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Naval Underwater Systems Center
New London Laboratory
New London, Connecticut 06320

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Technical Memorandum

GLOVER ASW Initiative Sea Test SW1 XBT Data

15 MARCH 1991

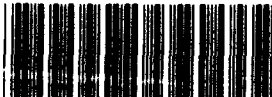
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Code 3121
Surface Ship Sonar

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ABSTRACT

The most recent Glover sea trial, January/February 1991, took place at various locations on the Blake Plateau and Basin, east of Florida on the Continental shelf and rise. The three platforms participating in these trials were the USNS Glover (T-AGFF-1), the R/V Range Rover (AUTEC), and the USS Providence (SSN-719). This report summarizes the temperature/sound speed profiles measured from each platform involved in the test along with some environmental data collected at sea during that period.

*(25) * Antisubmarine warfare, * Submarine detection, Sonar arrays, Sea testing, Nuclear powered submarines.*

ADMINISTRATIVE INFORMATION

This report was prepared under NUSC project number A23834, Glover ASW Initiative. The principal investigator was Delia Klingbeil. The sponsor was the Naval Sea System Command PMS411. Funding was provided under program element 63553.

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INTRODUCTION

Glover SW1 trials were conducted during January/February 1991. These trials included two separate deployments referred to as T2 and T3, during the last week of January and second week of February, respectively. Figure 1 shows the overall ocean area and "box" where this test occurred. Figure 2 shows a bottom contour plot of the area generated by the GEEP model (ref. 3). This memorandum provides listings and plots of the temperature/sound speed profiles measured from the three platforms involved in the test: the USNS Glover (T-AGFF-1), the R/V Range Rover (AUTECH), and the USS Providence (SSN-719). Some environmental data collected during these tests are also included.

OBJECTIVES

It was the Glover's intention to drop an XBT at the commencement (COMEX), termination (FINEX), and at the midpoint of each event. The comex XBT drop was taken about an hour before the actual comex of the event so that it could be incorporated into in-situ performance predictions and given to the shift leader prior to the start of a run.

The Range Rover's primary function was to simulate the submarine (receiver, echo repeater, beacon) as well as act as a source for studying various waveforms. Along with these objectives, the Range Rover collected environmental data in the test area. This included XBT data collection. The Range Rover was to collect XBT data at the COMEX, FINEX, and at two hour intervals during each event or as specified in the test plan. This data was to be used later for reconstruction and analysis purposes.

The Providence collected XBT data periodically during events for use in later reconstruction, modeling and analysis.

XBT DATA

USNS GLOVER

Expendable bathythermograph (XBT) temperature data were collected for the near-surface portion (0-2400 feet) of the water column at various locations during different events. Table 1 lists the XBTs taken on the Glover during SW1. The temperature profiles were entered into the Generic Sonar Model (GSM) which used the LEROY model to convert it to a Sound Speed Profile (SSP). A constant of 36.5 parts per thousand (ppt) was used for the salinity. Since this in-situ surface temperature profile (now converted to SSP) was only calculated to 2400 feet, it was then merged with the deep SSPs extracted from the historical Podeszwa data base (Ref. 1). The Podeszwa profiles for the area are shown plotted in Figure 3. The GSM (Ref. 2) was then used to produce a complete SSP plot using the CONGRATS fit submodel.

Appendix A shows the temperature profile data converted to sound speed plots and listings generated using this method. Generally, XBT data were taken prior to each event so as to have real-time in-situ sound speed-vs-depth profiles available for modeling purposes. True wind speed was measured and updated during each event. Bottom depth was extracted from the Historical Temporal Shipping (HITS) data base, which is built into the Generic Environmental Evaluation Program (GEEP, Ref. 3).

R/V RANGE ROVER

Temperature profile data were collected to depths between 100 and 750 meters using various XBT probes. At least one deep probe was used at each survey site. The data are in degrees (celsius) vs depth (meters) and not converted to a sound speed profile.

The Range Rover was equipped with an outboard XBT launcher mounted on the port rail. Data was collected by an XBT processor and transferred via RS-488 to a PC. A temperature profile was plotted on paper simultaneous to the XBT's descent. At the conclusion of the cast the data was stored on magnetic tape. Table 2 is a summary of the XBTs taken on the Range Rover during SW1. Appendix B shows the temperature profile plots recorded from the Range Rover.

USS PROVIDENCE

Table 3 show the positions and times of XBTs taken on the Providence. The plots of temperature/sound velocity are shown in Appendix C.

DIFFICULTIES

USNS GLOVER

There were several instances when the XBT fouled for unknown reasons. Perhaps the XBT wire came in contact with the RMES tow cable causing the the wire to break. There may have been some defective XBTs or the Glover may have been traveling too fast. On these occasions the cast would be repeated. Whenever possible, XBT's would be dropped while course changes were being made.

R/V RANGE ROVER

While conducting environmental surveys, the Range Rover towed a sound source. On a few occasions the tow cable to the source interfered with the XBT wire, cutting the XBT wire, and resulting in only a shallow cast. These casts were still useful for the near surface portion of the sound speed profile. High sea states during the trial caused wet decks and hazardous conditions, making some of the XBT drops difficult.

USS PROVIDENCE

There were no known equipment failures or problems taking XBTs on board the Providence. It would be desirable, however, to have more XBTs taken at shorter intervals during each event to give more accurate data analysis and reconstruction.

REFERENCES

- 1.) Podeszwa, E., "Sound Speed Profiles for the North Atlantic Ocean (U)", NUSC Technical Document 5447, 20 October 1976, (UNCLASSIFIED).
- 2.) Weinberg, H., "Generic Sonar Model (U)", NUSC Technical Document 5971D, 6 June 1985 (UNCLASSIFIED).
- 3.) Sonalyst Inc., "Generic Environmental Evaluation Program User's Guide", Sonalyst document MR8-0534-004, 1 December 1989.

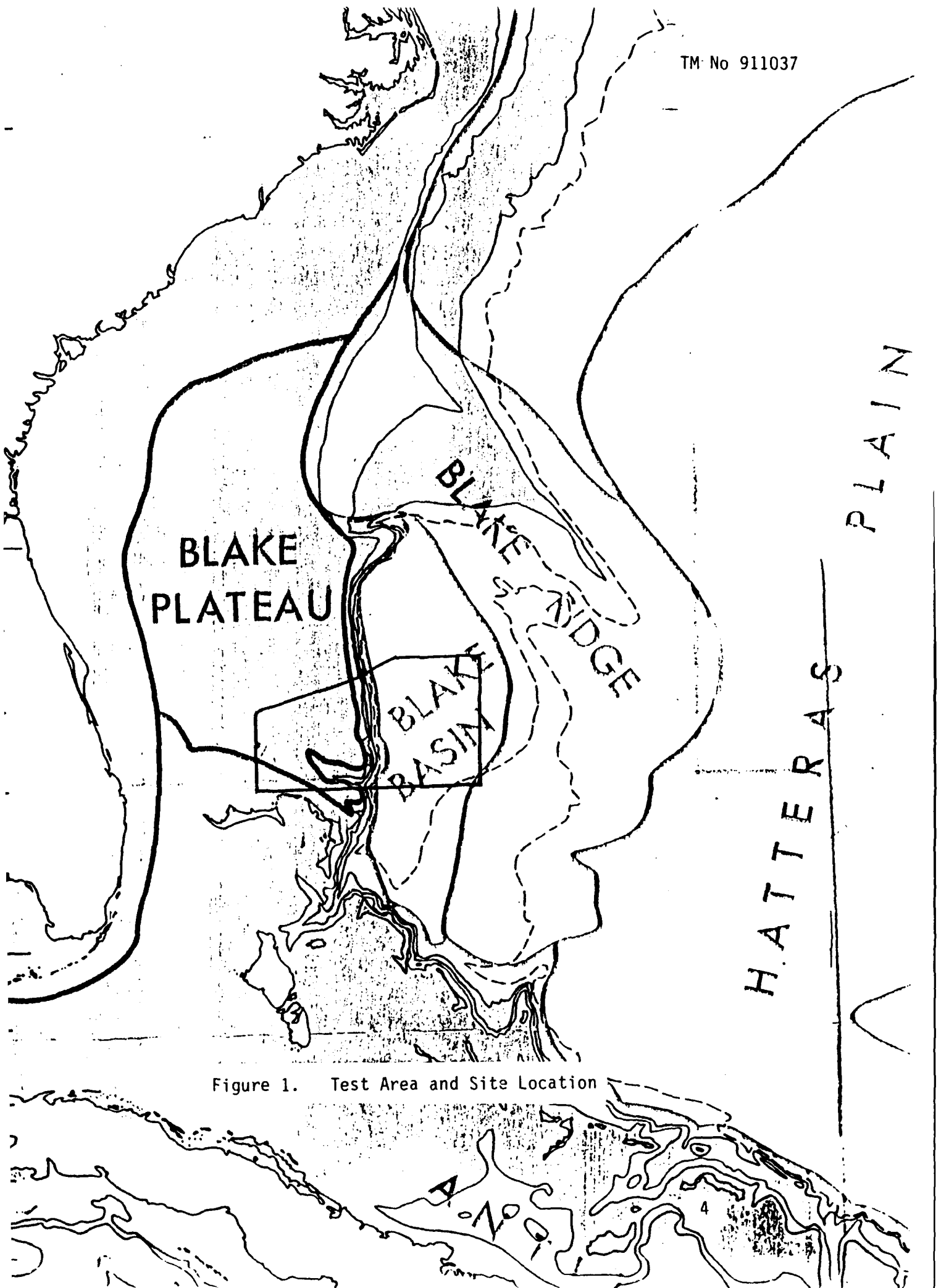


Figure 1. Test Area and Site Location

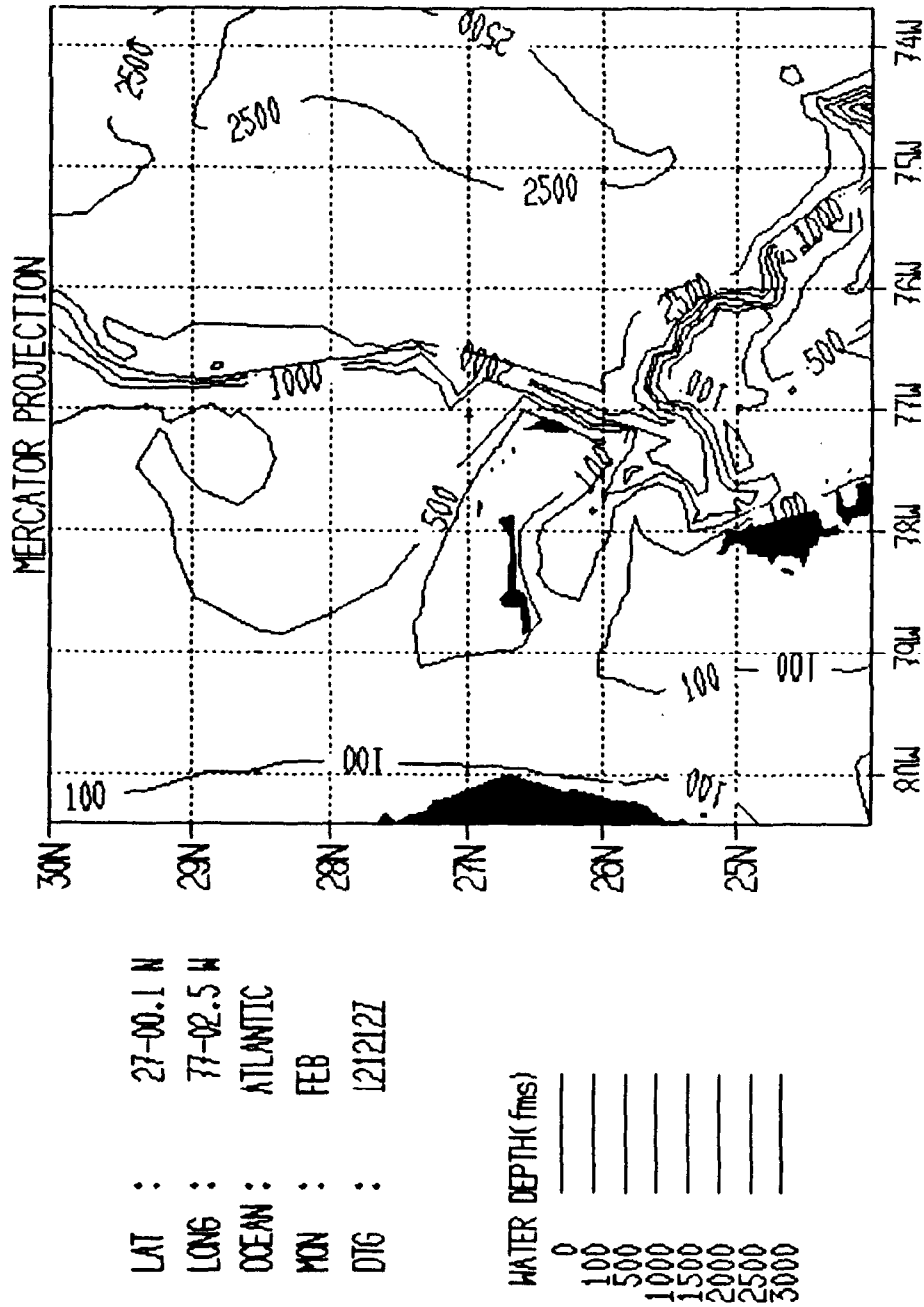
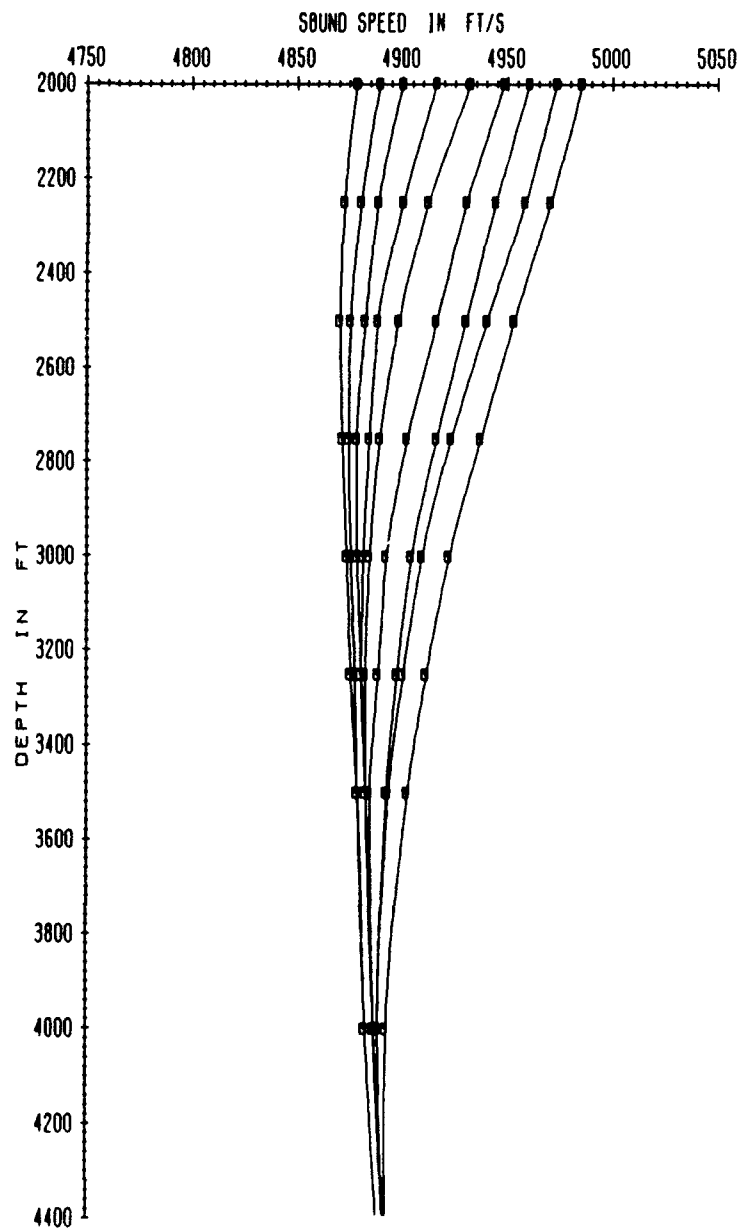


Figure 2. Bottom Characteristics Map

Figure 3. PODESZWA DEEP SOUND SPEED PROFILES
AREAS A9 THROUGH A17



XBT POSITION LATITUDE LONGITUDE	XBT TIME (ZULU)	XBT DAY (JULIAN)	BOTTOM DEP (FT)	WIND SPD (KNOTS)	MGS PROVINCE	PODESZA DEEP FILE	XBT FILE NAME
27-56.5N 78-14.2W	1251	031	3600.	13	6	A15	G031 1251.SVP
27-49.8N 77-55.7W	1543	031	3600.	15	6	A17	G031 1543.SVP
27-53.4N 78-16.1W	1750	031	3600.	13	6	A15	G031 1750.SVP
27-04N 77-25.4W	2300	031	3600.	7	6	A17	G031 3600.SVP
27-59.5N 76-58.8W	0422	032	3900.	4	4	A16	G032 0422.SVP
28-00.4N 77-21.4W	0800	032	3900.	4	4	A16	G032 0800.SVP
27-59.4N 77-40.2W	1244	032	3800.	15	4	A17	G032 1244.SVP
27-50.4N 76-50.6W	2220	032	15660.	16	4	A16	G032 2220.SVP
27-13N 76-59W	0100	046	5400.	35	4	A16	G046 0100.SVP
27-15N 76-51.4W	0500	046	5100.	25	4	A15	G046 0500.SVP
27-45.7N 77-07.6W	0845	046	4000.	32.5	4	A16	G046 0845.SVP
27-53N 77-05.4W	1245	046	3600.	30	4	A16	G046 1245.SVP
27-41N 78-01.6W	1830	046	3600.	33	4	A16	G046 1830.SVP
27-19.4N 75-41.3W	0030	048	15650.	24	5	A16	G048 0030.SVP
27-52.5N 75-40.7W	0320	048	15600.	15	5	A16	G048 0320.SVP
27-25.9N 75-55.1W	0950	048	15400.	18	5	A16	G048 0950.SVP
28-13.6N 75-47.6W	1525	048	15400.	7	5	A16	G048 1525.SVP
28-09.2N 76-15.8W	2000	048	15000.	4	5	A16	G048 2000.SVP
28-22.2N 76-54.6W	0000	049	3800.	10	4	A16	G049 0000.SVP
28-22.7N 77-08.7W	0315	049	3600.	10	4	A16	G049 0315.SVP
28-05.9N 77-44.8W	0715	049	3600.	15.5	4	A16	G049 0715.SVP
28-44.8N 78-14.6W	1115	049	3700.	16.5	4	A15	G049 1115.SVP

TABLE 1. USNS GLOVER SW1 XBT LOG

XBT POSITION LATITUDE LONGITUDE	XBT TIME (ZULU)	XBT DAY (JULIAN)	XBT PROBE	XBT DEPTH (M)	XBT ID #	SURFACE BUCKET TEMP (C)
27-45N 78-12W	0620	031	T-7	750.	1	24.4
27-48N 78-18W	1026	031	T-7	750.	2	24.4
27-44N 78-12W	1513	031	T-7	750.	3	24.6
27-46.7N 77-52.5W	2009	031	T-4	140.	4	24.4
27-46.7N 77-52.5W	2015	031	T-4	450.	5	24.4.
27-47N 77-03W	0139	032	T-4	450.	6	23.9
27-52N 77-05W	0524	032	T-4	125.	7	23.7
27-41N 77-34W	1005	032	T-4	450.	8	24.0
27-45.5N 77-36.8W	1317	032	T-4	450.	9	23.8
27-41.6N 76-37.5W	2216	032	T-4	450.	10	23.1
27-41.6N 76-37.5W	0203	033	T-7	210.	11	22.8
27-41.6N 76-37.5W	0211	033	T-7	350.	12	22.8

TABLE 2. R/V RANGE ROVER SW1 XBT LOG

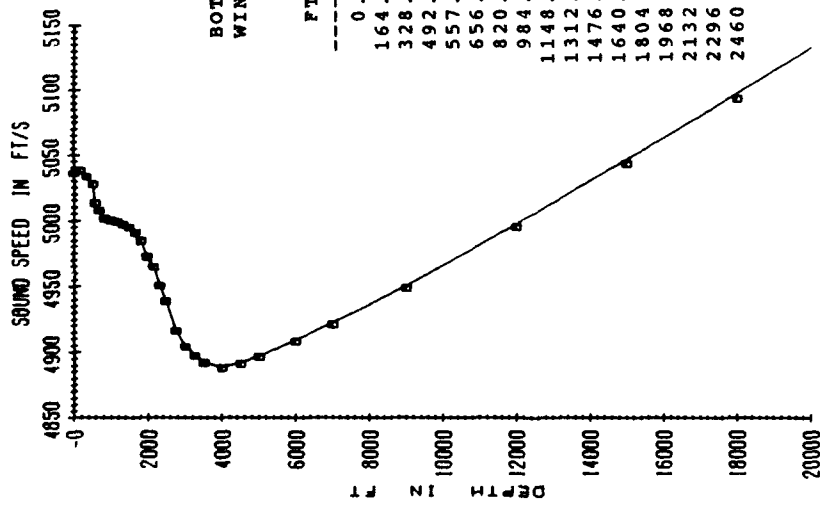
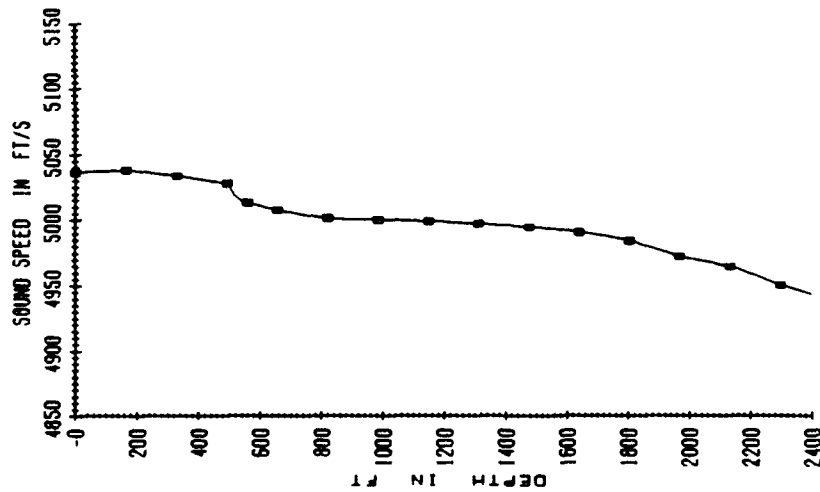
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27-49.9 78-83.9W	2345	046
28-03.7N 77-10.1W	0630	047
27-59N 78-06W	1400	047
27-59N 78-06W	1425	047
28-03N 77-11T	1800	047
28-11.9N 77-11.9W	0300	049
28-05.8N 77-13.9W	1800	049

TABLE 3. USS PROVIDENCE SW1 XBT LOG

APPENDIX A

USNS Glover Converted Sound Speed Profiles

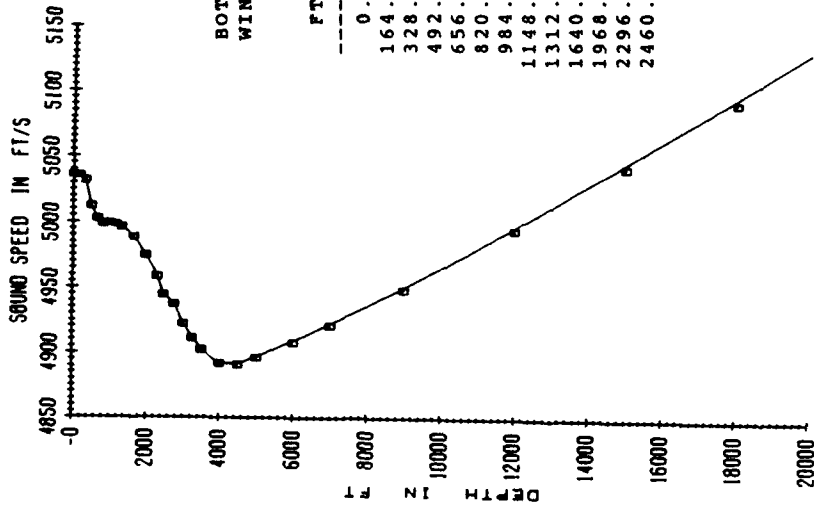
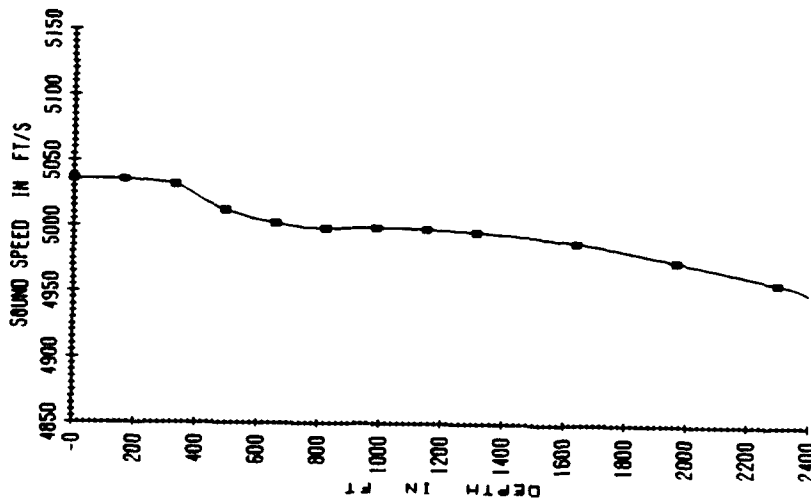
GLOVER - SOUND SPEED PROFILE
INSITU AT 1251Z DAY 031



XBT POSITION : 27-56.5N, 78-14.2W
BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 6
WIND SPEED = 13 KNOTS, MERGED WITH PODESZWA A15

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5035.9	2750.	4916.
164.0	5037.8	3000.	4904.
328.1	5033.3	3250.	4897.
492.1	5027.7	3500.	4892.
557.7	5013.2	4000.	4888.
656.2	5007.7	4500.	4891.
820.2	5001.3	5000.	4896.
984.3	5000.2	6000.	4908.
1148.3	4999.1	7000.	4921.
1312.3	4997.1	9000.	4949.
1476.4	4994.9	12000.	4995.
1640.4	4990.7	15000.	5044.
1804.5	4984.4	18000.	5094.
1968.5	4972.5	21000.	5146.
2132.5	4964.5		
2296.6	4950.6		
2460.6	4938.4		

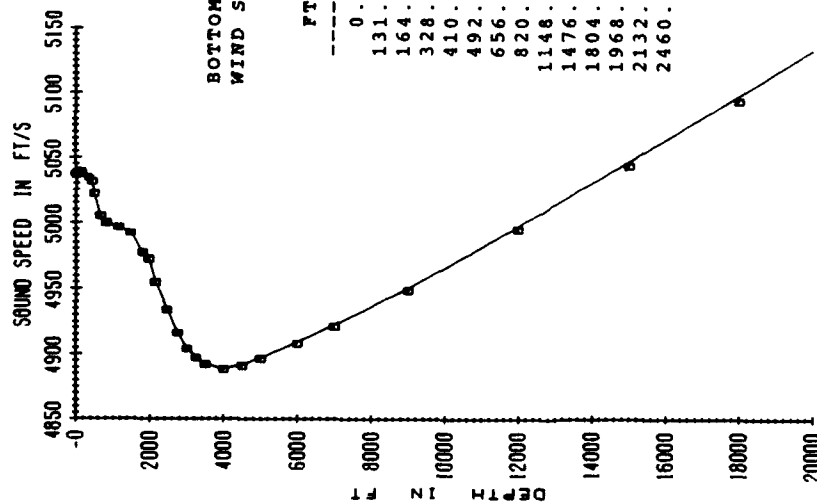
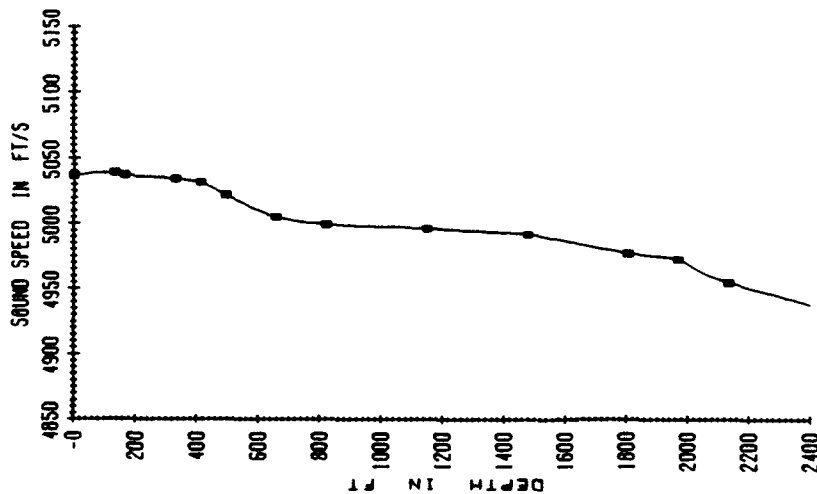
GLOVER - SOUND SPEED PROFILE
INSITU AT 1543Z DAY 031



XBT POSITION : 27-49.8N, 77-55.7W
BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 6
WIND SPEED = 15 KNOTS, MERGED WITH PODESZWA A17

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5035.9	2750.	4937.
164.0	5035.4	3000.	4922.
328.1	5031.6	3250.	4911.
492.1	5012.2	3500.	4902.
656.2	5002.3	4000.	4892.
820.2	4998.5	4500.	4891.
984.3	4999.3	5000.	4896.
1148.3	4998.2	6000.	4908.
1312.3	4996.1	7000.	4921.
1640.4	4988.7	9000.	4949.
1968.5	4974.6	12000.	4995.
2296.6	4958.5	15000.	5044.
2460.6	4944.2	18000.	5094.
		21000.	5146.

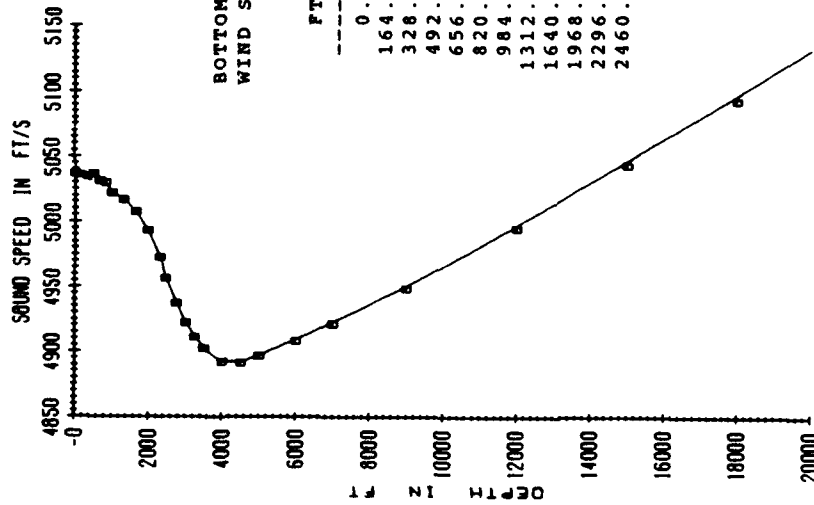
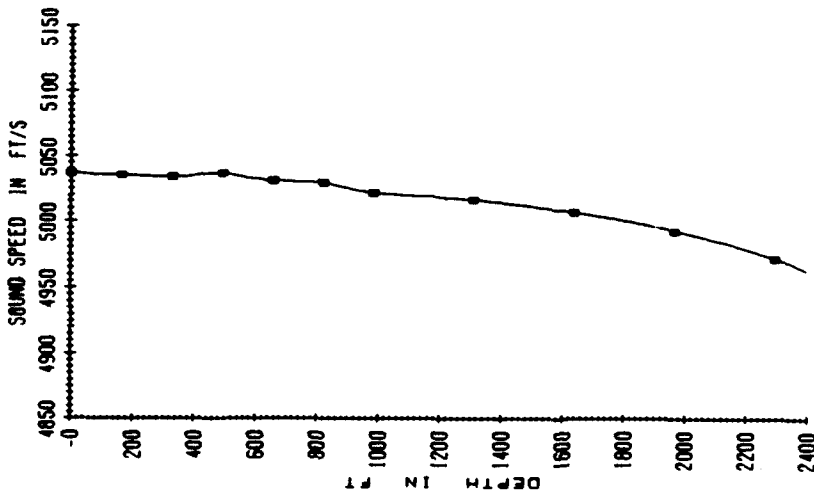
GLOVER - SOUND SPEED PROFILE
INSITU AT 1750Z DAY 031



XBT POSITION : 27-53.4N, 78-16.1W
BOTTOM DEPTH = 3600. FT. BOTTOM PROVINCE = 6
WIND SPEED = 13 KNOTS, MERGED WITH PODESZWA A15

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5036.7	2750.	4916.
131.2	5038.9	3000.	4904.
164.0	5037.0	3250.	4897.
328.1	5034.1	3500.	4892.
410.1	5031.3	4000.	4888.
492.1	5021.7	4500.	4891.
656.2	5005.0	6000.	4908.
820.2	4999.4	7000.	4921.
1148.3	4996.3	9000.	4949.
1476.4	4992.0	12000.	4995.
1804.5	4977.2	15000.	5044.
1968.5	4972.5	18000.	5094.
2132.5	4954.6	21000.	5146.
2460.6	4933.7		

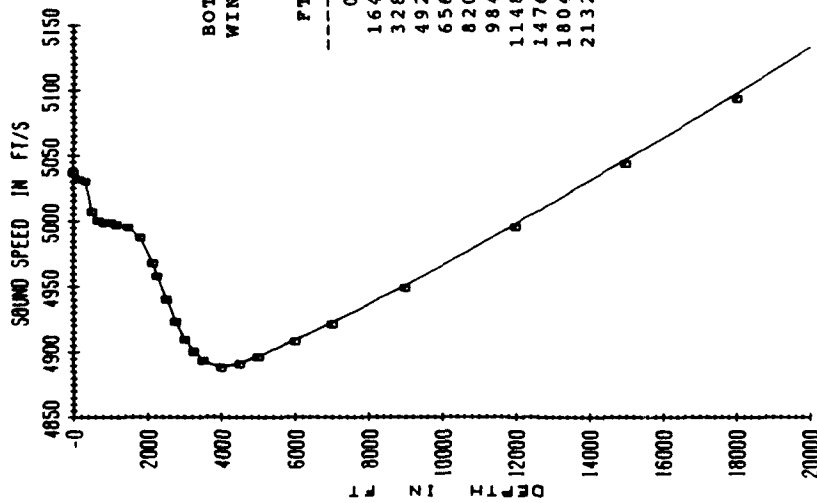
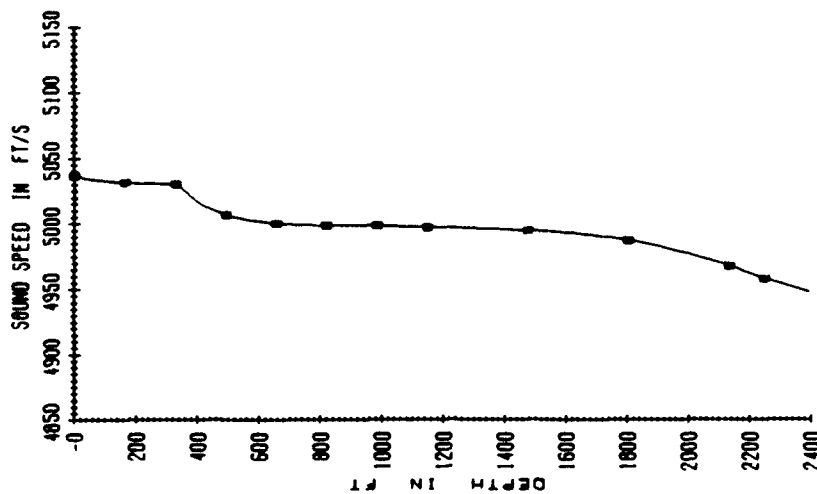
GLOVER - SOUND SPEED PROFILE
INSITU AT 2300Z DAY 031



XBT POSITION : 28-004N, 77-25.4W
BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 6
WIND SPEED = 7 KNOTS, MERGED WITH PODESZWA A17

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5036.7	2750.	4937.
164.0	5035.4	3000.	4922.
328.1	5034.1	3250.	4911.
492.1	5036.8	3500.	4902.
656.2	5031.2	4000.	4892.
820.2	5029.7	4500.	4891.
984.3	5022.0	5000.	4896.
1312.3	5016.7	6000.	4908.
1640.4	5007.2	7000.	4921.
1968.5	4993.1	9000.	4949.
2296.6	4972.6	12000.	4995.
2460.6	4956.7	15000.	5044.
		18000.	5094.
		21000.	5146.

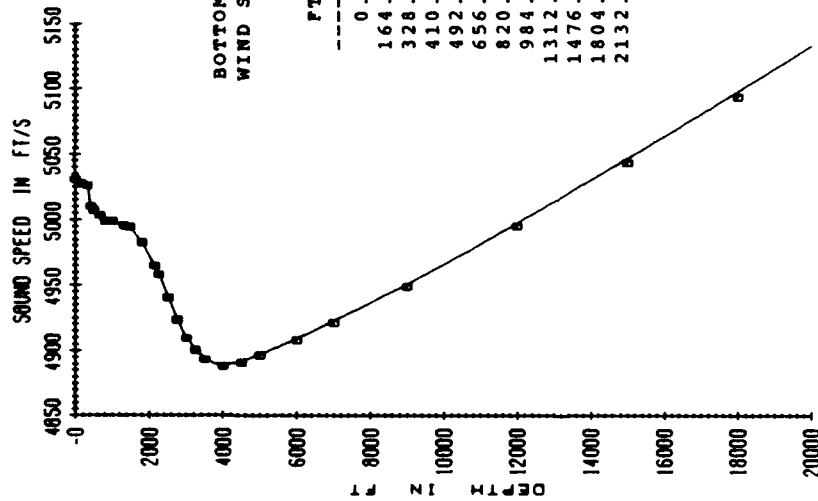
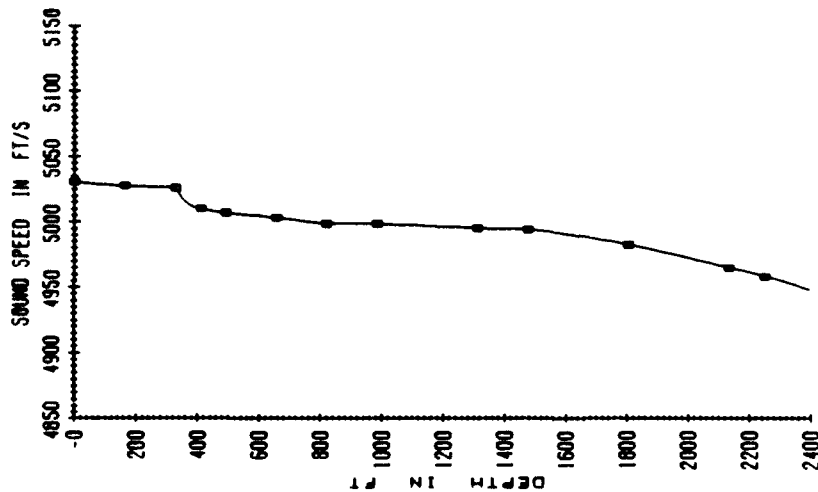
GLOVER - SOUND SPEED PROFILE
INSITU AT 0422Z DAY 032



XBT POSITION : 27-59.9N, 76-58.8W
BOTTOM DEPTH = 3900. FT, BOTTOM PROVINCE = 4
WIND SPEED = 4 KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5036.7	2250.	4958.
164.0	5031.4	2500.	4940.
328.1	5030.0	2750.	4923.
492.1	5006.8	3000.	4909.
656.2	5000.4	3250.	4900.
820.2	4998.5	3500.	4893.
984.3	4998.3	4000.	4888.
1148.3	4997.2	4500.	4891.
1476.4	4994.9	5000.	4896.
1804.5	4987.4	6000.	4908.
2132.5	4967.8	7000.	4921.
		9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

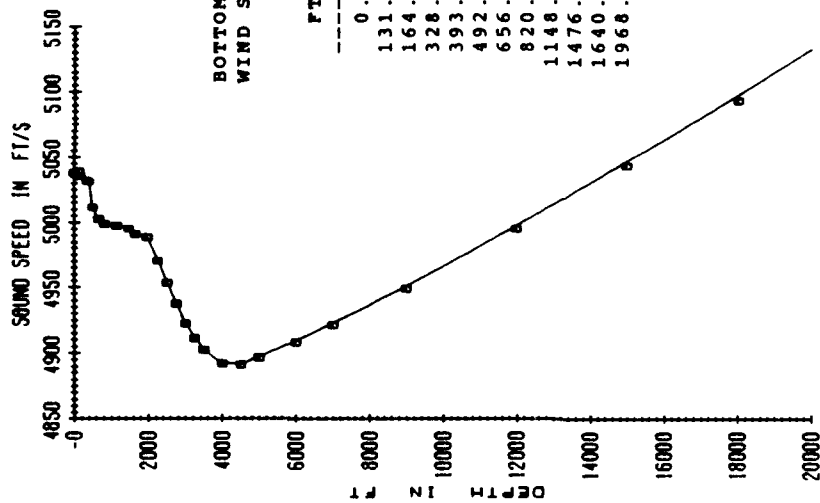
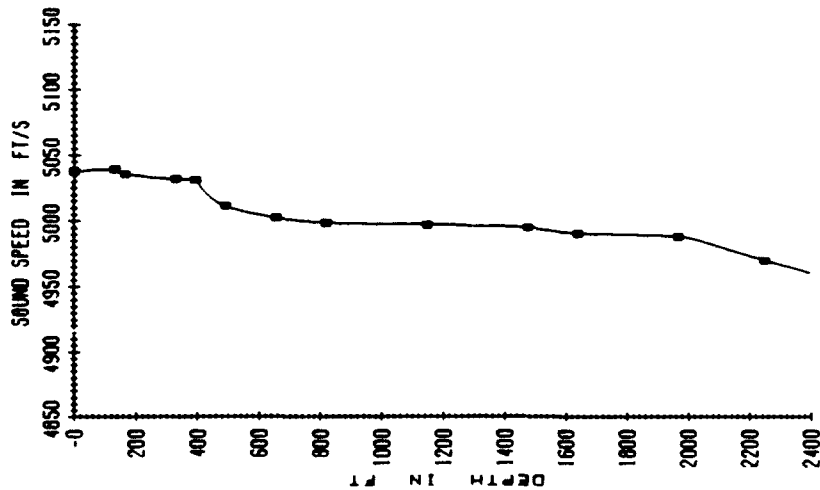
GLOVER - SOUND SPEED PROFILE
INSITU AT 0800Z DAY 032



XBT POSITION : 28-00.4N, 77-21.4W
BOTTOM DEPTH = 3900. FT, BOTTOM PROVINCE = 4
WIND SPEED = 4 KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5030.3	2250.	4958.
164.0	5027.3	2500.	4940.
328.1	5025.8	2750.	4923.
410.1	5009.9	3000.	4909.
492.1	5006.8	3250.	4900.
656.2	5003.2	3500.	4893.
820.2	4998.5	4000.	4888.
984.3	4998.3	4500.	4891.
1312.3	4995.1	5000.	4896.
1476.4	4993.9	6000.	4908.
1804.5	4982.3	7000.	4921.
2132.5	4964.5	9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

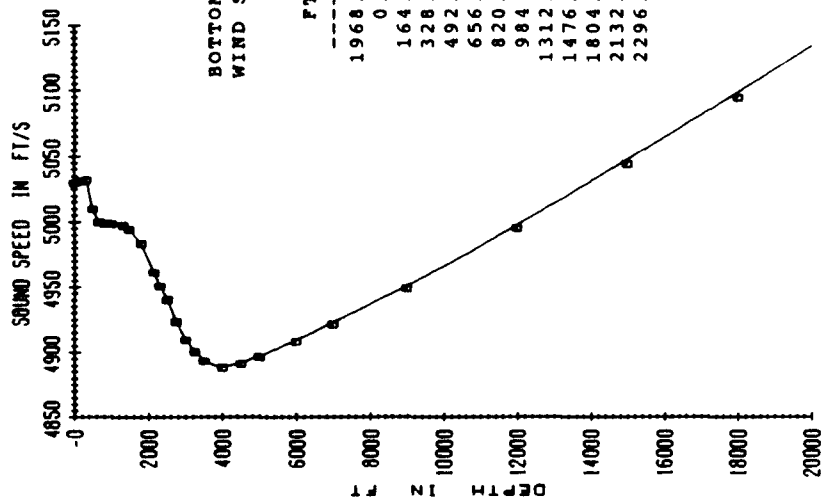
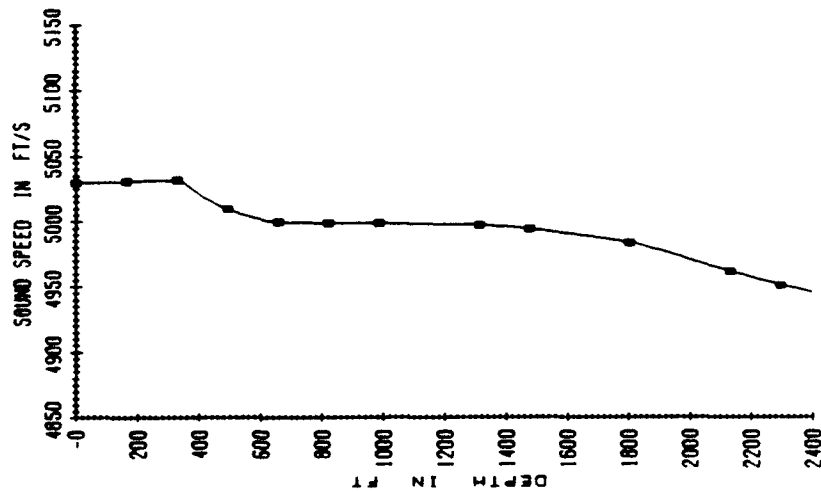
GLOVER - SOUND SPEED PROFILE INSITU AT 1244Z DAY 032



XBT POSITION : 27-59.4N, 77-40.2W
BOTTOM DEPTH = 3800. FT, BOTTOM PROVINCE = 4
WIND SPEED = 15 KNOTS, MERGED WITH PODESZWA A17

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5037.5	2250.	4970.
131.2	5038.9	2500.	4953.
164.0	5035.4	2750.	4937.
328.1	5031.6	3000.	4922.
393.7	5031.0	3250.	4911.
492.1	5011.3	3500.	4902.
656.2	5002.3	4000.	4892.
820.2	4998.5	4500.	4891.
1148.3	4997.2	5000.	4896.
1476.4	4994.9	6000.	4908.
1640.4	4990.7	7000.	4921.
1968.5	4988.1	9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

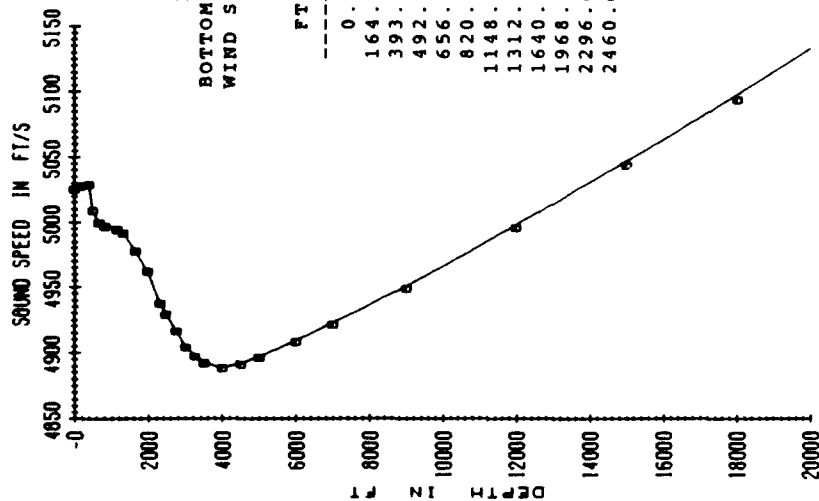
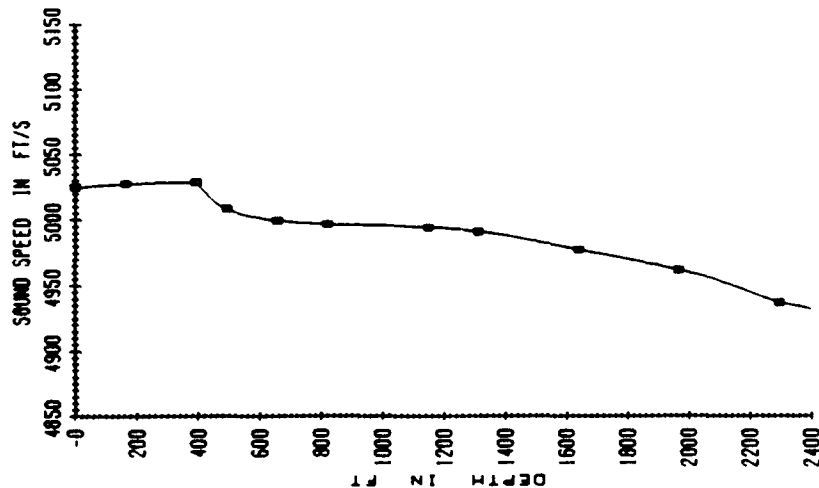
GLOVER - SOUND SPEED PROFILE
INSITU AT 2220Z DAY 032



XBT POSITION : 27-50.4N, 76-50.6W
BOTTOM DEPTH = 15660. FT, BOTTOM PROVINCE = 4
WIND SPEED = 16 KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
1968.5	4988.1	9000.	4949.
0.0	5029.5	2500.	4940.
164.0	5030.6	2750.	4923.
328.1	5031.6	3000.	4909.
492.1	5009.5	3250.	4900.
656.2	4999.5	3500.	4893.
820.2	4998.5	4000.	4888.
984.3	4998.3	4500.	4891.
1312.3	4997.1	5000.	4896.
1476.4	4993.9	6000.	4908.
1804.5	4983.3	7000.	4921.
2132.5	4961.3	9000.	4949.
2296.6	4950.6	12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

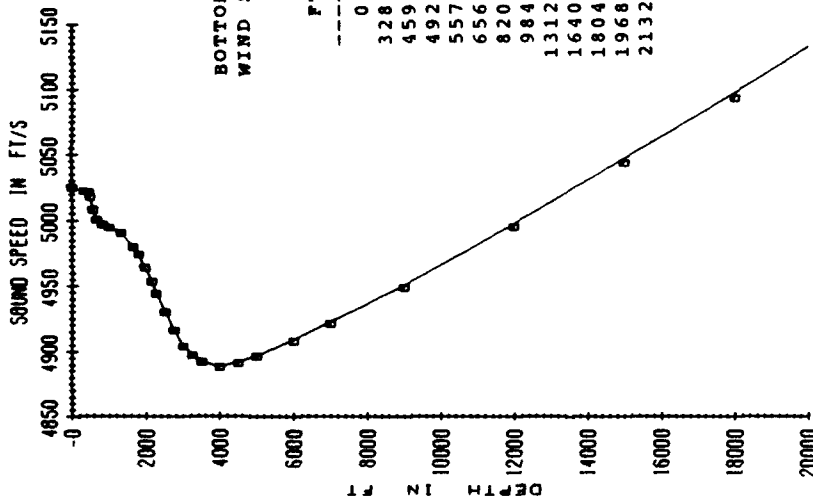
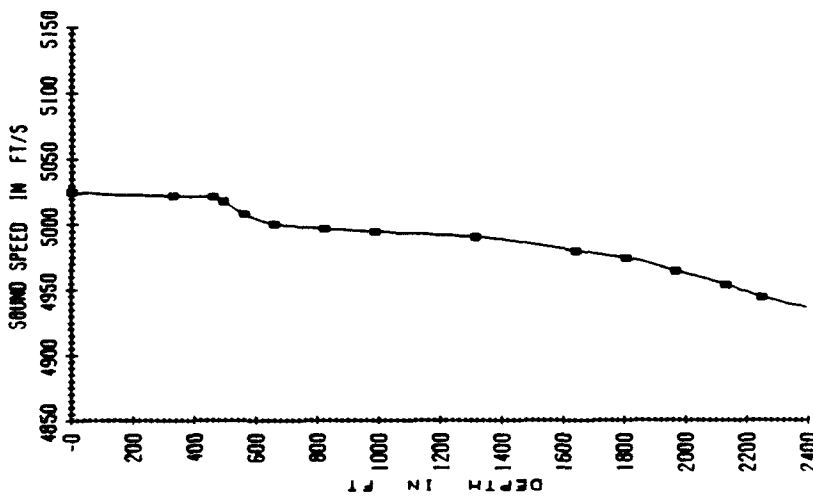
SOUND SPEED PROFILE, CLOVER INSITU AT 0100Z DAY 046



XBT POSITION : 27-13N, 76-59W
 BOTTOM DEPTH = 5400. FT, BOTTOM PROVINCE = 4
 WIND SPEED = 35 KNOTS, MERGED WITH PODESZWA A15

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5024.6	2750.	4916.
164.0	5027.3	3000.	4904.
393.7	5028.6	3250.	4897.
492.1	5008.6	3500.	4892.
656.2	4999.5	4000.	4888.
820.2	4996.6	4500.	4891.
1148.3	4994.4	5000.	4896.
1312.3	4991.2	6000.	4908.
1640.4	4977.6	7000.	4921.
1968.5	4961.8	9000.	4949.
2296.6	4936.9	12000.	4995.
2460.6	4929.0	15000.	5044.
		18000.	5094.
		21000.	5146.

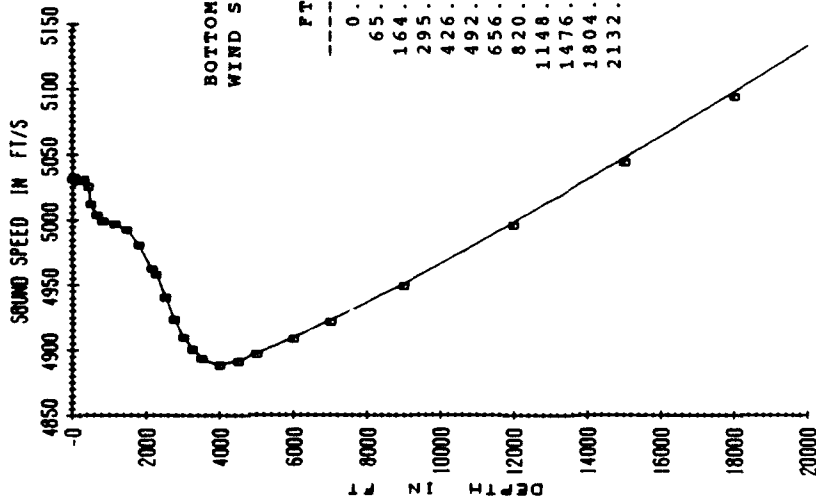
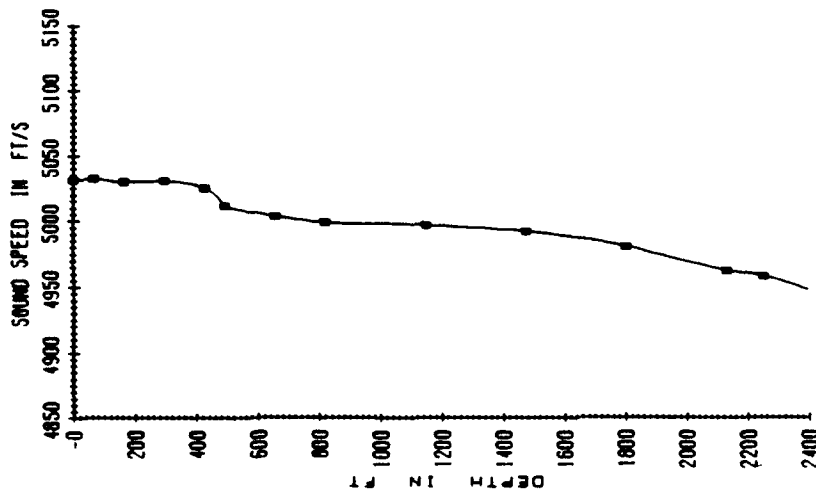
SOUND SPEED PROFILE, CLOVER
INSITU AT 0500Z DAY 046



XBT POSITION : 27-15N, 76-51.4W
BOTTOM DEPTH = 5100. FT, BOTTOM PROVINCE = 4
WIND SPEED = 25 KNOTS, MERGED WITH PODESZWA A15

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5024.6	2250.	4944.
328.1	5021.6	2500.	4930.
459.3	5021.2	2750.	4916.
492.1	5017.4	3000.	4904.
557.7	5007.9	3250.	4897.
656.2	5000.4	3500.	4892.
820.2	4996.6	4000.	4888.
984.3	4994.5	4500.	4891.
1312.3	4990.3	5000.	4896.
1640.4	4979.6	6000.	4908.
1804.5	4974.0	7000.	4921.
1968.5	4964.0	9000.	4949.
2132.5	4953.5	12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

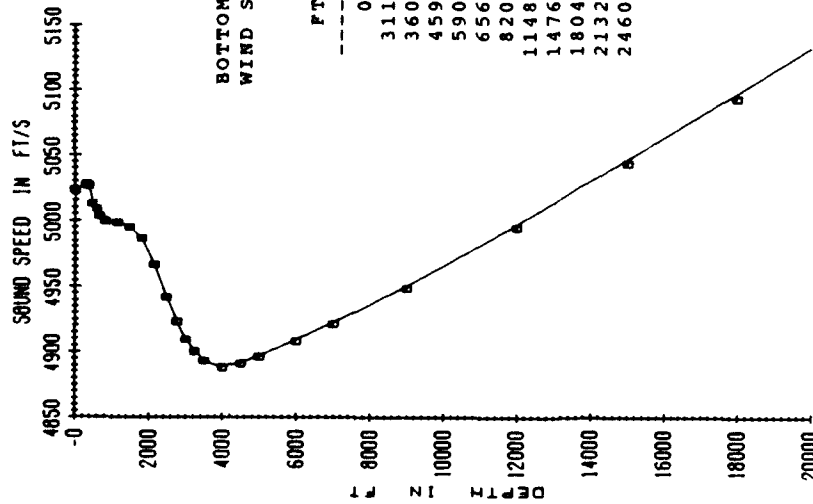
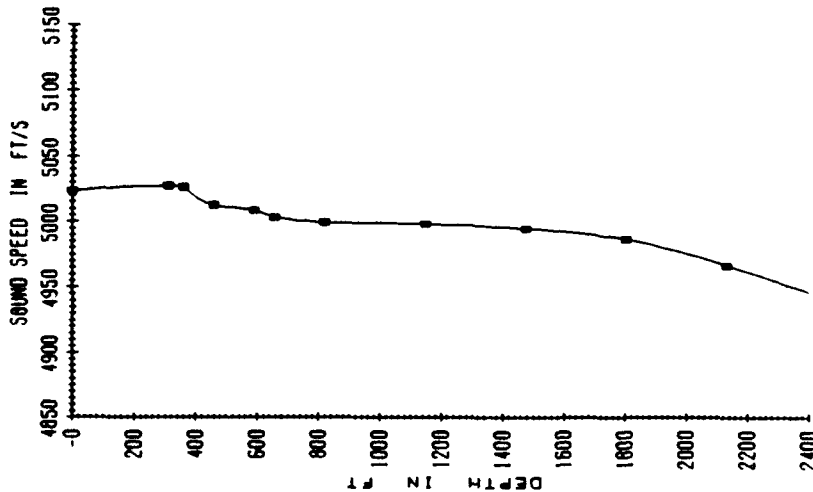
SOUND SPEED PROFILE, GLOVER INSITU AT 0845Z DAY 046



XBT POSITION : 27-45.7N, 77-07.6W
 BOTTOM DEPTH = 4000. FT, BOTTOM PROVINCE = 4
 WIND SPEED = 32.5 KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5031.1	2250.	4958.
65.6	5032.2	2500.	4940.
164.0	5029.7	2750.	4923.
295.3	5030.3	3000.	4909.
426.5	5024.9	3250.	4900.
492.1	5011.3	3500.	4893.
656.2	5003.2	4000.	4888.
820.2	4998.5	4500.	4891.
1148.3	4996.3	5000.	4896.
1476.4	4992.0	6000.	4908.
1804.5	4980.3	7000.	4921.
2132.5	4962.3	9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

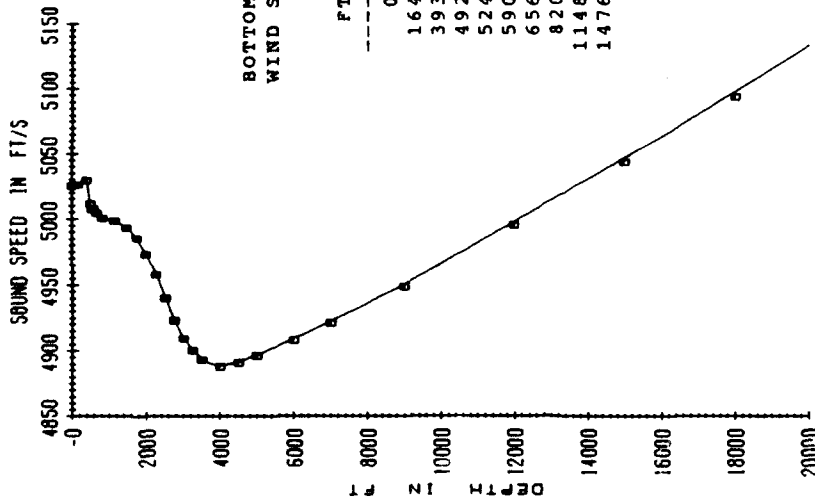
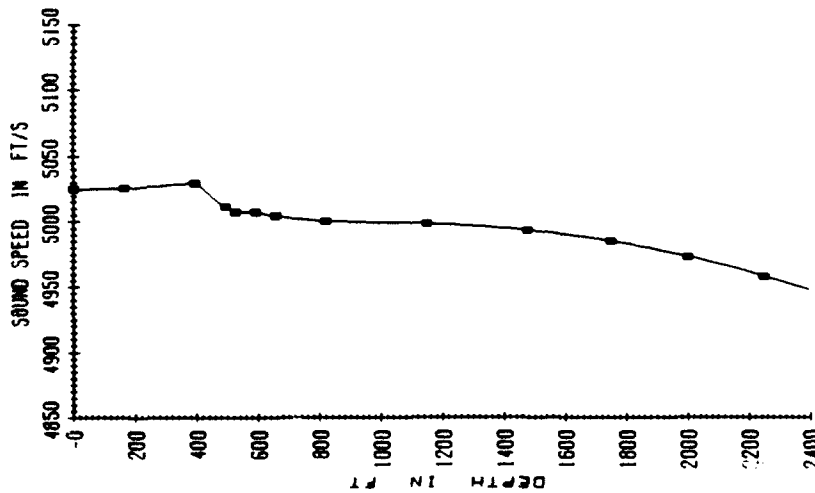
SOUND SPEED PROFILE, CLOVER INSITU AT 1245Z DAY 046



XBT POSITION : 27-53N, 77-05.4W
 BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 4
 WIND SPEED = 30. KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5022.9	2750.	4923.
311.7	5027.2	3000.	4909.
360.9	5026.4	3250.	4900.
459.3	5012.5	3500.	4893.
590.6	5008.4	4000.	4888.
656.2	5003.2	4500.	4891.
820.2	4999.4	5000.	4896.
1148.3	4998.2	6000.	4908.
1476.4	4994.9	7000.	4921.
1804.5	4986.4	9000.	4949.
2132.5	4966.7	12000.	4995.
2460.6	4941.9	15000.	5044.
		18000.	5094.
		21000.	5146.

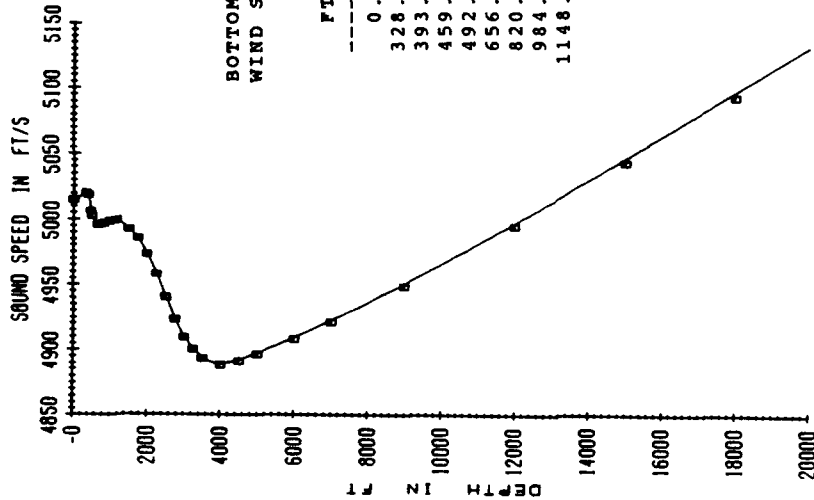
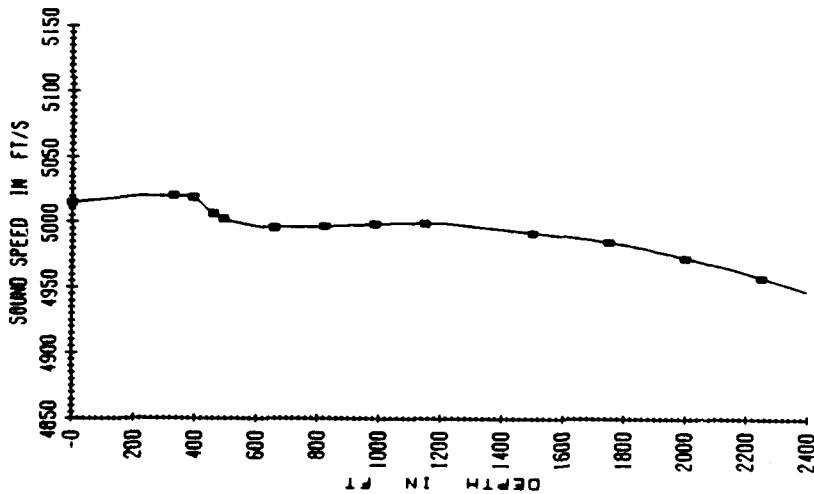
SOUND SPEED PROFILE, CLOVER
INSITU AT 1830Z DAY 046



XBT POSITION : 27-41N, 78-01.6W
BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 4
WIND SPEED = 33. KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5024.6	1750.	4985.
164.0	5025.6	2000.	4973.
393.7	5029.4	2250.	4958.
492.1	5011.3	2500.	4940.
524.9	5007.4	2750.	4923.
590.6	5007.5	3000.	4909.
656.2	5004.1	3250.	4900.
820.2	5000.3	3500.	4893.
1148.3	4998.2	4000.	4888.
1476.4	4993.0	4500.	4891.
		5000.	4896.
		6000.	4908.
		7000.	4921.
		9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

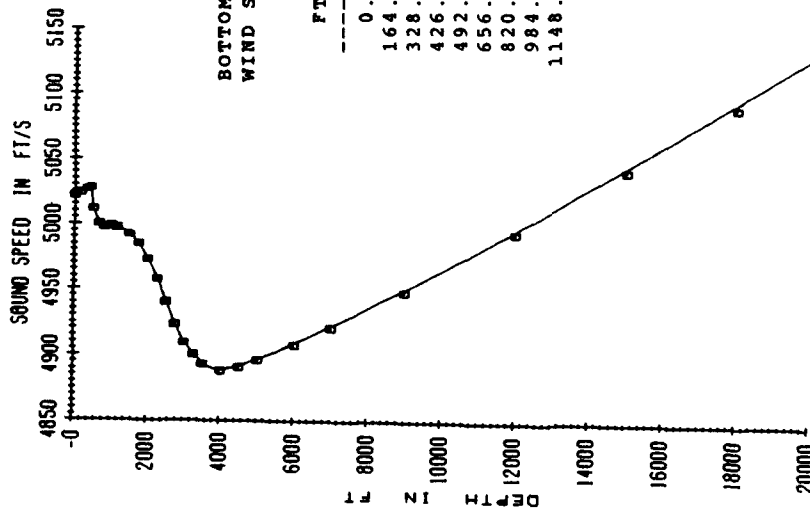
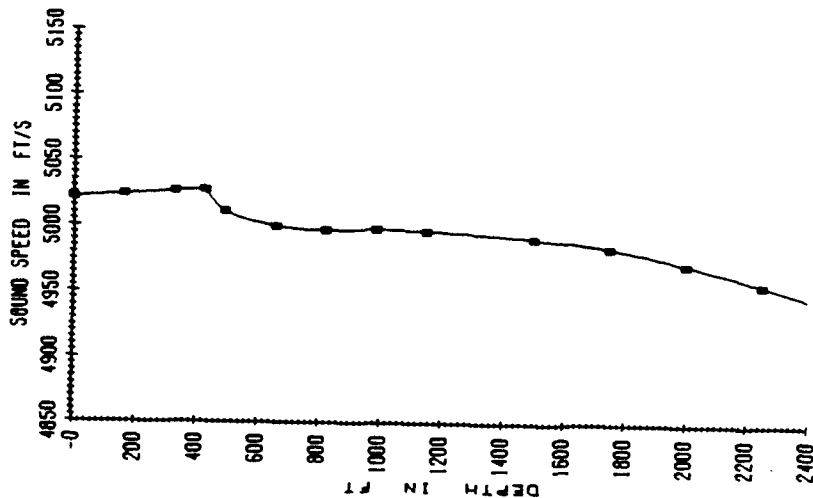
**SOUND SPEED PROFILE, CLOVER
INSITU AT 0030Z DAY 048**



XBT POSITION : 27-19.4N, 75-41.3W
 BOTTOM DEPTH = 15650. FT, BOTTOM PROVINCE = 5
 WIND SPEED = 24. KNOTS, MERGED WITH PODESZA A16

XBT DATA		PODESZA DATA	
FT	FT/S	FT	FT/S
0.0	5014.5	1500.	4992.
328.1	5019.9	1750.	4985.
393.7	5018.4	2000.	4973.
459.3	5006.3	2250.	4958.
492.1	5002.3	2500.	4940.
656.2	4995.8	2750.	4923.
820.2	4996.6	3000.	4909.
984.3	4998.3	3250.	4900.
1148.3	4999.1	3500.	4893.
		4000.	4888.
		4500.	4891.
		5000.	4896.
		6000.	4908.
		7000.	4921.
		9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

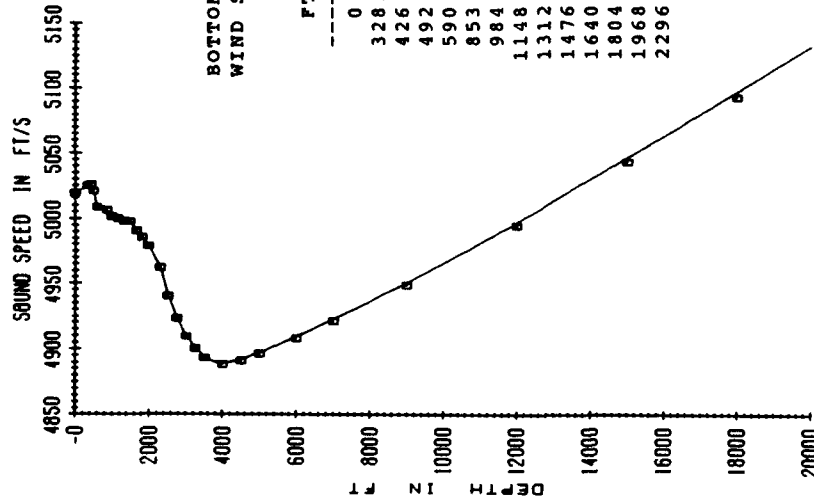
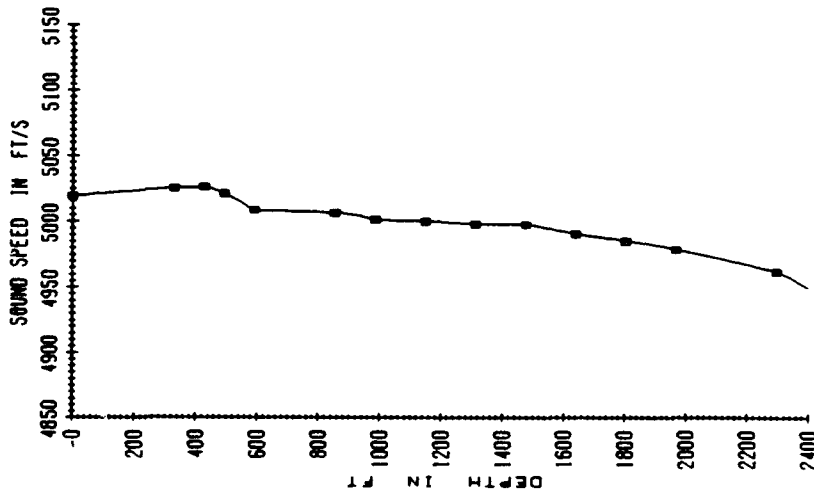
SOUND SPEED PROFILE, CLOVER
INSITU AT 0320Z DAY 048



XBT POSITION : 27-52.5N, 75-40.7W
BOTTOM DEPTH = 15600. FT, BOTTOM PROVINCE = 5
WIND SPEED = 15. KNOTS, MERGED WITH PODESZA A16

XBT DATA		PODESZA DATA	
FT	FT/S	FT	FT/S
0.0	5021.3	1500.	4992.
164.0	5024.0	1750.	4985.
328.1	5026.7	2000.	4973.
426.5	5027.4	2250.	4958.
492.1	5011.3	2500.	4940.
656.2	5000.4	2750.	4923.
820.2	4997.5	3000.	4909.
984.3	4998.3	3250.	4900.
1148.3	4997.2	3500.	4893.
		4000.	4888.
		4500.	4891.
		5000.	4896.
		6000.	4908.
		7000.	4921.
		9000.	4949.
		12000.	4995.
		15000.	5044.
		18000.	5094.
		21000.	5146.

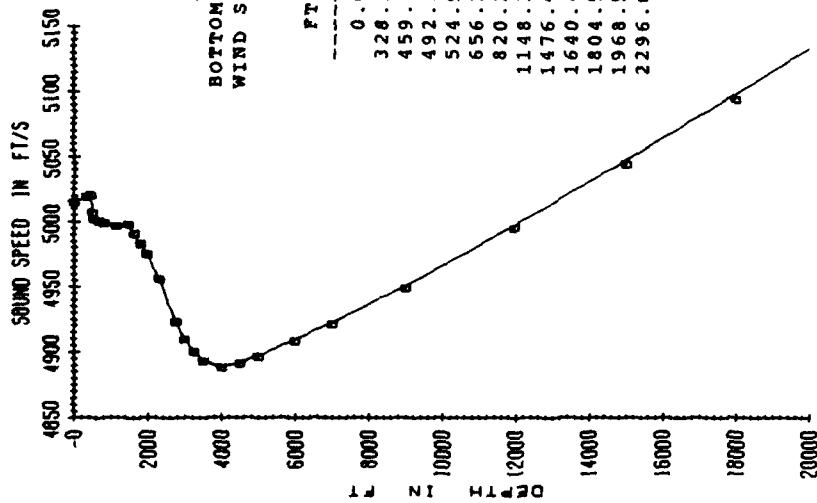
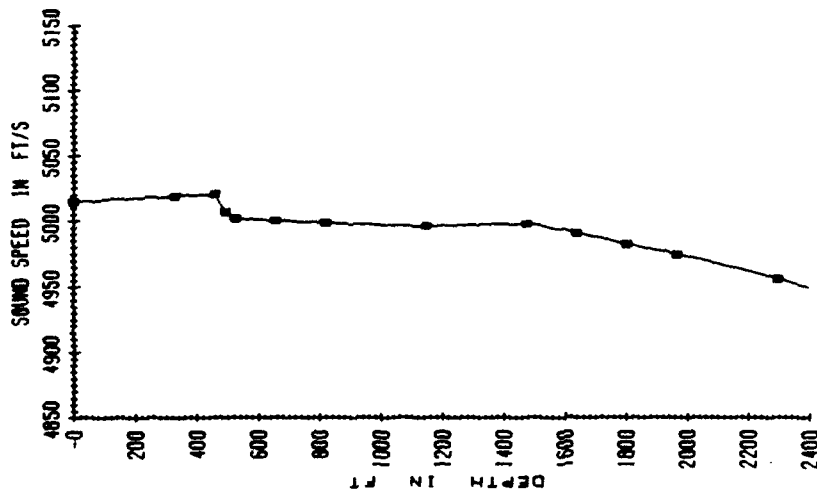
**SOUND SPEED PROFILE, CLOVER
INSITU AT 0950Z DAY 048**



XBT POSITION : 27-25.9N, 75-55.1W
BOTTOM DEPTH = 15400. FT, BOTTOM PROVINCE = 5
WIND SPEED = 18. KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5018.8	2500.	4940.
328.1	5025.0	2750.	4923.
426.5	5025.8	3000.	4909.
492.1	5020.9	3250.	4900.
590.6	5008.4	3500.	4893.
853.0	5006.4	4000.	4888.
984.3	5001.2	4500.	4891.
1148.3	5000.1	5000.	4896.
1312.3	4998.0	6000.	4908.
1476.4	4997.8	7000.	4921.
1640.4	4990.7	9000.	4949.
1804.5	4985.4	12000.	4995.
1968.5	4978.8	15000.	5044.
2296.6	4961.8	18000.	5094.
		21000.	5146.

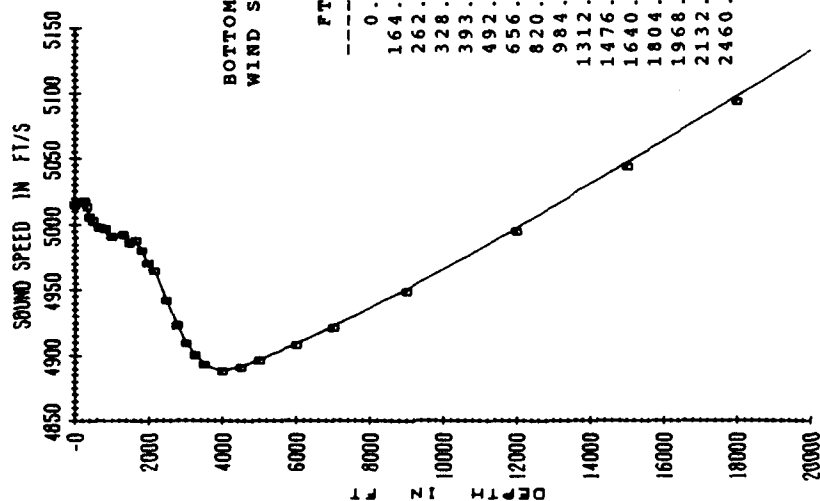
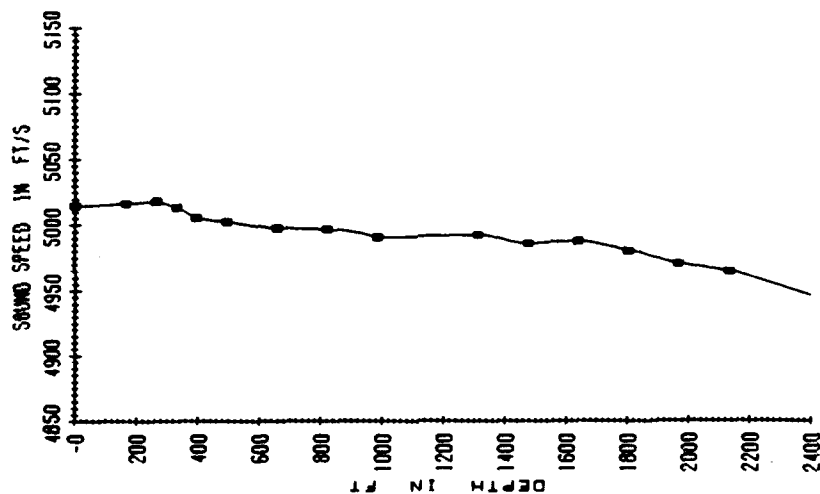
SOUND SPEED PROFILE, CLOVER INSITU AT 1525Z DAY 048



XBT POSITION : 28-13.6N, 75-47.6W
 BOTTOM DEPTH = 15400. FT, BOTTOM PROVINCE = 5
 WIND SPEED = 7. KNOTS, MERGED WITH PODES2WA A16

XBT DATA		PODES2WA DATA	
FT	FT/S	FT	FT/S
0.0	5014.5	2750.	4923.
328.1	5019.0	3000.	4909.
459.3	5020.3	3250.	4900.
492.1	5006.8	3500.	4893.
524.9	5001.9	4000.	4888.
656.2	5000.4	4500.	4891.
820.2	4998.5	5000.	4896.
1148.3	4996.3	6000.	4908.
1476.4	4997.8	7000.	4921.
1640.4	4990.7	9000.	4949.
1804.5	4982.3	12000.	4995.
1968.5	4974.6	15000.	5044.
2296.6	4956.2	18000.	5094.
		21000.	5146.

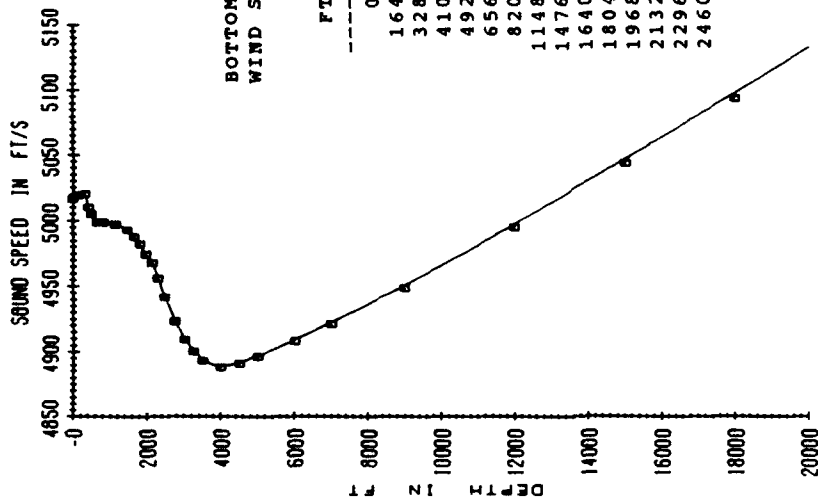
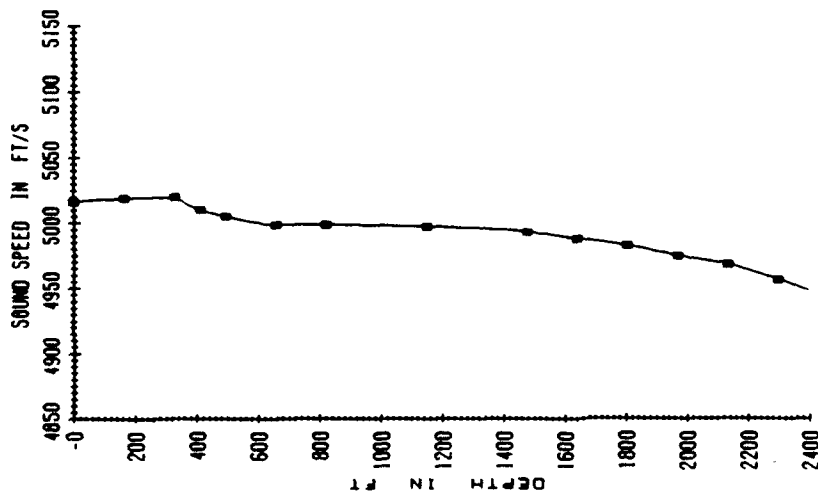
SOUND SPEED PROFILE, GLOVER INSITU AT 2000Z DAY 048



XBT POSITION : 28-9.2N, 76-15.8W
 BOTTOM DEPTH = 15000. FT, BOTTOM PROVINCE = 5
 WIND SPEED = 4. KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5014.5	2750.	4923.
164.0	5016.4	3000.	4909.
262.5	5018.0	3250.	4900.
328.1	5013.0	3500.	4893.
393.7	5005.2	4000.	4888.
492.1	5002.3	4500.	4891.
656.2	4997.6	5000.	4896.
820.2	4996.6	6000.	4908.
984.3	4990.7	7000.	4921.
1312.3	4992.2	9000.	4949.
1476.4	4986.0	12000.	4995.
1640.4	4987.7	15000.	5044.
1804.5	4980.3	18000.	5094.
1968.5	4970.4	21000.	5146.
2132.5	4964.5		
2460.6	4941.9		

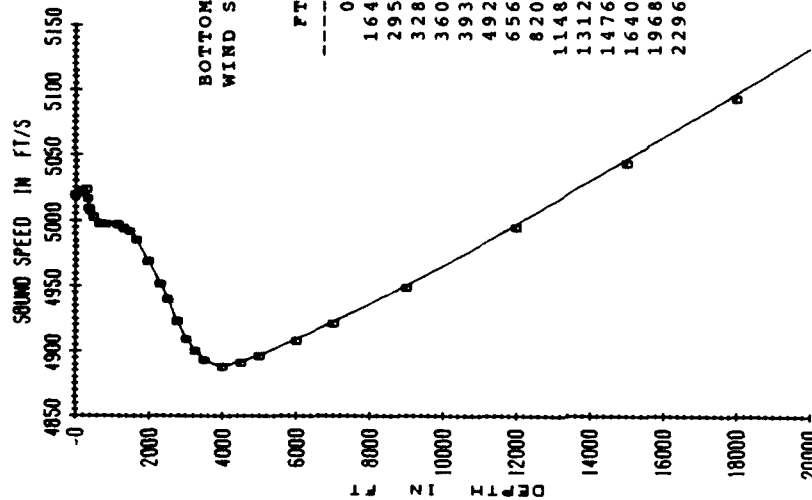
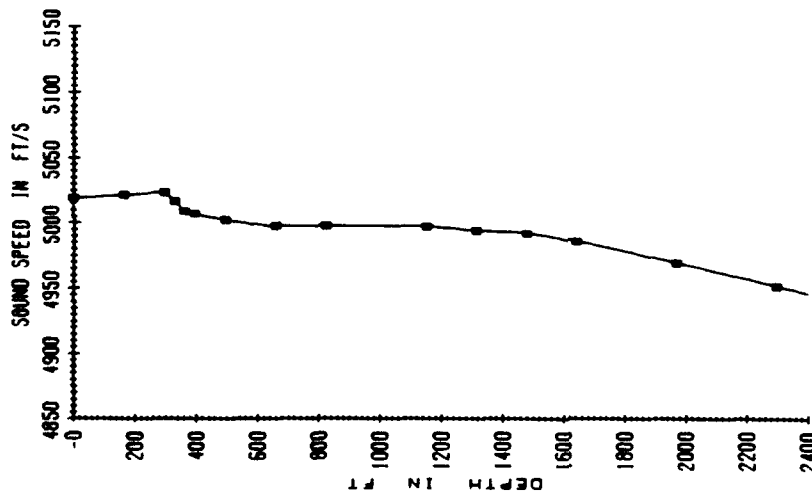
SOUND SPEED PROFILE, CLOVER INSITU AT 0000Z DAY 049



XBT POSITION : 28-20.2N, 76-54.6W
 BOTTOM DEPTH = 3800. FT, BOTTOM PROVINCE = 4
 WIND SPEED = 10. KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5016.2	2750.	4923.
164.0	5018.9	3000.	4909.
328.1	5019.9	3250.	4900.
410.1	5009.9	3500.	4893.
492.1	5005.0	4000.	4888.
656.2	4998.6	4500.	4891.
820.2	4998.5	5000.	4896.
1148.3	4997.2	6000.	4908.
1476.4	4993.0	7000.	4921.
1640.4	4987.7	9000.	4949.
1804.5	4982.3	12000.	4995.
1968.5	4974.6	15000.	5044.
2132.5	4967.8	18000.	5094.
2296.6	4956.2	21000.	5146.
2460.6	4941.9		

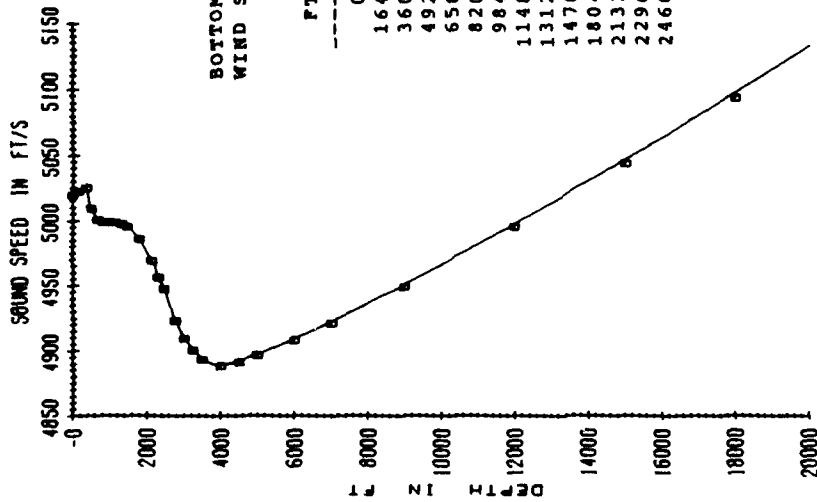
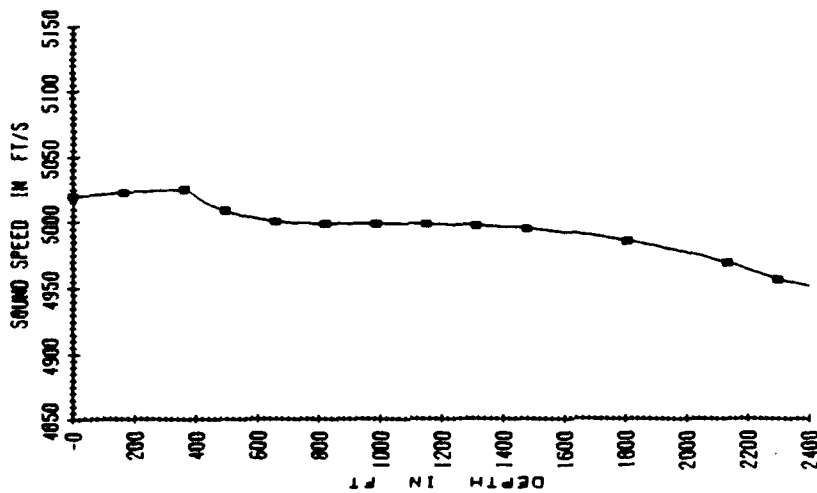
**SOUND SPEED PROFILE, GLOVER
INSITU AT 0315Z DAY 049**



XBT POSITION : 28-22.7N, 77-08.7W
 BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 4
 WIND SPEED = 10. KNOTS, MERGED WITH PODESZA A16

XBT DATA		PODESZA DATA	
FT	FT/S	FT	FT/S
0.0	5018.8	2500.	4940.
164.0	5021.4	2750.	4923.
295.3	5023.6	3000.	4909.
328.1	5016.5	3250.	4900.
360.9	5009.1	3500.	4893.
393.7	5007.0	4000.	4888.
492.1	5002.3	4500.	4891.
656.2	4997.6	5000.	4896.
820.2	4997.5	6000.	4908.
1148.3	4997.2	7000.	4921.
1312.3	4994.2	9000.	4949.
1476.4	4992.0	12000.	4995.
1640.4	4985.7	15000.	5044.
1968.5	4969.3	18000.	5094.
2296.6	4951.7	21000.	5146.

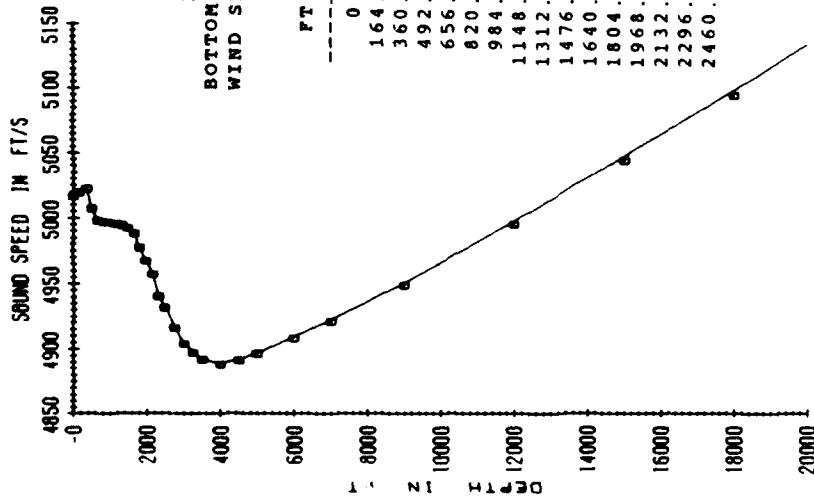
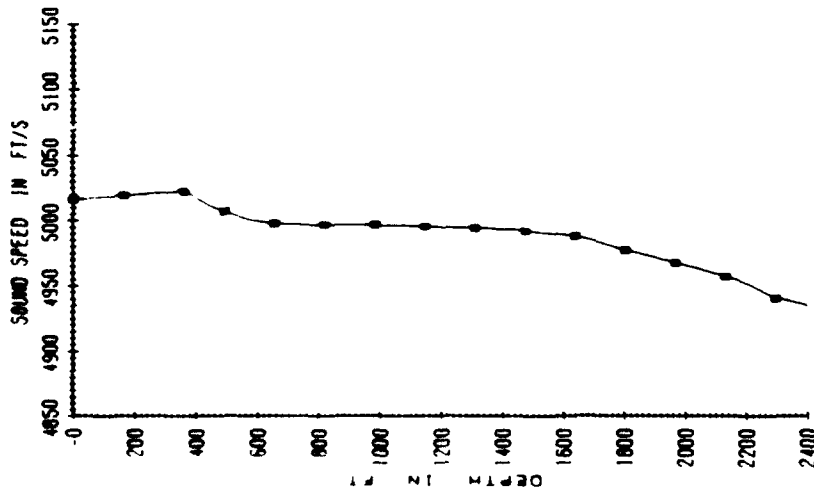
SOUND SPEED PROFILE, CLOVER
INSITU AT 0715Z DAY 049



XBT POSITION : 28-05.9N, 77-44.8W
BOTTOM DEPTH = 3600. FT, BOTTOM PROVINCE = 4
WIND SPEED = 15.5 KNOTS, MERGED WITH PODESZWA A16

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5019.6	2750.	4923.
164.0	5022.3	3000.	4909.
360.9	5024.7	3250.	4900.
492.1	5008.6	3500.	4893.
656.2	5000.4	4000.	4888.
820.2	4998.5	4500.	4891.
984.3	4998.3	5000.	4896.
1148.3	4998.2	6000.	4908.
1312.3	4997.1	7000.	4921.
1476.4	4994.9	9000.	4949.
1804.5	4985.4	12000.	4995.
2132.5	4968.8	15000.	5044.
2296.6	4956.2	18000.	5094.
2460.6	4947.6	21000.	5146.

SOUND SPEED PROFILE, CLOVER
INSITU AT 1115Z DAY 049



XBT POSITION : 28-44.8N, 78-14.6W
BOTTOM DEPTH = 3700. FT, BOTTOM PROVINCE = 4
WIND SPEED = 16.5 KNOTS, MERGED WITH PODESZWA A15

XBT DATA		PODESZWA DATA	
FT	FT/S	FT	FT/S
0.0	5016.2	2750.	4916.
164.0	5018.9	3000.	4904.
360.9	5022.1	3250.	4897.
492.1	5006.8	3500.	4892.
656.2	4997.6	4000.	4888.
820.2	4996.6	4500.	4891.
984.3	4996.4	5000.	4896.
1148.3	4995.3	6000.	4908.
1312.3	4994.2	7000.	4921.
1476.4	4992.0	9000.	4949.
1640.4	4987.7	12000.	4995.
1804.5	4977.2	15000.	5044.
1968.5	4967.2	18000.	5094.
2132.5	4956.9	21000.	5146.
2296.6	4940.3		
2460.6	4931.3		

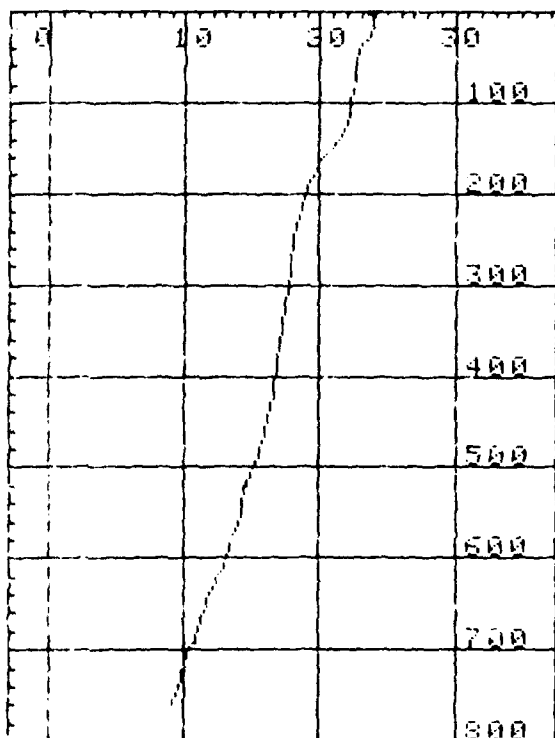
APPENDIX B

R/V Range Rover Temperature Profiles

SHIP RANGE ROVER
Cruise: SM1-T2
Probe: T-7 10-1
LAT: 27-45N
LON: 075-12W
JD: 31 GMT: 0620

sfc. bkt. Temp = 24.4°

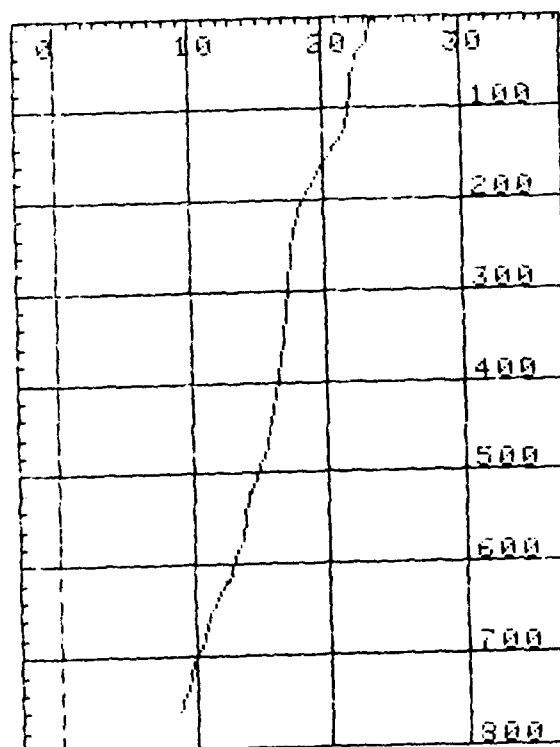
degree C vs Meters



SHIP RANGE ROVER
Cruise: SM1-T2
Probe: T-7 10-2
LAT: 27-48N
LON: 078-18W
JD: 31 GMT: 1026

sfc. bkt. Temp = 24.4°

degree C vs Meters



Tap 21

CAT	NAME	TYPE	BYTES	RECS	FILE
TEST1	DATA	256	24	1	
TEST2	DATA	256	24	2	
1	DATA	256	43	3	

XBT #

CAT	NAME	TYPE	BYTES	RECS	FILE
TEST1	DATA	256	24	1	
TEST2	DATA	256	24	2	
1	DATA	256	43	3	
2	DATA	256	43	4	

SHIP R/V RANGE ROVER

Cruise: BM1-T2

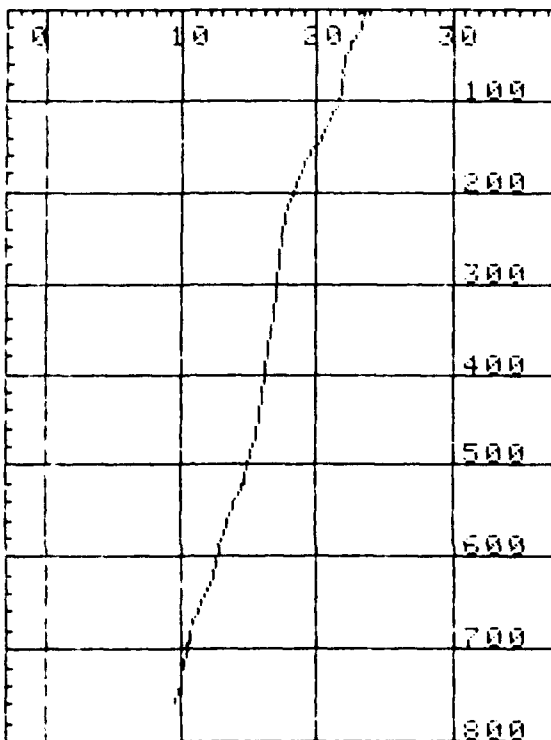
Probe: T-7 10:3

T: 37-44N

L: 078-12W

Start: 031 GMT: 0027 15132

degree C vs Meters



Red'd on File 5 - Tape II

TM No 911037

SHIP R/V RANGE ROVER

Cruise: BM1-T2

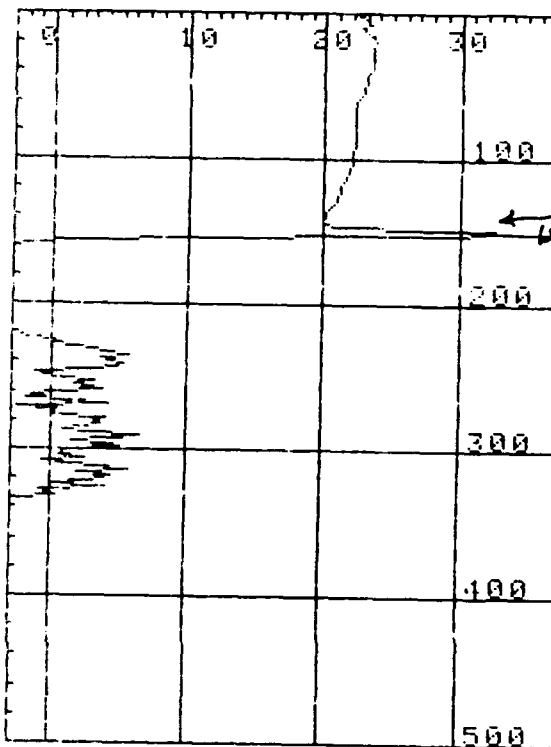
Probe: T-4 10:4

LAT: 37-46 N

LONG: 077-52.5W

JD: 39 GMT: 2009

degree C vs Meters

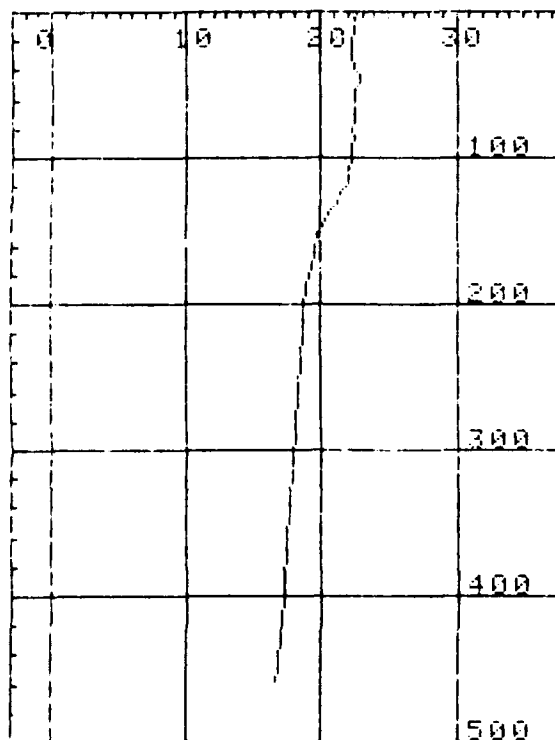


bad (wire break) - NOT SAVED

SHIP NAME RANGE ROVER
 Cruise: SW1-T2
 Probe: T-4 ID: 5
 LAT: 27-46.7N
 LON: 077-52.5W
 Day: 39 GMT: 2015

bkt. Temp = 24.4°C

degree C vs Meters

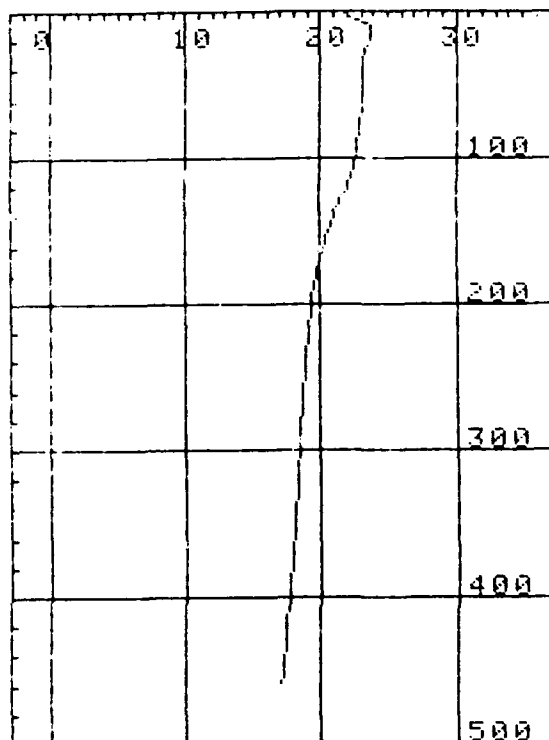


TM No 911037

SHIP NAME RANGE ROVER
 Cruise: SW1-T2
 Probe: T-4 ID: 6
 LAT: 27-47N
 LON: 077-03W
 Day: 32 GMT: 0139

bkt. Temp = 23.9°C

degree C vs Meters



TIME	TYPE	BYTES	RECS	FILE
TEST1	DATA	256	24	1
TEST2	DATA	256	24	2
	DATA	256	43	3
	DATA	256	43	4
	DATA	256	43	5
	DATA	256	24	6

TEST 5

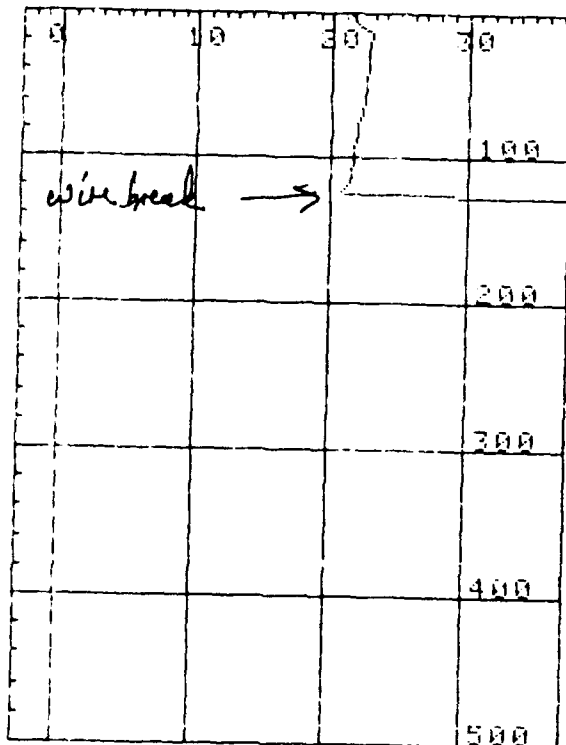
CAT	NAME	TYPE	BYTES	RECS	FILE
	TEST1	DATA	256	24	1
	TEST2	DATA	256	24	2
1		DATA	256	43	3
2		DATA	256	43	4
3		DATA	256	43	5
5		DATA	256	24	6
6		DATA	256	24	7

7

SHIP/RV RANGE ROVER
Cruiser SW1-T2
Probe T-4 ID:7
LAT 27-52.07N
LON 077-04.91W
JD: 32 GMT: 0524

*9 knots
surface = 23.7°C*

degree C vs Meters



4/10 d

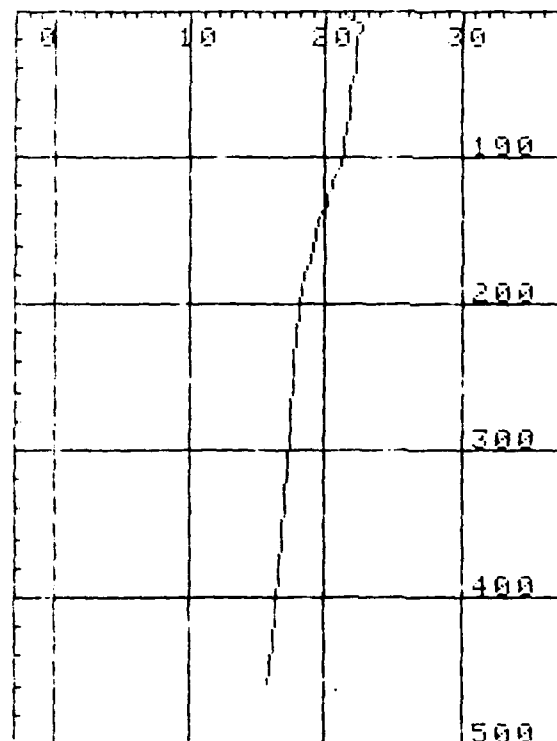
~~P.P.3.B.2.X.3.J.U.HI.HI.04.M2~~
~~3 ENABLE KBD 100~~
~~30 CONTROL 7,16 123~~
~~10 REPORT 1~~
~~20 SET TIMEOUT 7:3000~~
AT

NAME	TYPE	BYTES	RECS	FILE
EST1	DATA	256	24	1
EST2	DATA	256	24	2
	DATA	256	43	3
	DATA	256	43	4
	DATA	256	43	5
	DATA	256	24	6
	DATA	256	24	7
	DATA	256	24	8

SHIP/RV RANGE ROVER
Cruiser SW1-T2
Probe T-4 ID:8
LAT 27-41N
LON 077-34W
JD: 32 GMT: 1005

SSC. 6 KT. Temp = 24.0°C

degree C vs Meters



*surface
Temp = 24°C*

NAME	TYPE	BYTES	RECS	FILE
TEST1	DATA	256	24	1
TEST2	DATA	256	24	2
1	DATA	256	43	3
2	DATA	256	43	4
3	DATA	256	43	5
5	DATA	256	24	6
6	DATA	256	24	7
7	DATA	256	24	8
8	DATA	256	24	9

TM No 911037

SHIP: R/V RANGE ROVER

Cruise: SW1-T2

Probe: T-4 ID: 10

LAT: 27-41.6N

LOH: 076-37.5W

JDex: 32 GMT: 2216

Spec Temp 23.1°C

SHIP: R/V RANGE ROVER

Cruise: SW1-T2

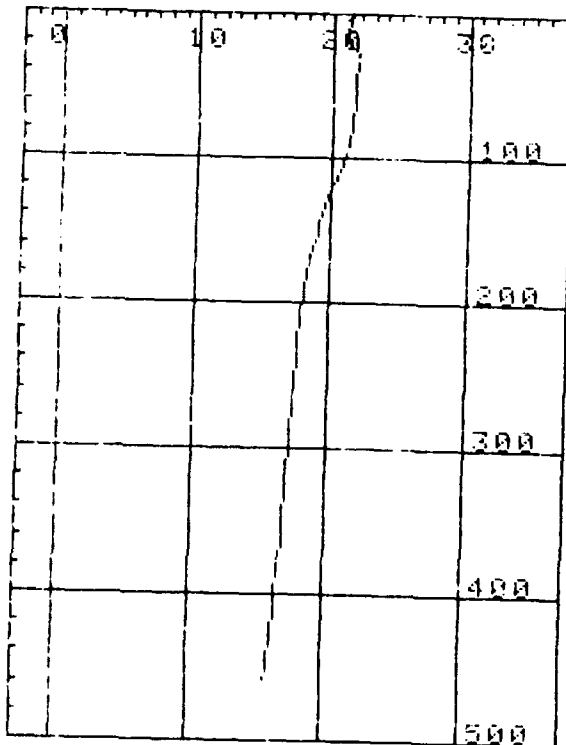
Probe: T-4 ID: 9

LAT: 27-45.5N

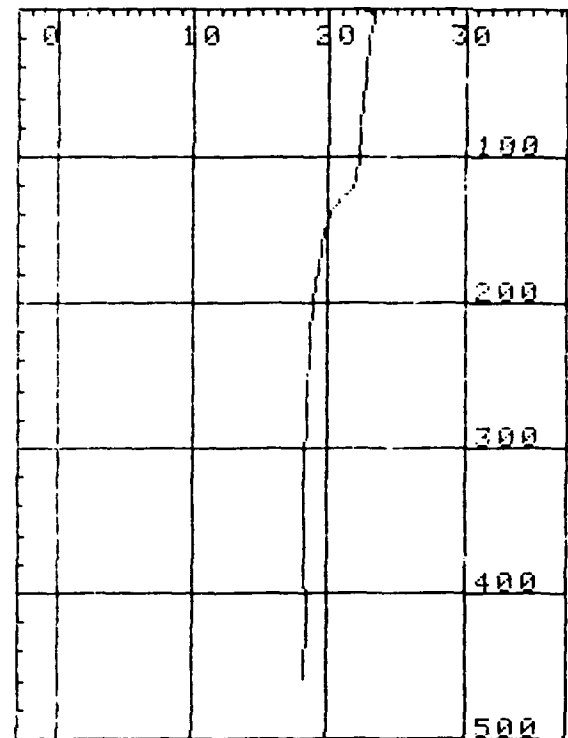
LOH: 077-36.8W

JDex: 32 GMT: 1317

degree C vs Meters



degree C vs Meters

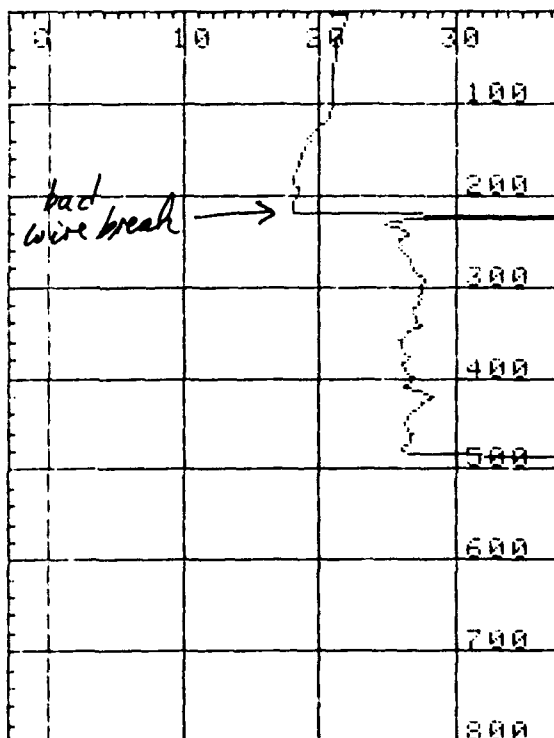


Saved as File 10 - Tape 7

CAT	NAME	TYPE	BYTES	RECS	FILE
	TEST1	DATA	256	24	1
	TEST2	DATA	256	24	2
1		DATA	256	43	3
2		DATA	256	43	4
3		DATA	256	43	5
5		DATA	256	24	6
6		DATA	256	24	7
7		DATA	256	24	8
8		DATA	256	24	9
9		DATA	256	24	10
10		DATA	256	24	11

SHIP R/V RANGE ROVER
Cruise: SW1-T2
Probe: T-7 ID: 11
LAT: 37-41.6N
LON: 076-37.5W
JDay: 33 GMT: 0203

degree C vs Meters

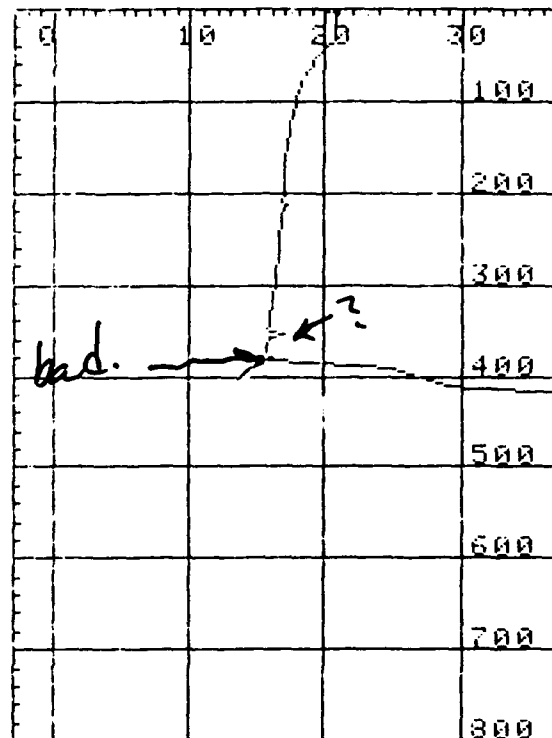


not saved (wire break)

TM No 911037
SHIP R/V RANGE ROVER
Cruise: SW1-T2
Probe: T-7 ID: 12
LAT: 37-41.6N
LON: 076-37.5W
JDay: 33 GMT: 0211

Sfc. bkt. Temp = 22.8°C

degree C vs Meters



DATA NAME	TYPE	BYTES	RECS	FILE
TEST1	DATA	256	24	1
TEST2	DATA	256	24	2
1	DATA	256	43	3
2	DATA	256	43	4
3	DATA	256	43	5
5	DATA	256	24	6
6	DATA	256	24	7
7	DATA	256	24	8
8	DATA	256	24	9
9	DATA	256	24	10
10	DATA	256	24	11
12	DATA	256	43	12

- last xbt drop on 1/4 Range Rover for this Test.

APPENDIX C

USS Providence Temperature Profiles

721

SHIP PROVIDENCE
EXERCISE CCSW2SN
LAT N2803.7
LONG W07710.1
DATE/TIME 16 FEB 91
CORSEC. 1.0

4262

TM No 911037

TIME 0830Z

TEMPERATURE (F°)

SOUND VELOCITY (FT./SEC.)

30
475040
480050
485060
490070
495080
500090
5050100
5100

SURFACE

100

200

300

400

500

600

700

800

900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

INCREASING DEPTH (FT.)

PART NO. 214857

CODE IDENT. 16343

30
475040
480050
485060
490070
495080
500090
5050100
510030
475040
480050
485060
490070
495080
500090
5050100
5100

C-2

SHIP 14002
EXERCISE 27-59N
LAT 028-06W
LONG _____
DA/MO/YR 16 FEB 91
CONSEC. NO. _____

4962

5107

TM No 911037

TEMPERATURE (°F)
SOUND VELOCITY (FT./SEC.)

TEMP

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

SURFACE

100
200
300
400
500
600
700
800
900
1000
1100
1200

INCREASING DEPTH (FT.)

5200

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500

0 40 50 60 70 80 90 100
50 4800 4850 4900 4950 5000 5050 5100

47° 5'

28°

62°

96°

5115

TM No 911037

SHIP
EXERCISE
LAT 27°39'N
LONG 078°06'W
DATE 16 14125Z FEB 91
CONSEC 123

4252

5107

Hvk 545fm

TEMP

TEMPERATURE (F°)
SOUND VELOCITY (FT./SEC.)

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

SURFACE

100
200
300
400
500
600
700
800
900
1000
1100
1200
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500

INCREASING DEPTH (FT.)

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

C-4

47° 5'

28°

62°

96°

51° 5'

TM No 911037

SHIP
EXERCISE
LAT 28-03N
LONG 077-11W
DATE/TIME 16/02/91
CONSEC. NO. 576FM

4962

5107

TEMPERATURE (F°)
SOUND VELOCITY (FT./SEC.)

30	40	50	60	70	80	90
4750	4800	4850	4900	4950	5000	5050

100
5100

SURFACE

100

200

300

400

500

600

700

800

900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

2400

2500

INCREASING DEPTH (FT.)

PART NO. 214857

CODE IDENT. 16348

30	40	50	60	70	80	90
4750	4800	4850	4900	4950	5000	5050

100
5100

30	40	50	60	70	80	90
4750	4800	4850	4900	4950	5000	5050

100
5100

C-5

721

SHIP 18 FEB 91

EXERCISE 0300Z

LAT 28° 11.9' N

LONG 077° 11.9' W

DATE/MO/YR

CONSEC. NO

560m

SSN-719

4902

RUN

SWESN

TM No 911037

TEMPERATURE (F)
SOUND VELOCITY (FT./SEC.)

30	40	50	60	70	80	90	100
4750	4900	5050	4900	4950	5000	5050	5100

SURFACE

INCREASING DEPTH (FT.)

30	40	50	60	70	80	90	100
4750	4900	5050	4900	4950	5000	5050	5100

30	40	50	60	70	80	90	100
4750	4900	4950	5000	5050	5100	5100	5100

47 5

TM No 911037

28°

62°

96°

SIIP

EXERCISE

LAT

LONG

DA/MO/YR

CONSEC. NO.

FINEX

SSN 719

4962

5107

TEMPERATURE (F°)
SOUND VELOCITY (FT./SEC.)

30	40	50	60	70	80	90	100
4750	4800	4850	4900	4950	5000	5050	5100

SURFACE

INCREASING DEPTH (FT.)

PART NO. 214857

CODE IDENT. 16948

30	40	50	60	70	80	90	100
4750	4800	4850	4900	4950	5000	5050	5100

30	40	50	60	70	80	90	100
4750	4800	4850	4900	4950	5000	5050	5100

C-7

LONG
DA MOYR
CODE IDENT

Time: 1845

23462

LAT - 27-49.9 N

LONG - 078-83.9 W

15 FEB 91

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

SURFACE

INCREASING DEPTH (FT.)

PART NO. 214357

CODE IDENT. 16843

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100

30 40 50 60 70 80 90 100
4750 4800 4850 4900 4950 5000 5050 5100