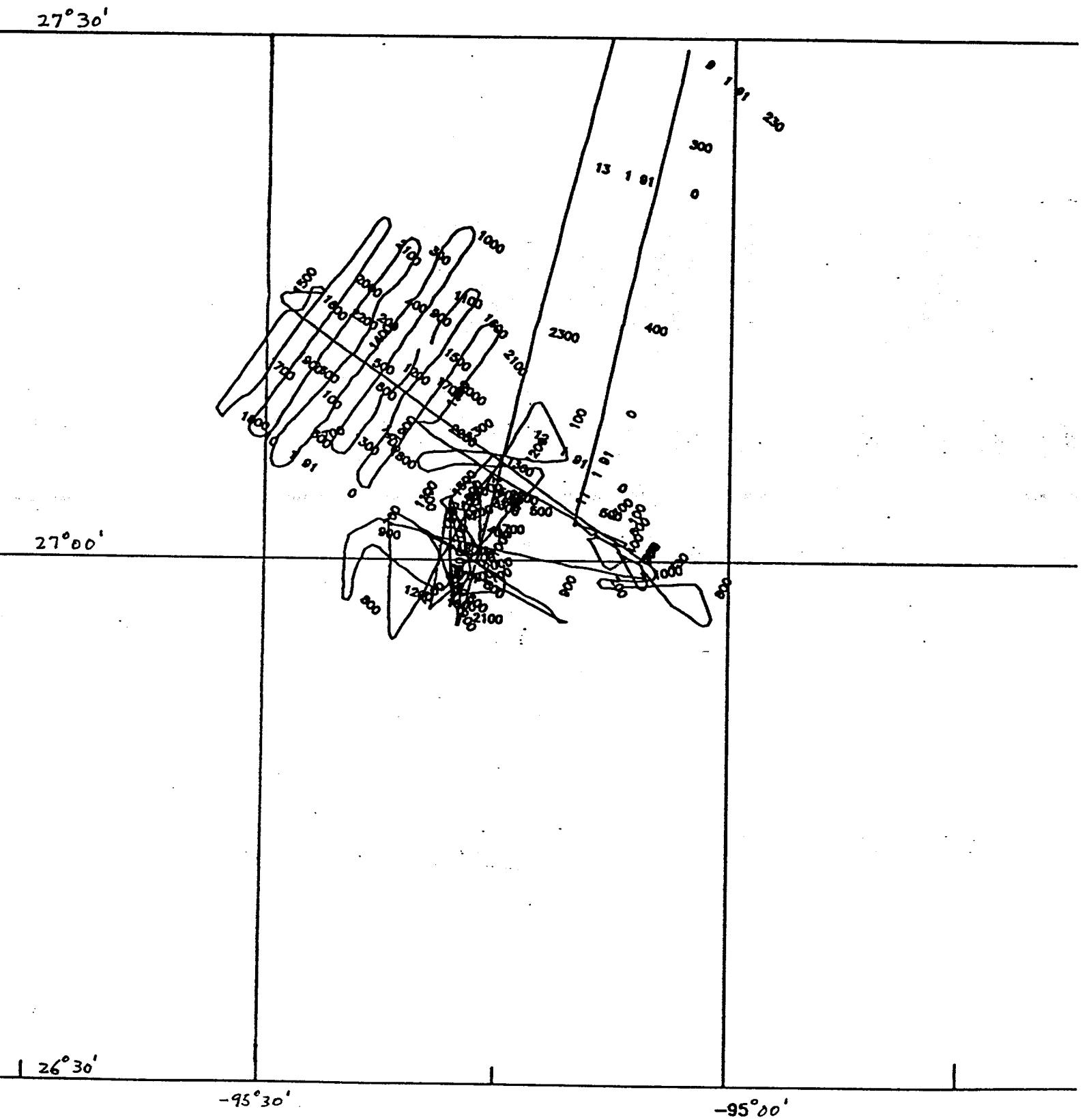
*Local time, in CST. Add 6 hours for UTC.
**To nearest 0.1 deg in latitude and longitude as given by a Northstar 6000 loran-C receiver.

(Table 1 continued: Page 2)

Time*	Location**	MCS / Air Gun	OBS	Heat Flow	Magnetic
10/04:15	27°18.4'N 95°16.9'W	Start line 8			
10/07:09	27°06.8'N 95°25.8'W	End line 8			
10/07:25	27°06.1'N 95°25.0'W	Start line 9			
10/09:35	27°15.3'N 95°17.4'W	End line 9			
10/09:39	27°15.5'N 95°17.1'W	Stop shooting			
10/09:54	27°15.0'N 95°16.6'W	Resume shooting			
		Start line 10			
10/12:17	27°05.2'N 95°24.0'W	End line 10			
10/12:35	27°04.1'N 95°23.4'W	Start line 11			
10/14:39	27°13.3'N 95°16.4'W	End line 11			
10/14:55	27°13.0'N 95°15.2'W	Start line 12			
10/16:00	27°08.0'N 95°19.1'W	End line 12	Stop recording		Stop recording
10/17:58	27°02.5'N 95°10.1'W		St 1 surfaced		
10/18:07	27°02.0'N 95°09.9'W		St 1 retrieved		
10/19:27	27°01.4'N 95°08.6'W		St 2 surfaced		
10/19:32	27°01.3'N 95°08.6'W		St 2 retrieved		
10/20:34	27°00.5'N 95°07.2'W		St 3 surfaced		
10/20:43	27°00.3'N 95°07.0'W		St 3 retrieved		
10/21:25	26°59.3'N 95°05.5'W		St 4 surfaced		
10/21:41	26°59.2'N 95°05.6'W		St 4 retrieved		
10/23/47	27°07.4'N 95°22.2'W			Probe in water	
11/00:42	27°04.6'N 95°23.1'W			Probe back on deck	
11/03:08	26°57.1'N 95°11.5'W	Start line 13			
11/05:13	27°02.7'N 95°21.6'W	End line 13			
		Start line 14			
11/06:31	26°55.7'N 95°22.0'W	End line 14			
		Start line 15			
11/08:28	27°03.4'N 95°16.7'W	End line 15			
11/09:07	27°04.0'N 95°16.4'W			Probe in water	
11/09:33	27°03.4'N 95°16.2'W			Probe on bottom	
11/09:51	27°03.1'N 95°16.2'W			Probe off bottom	
11/10:32	27°02.2'N 95°16.2'W			Probe on bottom	
11/10:47	27°01.9'N 95°16.2'W			Probe off bottom	
11/10:55	27°01.7'N 95°16.2'W			Probe out of water	
11/12:41	26°59.1'N 95°18.3'W			Probe in water	
11/13:11	26°57.5'N 95°17.8'W			Probe out of water	

(Table 1 continued: Page 3)

Time*	Location**	MCS / Air Gun	OBS	Heat Flow	Magnetic
11/14:48	26°59.1'N 95°18.0'W	Start line 16			
11/14:53	26°59.3'N 95°18.0'W	Stop shooting			
11/15:25	26°58.3'N 95°17.6'W	Restart line 16			
11/16:20	27°01.4'N 95°18.1'W	Stop shooting			
11/16:27	27°01.9'N 95°18.1'W	Resume shooting			
11/16:44	27°03.0'N 95°17.6'W	End line 16			
		Start line 17			
11/18:20	27°09.0'N 95°12.7'W	End line 17			
		Start line 18			
11/19:00	27°06.3'N 95°10.6'W	End line 18			
		Start line 19			
11/20:55	27°05.7'N 95°20.3'W	End line 19			
		Start line 20			
11/22:22	27°02.3'N 95°16.2'W	End line 20			
		Start line 21			
12/00:08	27°02.6'N 95°17.8'W	End line 21			
		Start line 22			
12/01:00	27°03.0'N 95°17.8'W	End line 22			
		Start line 23			
12/01:48	27°00.2'N 95°17.0'W	End line 23			
		Start line 24			
12/02:03	26°59.2'N 95°17.5'W	End line 24			
12/03:15	26°58.8'N 95°25.0'W				Start recording
12/07:45	27°03.1'N 95°17.3'W				End recording
12/09:07	27°02.9'N 95°18.3'W			Probe in water	
12/10:07	27°00.5'N 95°18.7'W			Probe on bottom	
12/10:25	27°00.4'N 95°18.7'W			Probe off bottom	
12/11:19	26°58.5'N 95°19.1'W			Probe on bottom	
12/11:30	26°58.4'N 95°19.1'W			Probe off bottom	
12/12:11	26°57.3'N 95°19.3'W			Probe on bottom	
12/12:22	26°57.2'N 95°19.3'W			Probe off bottom	
12/13:42	26°58.2'N 95°17.4'W			Probe on bottom	
12/13:52	26°58.2'N 95°17.4'W			Probe off bottom	
12/14:26	26°57.5'N 95°17.5'W			Probe on bottom	
12/14:37	26°57.4'N 95°17.5'W			Probe off bottom	
12/14:55	26°56.8'N 95°17.6'W			Probe on deck	


27°30'
27°00'
26°30'
-95°30'
-95°00'