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# TENDER DOCUMENT - ANNEX 1- SCOPE OF WORK

*Acquisition - and Processing of 3D seismic data – Barents Sea 2019*

*Ref no 2018/1020*



**NORWEGIAN PETROLEUM  
DIRECTORATE**

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# 1 3D Seismic acquisition programme 2019

In the 2012-2014 & 2016 seasons, the NPD has acquired substantial volumes of 2D seismic data in the Barents Sea North and Northeast. Further to this, NPD now plans to acquire and process a 3D seismic survey in these waters.

The 2019 3D seismic survey has a scope of approximately 1.000 Km<sup>2</sup> of full-fold data coverage.

Due to the nature of fishing activities, changes to the ice-edge and/or changes to the survey programme – the schedule and scope may be modified / changed during the cruise - in agreement with NPD and the Contractor.

## 2 Project timing and funding

### 2.1 Project timing

The timing of the seismic acquisition programme is critical due to weather conditions and fishing activities. NPD therefore prefers that the acquisition is done within the time period as from early August to mid September. The suppliers must provide an account of vessel availability. The acquisition is under all circumstances conditional upon NPD and the supplier reaching a mutual agreement concerning the time period for the acquisition.

### 2.2 Project funding

The project is subject to funding from the Norwegian Government. NPD therefore reserves the right to stop the bidding process or declare it null and void or reduce the volume of the programme due to budgetary reasons or unforeseen circumstances outside NPD's control.

We require the bid to be structured the following way:

**Price Table 1** (all in NOK ex. VAT)

Production Rates – 3 (4) options: NOK per km pop-to-pop:		Work-scope approx. 1.000 km <sup>2</sup> of full-fold 3D seismic data
This cost is including the 3D data processing (ref. 5.)		
Standby- Rate per hour:	Mobilization and De-mobilization Cost (Lump Sums):	
Additional Cost: Grav. – Mag. Data, Evt. Additional Support Vessel:		
Eventual additional Data Processing Cost (add-in optional):		

## 3 Technical specifications

### 3.1 3D Seismic Data Acquisition

The acquisition of the 3D seismic streamer data should be performed with the highest quality industry equipment and geometry.

As we wish to survey in northern waters - we will require the bidder to provide an accurate description of the survey vessel's Ice Classification and the vessel's ability to survey in such northern waters. (This applies both to the Seismic Vessel as well as Support Vessels).

Bidders are required to provide documentation with a detailed description and particulars of the geophysical benefits of their streamer system, as well as a description of other attributes and benefits of such system. In particular, towing and towing depth, hereby weather (productivity) impact should be described.

#### Basic Survey parameters:

No. of sources:	3 (flip-flop-flap, 3-source alternate shooting)
Shot (pop) interval:	12.5 m i.e. 37.5 m from flip-to-flip
Source depth:	7.0 m – 9.0 m - contractor to indicate / recommend
Source size:	circa 2000-3000 cu.in. per source (relatively small, 2-string array)
Streamers active length:	8,000 m
Group interval:	outtake every 12.5 m
No. of streamers:	12 - 14
Near offset:	circa 80-100 m for the inner streamers and as short as operational feasible
Streamers depth:	Constant depth tow 15 m – 25 m depending on streamer system
Record length:	7 - 8 Sec. (to be evaluated)
Sampling rate:	2 ms
Streamers separation:	75 m for <b>Bid Options 1-2</b> , 100 m for <b>Bid Option 3</b>
Source separation:	Contractor to suggest triple-source configurations for both 75 m & 100 m streamer separation cases

Available options for the acquisition geometry and source configurations shall be specified. The bid should contain a detailed technical description of proposed equipment. Contractor shall also indicate their 'streamer fanning' strategy (if applicable).

Vessel production speed shall be optimized and set as high as possible without consideration to eventual residual shot energy on the very last part of each recording. In the bid the Contractor shall indicate their preferred way to handle this - as well as provide an indication of their maximum production speed.

#### 3D Survey objectives / Zone of Interest

In the 3D survey area the seabed is fairly uniform situated at approx. 175 – 185 m (i.e. 235-250 ms). In the centre of the survey area Jurassic rocks are situated right below the seafloor (subcrop) and Cretaceous rocks in a rim around the centre of the survey area. I.e. this rather hard seafloor is setting up a system of WB-period multiples that we will have to attempt to eliminate/reduce. There are several zones of interest, approx.: 1) 500-800 ms; 2) 1000-1500 ms & 3) 1800-2200 ms & 4) the deepest point of interest is down to ~3500 ms. We conclude that none of these zones should be in conflict with utilizing a 12.5 m pop interval with respect to residual shot energy in the window of interest.

#### 3D Survey Area – Volume Calculations:

The survey area is planned as a pentagon shape where 4 (four) of the sides are pairwise parallel.

Survey width: 28,3 Km

Average Line Length: 35,5 Km + 4 Km = 39,5 Km (with ½ cable-length runout)

FF-area: 35.5 x 28.3 = 1005 km<sup>2</sup>

1. For a 75 m Cable Separation, 12 streamer solution – (Sail line every 450 m) – amounts to 2.489 vessel-Km, PRIMELINE
2. For a 75 m Cable Separation, 14 streamer solution – (Sail line every 525 m) – amounts to 2.133 vessel-Km, PRIMELINE
3. For a 100 m Cable Separation, 14 streamer solution – (Sail line every 700 m) – amounts to 1.580 vessel-Km PRIMELINE

Infill: It is the intension of the NPD to minimize or even avoid to acquire infill data. We believe that a combination of A) Shooting for coverage & B) modern data-regularization and interpolation alorithms in combination with overall good/dense sampling – together will aid a good help in this respect.

### 3.2 Navigation specifications

The bidder should make use of an industry standard navigation / in-sea positioning system.

The bidder shall specify in detail the navigation system which will be applied for the 3D seismic acquisition.

The bidder is responsible for navigation supply. Navigation data shall be processed by bidder in order to produce final positions for each source and trace.

The centre of sources shall at all times be determined better than +/- 5 m. Receivers shall at all times be determined better than +/- 10 m. Both figures shall refer to a confidence level of 95%.

### 3.3 Additional services

Provision of one Support/Scout/Work- boat for the planned survey shall be included in the prices specified in Section 7 in this document.

Provision of an eventual additional Support/Scout/Work- boat shall be quoted as an additional cost item.

NPD may consider other geophysical measurements to be made simultaneously. The bidder is requested to specify arrangements and costs for inclusion of the following additional geophysical equipment:

- Gravity field data
- Magnetic field data

The bidder shall herein quote a solution for both acquisition and processing of Gravity and Magnetic data.

## 4 Data quality

The bidder shall provide Quality Control during the acquisition of the data.

For the seismic acquisition programme, vessels that are constructed, equipped and operated in accordance with relevant requirements from the competent Authorities in the country of registration and from a first class international classification bureau approved by IACS, shall be used.

The bidder shall describe his routines for quality control of the data, using acceptable, industry standards such as “Procedures and Specifications for Field Operations and Data Processing” as an appendix to the response to tender.

The bidder shall:

- Give details of the vessel to be used and all its maritime equipment (sources, streamers, navigation and positioning system). The vessel and the equipment should satisfy the highest industry standards.
- Give a description of the vessel and relevant equipment for carrying out the assignment and copies of relevant certifications.

The bidder shall describe his seismic QC system for recording, monitoring and analysis of seismic and navigation data.

All equipment, instruments and other materials supplied by the bidder are subject to approval by NPD before commencement of the survey acquisition.

A representative of NPD shall be onboard the survey vessel at all times for quality control. This does not, however, exempt the bidder from his responsibility of delivering all products to the specified acceptable standard / quality. In addition, a fisheries representative will also be required to be onboard (this cost will be covered by NPD), and other NPD personnel (if decided by NPD) will be onboard during the acquisition.

## 5 3D Seismic data processing

3D seismic data processing should be integrated into the Proposal.

3D Data Processing route;

NPD's suggest processing route. We expect the Contractor to comment and add-in to the processing sequence, as deemed necessary.

Eventual Price / Cost implications should be quoted and properly labeled.

- Reformat from SEG-D, Static shift correction for source/receiver depth.
  - Bad shot and channel edits.
- Gain Recovery / Spherical divergence correction
- Merging the seismic traces to the navigation/positioning
- Resample to 4 ms
- Noise attenuation. The data will be searched for spikes, spurious high amplitudes and swell noise
- Resample to 1 ms.
- Multi-domain noise attenuation - as well as search for spikes, spurious high amplitudes and swell & tug noise.
- De-ghosting and re-datum
- Deterministic signature deconvolution (zero phasing) which shall be applied using an operator designed to transform the modeled far field source signature to its zero phase equivalent. This process shall also take care of air gun bubble pulse (de-bubble)
- Linear noise attenuation in shot and receiver domain, focused on direct arrivals and refractions, contractor to specify methods
- Inverse Q filter, phase only (place in sequence to be decided)
- Up to 6-passes of de-multiple before migration including (order and methods subject to testing):
- 1st pass de-multiple: 2D Surface Related Multiple Elimination (SRME), as appropriate
- 2nd pass de-multiple: Wave Equation Multiple Attenuation
- 3rd pass de-multiple: Shallow Water De-multiple (SWD)
- 4th and 5th pass de-multiple: Tau-p De-convolution & Mute in shot and receiver domain. Mute in tau-p domain should be adapted to water depth. Data should be interpolated in shot domain before receiver domain tau-p transform.
- De-multiple pass 1-5 applied either in sequential mode or using multi model least squares adaptive subtraction, following testing
- Tau-p dip filter (shot and receiver domains, if necessary).
- First pass velocity analysis every 1 x 1 Km. All velocity picking should be performed in agreement/co-operation with NPD staff. The data shall be muted (& proper pre-conditioned) prior to all velocity analysis.
- FX de-convolution
- Common offset linear noise attenuation (FK filter), as appropriate
- 6th pass de-multiple: Hi-Resolution Parabolic Radon de-multiple with appropriate interpolation
- Second pass velocity analysis every 500 x 500 m. Input to Pre stack time migration (PSTM).
- Data interpolation / regularization to 12,5 x 12,5 m
- 3D Pre stack time migration (PSTM)
- Third pass velocity analysis every 1 km. Final velocities (to be exported to EssoV2 and diskos98.1 formats)
- 7th pass de-multiple: Hi-Resolution Parabolic Radon de-multiple with appropriate interpolation
- NMO correction. Pre-stack scaling, inner- and outer trace mute.
- 3D binning and Stacking
- Relevant post stack signal enhancement procedures
- Post-stack Filtering & Scaling
- SEG-Y output

Regarding On-board Data Processing: For the purpose of this project the NPD do not require "on-board data processing" services. However, should the contractor have resources on-board for CONCURRENT processing, then this could provide a head-start for the total data-processing - and hence shorten the overall project turnaround time.

## 6 Data delivery and final products

### 6.1 General

Raw 3D seismic data:

The bidder shall deliver raw 2D acquired seismic data on 3592 tapes as standard SEG-D. All navigation data shall be delivered on a suitable medium in standard UKOOA P1&P2 format.

All raw seismic data and all navigation data shall with no undue delay, and in any case no later than three weeks after survey completion, be shipped to NPD offices in Stavanger.

### 6.2 Data delivery

The following list of data shall be delivered to NPD:

- Two copies of seismic field data on 3592 tapes in SEG-D format.
- Navigation data, UKOOA P2/94 and P1/90 on 3592 tapes.
- TOC files including tape-, acquisition- and FFID logs on CD-ROM.
- CMP map on CD-ROM and one paper copy.

#### Products to be delivered after 3D data processing:

<b>Item</b>	<b>Format</b>	<b>Media</b>
Final processing report	MS Word or PDF format	USB stick
Raw field data as received from client	SEG-D	3592
Final stacking & migration velocities	EssoV2xy or diskos98.1	USB stick
Raw CDP gather before PSTM	SEG-Y	Hard disk
Raw common image gather (CIG) after PSTM	SEG-Y	Hard disk
Raw migration full-offset stack volume and sub stack volum (near,- mid- and far- angle)	SEG-Y	Hard disk
Final PSTM (unscaled true amplitudes full offset volume)	SEG-Y	Hard disk
Final PSTM (TVS full offset volume)	SEG-Y	Hard disk
3D bin cell position data	UKOOA P1-90	USB stick

### 6.3 Reporting

The following reports shall be delivered to NPD:

- Observers' Logs, Navigation Logs and Tape Logs on CD-ROM
- Onboard Seismic Processing QC and Calibration Report (delivered on completion of fieldwork) on CD-ROM
- Final acquisition reports on CD-ROM and one paper copy.

## 7 Costs

### 7.1 General conditions

- All costs shall be stated in NOK ex. VAT
- All conventional navigation costs, surface positioning and in-sea positioning shall be included in the acquisition cost.
- Costs related to equipment performance and acceptance tests shall be covered by the bidder.
- Provision of one Support/Scout/Work- boat for the planned survey shall be included in the prices.
- The bidder shall allow adequate time, at no cost to NPD, for checkout by NPD of all systems (including seismic, navigation/positioning equipment) under operating conditions, i.e. with streamer(s) and energy sources deployed and test shots recorded. A formal start of operations is conditional upon a satisfactory checkout.

### 7.2 Production rate

Production rates shall be quoted for 3 (three) alternatives as indicated in Price table 1, cf. section 2.2 "Project funding".

Kilometer rates, pop-to-pop: For Scope see 3.1 marked " 3D Survey Area – Volume Calculations "

- **Bid Option 1: 12 streamers tow – 75 m streamer separation and 3-source pop every 12,5 m**
- **Bid Option 2: 14 streamers tow – 75 m streamer separation and 3-source pop every 12,5 m**
- **Bid Option 3: 14 streamers tow – 100 m streamer separation and 3-source pop every 12,5 m**
- **Alternative Bid Option (4): Contractor to propose alternative tow/solution (Optional / not required)**

As a minimum requirement Bid Option 1 must be quoted. However, bidders are encouraged also to bid for Options 2 and 3 (as well as option 4).

The following costs shall be included in all rates stated:

- Costs for 3D Data Processing (covered by above 5. 3D Seismic data processing)
- Costs for geophysical pre-survey planning
- Costs for logistical survey planning
- All the specified nav. processing (including post-processing of navigation data to UKOOA P1/90 format), end products and consumables (tapes etc)

### 7.3 Standby rate

Standby rate shall be stated as rate per day (24 hours).

Standby time is classified as time spent on:

- Waiting on weather
- Waiting due to seismic interference or other circumstances (e.g. fishing activity)
- Waiting due to marine conditions preventing or delaying the seismic operation to go-head, outside control of the contractor – also including time spent on port calls and other steaming on specific request by company
- Waiting due to Force Majeure
- Non-operational periods due to instructions received from the Company to delay the Work

The breakdown of timing regarding production and standby shall, on a daily basis, be agreed between the Party Chief and the NPD representative onboard. The bidder's breakdown standards on this issue must be part of the tender documentation.

Downtime due to technical breakdown and Contractor's crew change must be covered by the bidder.

### 7.4 Transit rate

Eventual Transit: Transit rate classified as steaming- and transit between survey areas. Likely N/A.

Transit rate shall be stated as rate per hour.



## 7.5 Mobilization and demobilization

The exact position(s) for the survey will be furnished upon contract award. Contractor shall suggest alternative ways and alternative harbours for mobilization and demobilization for this Barents Sea survey. The costs shall be stated as Lump Sums.

The required steaming time to the survey area from Honningvåg (Northcape) would be 46 hours at 13 knots cruising speed.

The mobilization period will be regarded as finished when the equivalent of one prime line in each survey direction has been successfully recorded, and all equipment work correctly as far as it can be reasonably demonstrated to the satisfaction of the NPD's representative onboard. The production time will then be counted from the first accepted shot point on the first accepted line.

## 7.6 Seismic data processing

Cf. section 5 "Seismic data processing".

## 7.7 Early termination fee

See annex 2 – General Conditions of Contract.

# 8 Contract conditions

NPD will use a revised version of the NPD 2010 standard contract - which again is based on IAGC standard contract conditions. These terms and conditions are enclosed to the tender document in annex 2 – 5.

The bidder shall complete schedules B- i, listed in annex 3, as appropriate.

Minor reservations with reference to specific contract clauses must be quoted with alternatives, cf. tender document section 6.2 Disposition of tender, "DOC05 – Contractual"

### **This type of procedure does not allow for contract negotiations.**

Significant reservations by the bidder regarding the terms stipulated in this bidding invitation, in the competition specifications or the contractual terms may affect his chances of being awarded the contract.

We specially refer to the Norwegian public procurement regulations. According to this, an offer shall be rejected if the bidder has made significant reservations to the contract conditions.

The contract (GCC) contains a prohibition against social dumping, cf. clause 4.1.8. NPD is obliged by law to use this clause in our contracts. Reservations against this clause will be regarded as significant reservations and will lead to rejection of the bid.