Specifications of
Trend Survey on “Non-seismic Geophysical Survey Methods and Applications” in Oil and Gas Exploration

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1. Purpose of the survey

In recent years, owing to the technical innovation in the non-seismic geophysical survey, the number of cases where exploration risk has been reduced by applying these technologies, is increasing. Such Non-seismic geophysical survey includes marine electromagnetic survey (below as CSEM), airborne gravity & magnetic survey, airborne gravity gradiometry survey, magnetotelluric (below as MT) and electromagnetic survey.

For example, CSEM has firmly established as an important geophysical tool in the offshore environment in the last 10 years and become an essential tool for the exploration in Barents Sea, Norway. Some oil companies in the area who adopt CSEM achieved a high exploration success rate. In the onshore frontier area, e.g. Kenya or Tanzania, it is difficult to obtain clear images in seismic or acquire of 3D seismic data. Airborne gravity gradiometry helps the interpretation of sparse 2D seismic lines and brings about the exploration success. The basement structure survey using 3D MT is beginning to be applied at the area where it is difficult to implement a seismic survey data. Besides, non-seismic geophysical survey is environment friendly.

Exploration in the areas seismic survey is effective would be mature in the future and it is predicted that exploration in difficult areas, such as frontier where exploration is difficult only with seismic survey, will be increased. Therefore, it seems that opportunities to require non-seismic geophysical survey will increase. Meantime, most of Japanese oil companies, however, have the problem that they have few or no experts in non-seismic geophysical survey.

The purpose of this trend survey will be conducted to summarize the current situation, the problems and the latest technical trend about non-seismic Geophysical Survey Methods and their application in the oil and gas exploration. This survey includes literature survey and interview survey with oil companies/service companies as well as the contractor’s own information. Results of this survey would be provided to JOGMEC and Japanese oil companies.

2. Scope of work

This survey shall focus on examples of non-seismic geophysical survey in oil and gas exploration.
JOGMEC welcomes applicants to provide additional suggestions and recommendations, which will be considered in the proposal evaluation.

2.1. **Targeted geophysical survey methods and their survey items**

- **Marine CSEM and Marine MT**
  - Data acquisition and processing method of each service company
  - Characteristics and limitation (applicable water depth, survey depth, etc.) of each method
  - Characteristics and QC points in the inversion algorithm of each service company
  - Evaluation and interpretation method of the outcomes and attributes
  - Method and their evaluation of feasibility study
  - Tools of interpretation and evaluation
  - Joint inversion and/or interpretation with seismic

- **MT, TDEM (TEM) on land**
  - Data acquisition and processing method
  - Characteristics and QC points in the inversion algorithm
  - Solution for a galvanic distortion and a static shift
  - Objective of the methods and limitation (survey depth, etc.)
  - Joint inversion with gravity or seismic and integrated interpretation

- **Airborne gravity, magnetic and airborne gravity gradiometry**
  - Data acquisition and processing method
  - Objective of the methods and how to interpret attributes
  - Method of the gravity inversion
  - Information of the database services (paid or free)

- **Integrated interpretation or Joint inversion**
  - Information or achievement obtained from Integrated interpretation or Joint inversion
  - Integration and interpretation tools and software

First, review the concepts, current situation and issues of each non-seismic geophysical exploration in the current oil and gas exploration.

Second, conduct the literature survey, the interview survey to service companies and oil companies.

Finally, summarize as the classified and organized examples about their target, purpose, application method (including their analysis / interpretation method) and effect of non-seismic geophysical survey methods in oil and gas exploration.

2.2. **Literature survey**

The contractor shall conduct research on the subjects of 2.1. based on its experience and knowledge,
and literature survey of EAGE, SEG, AAPG, NGF (Norsk Geologisk Forening), E&P, ASEG, SEGJ (Exploration Geophysics), for examples. The survey shall focus on the case studies.

2.3. Interview survey with service companies
A service company shall be a company that provides data acquisition and processing/analysis services and a company that provides data analysis and interpretation services.

Interview survey on the following items to the service company shall be compiled their contents and information that each company's experience, knowledge and information which difficult to obtain from the literature survey. Also interview researchers/experts to obtain their opinions on features and evaluation of inversion processing in each service companies.

- General data acquisition and processing services provided for oil companies.
- Their unique data acquisition and processing technology.
- Points in Feasibility Study, Data Acquisition and Processing to be noted by the company side.
- Information on new technology and future development on their service.
- Interpretation technology and the integrated interpretation method with seismic (including the information on tools and software).

2.4. Interview survey with oil/gas companies
Oil companies positively using non-seismic geophysical survey are selected from the literature survey. Interview the following items with these companies and compile information on each company's experience, knowledge and information that difficult to obtain from the literature survey.

- The motivation to use non-seismic geophysical survey methods.
- Experience, purpose, efficiency and problems of non-seismic geophysical survey methods.
- Structure of the evaluation work of non-seismic geophysical survey methods.
- Number of experts and their work in charge.
- Whether can they conduct inversion analysis of non-seismic geophysical data in-house?
- Software for their work.

2.5. Case Study
Case Study will clarify the effectiveness and problems of non-seismic geophysical exploration technology. Select cases that contain a lot of information especially from the literature survey, compile multiple articles and reconstruct the case study through Q & A to the author. The survey method of interest is CSEM and the aerial gravity gradient method (preferably including gravitational / magnetic methods in the air).

2.6. Summary and Future Trend
Summarize the current status of the non-seismic geophysical survey method and discuss their future prospects.

*Please write if you have additional proposals of the surveys other than listed above in 2.Scope of Work. Those shall be positively taken into account during technical bid consideration.

3. Deliverables

3.1. Final presentation

The contractor shall give a presentation on results of the survey to JOGMEC and Japanese oil industries including E&P companies, universities, and governmental agencies. The final presentation will be held at the JOGMEC office in Japan.

(JOGMEC will organize the 1 (one) day for final presentation meeting.)

The presentation materials of the meeting shall be submitted to JOGMEC at least one week before the final presentation meeting and these materials are to be distributed to all participants.

3.2. Report

Reports shall include and satisfy all of the following requirements:

(1) Bi-weekly progress report:
   Progress shall be reported electronically every two weeks to JOGMEC person in charge.

(2) Interim reports (50% Review):
   Interim reports (50% Review) shall be submitted electronically 3 months after the start of the contract.

(3) Draft of the final report:
   A draft of the final report shall be submitted electronically one month before the end of the contract.
   The draft of final reports will be finalized after JOGMEC review.

(4) The final reports shall be submitted no later than the end of the contract with
   - Hard copy: 3 copies
   - Digital file: 2 copies of CD (s) or DVD(s)
   The digital file shall be in MS Word or other editable/duplicable format. This report shall be disclosed to the Japanese oil industry.

4. Duration of survey

The survey is expected to take about 7 months and be complete by January 31th, 2018.
5. Budget

Budget for the work is up to JPY 26,000,000 (US$ 228,070 at US1$=JPY 114).
(The above price is considered the limits for the project budget. The proposed amount shall be taken into account during bid consideration.)

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