DEH.

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CRUISE REPORT

Ship Name: ROBERT D. CONRAD **Cruise No:** 21-13

Departure: 8 August 1978 (Date) **from** Bergen, Norway (Port)

Arrival: 7 September 1978 (Date) **at** Bergen, Norway (Port)

Days at Sea: 30 **Days Foreign Port:** 3
No. of days in arrival port

Area of Operation: Norwegian Margin 62°N - 70°N

Program Description: Multi-channel seismic, gravity, magnetics, bathymetry and a detailed sonobuoy survey.

Participants: **(All L-DGO unless otherwise specified)**

Marek Truchan	Co-Chief Scientist
Robert Leyden	Co-Chief Scientist
Carlos Gutierrez	MCS Technician
Daniel Hutchison	Gravity
William Koczynski	E.T.
Karen Jacobs	E.T.
Ross Rottier	E.T.
Kenneth Winslow	Air gun Technician
John DiBernardo	Air gun Technician
Charles Salcedo	E.T. MCS
Arnold Stein	E.T. MCS
Robert Suozzo	Computer Technician
Annik M. Myhre	Norwegian Observer - [illegible]
John Mutter	MCS Observer

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

CRUISE REPORT

R/V CONRAD 2113

OBJECTIVES

The scientific objectives of leg 13 were to measure the sedimentary column in velocity and thickness along the lines in Figure 1. To help establish the transition from oceanic to continental crust. To add information to what is known about the Voring plateau and escarpment, the Faroe-Shetland escarpment, the Lofoton basin and trends in basement gravity highs along the shelf edge. Evaluation of results must await processing and data reduction. A great deal of geophysical data has been gathered and published from this region. The contribution of C-2113 will hopefully add detail and support to previously published results.

RC-21 leg 13 departed Bergen approximately 0600 August 8 for fueling and sea. As the streamer was deployed to start line 159 two pounds of lead were removed from each section and one section was topped up with oil. The streamer towed almost constantly during leg 13 at a depth of 55-60 feet. Profiling commenced at 0040 on August 9 and we were on line 159 at 0100.

OPERATIONAL PROBLEMS

Figure 2, a log of guns firing on each line, serves as a summary of air gun operational problems on C-2113 as the DFS IV system gave essentially no problems. Likewise the dry lab equipment, drum profilers, echo sounders, magnetics and gravity recorders all worked continuously. The monitor records indicated little difference when two guns without wave shape kits were fired or the usual configuration of two with and two without wave shape kits. The operation log Figure 2 does not, however, indicate our preconceived or developed plan to only use two guns in certain areas. Breakdowns did often occur on relatively fortuitous portions of lines and where the 2 gun portions of the lines are supported by data from sonobuoys we are optimistic that the total sediment column was sampled.

The 2 gun portion of line 159 and the continuous use of 2 guns along line 160 indicates where heads were changed on the 671 diesel driving compressor

number 1. A valve in number 2 cylinder burned necessitating the head change. A new (rebuilt) head was purchased in Bergen after leg C-2113 because due to a chipped valve sleeve the burned head could not be rebuilt with any guarantee. The chipped valve sleeve was not the one which burned. The landward thicker sedimentary portion of line 160 designated 160A in Figure 1 was completed with 4 guns operational. It should be pointed out that the relative short gaps in each line of Figure 2 indicating when 2 guns are used are 24 hour preventative maintenance gaps when the compressors are individually stopped for oil. Guns 1 and 3 without wave shape kits were used during these periods. Lines 163, 164 and 164A (Figures 1 and 2) were recorded with 2 guns because the oil pump in the 671 diesel driving compressor number 1 failed. Messages sent to the ship's agent in Bergen and to Lamont were promptly and efficiently acted upon and two oil pumps were delivered to CONRAD off of the coast by the Trondheim pilot boat. The pump was installed enroute to line 165 and 4 guns were on line to start that line. Retrieving and paying out of the streamers before and after the run to Trondheim went smoothly. The tail buoy light and radar reflector mast was repaired and strengthened at this opportunity and performed well for the rest of the cruise. The gaps of approximately 125 shot points at the end of line 165 Figures 1 and 2, was due to rupture of the third stage intercooler of compressor number 1 and the subsequent water pump failure from compressor 2. Replacement of the burned pump impellor enabled us to complete the seaward end of 165 with 2 guns and the intercooler was changed prior to the beginning of line 166. The only significant data gap of the cruise occurred on line 169 where 620 shot points or roughly 3 hours and 25 minutes of taped data were lost. The reason for the failure was partial loss of air pressure when a check or safety valve failed in the line. This valve, located in the lazarette is designed to electrically shut down the DFSIV system when air pressure drops to 700 lbs. Due to its malfunction the DFSIV system received a shut down signal while pressure was in the line and the guns were firing at over 1,000 P.S.I.. Attention was incorrectly directed towards tape drives etc. until the leaking valve was discvoered. The gap shown in Figure 2, therefore, represents a true

loss of taped MCS data but not single channel data. Single channel reflection data and one sonobuoy (296) was recorded on the two dry lab drum recorders. The defective valve was isolated from the system and left out of the system for the remainder of leg 13. A replacement was installed in Bergen.

A time gap which does not interrupt lines (Figure 1) occurred between lines 170 and 171. Seventeen hours were lost from the cruise after an injury was sustained by one of our scientists. A decision to break operations to take him ashore was made. Although he (Ross Rottier) recovered sufficiently to not warrant taking him ashore operations were halted for extensive radio communications and the streamer was hauled in preparation for his evacuation. Ross visited a doctor and was X-rayed in Bergen and permitted to continue for the next leg C-2114. No data was lost but line 171 started 17 hours after completion of line 170. The operations log also does not show that at the beginning of line 174 the streamer rose near the surface in heavy flowing seas. Unstable conditions lasted less than one hour. There are several possible causes for this anomalous behavior in the streamer which normally stayed stable. A bird or birds on the streamer may have flipped during the turn or the unusually high following sun may have temporarily started a long streamer occilliation. Anyway slowing then speeding the ship seemed to solve the problem. Once the streamer stabilized at 50-60 feet 5 kts. was resumed.

Mechanical problems with the engines and compressors as previously described caused interruptions in air supply hence intermittent 4 gun operations. The other basic problem was a progressive deterioration in the time span between servicing guns. Previous multi-channel legs have not been plagued by this problem. The modification of the towing harnesses on guns 1 and 3 so they could be fired without wave shape kits did prevent cracking of the tail assemblies. The harnesses, however, do put uneven stress on the extremities of the guns which makes disassembly and assembly difficult. An inordinate amount of time was spent when these guns failed (1 and 3). Increased frequency of failure in all the guns during the cruise

was finally traced to blown out, in line, air filters. Line 174 Figure 2 shows individual gun failures and intentional interruption to service and rebuild guns and add filters. Upon examination it was confirmed that the filters in each air line were blown out. The metallic filter elements as well as contaminents they were designed to stop, had been going into the guns causing many of our single gun problems.

New filters and rebuilt guns served well on line 175. The power failure necessitating breaking this line into 175 and 175A was an interuption of only minutes but it caused the shot counter to automatically reset at slot 0001. During line 175A the wave shape kits were removed from guns 2 and 4 to try for maximum penetration. The sonobuoys recorded while in this mode, 314, 315, did indicate that better penetration was achieved. However, by line 176 Figure 2 the guns without wave shape kits and modified harnesses were loosing tail assemblies and associated parts (solinoid valves air fittings, etc.). By line 177 gun 1 was finished for the cruise due to a cracked spring retainer and no more spares. To save gun 2 and 4 from flailing to death, the wave shape kits were put back in. At the end of the cruise 4 tail assemblys were given to the shipyard for welding. The spring retainer failures which occurred throughout the cruise may be a design weakness in the guns. There were 4 of these failures which seems excessive in view of the fact that the guns appear to be built with high precision. It has been suggested that fatigue from previous legs suddenly took its toll or that the colder water (approximately $50^{\circ}F$) contributed. We suggest that heavier springs should be routinely used and extra heavy springs when the wave shape kits are removed.

Upon arrival in Bergen routine maintenance was performed on the compressors and their diesel engines. When the oil was drained from number 2 compressor metal bits were found in the sump. They were found to belong to the ball retainer cage for the forward main bearing on compressor number 2. As we were in the shipyard help was employed to tear down the compressor, replace both main bearings and reassemble. The job was completed by Friday night, September 8.

SONOBUOYS

A total of 73 successful buoys were deployed. Their locations are shown in Figure 1.

The military sonobuoys used on C-2112 were model SSQ57A. They performed well even in high seas. Their lower antenna heigth and higher frequency relative to the commercial buoys limited their range. They were, however, consistently reliable and we assume the data from these buoys will prove especially valuable for sedimentary velocity analysis. Forty-three of these buoys were deployed and 32 worked well. Six of the eleven failures were attributed to hitting the streamers on tailbuoy. The commercial buoys manufactured by Select International were extremely good when they worked. The unreliability of these fragile devices and modifications we found helpful in reducing failures follows.

PERFORMANCE OF SELECT INTERNATIONAL BUOYS C-21-13

Of the 57 select international buoys deployed on C-21 leg 13, 21 were unsatisfactory for various reasons. Of the 21 we believe that only 7 could be attributed to loss due to the streamer or tail buoy. These 7 lasted more than 10 minutes but less than 22 minutes. The latter time is when the sonobuoy is clear of the streamer tail buoy at 5 kts ship's speed. Two additional failures were due to mast failure on launching. This leaves 12 buoys which we feel failed due to electrical or mechanical malfunctions attributed to the manufacturer.

To further qualify these failures there was one instant failure and 5 others that occurred before the buoy could have reached the streamer (approximately 8 minutes). One explanation is that when the phone reached operating depth (60 feet) the lead parted.

Five passed the tail buoy and lasted between 42 minutes and 1 hour and 20 minutes before giving unacceptable high noise. One other buoy was just classified as noisy from the start.

The above results do not accurately reflect the quality control of select buoys.

Without a doubt, the select sonobuoys are less reliable if launched without on-deck testing procedures described below. Indeed, perhaps as many as 50% would have been duds had we believed in the "self-activating, pre-tested, etc." reassuring statements in the accompanying literature. Of the first 6 tested on deck (starting with buoy #284) 3 would have failed or have been noisy because their flow cage did not detach. The releasing mechanism is a definite weakness in design. The mast is simply fragile and should be strengthened for launching in average seas.

PROCEDURE USED ON C-2113 FOR PREPARING AND TESTING SELECT BUOYS

1. Remove and save water soluable tape, add Scotch electric to hold weighted base in buoy.

2. Pull security ring, immerse in sea water in 20 gallon can.

3. Check signal and carrier both channels of receiver and or military receiver.

4. Remove, dry base, check for flow cage detachment.

5. Remove Scotch electric tape, take out lead base and phone assembly. Reach in with pliars and remove flow cage retainer plug. The latter should be done regardless of if cage detaches because it is possible for the cage to reattach itself upon impact with the water.

6. Replace water soluable tape and secure.

MAST

The mast base is screwed in about one turn when it comes from the manufacturer.

1. Remove base, add scotch waterproof adhesive and screw in firmly.

2. Attach lower mast. Tape base-mast connection with friction tape.

3. At mast base make 3 or 4 stays to upper part of buoy using friction tape.

4. Cover scuttle with Scotch waterproof adhesive and Scotch electrical tape.

SUMMARY

A total of 2995.4 nautical miles of MCS data were recorded along lines 159-179 Figure 1, Table 1. Ticks along the lines locate 73 successful sonobuoys recorded on tape and on the dry lab drum recorders. A total of 1216 magnetic tapes were used on leg 13 (Table 1). Data length of 12 seconds was used throughout with a 4 msecs sampling rate. Delay changes were kept to a minimum.

Ships speed was maintained at close to 5 kts with good navigation control from satellite and Loran C fixes. Small departures from speed were compensated for by adjusting the air gun firing rate to ensure 50 meter spacing between shots.

Continuous gravity magnetics and single channel seismic were recorded with no gaps. Generally favorable weather prevailed. Dedicated assistance from all ship's departments helped to make the cruise a success.

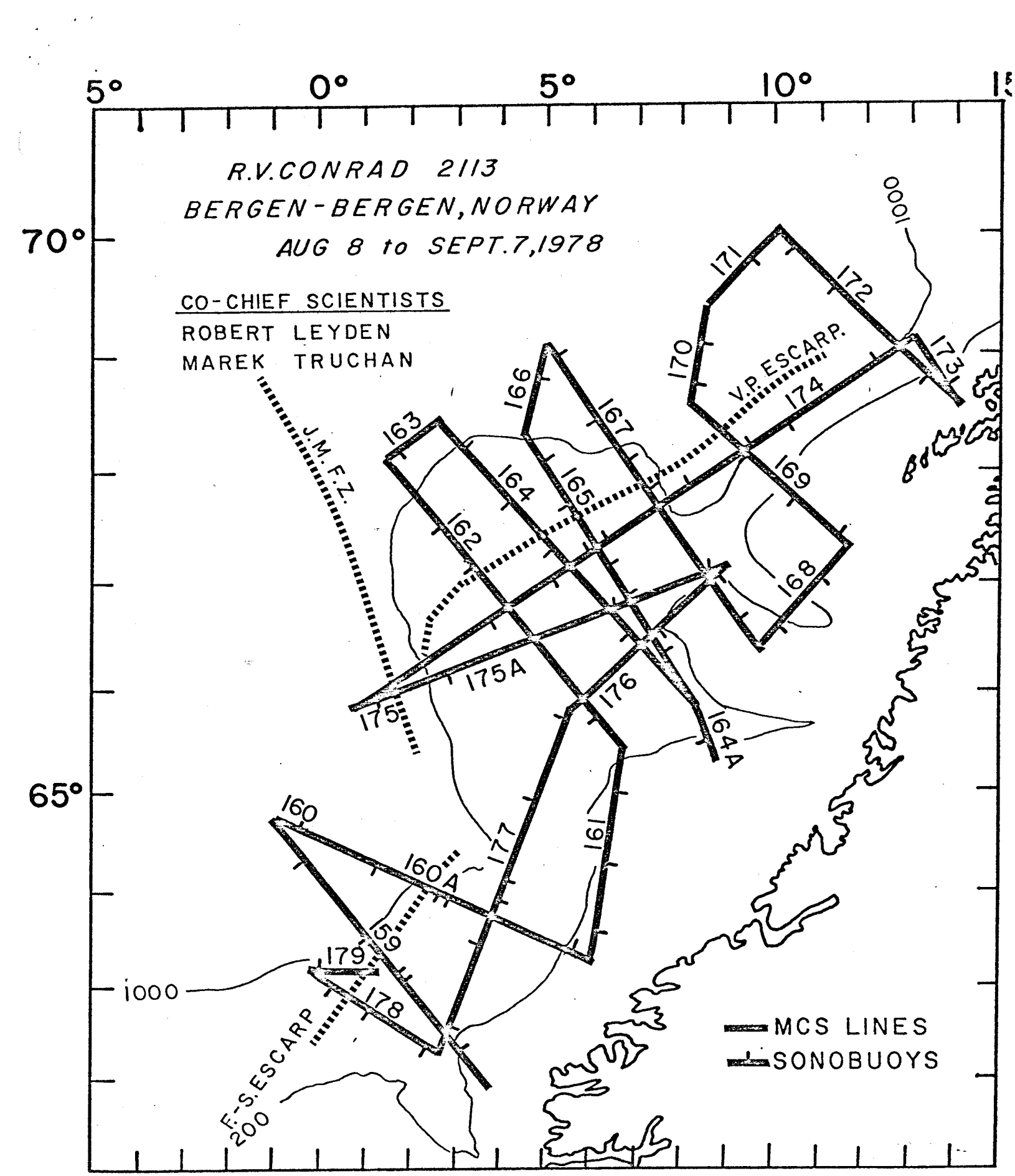

5°
0°
5°
10°
70°
65°
R.V. CONRAD 2113
BERGEN - BERGEN, NORWAY
AUG 8 to SEPT. 7, 1978
CO-CHIEF SCIENTISTS
ROBERT LEYDEN
MAREK TRUCHAN
J.M.F.Z.
V.P. ESCARP.
F-S. ESCARP.
1000
200
MCS LINES
SONOBUOYS

Figure 1

MULTICHANNEL SEISMIC LINES RECORDED

R/V ROBERT D. CONRAD CRUISE 2113

Bergen to Bergen, Norway Leg

Aug. 8 to Sept. 7, 1978

MCS Line	Date	Start Time	Date	End Time	No. of Shot Points	Nautical Miles
159	Aug. 9	0100	Aug. 10	2000	8457	228.6
160	Aug. 11	0127	Aug. 11	0940	1518	41.0
160A	Aug. 11	1717	Aug. 13	0642	6698	181.0
161	Aug. 13	0749	Aug. 14	1018	4851	131.0
162	Aug. 14	1213	Aug. 16	0506	7556	204.2
163	Aug. 16	0625	Aug. 16	1229	1098	29.7
164	Aug. 16	1329	Aug. 18	0742	7708	208.3
164A	Aug. 18	0755	Aug. 18	1459	1278	34.5
165	Aug. 19	1548	Aug. 21	0307	6213	167.9
166	Aug. 21	0551	Aug. 21	1556	1775	48.0
167	Aug. 21	1739	Aug. 23	0946	7378	199.4
168	Aug. 23	1035	Aug. 24	0110	2696	72.9
169	Aug. 24	0203	Aug. 25	0112	4268	115.4
170	Aug. 25	0228	Aug. 25	1441	2139	57.8
171	Aug. 26	0710	Aug. 26	1743	1863	50.4
172	Aug. 26	1848	Aug. 27	1948	4638	125.4
173	Aug. 27	2037	Aug. 28	0500	1535	41.5
174	Aug. 28	0612	Aug. 31	0530	13,018	351.8
175	Aug. 31	0648	Aug. 31	1500	1522	41.0
175A	Aug. 31	1509	Sept. 1	0200	6441	174.1
176	Sept. 2	0250	Sept. 3	0106	4120	111.4
177	Sept. 3	0243	Sept. 5	0319	8838	238.9
178	Sept. 5	0424	Sept. 6	0036	3630	98.1
179	Sept. 6	0119	Sept. 6	0956	1594	43.1
				TOTAL =		2,995.4 n. miles

Total number of field tapes = 1,216

TABLE 1

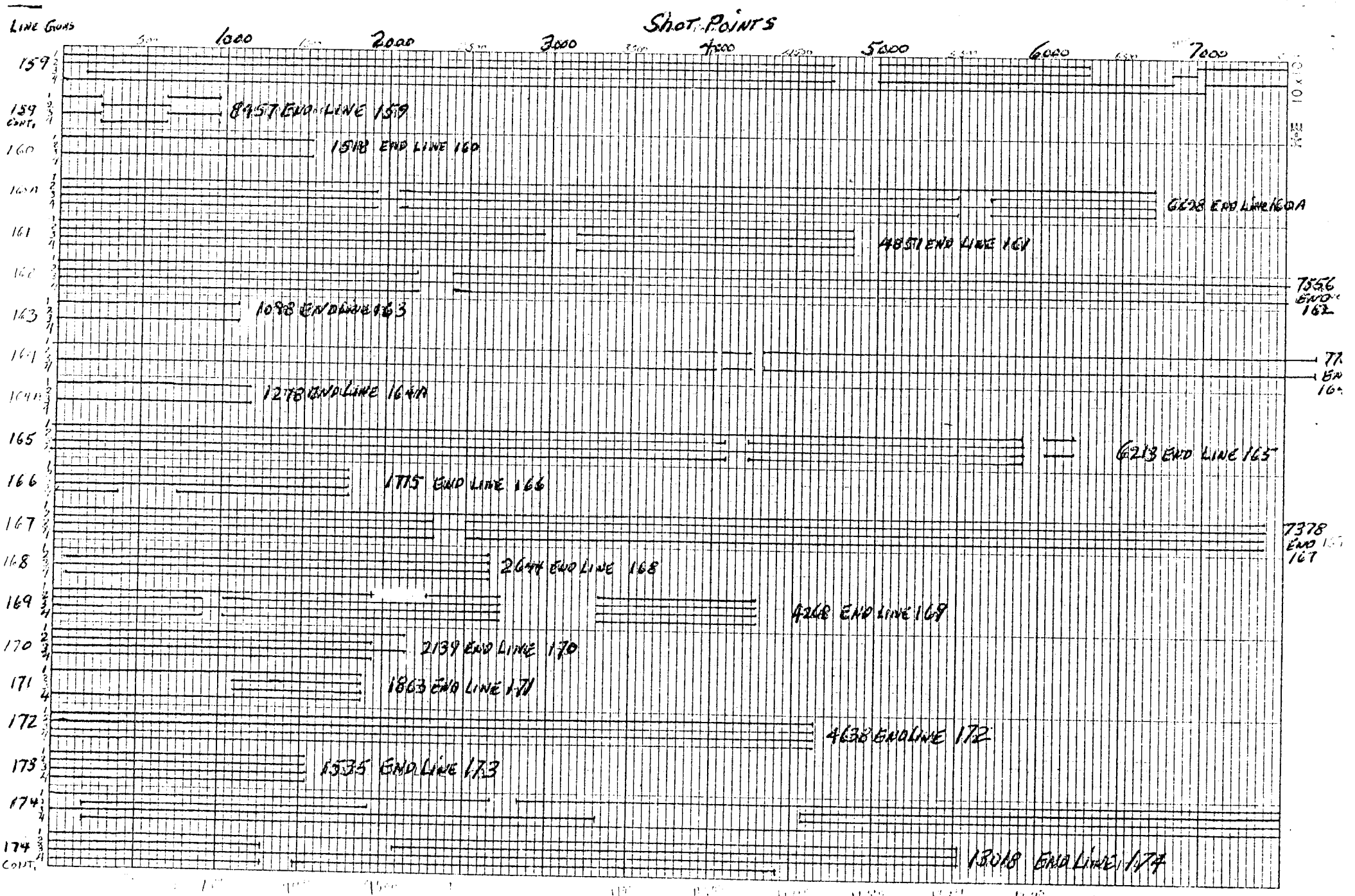
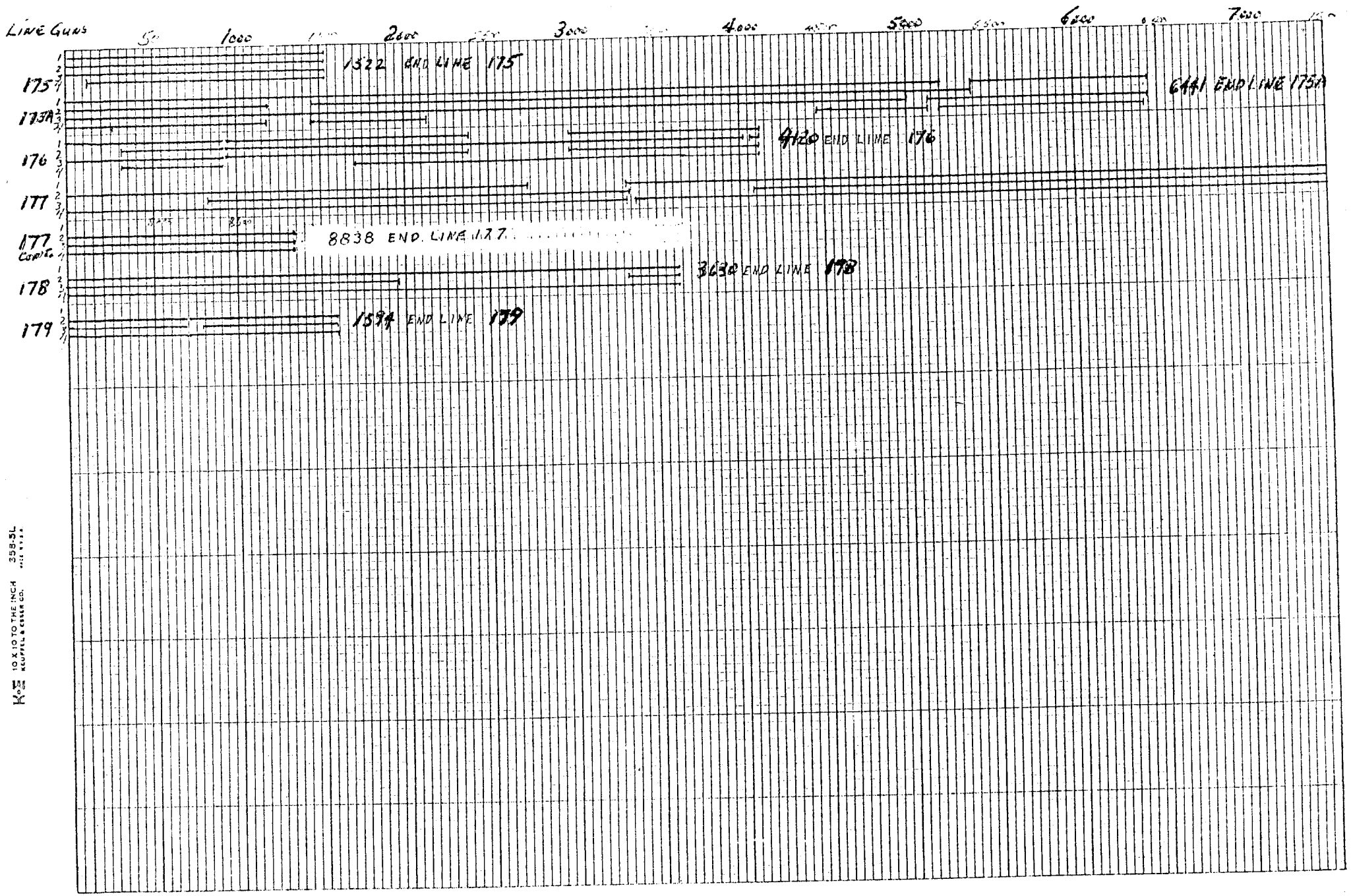

Shot Points
Line Guns
1000
2000
3000
4000
5000
6000
7000
159
159 cont.
160
160A
161
162
163
164
164A
165
166
167
168
169
170
171
172
173
174
174 cont.
8457 End Line 159
1518 End Line 160
6628 End Line 160A
4851 End Line 161
7556 End 162
1098 End Line 163
1278 End Line 164A
6213 End Line 165
1775 End Line 166
7378 End 167
2644 End Line 168
4268 End Line 169
2139 End Line 170
1863 End Line 171
4638 End Line 172
1535 End Line 173
13018 End Line 174

Figure 2



10 X 10 TO THE INCH 358-5L
KEUFFEL & ESSER CO.

Figure 2