# Technical Report for Raw 2D MCS Reflection Data,

R/V Sonne Cruise 294, Vancouver (Canada) – Port Hueneme (USA), 13/09/22 - 27/10/23

Michael Riedel<sup>®</sup>, Jörg Bialas<sup>®</sup>, Elisa Klein<sup>®</sup>, Cord Papenberg<sup>®</sup>, Janine Berndt<sup>®</sup>, GEOMAR

Keywords: 2 D multichannel seismic (MCS) reflection data – raw data – GI Gun – GGun array – earthquake – tsunami – Cascadia subduction zone – deformation front – gas hydrates –BSR–carbon-capture & storage (CCS)

Coordinates: *Median Latitude*: 49.36135 \* *Median Longitude*: -128.05476 \* *South-bound Latitude*: 47.55729 \* *West-bound Longitude*: -129.20661 \* *North-bound Latitude*: 50.29167 \* *East-bound Longitude*: -126.30441

### **Abstract**

The raw 2D multichannel seismic reflection data in this project were acquired during expedition SO294 offshore Vancouver Island, Canada, using two different sources, i.e., a single GI Gun and a GGun array. The data were recorded with an 184-channel streamer. The objectives of expedition SO294 were twofold: provision of geophysical images to constrain the hazard potential of the Cascadia subduction zone, and to constrain the geophysical properties of the oceanic crust to assess its storage potential for carbon capture and storage (CCS). The data comprise 1660 line kilometers and are provided in raw format (SEG-D) and associated standardized metadata. Detailed information on the acquisition can be found in the SO294 cruise report (<a href="https://doi.org/10.48433/cr\_so294">https://doi.org/10.48433/cr\_so294</a>). In addition, this technical report is provided with the 2D multichannel seismic reflection data set.

### 1 Introduction

Expedition SO294 served two scientific projects. The main part of the cruise was concerned with the project CLOCKS: "Northern Cascadia: Extent of locked zone, prism deformation, slip-to-toe, and the edge of subduction". The Cascadia subduction zone extending from northern California to the northern tip of Vancouver Island, remains unbroken by a megathrust earthquake since January 26, 1700, which is known from tsunami records in Japan. Based on previous studies, the megathrust fault on the subducting Juan de Fuca (JdF) Plate is believed to be fully locked. Along a 2D profile from the deformation front to the shelf off Vancouver

Island, marine MT data were recorded for one month. A landward extension of the profile across Vancouver Island was recorded by the University of Alberta. We acquired seismic data across the deformation front at the central northern Cascadia margin to image faulting and identify potential slip-to-toe events where the megathrust may have ruptured out to the deformation front. Seismic data were also collected in the Winona Basin (Explorer Plate) to address the extent of subduction off northern Vancouver Island. All seismic shots were corecorded on Ocean-Bottom-Seismographs (OBS) to allow P-wave and S-wave velocity analysis.

The second project is a collaborative study between GEOMAR and Ocean Networks Canada (ONC) on potential CO<sub>2</sub> storage in marine basalt complexes called CASCADIA CO<sub>2</sub> (CCO<sub>2</sub>). The project aims to study the lateral variability of the basalt formations and their physical properties by acquiring seismic data on OBS optimized for the measurement of S-waves - a dataset yet missing in the assessments of the CO<sub>2</sub> storage potential of basalt.

### 2 Seismic Acquisition

During SO294, several types of long-term monitoring instruments were deployed on the central accretionary prism: nine short-period long-term OBS (JAMSTEC), six OBP (Kobe Univ., Tokyo Univ., JAMSTEC), and six broad-band long-term OBS (GEOMAR). An additional eleven short-period long-term OBS (JAMSTEC) were deployed north of the Nootka Fault in the Winona Basin region. These instruments will be recovered during expeditions led by the GSC in 2023 (OBS, Douglas et al., 2024) and 2024 (OBP).

A total of 54 short-term OBS used for active-source seismic refraction analyses were used in three sub-regions of the study area: 22 OBS were deployed along two perpendicular profiles in the Cascadia Basin with the CCO2 project, 20 OBS were used along two parallel profiles in the Winona Basin, and 12 OBS were used in one profile across the central accretionary prism off Vancouver Island.

The seismic refraction experiments were carried out with a six GGun array with a combined volume of 2840 in<sup>3</sup> (84 L) and a total of 370 km of profile length was acquired across the OBS. An additional 180 km were acquired on cross-lines not directly above the 2D OBS profiles. High-resolution seismic reflection imaging was achieved using a single GI airgun (355 in<sup>3</sup>, 6 L) and a MCS streamer consisting of 184 channels at 1.56 m spacing over a 290 m total active length. Reflection data were acquired in the Winona Basin (685 km) and across the deformation front of the central accretionary prism off Vancouver Island (425 km).

During SO294, a total of 1660 km of 2D multichannel seismic (MCS) reflection data were acquired, forming an extensive grid of lines in each of the three research areas (Figure 3). The goal was to image the subsurface with a focus on the oceanic crust. In total, we shot seven surveys with two different acquisition geometries. P1000 (Figure 4) was part of the secondary user project CCO2. Surveys P2000, P3000, and P7000 were part of OBS refraction

measurements, while P4000, P5000, and P6000 were dedicated to high-resolution streamer seismic acquisition. A list of lines acquired for each setup can be found in 6 Acknowledgments.

### 2.1 Streamer Set-up

We used 23 active streamer sections each consisting of eight channels at a spacing of 1.5625 m (Geometrics GeoEel streamer segments, 12.5 m). This resulted in 287.5 m of active streamer length. In Figures 1 and 2, the streamer set-up, deck geometries, and gun settings for the 2D surveys are visualized. The receiver system consisted of a 40 m-long tow cable (from the stern of the vessel), a 20 m-long stretch section, followed by 23 active streamer sections (7 oil-filled, 16 solid-state) and another stretch section, to reduce the drag noise of the tail-buoy at the end of the streamer. The active sections were connected with analog-to-digital (AD) converter modules, which communicated with the recording system in the lab via a TCP/IP protocol. A repeater connected the deck cable and the tow cable (lead-in). In the lab, the streamer power supply unit constituted the connection between the recording system and the AD modules. It also handled the management of the streamer power supply.

For maintaining a constant streamer depth of 2 m (4 m for P7000), four bird Remote Units (RUs) were attached to the streamer during the survey. The birds communicated with the controller via coils embedded in the streamer and the information was transmitted via a twisted pair of wires within the deck cable. Two RUs were directly attached to the stretch and the 5<sup>th</sup> active section. The other two were attached to 1.56 m long bird sections added to the streamer between the active sections 13/14 and 19/20. The bird sections did not contain hydrophones. As a consequence, the total length of the streamer is 290.6 m.

The seismic data were A/D converted within digitizing bottles within each streamer segment and transferred to the ship using an ethernet network. The data were recorded with an SPSU and Geometrics software in SEG-D format.

For navigation, we mounted a GPS antenna on the ship's superstructure close to the stern of the vessel. The position of this GPS antenna was measured with a tape measure and related to the towing points of the airgun source and the streamer. The navigation data were logged in parallel to the seismic data.

### 2.2 Seismic Sources

### 2.2.1 GI Gun

For the high-resolution MCS surveys P4000, P5000, and P6000 (Figure 1), a single GI Gun was used as the seismic source. It was attached to a stringer by two steel chains of about 1 m in length. The set-up was stabilized in a water depth of ~2 m by a large float, attached to the stringer. The gun was operated in Harmonic 355 mode (250 in<sup>3</sup> generator and 105 in<sup>3</sup> injector chamber) with a pressure of 140 bar. The injector pulse was triggered with a delay of 63 milliseconds after the generator. The shot interval was 10 seconds, equivalent to ~25 m shot point distance at a survey speed of ~4 kn.

### 2.2.2 GGun Array

The GGun array used during SO294 (Figure 2) consisted of six (6) GGuns operated at a pressure of 140 bar. Two GGuns each formed a cluster, and three clusters were towed together at a distance of 2.5 m from each other. The total length of the array is 8 m. Cluster 1 and 3 consisted of two 520 in<sup>3</sup> guns, and the middle cluster comprised two 380 in<sup>3</sup> guns. The total volume was 2840 in<sup>3</sup> (~ 46 L). The port-side deployment rail was used to deploy the array from the stern of the vessel. During data acquisition, the array was towed 49 m behind the ship's stern at 8 m depth. To achieve sufficient ray coverage while avoiding previous shot noise and allow receivers on land stations to record the signals, the GGun array was used with a shot interval of 60 s, translating to a shot point distance of 150 m at 4 kn speed.

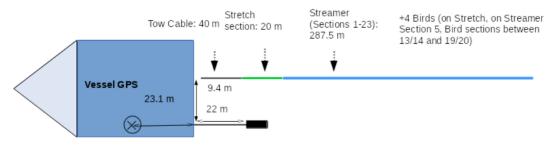
A detailed description of the streamer and source setup can be found in 8 Appendix.

Table 1: Data acquisition parameters for SO294

\* Includes bird sections; + measured relative to GPS antenna

	P1000	P2000	P3000	P4000	P5000	P6000	P7000
Shot rate (s)	60	60	30	10	10	10	30
Record length (s)	12	12	12	8	8	8	12
Sample rate (ms)	1	1	1	0.5	0.5	0.5	1
Shot mode	GGun Array	GGun Array	GGun Array	GI Gun Harmonic 355	GI Gun Harmonic 355	GI Gun Harmonic 355	GGun Array
Streamer depth (m)	2	2	2	2	2	2	4
Total Streamer Length (m)*	290.6	290.6	290.6	290.6	290.6	290.6	290.6
Delay (ms)	55	55	55	150	150	150	55
Gun-offset to port (m)+	0	0	0	0	0	0	0
Gun-offset aft (m)+	68.1	68.1	68.1	45.1	45.1	45.1	68.1
Streamer offset to port (m) <sup>+</sup>	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Streamer offset aft (m)+	83.1	83.1	83.1	83.1	83.1	83.1	83.1

### Survey: P4000, P5000, P6000



Streamer Sections: 8 hydrophone groups with a group spacing of 1.5625 m per streamer
Source: 1 GI-Gun, 140 bar, 355 harmonic mode
GPS-GUN-OFFSET: 0m to starboard side, 45.1m aft
GPS-STREAMER-OFFSET (FC): 9.4 m starboard, 83.1m aft
Length bird section: 1.56 m

Figure 1: Survey geometry for 2D seismic acquisition using a single GI airgun during SO294

# Strevey: P1000, P2000, P3000, P7000 Tow Cable: 40 m Stretch section: 20 m (Sections 1-23): 287.5 m +4 Birds (on Stretch, on Streamer Section 5, Bird sections between 13/14 and 19/20) Vessel GPS 23.1 m 41 m 41 m 45 m

Streamer Sections: 8 hydrophone groups with a group spacing of 1.5625 m per streamer Source: 6 G-Guns, 140 bar

GPS-GUN-OFFSET: 0m to starboard side, 68.1 m aft

GPS-STREAMER-OFFSET (FC): 9.4m to portside, 83.1m aft

Length bird section: 1.56 m

Figure 2: Survey geometry for 2D seismic acquisition using a GGun array during SO294

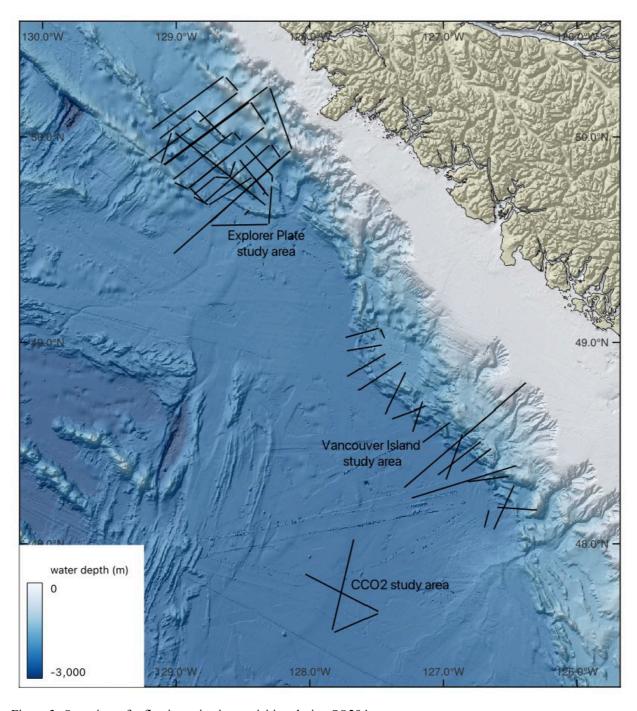


Figure 3: Overview of reflection seismic acquisition during SO294

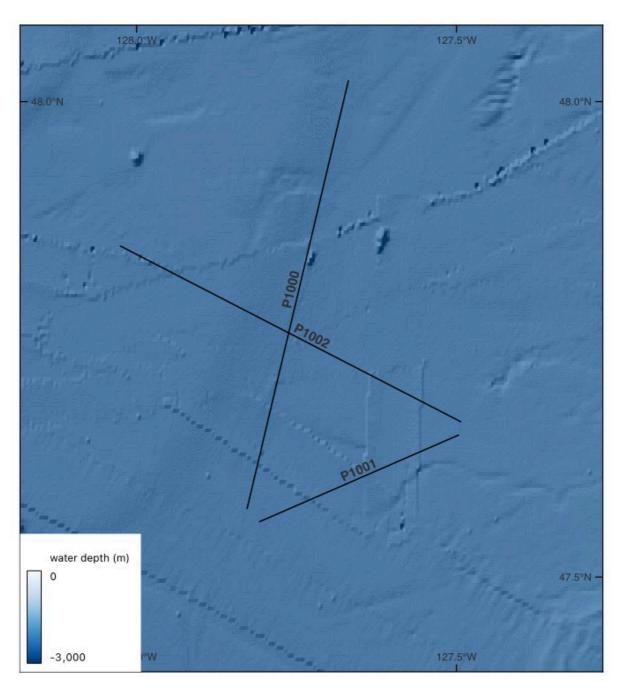


Figure 4: SO294 seismic survey P1000 in the CCO2 study area

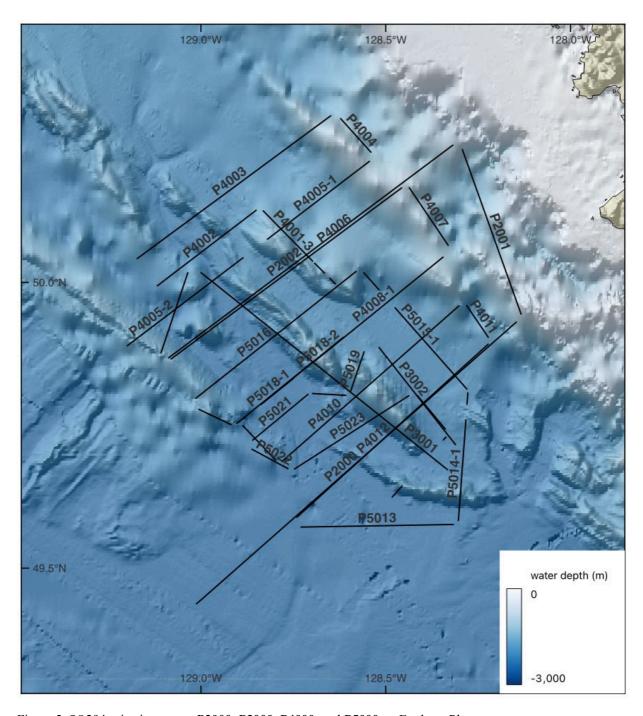


Figure 5: SO294 seismic surveys P2000, P3000, P4000, and P5000 on Explorer Plate

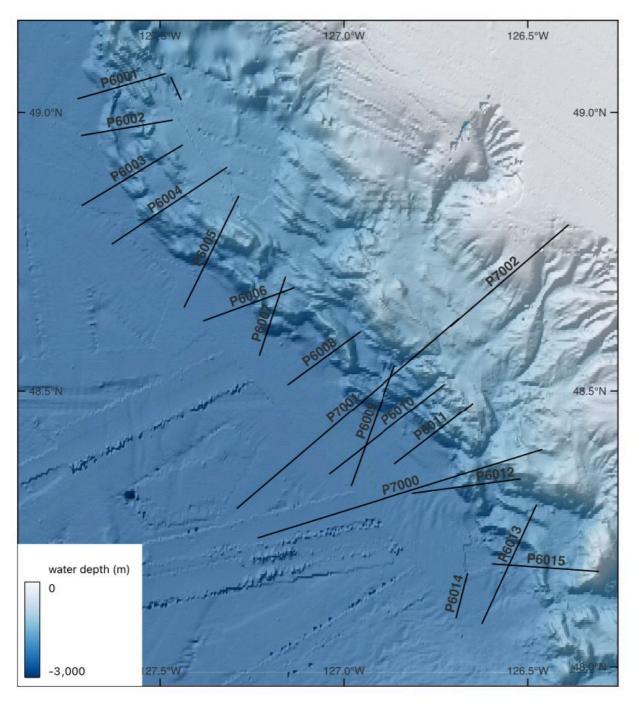


Figure 6: SO294 seismic surveys P6000 and P7000 off Vancouver Island

### 3 Data Description

The complete raw 2D multichannel reflection seismic data set has been archived at the German repository PANGAEA. The data have been quality controlled before archiving. However, for completeness, all recorded shots, whether qualified or not, have been included in the archiving process.

In addition, the seismic watchkeeping log called SO294\_2D\_Seismic\_watchkeeping\_log.xls documents any changes or problems during the acquisition and logging of the data. The navigation files listed in Table 2 have been attached and linked to the data set.

Please note that the line numbering in this technical report has been revised after the first quality control and might differ from the original line numbering referred to in the original logs and final report linked to this data set.

Table 2: Supplement

Item	Description
SO294_Schiff.txt	Navigation text file –
	Start 20.09.2022 at 21:29:43
	End 22.09.2022 at 21:13:21
SO294_P1000_Schiff.txt	Navigation text file
	Start 20.09.2022 at 21:28:07
	End 20.09.2022 at 21:29:15
SO294_P2000_Schiff.txt	Navigation text file
	Start 28.09.2022 at 22:31:12
	End 30.09.2022 at 05:49:09
SO294_P3000_Schiff.txt	Navigation text file
	Start 30.09.2022 at 05:49:24
	End 30.09.2022 at 20:57:29
SO294_P4000_Schiff.txt	Navigation text file
	Start 30.09.2022 at 20:57:48
	End 03.10.2022 at 04:13:26
SO294_P5000_Schiff.txt	Navigation text file
	Start 03.10.2022 at 04:13:46
	End 04.10.2022 at 17:28:54
SO294_P6000_Schiff.txt	Navigation text file
	Start 12.10.2022 at 16:28:40
	End 14.10.2022 at 22:18:31
SO294_P7000_Schiff.txt	Navigation text file
	Start 14.10.2022 at 22:19:42
	End 15.10.2022 at 23:43:39
SO294_P1000.0000.Nav.txt	Navigation text file for SP 1000-2063
SO294_P2000.0000.Nav.txt	Navigation text file for SP 3000-4748
SO294_P3000.0000.Nav.txt	Navigation text file for SP 5000-6710
SO294_P4000.0000.Nav.txt	Navigation text file for SP 7000-41662
	Covering P4000 and P5000
SO294_P6000.0000.Nav.txt	Navigation text file for SP 43000-62033
SO294_P7000.0000.Nav.txt	Navigation text file for SP 64000-64120
SO294_P7001.0000.Nav.txt	Navigation text file for SP 64500-66640
SO294 P7002.0000.Nav.txt	Navigation text file for SP 67000-67600
SO294 2D Seismic watchkeeping log.xls	Watchkeeping log for 2D MCS reflection RAW data
	Technical report for 2D MCS reflection RAW data
https://doi.org/10.48433/cr_so294	Cruise Report SO294

### 4 Data Quality/ Accuracy

The seismic data are of good quality and do not show significant noise apart from a bubble pulse and the seafloor multiple. Due to the relatively soft seafloor both these noise sources do not affect the imaging in a significant way. Still, it will be useful to suppress the seafloor multiple with more sophisticated processing as the data show clear evidence of primary reflections below the onset of the first seafloor multiple, especially in shallow water <1500 m water depth. The penetration of the seismic data is generally good reaching more than 1 s two-way travel time in parts of the survey area.

However, some interruptions occurred during the data acquisition for various reasons, e.g., spotting marine mammals, troubleshooting regarding the acquisition, weather downtime, etc. Any problems regarding metadata identified during quality control after the survey have been listed for each setup individually in a spreadsheet in the appendix.

Please note that these lists do not cover all shot points recorded and archived. Only shot points identified to have an issue are included.

Table 3: Abbreviation

ntbp	not to be processed (Please note: This just might be a suggestion even if there exists a SEGD file
	due to major acquisition problems!)
SP	Shot Point
FSP	First Shot Point
FGSP	First Good Shot Point
LSP	Last Shot Point
LGSP	Last Good Shot Point
NMEA	NMEA 0183 is a combined electrical and data specification for communication between marine electronics such as echo sounders, sonars, anemometers, gyrocompass, autopilot, GPS receivers, and many other types of instruments. It has been defined and is controlled by the National Marine Electronics Association (NMEA). This standard provides different versions depending on the setup of the recording systems. However, they all fulfill the requirements of GPS positioning and time. In case, the string has been "not recorded", necessary metadata like positioning can be obtained via DShip.
+	Information taken from
$\rightarrow$	Consequences/ Action taken as a result of

### 5 Data Availability/ Access

The raw seismic files and all corresponding logs and spreadsheets or files have been archived at PANGAEA <a href="https://doi.pangaea.de/10.1594/PANGAEA.961490">https://doi.pangaea.de/10.1594/PANGAEA.961490</a>

The data will be freely available after the end of the moratorium period of four years ending 27<sup>th</sup> October 2027, unless the author has applied for an extension. When using the data, please cite this data publication. Recommended citation is:

Riedel, M., Bialas, J., Klein, E., Berndt, J., 2024. 2D multichannel seismic reflection raw data (GI Gun & GGun array entire dataset) of RV SONNE during cruise SO294. PANGAEA, https://doi.pangaea.de/10.1594/PANGAEA.961490

### 6 Acknowledgments

We acknowledge the Nuu-Chah-Nulth Tribal Council (NTC) and their member Nations as well as the Quatsino and Pacheedaht Nations on whose marine traditional territories we conducted our science.

The Federal Ministry of Education and Research (BMBF) funded the project under grants 03G0294A (CLOCKS) and 03G0294B (CASCADIA) with extra funding and the use of large-scale equipment from GEOMAR.

Further additional funding has been provided through the Japan Society for the Promotion of Science (JSPS), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), University of Tokyo, Kobe University, Geological Survey of Canada (Public Safety Geoscience Program), Ocean Networks Canada, and the University of Alberta for the land MT-Program.

### 7 References

Douglas, K., Côté, M., Riedel, M., Podhorodeski, A., and Obana, K., 2024. 2023003PGC cruise report: Northern Cascadia Subduction Zone international research expedition, offshore British Columbia; Geological Survey of Canada, Open File 9072, 120 p. <a href="https://doi.org/10.4095/332361">https://doi.org/10.4095/332361</a>

# 8 Appendix

### 8.1 Details for **P1000**

(Please refer also to Figure 4: SO294 seismic survey **8.1** Details for in the CCO2 study area.)

Table 4: Seismic profiles for P1000
(FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_69-1	P1000	1108	1455	48.021845°N	127.669558°W	47.572512°N	127.827843°W
SO294_69-1	P1001	1475	1651	47.558552°N	127.808177°W	47.649790°N	127.497463°W
SO294 69-1	P1002	1665	1966	47.664035°N	127.493997°W	47.848633°N	128.025807°W

Table 5: Data acquisition parameters for P1000

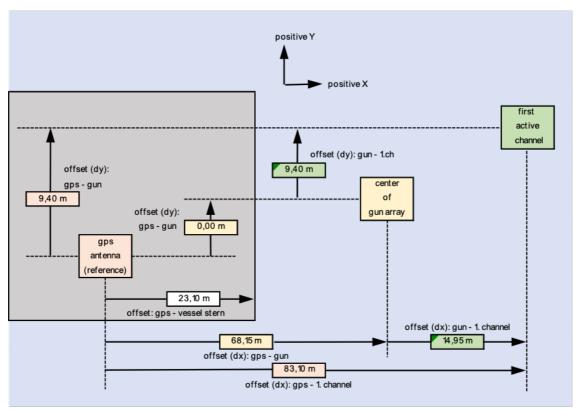
<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

	P1000	
Shot rate (s)	60	
Record length (s)	12	
Sample rate (ms)	1	
Shot mode	GGun Array	
Streamer depth (m)	2	
Total Streamer Length (m)*	290.6	
Delay (ms)	55	
Gun-offset to port (m) <sup>+</sup>	0	
Gun-offset aft (m) <sup>+</sup>	68.1	
Streamer offset to port (m)+	9.4	
Streamer offset aft (m) <sup>+</sup>	83.1	

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		.91	Geoffel Shamer	٧×	#7:49-56	12,50 m	149,81m			32	Confidition	N N		0.33 m	241,51m				48.	Geofal Strawer	Α×	#22: 169- 176	12,50 m	345,38m							
7		15.	GeofelDigitizer	N/A		0,33 m	137,31m			34	Geofal Gramae	A/N	#14-105-113	12.50 m	241,18 m				47.	Geo Bel Digitizer	N/A		0,33 m	332,88 m							
20.09.2022		14.	Geofal Streamer	N/A	#6:41-48	12,50 m	136,98 m			30	Confidition	A/A		0.33 m	228,68 m				46.	GeoEdl Streamer	N/A	#21: 161 - 168	12,50 m	332,55 m							
20.		13.	GeoEdDigitizer	N/A	#	0,33m	124,48 m		Navigation Bind	200	5			156m	+-	4			45.	GeoEelDigtizer	N/A	¥	0,33m	320,05 m							
	Navigator Bird N/A	12.	Sectel Streamer Ge	N/A	#5:33-40	12,50 m	124,15m 1	l	Z	86	Lucia	_	113. 07. 104		+	1			44.	Sectel Steamer Ge	N/A	#20: 153 - 160	12,50 m	319,72m 3;							
	S.	11.	GeoEdDigitieer Ge	٧×	#	0,33m 1	111,65 m 12			27	3			0.33m	+-	1			43.	Geo EdDigt ker 60	N/A	#20		307,22m 3							
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		.8	er Geofel Stre	N/A	#3:17-24	12,50 m	າ 98,49m			24	200		#11.81.88		+	+			40.	er Geo EelDigitizer	N/A	144	0,33 m	n 292,83 m							
		7.	GeoEdDigtizer	N/A		0,33 m	85,99m			23	Confidition	Ϋ́		0.33	+	4			39.	GeoEd Strean	A/N	#18: 137 - 144	12,50 m	292,50 m							
		.9	Geotel Steamer	N/A	#2:9-16	12,50 m	85,66 m			22	Geofal Strame	Ϋ́	# 10.73-80	12.50 m	188,30 m				38.	GeoEdDigtizer	N/A		0,33m	280,00 m							
		5.	GeoEdDigtizer	A/A		0,33m	73,16 m			24	Confidence	N/A		0.33m	175,80m				37.	GeoEel Streamer	N/A	#17: 129 - 136	12,50 m	279,67m							
		4.	Geoffel Steamer	ΝA	# 1:1-8	12,50 m	72,83 m			20	Gerfel Steamer	¥ Z	#9.65-72	12.50 m	175,47m				36.	Geo EalDigt ker	Υ'N		0,33m	267,17 m		52.	tail-buoy	ΑŅ		0,00m	378,21m
		3.	Geo EeDigtirer	ΑŅ		0,33 m	60,33 m			10	Confidence	A N		0.33 m	162,97m				35.	GeoEel Streamer	ΑN	#16: 121 - 128	12,50 m	266,84m		51.	GeoEel Vibro	ΑŅ		20,00 m	378,21m
	Navigator Bird	2.	GeoEelVibro	۷ 2		20,00m	60,00m			18	3mer	-	#8.57-64	12.50 m	162,64 m				34.	Geo BelD igt izer	۷ 2	-	0,33 m	254,34 m		50.	GeoEel Steamer	¥ ≷	#23: 177- 184	12,50 m	358,21m
		1.	eofel TomCable	A/A		40,00m	40,00m			17	Confolitions	N/A		0.33 m	┿	┨			33.	G edited Streamer	N/A	#15: 106 - 120	12,50 m	254,01m		49.	GeoffelDigitizer	A/A	**	$\dashv$	345,71m
Cruise: SO294_CLOCKS Line: P1000			cable length 378,21 m						400	record length 12 c	4					_															

Figure 7: Streamer setup for P1000





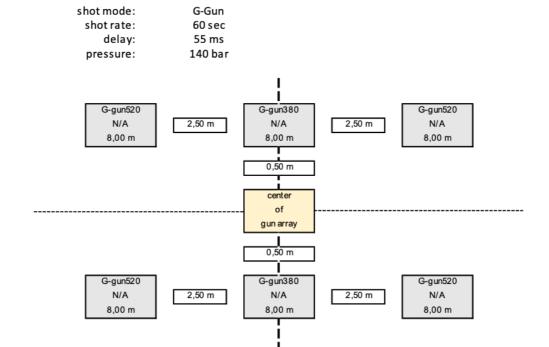


Figure 8: Source setup for P1000

### 8.2 Details for **P2000**

(Please refer also to Figure 5: SO294 seismic surveys P2000, P3000, P4000, and P5000 on Explorer Plate.)

Table 6: Seismic profiles for P2000

(FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_135-1	P2000	3131	3765	49.437170°N	129.011573°W	49.930683°N	128.147040°W
SO294_135-1	P2001	3780	4046	49.944942°N	128.133790°W	50.230633°N	128.292562°W
SO294_135-1	P2002	4065	4740	50.238197°N	128.318718°W	49.868710°N	129.086827°W

Table 7: Data acquisition parameters for P2000

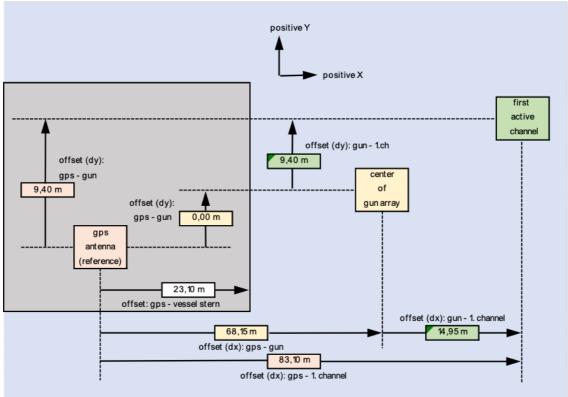
<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

	P2000	
Shot rate (s)	60	
Record length (s)	12	
Sample rate (ms)	1	
Shot mode	GGun Array	
Streamer depth (m)	2	
Total Streamer Length (m)*	290.6	
Delay (ms)	55	
Gun-offset to port (m) <sup>+</sup>	0	
Gun-offset aft (m) <sup>+</sup>	68.1	
Streamer offset to port (m) <sup>+</sup>	9.4	
Streamer offset aft (m) <sup>+</sup>	83.1	

			mer		92	۶	٤		Γ	7	izer			٦	٤		ı		mer		176	۽	ε							
		16.	Geoffel Shra	₹	#7:49-56	12,50 m	149,81m		1	35.	GeofeDigtizer	∢ Ž		0,33 m	241,51m			48.	Geoled Steamer	∢ Ž	#22: 169- 176	12,50 m	345,38m							
52		15.	GeofelDigitizer	A/N		0,33 m	137,31m		1	31.	G eoEel Streamer	N/A	#14: 105 - 112	12,50 m	241,18 m			47.	Geo BelDigitizer	A/A		0,33 m	332,88 m							
29.09.2022		14.	Geofiel Streamer	N/A	#6:41-48	12,50 m	136,98 m		[	30.	GeoEdDigtizer	N/A		0,33 m	228,68 m			46.	GeoEd Streamer	A/A	#21: 161 - 168	12,50 m	332,55 m							
29		13.	GeoEdDigitizer	N/A		0,33m	124,48 m	Navigat or Bird	K/N	29.	Geo Ed Bird 50	A/A		1,56m	228,35 m			45.	GeoEdDigitizer	A/N		_	320,05 m							
	Navigator Bird N/A	12.	Geobel Steamer	N/A	#5:33-40	12,50 m	124, 15 m	*	1	1	mer	A/N	#13: 97 - 104	12,50 m	226,79m			44.	G ao Ee I Streamer	A/N	#20: 153 - 160		319,72m							
	z	11.	GeoEdDigitieer	ΑN	#	0,33m	111,65 m			+	502	۷ Ž	#	0,33m	214,29m 2			43.	Geo Eel Digit it er	۷ Ž	#2	_	307,22m							
Date:		10.	Geoffel Streamer Go	ΑN	#4:25-32	12,50 m	111,32 m 1			26.	ner	۷ 2	#12: 89 - 96	12,50 m	213,96m 2	Navigator Bird	ΝA	42.	Geo Eel Bird ISO Ge	ΥŅ		1,56 m	306,89m 3							
		9.	GeofeDigtizer Geo	٧×	#	0,33 m	98,82m 11		-	Z2·	200 Ge	<b>∀</b> ≥	#17	0,33 m 1	201,46 m 21	Nav		41.	Georgel Streamer Geo	ΥŅ	#19: 145- 152		305,33 m 30							
		_	iamer	H	- 24		Н		+	1	reamer		1-88	-	Н			-			#19:	_	$\boldsymbol{\vdash}$							
		.8	er Geoffel Str	N/A	#3:17-24	12,50 m	n 98,49m			24.	90	N/A	#11:81-88	12,50 m	n 201,13 m			40.	or Geo Eel Digitizer	A/A	44	_	n 292,83 m							
		7.	GeoEdDigtizer	A/A		0,33 m	85,99m			23	GeoEdDigitize	Υ/N	_	0,33 m	188,63 m			39.	GeoEd Stream	N/A	#18: 137 - 144	_	292,50 m							
		.9	Geottel Stramer	N/A	#2:9-16	12,50 m	85,66 m			72.	GeoEel Stramer	N/A	# 10:73-80	12,50 m	188,30 m			38.	GeoEdDigtizer	A/A		0,33m	280,00 m							
		5.	GeoEdDigitzer	N/A		0,33m	73,16 m		[	21.	GeoEdDigtizer	A/A		0,33m	175,80m			37.	GeoEel Streamer	N/A	#17: 129 - 136	12,50 m	279,67 m							
		4.	Geoffel Steamer	ΑN	#1:1-8	12,50 m	72,83 m		[	50.	Geofel Steamer	∢ ≥	#9:65-72	12,50 m	175,47 m			36.	Geo BáDigt ker	۷ گ		0,33m	267,17 m		52.	tail-buoy	٧×		m00'0	378,21m
		3.	Geo EeDigtizer	٧Ž		0,33 m	60,33 m		,	19.	Seo SeDigtizer	∢ Ž		0,33 m	162,97 m			35.	GeoEel Streamer	۷ ک	#16: 121 - 128	12,50 m	266,84 m		51.	GeoEel Vibro	٧×		20,00 m	378,21m
	Navigator Bird	2.	GeoEelVibro	۷ 2		20,00m	60,00m		,	<u>6</u>	SeoEel Steamer	∢ Ž	#8:57 - 64	12,50 m	162,64 m			34.	Geo EelD igit izer	۷ Ž	#	_	254,34 m		50.	Georgel Steamer	٧Ž	#23: 177- 184	12,50 m	358,21m
	-	1.	Geotel TowCable	N/A		40,00m	40,00m			14.	GeofelDigitizer	A/N	#	0,33 m	150,14 m			33.	G eoffel Streamer	A/N	#15: 106 - 120	12,50 m	254,01m		49.	GeofelDigitizer	N/A	lt.	0,33 m	345,71m
CLOCKS			6	000000					THE		2 m										1#		<u> </u>			9				[**]
Cruise: SO294_CLOCKS			cable length 378,21 m					-	sample rate	record lengtn	streamer depth																			

Figure 9: Streamer setup for P2000





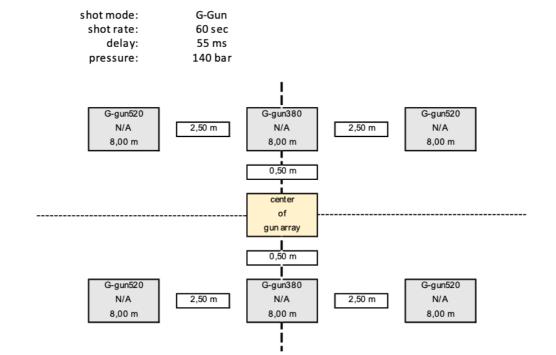


Figure 10: Source setup for P2000

### 8.3 Details for **P3000**

(Please refer also to Figure 5: SO294 seismic surveys P2000, P3000, P4000, and P5000 on Explorer Plate.)

Table 8: Seismic profiles for P3000

(FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_135-1	P3000	5007	5244	49.877333°N	129.107863°W	50.016430°N	129.035490°W
SO294_135-1	P3001	5304	6220	50.016918°N	128.999400°W	49.673140°N	128.333278°W
SO294_135-1	P3002	6323	6714	49.716955°N	128.311385°W	49.886465°N	128.517842°W

Table 9: Data acquisition parameters for P3000

<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

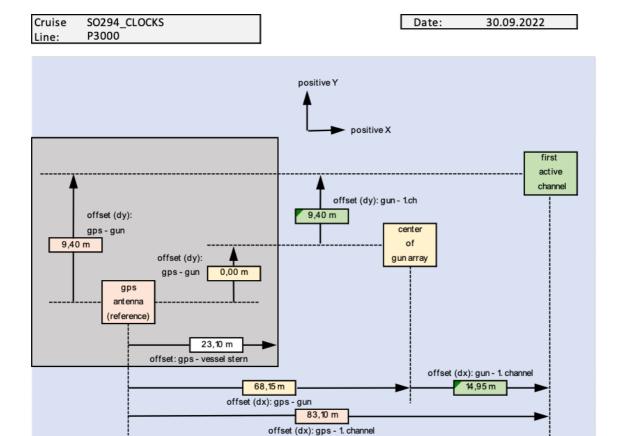
	P3000	
Shot rate (s)	60	
Record length (s)	12	
Sample rate (ms)	1	
Shot mode	GGun Array	
Streamer depth (m)	2	
Total Streamer Length (m)*	290.6	
Delay (ms)	55	
Gun-offset to port (m) <sup>+</sup>	0	
Gun-offset aft (m) <sup>+</sup>	68.1	
Streamer offset to port (m) <sup>+</sup>	9.4	
Streamer offset aft (m) <sup>+</sup>	83.1	

Table 10: Troubleshooting for P3000

Profile	Item	SP	Problem	Details/Action taken
		Range		
P3002	SP	6711-	ASCII files exist	NMEA created via SO294 P3000 Schiff.txt
		6713	but no NMEA	← SO294_2D_Seismic_watchkeeping_log.xls
			← not in SO294_P3000.0000.Nav.txt	
P3002	LGSP	6714	ASCII file exists	NMEA created via SO294 P3000 Schiff.txt
			but no NMEA	← SO294 2D Seismic watchkeeping log.xls
			← not in SO94_P3000.0000.Nav.txt	
P3000	LSP	6715	ASCII file exists	NMEA created via SO294_P3000_Schiff.txt
			but no NMEA	← SO294 2D Seismic watchkeeping log.xls
			← not in SO94_P3000.0000.Nav.txt	→ ntbp

	Γ	7	- 50		95	_	اء			Г	ь				ء	l		ı		10		176	_	۽							
		10	Geoffel Sheame	٧N	#7:49-56	12,50 m	149,81m			32.	Geo EeD git izer	¥ Ž		0,33 m	241,51m				48.	Geofel Steams	Α×	#22: 169- 176		345,38m							
22	,	12.	GeofelDigitizer	N/A		0,33 m	137,31m			31.	G eoEel Streamer	N/A	#14: 105 - 112	12,50 m	241,18 m				47.	Geo BelDigitizer	N/A		0,33 m	332,88 m							
30.09.2022	,	<del>4</del> .	Geofal Stramer	N/A	#6:41-48	12,50 m	136,98 m			30.	GeoEdDigitizer	N/A		0,33 m	228,68 m				46.	GeoEd Streamer	N/A	#21: 161 - 168	12,50 m	332,55 m							
30	,	-33	GeoEdDigtizer	N/A		0,33m	124,48 m		Navigator Bird	29.	Geo Ed Bird 50	N/A		1,56m	228,35 m				45.	Geo Eel Digitizer	A/N		_	320,05 m							
Naviget or Bird	A/N	15.	Geobel Steamer	N/A	#5:33-40	12,50 m	124,15m	٠		28.	G eoEel Steamer	N/A	#13: 97 - 104	12,50 m	226,79m				44.	G apEel Streamer	N/A	#20:153-160		319,72m							
į. į	,	ŧ:	GeoEdDigtizer	ΑN		0,33m	111,65 m			27.	GeoEdDigtizer	Z A		0,33m	214,29m				43.	Geo Eel Digit it er	ΥŽ		_	307,22m							
Date:	,	J0.	Geoffel Streamer	N/A	#4:25-32	12,50 m	111,32 m			26.	GeoEel Streamer	¥ Ž	#12: 89 - 96	12,50 m	213,96 m		Navigator Bir d	ΑN	42.	Geo Eel Bird ISO	۷ Ž		1,56 m	306,89m							
	,	oi	GeofeDigt izer	ΑN	44	0,33 m	98,82m			25.	Geo EeD git laar	¥ Ž	#	0,33 m	201,46 m				41.	GeoEel Streamer	ΥŽ	#19: 145- 152	12,50 m	305,33 m							
		ωi	5 collel Stramer	N/A	#3:17-24	12,50m	98,49m			24.	G coEci Streamer	N/A	#11:81-88	12,50 m	201,13 m				40.	Geo Bel Digitizer	N/A	#	0,33 m	292,83 m							
	ļ		GeoEdDigitizer	N/A	#	0,33 m	85,99m			23.	GeoEelDigtizer	N/A	#	0,33 m	188,63 m				39.	SeoEd Streamer	N/A	#18: 137 - 144	12,50 m	292,50 m							
	-	9	Seofiel Steamer G	N/A	#2:9-16	12,50 m	85,66 m			22.	GeoEel Streamer G	N/A	# 10:73-80	12,50 m	. 188,30 m				38.	GeoEdDigitizer	N/A	#	0,33m	280,00 m 2							
		ć.	Geo EdDigitizer C	N/A	**	0,33m	73,16 m			21.	Geo Ed Digitiz or	N/A	*	0,33m	175,80m				37.	GeoEel Steamer G	N/A	#17: 129 - 136		279,67m 2							
	-	4.	Seofel Steamer G	ΑN	#1:1-8	12,50 m	72,83 m			20.	Geofel Steamer G	A N	#9:65-72	12,50 m	175,47m				36.	Geo EalDigitite er	N/A	¥	0,33m	267,17m 2		52.	tail-buoy	۷ Ž		0,00m	378,21m
		က်	Gao EeDigt is or	ΑN		0,33 m	60,33 m			19.	Geo EeDigt ker	۸×	*	0,33 m	. 162,97 m				35.	GeoEel Streamer	ΑN	#16: 121 - 128	12,50 m	266,84m		51.	GeoEel Vibro	ΑŅ		20,00 m	┿
Navignor Brd	۷ ک	-	GeoEelVibro	۷ Ž		20,00 m	60,00m			18.	GeoEel Steamer	4 2	#8:57 - 64	12,50 m	162,64 m				34.	Geo EeD igt izer	۷ 2	*		254,34 m		50.	Geodel Steamer	۷ Ž	#23: 177- 184	12,50 m	358,21m
	١.	-	Geofel TomCable	A/N		40,00m	40,00m			17.	Geo Eel Digitizer	N/A	*	0,33 m	150,14 m				33.	G eoEel Streamer	N/A	#15: 106 - 120	12,50 m	254,01m 2		49.	GeoffelDigitizer	N/A	#	0,33 m	345,71m
Cruise: SO294_CLOCKS Line: P3000	L	_	cable length 378,21 m	000000					cample rate 1 ms	ء	th 2m							'				te .									<u> </u>

Figure 11: Streamer setup for P3000



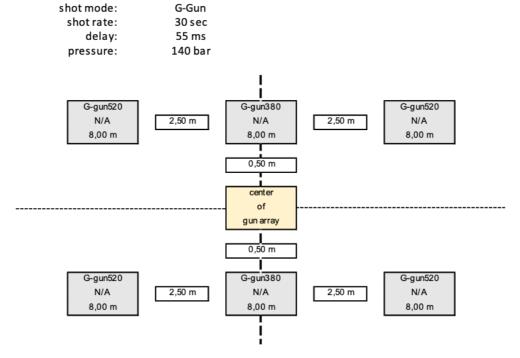


Figure 12: Source setup for P3000

### 8.4 Details for **P4000**

(Please refer also to Figure 5: SO294 seismic surveys P2000, P3000, P4000, and P5000 on Explorer Plate.)

Table 11: Seismic profiles for P4000 (FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_136-1	P4001-1	7375	7440	49.997588°N	128.636365°W	50.006888°N	128.650918°W
SO294_136-1	P4001-2	7700	7820	50.016375°N	128.665765°W	50.033338°N	128.692050°W
SO294_136-1	P4001-3	8000	8604	50.037157°N	128.697867°W	50.124280°N	128.831100°W
SO294_136-1	P4002	8672	9805	50.125357°N	128.850735°W	49.994383°N	129.117240°W
SO294_136-1	P4003	10175	12226	50.041590°N	129.171955°W	50.289112°N	128.648945°W
SO294_136-1	P4004	12325	12696	50.284097°N	128.621512°W	50.226298°N	128.540128°W
SO294_136-1	P4005-1	12783	13822	50.210218°N	128.544237°W	50.075242°N	128.819723°W
SO294_136-1	P4005-2	14091	15420	50.042643°N	128.886343°W	49.889827°N	129.198585°W
SO294_136-1	P4006	16124	18604	49.866642°N	129.080208°W	50.164078°N	128.457300°W
SO294_136-1	P4007	18678	19404	50.164367°N	128.435938°W	50.064750°N	128.331097°W
SO294_136-1	P4008-1	19540	20914	50.043865°N	128.345085°W	49.862680°N	128.691977°W
SO294_136-1	P4008-2	21158	21510	49.832095°N	128.750378°W	49.787117°N	128.836997°W
SO294_136-1	P4008-3	21683	21697	49.763908°N	128.880753°W	49.762048°N	128.884335°W
SO294_136-1	P4009	21757	22147	49.749947°N	128.886415°W	49.690177°N	128.798557°W
SO294_136-1	P4010	22212	24383	49.686895°N	128.781053°W	49.959083°N	128.301913°W
SO294_136-1	P4011	24455	24764	49.959613°N	128.280827°W	49.904642°N	128.222812°W
SO294_136-1	P4012	24834	27014	49.892163°N	128.222983°W	49.589587°N	128.739927°W

Table 12: Data acquisition parameters for **P4000** 

<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

	P4000	
Shot rate (s)	10	
Record length (s)	8	
Sample rate (ms)	0.5	
Shot mode	GI Gun Harmonic 355	
Streamer depth (m)	2	
Total Streamer Length (m)*	290.6	
Delay (ms)	150	
Gun-offset to port (m) <sup>+</sup>	0	
Gun-offset aft (m)+	45.1	
Streamer offset to port (m)+	9.4	
Streamer offset aft (m) <sup>+</sup>	83.1	

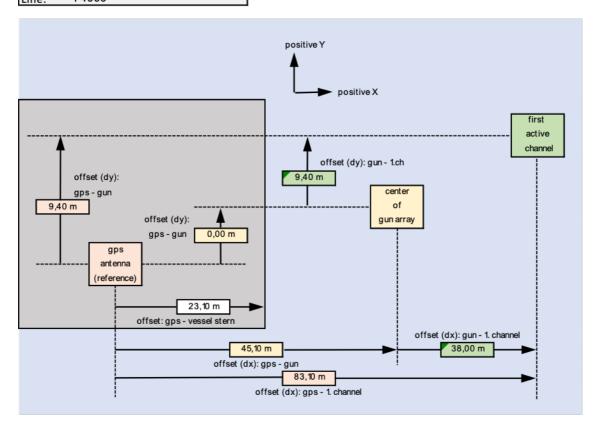
Table 13: Troubleshooting for P4000

Profile	Item	SP	Problem	Details/Action taken
		Range		
P4001	SP	7441-	Geometrics crashed	← SO294_2D_Seismic_watchkeeping_log.xls
		7447		→ ntbp
P4001	SP	7448-	Geometrics crashed	← SO294_2D_Seismic_watchkeeping_log.xls
		7669	(no ASCII files and no SEGD files)	→ ntbp
P4001	SP	7821-	Geometrics crashed	← SO294_2D_Seismic_watchkeeping_log.xls
		7825		→ ntbp
P4001	SP	7826-	Geometrics crashed	← SO294 2D_Seismic_watchkeeping_log.xls
		7999	(no ASCII files and no SEGD files)	→ ntbp
P4005	SP	13823-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		14090		→ ntbp
P4008	SP	20915-	No recording	← SO294 Cruise Report (Table 6.2.1)
		21157		← SO294_2D_Seismic_watchkeeping_log.xls;
				→ ntbp
P4008	SP	21511-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		21682		→ ntbp
P4000	SP	27049	ASCII file exists	NMEA created via SO294_P4000_Schiff.txt
			but no NMEA	
			← not in SO294_P4000.0000.Nav.txt	

	P4000										Date:	ن <u>و</u>		30	30.09.2022	77	
					Naviget or Bird								Navigator Bird N/A				
		1.	2.	3.	4.	5.	.9	7.	8.	.6	10.	11.	12.	13.	14.	15.	16.
cable length 378,21 m		Geotel TomCable	GeoEelVibro	Geo EeDigtirer	Geoffel Streamer	GeoEdDigitzer	Geottel Streamer	GeoEdDigitizer	G rollel Stramer	Geo felbigt izer	Geoffel Stramer	GeoEdDigtizer	Geotel Steamer	GeoEdDigitizer	Geotel Streamer	GeofelDigitizer	Geoffel Sheamer
	000000	N/A	4 2	ΥŽ	٧×	A/A	A/A	A/A	N/A	ΥŽ	٧×	ΑŅ	A/A	A/A	N/A	A/A	<b>∀</b> Ž
					# 1: 1-8		#2:9-16		#3:17-24		#4:25-32		#5:33-40		#6:41-48		#7:49-56
		40,00m	20,00 m	0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
		40,00m	60,00m	60,33 m	72,83 m	73,16 m	85,66 m	85,99m	98,49m	98,82m	111,32 m	111,65 m	124,15 m	124,48 m	136,98 m	137,31m	149,81m
													•				
samula rata	0 5 ms													Navigator Bird			
record length	8 s	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.
streamer depth	4-6 m	Geo Bel Digitizer	GeoEel Steamer	Goo EerDigt ker	Geofel Streamer	GeoEdDigtizer	GeoEel Streamer	GeoEdDigtizer	G to Eel Streamer	Geo SelD igt laer	GeoEel Streamer	Gco Ed Digit is or	G eoEel Streamer	Geo Ed Bird 50	GeoEdDigitizer	G coEel Streamer	GeofeDigtizer
		N/A	∢ ≥	ΑŅ	ΑN	۷/۷	A/N	N/A	N/A	۷ ک	∀ Ž	ΑŅ	N/A	N/A	N/A	A/N	∢ Ž
			#8:57-64		#9:65-72		#10:73-80		#11:81-88		#12: 89 - 96		#13: 97 - 104			#14: 105 - 112	
		0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	1,56m	0,33 m	12,50 m	0,33 m
		150,14 m	162,64 m	162,97 m	175,47 m	175,80m	188,30 m	188,63 m	201,13 m	201,46 m	213,96 m	214,29m	226,79m	228,35 m	228,68 m	241,18 m	241,51m
										_							
											Navigator Bird						
		33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.
		G edfel Streamer	Geo EelD igt izer	GeoEel Streamer	Geo BáDigt ker	GeoEel Steamer	GeoEdDigtizer	GeoEd Streamer	Geo Eel Digitizer	GeoEel Streamer	Geo Eel Bird ISO	GeoEdDigtker	G actel Steamer	GeoEelDigtizer	GeoEd Stramer	Geo EelDigitizer	Geolfel Steamer
		N/A	۷ ک	N/A	ΑN	A/N	A/A	N/A	N/A	ΥŽ	۷ گ	Ϋ́	N/A	N/A	N/A	N/A	Υ
		#15: 106 - 120		#16: 121 - 128		#17: 129 - 136		#18: 137 - 144		#19: 145- 152			#20: 153 - 160		#21: 161 - 168		#22: 169- 176
		12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	1,56 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
		254,01m	254,34 m	266,84m	267,17 m	279,67m	280,00 m	292,50 m	292,83 m	305,33 m	306,89m	307,22m	319,72m	320,05 m	332,55 m	332,88 m	345,38 m
		49.	50.	51.	52.												
		GeoffelDigitizer	GeoEel Steamer	GeoEel Vibro	tail-buoy												
		N/A	ΑŅ	ΑŅ	ΑŅ												
			#23: 177- 184														
		0,33 m	12,50 m	20,00 m	m00'0												
		345.71m	358.21m	378.21m	378.21m												

Figure 13: Streamer setup for P4000





shot mode: GI-Gun shot rate: 10 sec delay: 150 ms pressure: 140 bar



Figure 14: Source setup for P4000

### 8.5 Details for **P5000**

(Please refer also to Figure 5: SO294 seismic surveys P2000, P3000, P4000, and P5000 on Explorer Plate.)

Table 14: Seismic profiles for P5000 (FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_136-1	P5013	29087	30424	49.572142°N	128.728695°W	49.576702°N	128.317462°W
SO294_136-1	P5014-1	30502	31497	49.583785°N	128.303370°W	49.759883°N	128.283053°W
SO294_136-1	P5014-2	31651	31759	49.787665°N	128.279968°W	49.807128°N	128.277808°W
SO294_136-1	P5015	31803	32881	49.814253°N	128.280778°W	49.955548°N	128.474343°W
SO294_136-1	P5016	33407	35009	50.018932°N	128.580265°W	49.797867°N	129.013672°W
SO294_136-1	P5017	35142	35414	49.778405°N	129.004970°W	49.751828°N	128.918385°W
SO294_136-1	P5018-1	35458	36183	49.754053°N	128.902692°W	49.860888°N	128.698048°W
SO294_136-1	P5018-2	36971	37471	49.833620°N	128.749073°W	49.904057°N	128.614987°W
SO294_136-1	P5019	37695	38021	49.878837°N	128.558630°W	49.810990°N	128.594450°W
SO294_136-1	P5020	38080	38368	49.803003°N	128.608100°W	49.806202°N	128.697522°W
SO294_136-1	P5021	38410	38996	49.804692°N	128.710470°W	49.724778°N	128.859433°W
SO294_136-1	P5022	39085	39385	49.708530°N	128.861507°W	49.674778°N	128.764758°W
SO294_136-1	P5023	39439	40537	49.674270°N	128.746392°W	49.802248°N	128.437623°W
SO294_136-1	P5024	40618	40939	49.802200°N	128.413772°W	49.744158°N	128.338795°W
SO294_136-1	P5025-1	41006	41037	49.729915°N	128.337100°W	49.724930°N	128.343760°W
SO294_136-1	P5025-2	41546	41661	49.643670°N	128.456360°W	49.625062°N	128.482162°W

Table 15: Data acquisition parameters for P5000

<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

	P5000	
Shot rate (s)	10	
Record length (s)	8	
Sample rate (ms)	0.5	
Shot mode	GI Gun Harmonic 355	
Streamer depth	2 m	
Total Streamer Length (m)*	290.6	
Delay (ms)	150	
Gun-offset to port (m) <sup>+</sup>	0	
Gun-offset aft (m) <sup>+</sup>	45.1	
Streamer offset to port (m) <sup>+</sup>	9.4	
Streamer offset aft (m) <sup>+</sup>	83.1	

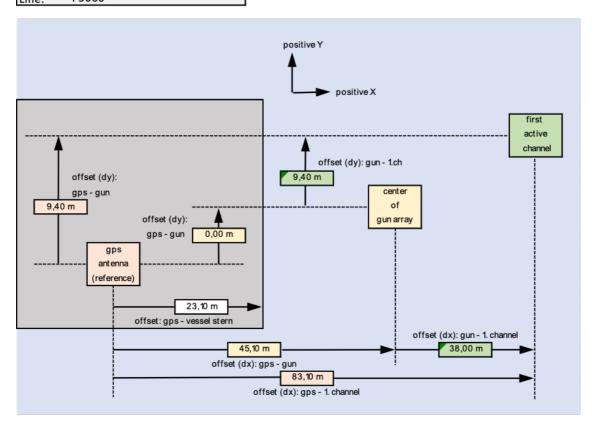
Table 16: Troubleshooting for **P5000** 

Profile	Item	SP	Problem	Details/Action taken
		Range		
P5014	SP	31498-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		31650		→ ntbp
P5015	SP	32882-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		33119		→ ntbp
P5015	LGSP	33333	Wrong in SO294 Cruise Report	Personal communication with watch keeper
			(Table 6.2.1)	(after cruise)
P5018	SP	36184-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		36970		→ ntbp
P5019	SP	37968	ASCII file exists	← SO294_P5000_Schiff.txt
			but no NMEA	← SO294_2D_Seismic_watchkeeping_log.xls
			← not in SO-294_P4000.0000.Nav.txt	→ ntbp
			Time mismatch (frozen clock) in	
			SO294_P5000_Schiff.TXT	
P5025	SP	41038-	Shut down	← SO294 Cruise Report (Table 6.2.1)
		41545		→ ntbp
P5000	SP	41662	Shut down	← SO294 2D Seismic watchkeeping log.xls
				→ ntbp

SO294_CLOCKS P5000					Naviget or Bird						Date:	<u></u>	Naviget or Bird	03	03.10.2022	22	
,	,	,			ΑŅ,	,	,	,	,	,	ş	;	N/A	\$	;	ļ	ş
1, 2, 2.		2.		69	4.	5.	9.	7.	8.	6	10.	11.	12.	13.	4.	15.	16.
		NA		A N	ΥŽ	N/A	A/N	N/A	A/A	NA	ΑN	NA NA	N/A	N/A	A/N	N/A	ΥŽ
					#1:1-8		#2:9-16		#3:17-24		#4:25-32		#5:33-40		#6:41-48		#7:49-56
40,00m 20,00m		20,00m		0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
40,00m 60,00m	Н	60,00m		60,33 m	72,83 m	73,16 m	85,66 m	85,99 m	98,49 m	98,82m	111,32 m	111,65 m	124,15m	124,48 m	136,98 m	137,31m	149,81m
0,5 ms														N/A			
8 s 17. 18.	H	18.		19.	20.	21.	22.	23.	24.	25.	.92	27.	28.	29.	30.	31.	32.
4 - 6 m GeoEel Straumer	Geo Bel Digitizer GeoEel Steamer	GeoEel Streamer		Geo EeDigt ker	Geofel Steamer	GooEdDigitzer	GeoEel Streamer	GeoEdDigtizer	G to Eel Streamer	Geo SelD igt izer	GeoEel Streamer	GeoEdDigtizer	G ao Eel Stroamer	Geo Ed Bird 50	GeoEdDigtizer	G coEel Streamer	Geo SeD igt lzer
N/A N/A		A N		ΝA	Α×	N/A	A/N	N/A	N/A	Υ'N	ΝA	ΑN	N/A	N/A	N/A	N/A	ΥŽ
#8:57 - 64	#8:57 - 64	#8:57 - 64			#9:65-72	**	#10:73-80		#11:81-88		#12: 89 - 96		#13: 97 - 104			#14: 105 - 112	
12,50 m	12,50 m	_		0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	1,56m	0,33 m	12,50 m	0,33 m
150,14 m 162,64 m	162,64 m	Н	, I	162,97 m	175,47 m	175,80m	188,30 m	188,63 m	201,13 m	201,46 m	213,96m	214,29m	226,79m	228,35 m	228,68 m	241,18 m	241,51m
										_							
											Navigator Bird						
33. 34.	$\vdash$	34.	1	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.
G sofel Smarrer Geo ExD git in F	9	9	Ö	e o E el Streamer	Geo EalDight iz er	GeoEel Steamer	GeoEelDigtizer	GeoEd Streamer	Geo Bel Digitizer	GeoEel Streamer	Geo Eel Bird ISO	Geo Eel Digitizer	G actel Steamer	GeoEelDigtizer	GeoEd Streamer	Geo Eel Digitizer	Geofal Steamer
N/A N/A	۷ ک			ΑŅ	¥ ≷	A/N	A/N	N/A	N/A	ΑŅ	Ϋ́	ΑŅ	N/A	N/A	N/A	A/N	ΥŽ
#15: 106 - 120 #16		#16	#16	#16: 121 - 128		#17: 129 - 136		#18: 137 - 144		#19: 145- 152			#20:153-160		#21: 161 - 168		#22: 169- 176
12,50m 0,33m 12	0,33 m		72	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	1,56 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
254,01m 254,34m 266	254,34 m	Н	266	266,84 m	267,17 m	279,67m	280,00 m	292,50 m	292,83 m	305,33 m	306,89m	307,22m	319,72m	320,05 m	332,55 m	332,88 m	345,38m
49. 50.	H	50.		51.	52.												
Geo Eel Digitizer Geotal Swamer	Geodel Steamer	amer	_	GeoEel Vibro	tail-buoy												
N/A N/A	L	∢ Ž		Ϋ́	∢ Ž												
#23: 177- 184	#23: 177- 184	#23: 177- 184															
-	-	12,50m		20,00 m	m00'0												
345,71m 358,21m	Н	358,21m	-	378,21m	378,21m												

Figure 15: Streamer setup for P5000





shot mode: GI-Gun shot rate: 10 sec delay: 150 ms pressure: 140 bar



Figure 16: Source setup for P5000

### 8.6 Details for **P6000**

(Please refer also to Figure 6: SO294 seismic surveys P6000 and P7000 off Vancouver Island.)

Table 17: Seismic profiles for P6000 (FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_208-1	P6000	43188	43382	49.023360°N	127.444830°W	49.062435°N	127.471187°W
SO294_208-1	P6001	43452	44343	49.069332°N	127.487902°W	49.025045°N	127.724378°W
SO294_208-1	P6002	44700	45506	48.959192°N	127.714015°W	48.986497°N	127.468747°W
SO294_208-1	P6003	45749	46702	48.941707°N	127.441098°W	48.834025°N	127.712963°W
SO294_208-1	P6004	47187	48354	48.765102°N	127.631380°W	48.901557°N	127.320638°W
SO294_208-1	P6005	48717	49777	48.849897°N	127.288022°W	48.651660°N	127.435325°W
SO294_208-1	P6006	50003	50808	48.626770°N	127.382198°W	48.685848°N	127.137072°W
SO294_208-1	P6007	51067	51803	48.704967°N	127.160493°W	48.564792°N	127.230838°W
SO294_208-1	P6008	52206	52984	48.511370°N	127.153325°W	48.606797°N	126.956742°W
SO294_208-1	P6009	53417	54532	48.544722°N	126.862738°W	48.328062°N	126.980438°W
SO294_208-1	P6010	54848	56186	48.349505°N	127.039445°W	48.511312°N	126.725745°W
SO294_208-1	P6011	56541	57354	48.476260°N	126.649057°W	48.367720°N	126.860988°W
SO294_208-1	P6012	57715	58734	48.313798°N	126.812542°W	48.339758°N	126.519515°W
SO294_208-1	P6013	59015	60084	48.292068°N	126.475287°W	48.077680°N	126.622898°W
SO294_208-1	P6014	60361	60786	48.088282°N	126.693577°W	48.168237°N	126.662790°W
SO294_208-1	P6015	61035	62024	48.185660°N	126.594253°W	48.172005°N	126.307007°W

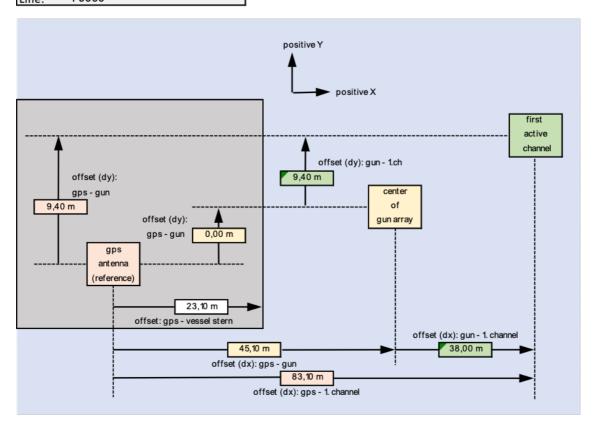
Table 18: Data acquisition parameters for P6000

<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

	P6000
Shot rate (s)	10
Record length (s)	8
Sample rate (ms)	0.5
Shot mode	GI Gun Harmonic 355
Streamer depth (m)	2
Total Streamer Length (m)*	290.6
Delay (ms)	150
Gun-offset to port (m) <sup>+</sup>	0
Gun-offset aft (m) <sup>+</sup>	45.1
Streamer offset to port (m) <sup>+</sup>	9.4
Streamer offset aft (m) <sup>+</sup>	83.1

Figure 17: Streamer setup for P6000





shot mode: GI-Gun shot rate: 10 sec delay: 150 ms pressure: 140 bar

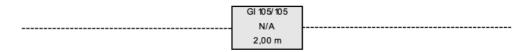


Figure 18: Source setup for P6000

### 8.7 Details for **P7000**

(Please refer also to Figure 6: SO294 seismic surveys P6000 and P7000 off Vancouver Island.)

Table 19: Seismic profiles for P7000

(FGSP stands for First Good Shot Point and LGSP stands for Last Good Shot Point)

Event	Profile	FGSP	LGSP	LAT Start	LONG Start	LAT End	LONG End
SO294_209-1	P7000	64716	65585	48.392728°N	126.461568°W	48.233198°N	127.233643°W
SO294_209-1	P7001	65711	66586	48.286932°N	127.291162°W	48.629993°N	126.687290°W
SO294_209-1	P7002	67141	67600	48.617107°N	126.707712°W	48.798535°N	126.389017°W

Table 20: Data acquisition parameters for P7000

<sup>\*</sup> Includes bird sections; + measured relative to GPS antenna

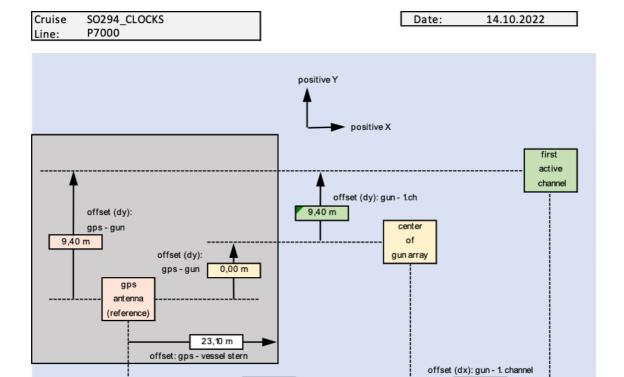
	P7000
Shot rate (s)	30
Record length (s)	12
Sample rate (ms)	1
Shot mode	GGun Array
Streamer depth (m)	4
Total Streamer Length (m)*	290.6
Delay (ms)	55
Gun-offset to port (m) <sup>+</sup>	0
Gun-offset aft (m) <sup>+</sup>	68.1
Streamer offset to port (m) <sup>+</sup>	9.4
Streamer offset aft (m) <sup>+</sup>	83.1

Table 21: Troubleshooting for P7000

Profile	Item	SP	Problem	Details/Action taken
		Range		
P7000	SP	64061	ASCII file exists	NMEA created via SO294_P7000_Schiff.txt
			but no NMEA	← SO294_2D_Seismic_watchkeeping_log.xls
			← not in SO294_P7000.0000.Nav.txt	
P7000	SP	64121-	Geometrics crashed	← SO294_2D_Seismic_watchkeeping_log.xls
		64125		→ ntbp
P7000	SP	64917	ASCII file exists	NMEA created via SO294_P7000_Schiff.txt
			but no NMEA	← SO294_2D_Seismic_watchkeeping_log.xls
			← not in SO294_P7001.0000.Nav.txt	
P7001	SP	66411	ASCII file exists	None as SP has simply been skipped by the
			but no NMEA	system
			← not in SO294_P7001.0000.Nav.txt	
			Time issue	
P7000	SP	66641-	Geometrics crashed	← SO294_2D_Seismic_watchkeeping_log.xls
		66643		→ ntbp
P7000	SP	67601-	Shut down	← SO294_2D_Seismic_watchkeeping_log.xls
		67603		→ ntbp

Cruise: SO294_CLOCKS Line: P7000	LOCKS										Da	Date:		14	14.10.2022	52	
					Navigetor Bird								Navigator Bird				
		+-	2.	3.	4	5.	.9	7.	80	6	10.	1;	12.	13.	44	15.	.91
cable length 378,21 m		Geoffel TomCable	GeoEelVibro	Gco EeDigtizer	Geoffel Steamer	GeoEdDigitizer	GeoDel Steamer	GeoEdDigtizer	Geofel Streamer	Geofel igt izer	Geoffel Streamer	GeoEdDigtizer	Geobel Steamer	GeoEdDigtizer	Geofel Stramer	GeofelDigitizer	Geoffel Steamer
	000000	A/N	∢ Ž	ΑN	٧×	A/N	A/N	A/A	N/A	Α×	ΑŅ	٧×	A/A	A/A	A/N	A/A	∢ ≥
					#1:1-8		#2:9-16		#3:17 - 24		#4:25-32		#5:33-40		#6:41-48		#7:49-56
		40,00m	20,00m	0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
		40,00m	60,00m	60,33 m	72,83 m	73,16 m	85,66 m	85,99 m	98,49m	98,82m	111,32 m	111,65 m	124,15 m	124,48 m	136,98 m	137,31m	149,81m
													<u>'</u>				
														Navigat or Bird			
sample rate	1 ms													N/A			
record length	12 s	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	.62	30.	31.	32.
streamer depth	2 m	GeofielDigitizer	GeoEel Streamer	ez jeplet ker	Geofel Steamer	Geo Ed Digitiz er	GeoEel Stramer	GeoEdDigtizer	G eoEel Streamer	Geo SelD igt laer	GeoEel Streamer	GeoEdDigtizer	G eoEel Streamer	Geo Ed Bird 50	GeoEdDigtizer	G eoEel Streamer	GeofelDigt izer
		N/A	∢ Ž	ΥŅ	ΑN	A/N	A/N	A/N	N/A	ΥŽ	ΑŅ	∢ Ž	N/A	N/A	A/N	A/N	∢ ≥
			#8:57 - 64		#9:65-72		# 10:73-80		#11:81-88		#12: 89 - 96		#13: 97 - 104			#14: 105 - 112	
		0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	0,33 m	12,50 m	0,33m	12,50 m	1,56m	0,33 m	12,50 m	0,33 m
		150,14 m	162,64 m	162,97 m	175,47 m	175,80m	188,30 m	188,63 m	201,13 m	201,46 m	213,96 m	214,29m	226,79m	228,35 m	228,68 m	241,18 m	241,51m
											Navigator Bird						
											ΑN						
		33.	34.	35.	36.	37.	38.	39.	40.	41.	42.	43.	44.	45.	46.	47.	48.
		Geoffel Streamer	Geo EeD igit izer	GeoEel Streamer	Geo BilDigitizer	GeoEel Streamer	GeoEelDigtizer	GeoEd Streamer	Geo Eel Digitizer	GeoEel Stramer	Geotel Bird ISO	GeoEelDigtiter	G eoEel Streamer	GeoEelDigitizer	GeoEd Streamer	GeofelDigitizer	GeoEel Steamer
		N/A	∀ Ž	ΑN	٧×	A/A	N/A	N/A	A/A	ΥN	ΥŽ	۷ Ž	A/A	N/A	A/A	A/A	∢ ≥
		#15: 106 - 120		#16: 121 - 128		#17: 129 - 136		#18: 137 - 144		#19: 145- 152			#20: 153 - 160		#21: 161 - 168		#22: 169- 176
		12,50 m	0,33 m	12,50 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m	1,56 m	0,33m	12,50 m	0,33m	12,50 m	0,33 m	12,50 m
		254,01m	254,34 m	266,84m	267,17 m	279,67m	280,00 m	292,50 m	292,83 m	305,33 m	306,89m	307,22m	319,72m	320,05 m	332,55 m	332,88 m	345,38m
		49.	50.	51.	52.												
		GeofelDigitizer	Geotel Steamer	GeoEel Vibro	tail-buoy												
		N/A	∢ Ž	ΑN	ΑN												
			#23: 177- 184														
		0,33 m	12,50 m	20,00 m	m00'0												
		345,71m	358,21m	378,21m	378,21m												

Figure 19: Streamer setup for P7000



offset (dx): gps - 1. channel

14,95 m

68,15 m

offset (dx): gps - gun

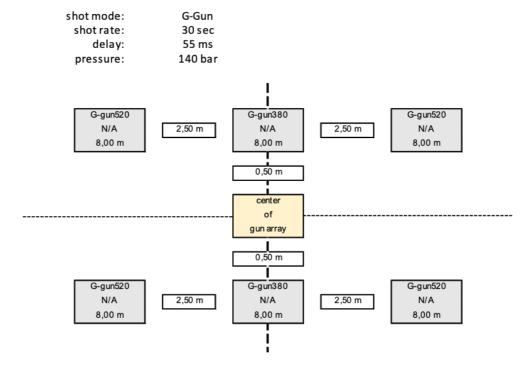


Figure 20: Source setup for P7000

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