First EAGE Workshop on Practical Reservoir Monitoring

6-9 March 2017
Amsterdam, The Netherlands
First EAGE Workshop on Practical Reservoir Monitoring

Technical Committee

Jeremy Henderson (chair)  
Nexen Petroleum,  
United Kingdom

Paulo Johann  
Petrobras, Brazil

Colin MacBeth  
Institute of Petroleum Engineering, Heriot-Watt University, United Kingdom

Mark Thompson  
Statoil, Norway

Kanglin Wang  
Shell, USA

About the Workshop

The oil and gas industry is currently in a low-price regime, which is possibly the new ‘norm’ for the foreseeable future. In such an environment, development projects requiring large capital outlays with lead-times as long as decades, are looking increasingly unattractive. Reservoir monitoring offers the possibility of improving production profiles of existing fields and yielding returns in months and years.

The aim of this workshop is to investigate how reservoir monitoring processes – utilizing geophysical, geomechanical and reservoir engineering data – can be optimized in order to realize the full recovery potential of any oil and gas field, with an emphasis on practical applications of integrated studies incorporating use of reservoir monitoring data by reservoir engineers, production engineers and others. The benefits of different approaches to incorporate geophysical and engineering data for reservoir monitoring purposes will be investigated through case studies and discussion. A global perspective highlighting the use of reservoir monitoring in varied geographic and geological settings will be encouraged; highlighting that reservoir monitoring is now actively used beyond the ‘traditional’ heartlands represented by its early uptake in North Sea sandstone reservoirs. Finally, the progress of permanent reservoir monitoring, the theme of previous workshops and the value it generates will be explored, as will new ideas and future trends for 4D techniques and applications.

Workshop Overview

Monday 6 March  
Icebreaker Reception

Tuesday 7 March  
Technical Programme

Wednesday 8 March  
Workshop Dinner

Thursday 9 March  
Technical Programme

General Information

Venue

The workshop will take place at the Hotel Casa in Amsterdam, The Netherlands.

The hotel is located in the up-and-coming Amsterdam East neighborhood, now famous for its amount of green and trendy hotspots, offering diverse choices for food, drinks and shopping. Hotel Casa does not only have an interesting history but it is also home to East57, a special food and retail concept in the Amsterdam East district.

The venue is situated only a stone’s throw away from Amsterdam Amstel Station and Amsterdam’s ring road A10, which makes it easily accessible both by car and public transport.

Eerste Ringdijkstraat 4  
1097 BC, Amsterdam  
+31(0)20 665 1171  
info@hotelcasa.nl

Accommodation

Accommodation is not included in the registration fee and is to be secured at the participant’s own discretion. EAGE has negotiated discounted accommodation rates at Hotel Casa. Please note that this is an extra service. Participants are free to book their accommodation elsewhere. More information is available on the website.

Catering

The following is included in the workshop registration fee:

• Lunch on Tuesday, Wednesday and Thursday
• Coffee breaks on all workshop days
• Icebreaker Reception and Conference Dinner
Technical Programme

Oral Presentations - Tuesday 7 March

UVA Room 2-4

OPENING SESSION

09:00 HSE & Welcome - J. Henderson (Nexen Petroleum U.K.) & K. Wang (Shell Exploration & Production Company)
09:30 Keynote Speaker - O. Barkved (Petoro, Norway)
10:00 Coffee break

THE 4D BUSINESS CASE IN A LOW-COST WORLD
C. MacBeth (Institute of Petroleum Engineering, Heriot-Watt University) & P. Johann (Petrobras)

10:30 Tu PRM 01 - Valuation of Marine Seismic Monitoring Technologies - J.L. Lopez* (Shell), J.K. Przybysz-Jarnut (Shell), B.E. Cox (Shell) & K. Rattansingh (Shell)
10:45 Tu PRM 02 - Extracting the Value from Non-repeat Seismic Surveys - D. Eckert* (Statoil ASA)

11:15 Tu PRM 04 - Large-scale Numerical Simulation of Reservoir Monitoring - SEAM Time Lapse - D. Smit* (SEAM), S. Oppert (Chevron Energy Technology Company), J. Stefani (Chevron Energy Technology Company), V. Artus (Kappa Engineering), J. Herwanger (MG Geomechanics, Ikon Science), P. Popov (MP Geomechanics, Ikon Science), A. Bottrill (MP Geomechanics, Ikon Science), L. Tan (Advanced Geophysical Technology), J. Liu (Advanced Geophysical Technology), W. Abriel (SEG), R. Detomo (SEG), W. Barkhouse (SEG) & M.L. Oristaglio (Yale University, SEAM)
11:30 Discussion
12:00 Lunch break

COST-EFFECTIVE 4D OPERATIONS
M. Thompson (Statoil) & J. Henderson (Nexen Petroleum U.K. Ltd)

13:00 Tu PRM 05 - Small Airgun Sources for Frequent Low-Cost 4D Reservoir Surveillance - D. Chalenski* (Shell), K. Wang (Shell), M. Tatanova (Shell), J.L. Lopez (Shell), P. Hatchell (Shell) & P. Dutta (Shell)
13:15 Tu PRM 06 - Cost-effective 4D with Signal-apparition-enabled Sim Source Acquisition - Preliminary Results from an OBS Field Test - K. Eggenberger* (Seismic Apparition GmbH), J.O.A. Robertsson (Seismic Apparition GmbH), D.J. van Manen (Seismic Apparition GmbH), F. Andersson (Seismic Apparition GmbH), A.S. Pedersen (Statoil ASA), M. Thompson (Statoil ASA) & L. Amundsen (Statoil ASA)
13:30 Tu PRM 07 - Executing the Repeat Contract a Case Study from Brazil - P. Sack* (Sound Oceanics LLC) & F. Gonzalez (Sound Oceanics, LLC)
13:45 Tu PRM 08 - A Successful 4D Monitor Survey over a Complex Working Oil Field - P.G. Stewart* (OceanGeo) & E. Ogu (TEPNG)
14:00 Tu PRM 09 - Long Duration Time-lapse Experiment in Al Wasse, Saudi Arabia Using an Ultra-stable Seismic Source - J. Kasahara* (Tokyo University of Marine Science and Technology), K. Al Damegh (KACST), G. Al-Anezi (KACST), F. Almalki (KACST), K. AlYousef (KACST), I. Alrougy (KACST), D. Eckert* (Statoil ASA)
14:15 Discussion
15:00 Coffee break

REALISING THE VALUE OF DATA
M. Thompson (Statoil) & C. MacBeth (Institute of Petroleum Engineering, Heriot-Watt University)

15:45 Tu PRM 11 - Results from a 4D Seismic Campaign to Unlock the Remaining Potential from the Rotliegend Gas Fields of the Southern Nort - J.P. Brain* (Shell UK Ltd)
16:00 Tu PRM 12 - Water Injection Monitoring in a Fluvial Producing Field in Malaysian Basins Using Time-lapse Seismic Inversion - S. Danaei* (University Technology PETRONAS), T.C. Ratnam (University Technology PETRONAS) & D.P. Ghosh (University Technology PETRONAS)
16:30 Discussion
### Oral Presentations - Wednesday 8 March

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Coffee break</td>
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<tr>
<td>09:15</td>
<td><strong>We PRM 04</strong> - Integration of Continuous Time Lapse Seismic Data into Reservoir Models Using Onset Times - G. Hetz* (Texas A&amp;M University), A. Datta-Gupta (Texas A&amp;M University), J.K. Przybysz-Jarmut (Shell Global Solutions International B.V.) &amp; J.L. Lopez (Shell International Exploration &amp; Production Inc.)</td>
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<tr>
<td>10:00</td>
<td><strong>We PRM 06</strong> - Maximize Value with Efficient Next-generation Fiberoptic Monitoring Solutions - D. Lecerf* (Petroleum Geo-Services) &amp; A. Smith (Petroleum Geo-Services)</td>
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<tr>
<td>11:00</td>
<td><strong>We PRM 07</strong> - Fibre Optic Sensor Arrays for Large Area Reservoir Monitoring - P. Nash* (Singular Geophysical)</td>
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<tr>
<td>11:15</td>
<td><strong>We PRM 08</strong> - Continuous Subsurface Monitoring by Passive Seismic with Distributed Acoustic Sensors - The &quot;Stanford Array&quot; Experiment - E.R. Martin (Stanford University), B.L. Biondi* (Stanford University), M. Karrenbach (OptaSense Ltd.) &amp; S. Cole (OptaSense Ltd.)</td>
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<tr>
<td>11:30</td>
<td>Discussion</td>
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<tr>
<td>12:00</td>
<td>Lunch break</td>
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<tr>
<td>13:00</td>
<td><strong>We PRM 09</strong> - The Evolution of Life of Field Seismic Data on the Clair Field - M. Ball* (BP Exploration Operating Company Ltd), A. Mathieson (BP Exploration Operating Company Ltd) &amp; S. Souls (BP Exploration Operating Company Ltd)</td>
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<tr>
<td>13:15</td>
<td><strong>We PRM 10</strong> - Practical Example of Data Integration in a PRM Environment, BC-10, Brazil - H. Ebadi* (Shell International Exploration &amp; Production), K. Wang (Shell International Exploration &amp; Production), M. Seixas (Shell International Exploration &amp; Production), G. Kumar (Shell International Exploration &amp; Production), G. Brew (Dynamic Graphic Inc.) &amp; T. Mashiotta (Dynamic Graphic Inc.)</td>
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<tr>
<td>13:30</td>
<td><strong>We PRM 11</strong> - Using PRM Data for Reservoir Management An Interpreter’s View - P. Sabel* (Statoil ASA), T. Kindingstad (Statoil ASA), T.A. Melby (Statoil ASA) &amp; B. Satyavolu (Statoil ASA)</td>
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### Oral Presentations - Thursday 9 March

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<th>Time</th>
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<tr>
<td>13:45</td>
<td><strong>We PRM 12</strong> - Permanent Reservoir Monitoring at Jubarte Field – 4D Results and Reservoir Characterization - W.L. Ramos Filho* (PETROBRAS), P. Dariva (PETROBRAS), C.C. Born (PETROBRAS), I.B. Zorzanelli (PETROBRAS), A. Goertz (PGS) &amp; A. Smith (PGS)</td>
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<tr>
<td>14:45</td>
<td><strong>We PRM 14</strong> - Quantitative Seismic Reservoir Monitoring by Using a Wave-equation Based AVO Technology - P. Haaffinger (Delft Inversion), P. Doulgeris (Delft Inversion) &amp; A. Gisolf* (Delft Inversion)</td>
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<tr>
<td>16:00</td>
<td><strong>We PRM 16</strong> - Full Waveform Inversion for Reservoir Monitoring - Pushing the Limits of Subsurface Resolution - M. Harramov (ExxonMobil, previously at Stanford University) &amp; B.L. Biondi* (Stanford University)</td>
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### UVA Room 2-4

**SEISMIC MONITORING OF HEAVY OIL RESERVOIRS**

K. Wang (Shell Exploration & Production Company) & P. Johann (PETROBRAS)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:30</td>
<td>We PRM 01 - Quantitative Interpretation of 4D-3C Seismic Data for an Oil-sands Reservoir - C. Dumitrescu* (Terra-1Q Ltd)</td>
</tr>
<tr>
<td>08:45</td>
<td>We PRM 02 - Rock Physics and Time-lapse Seismic Analysis of Thermal Heavy Oil Production - E.P. Mutual* (Qeye Labs) &amp; D. Cho (Qeye Labs)</td>
</tr>
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### UVA Room 2-2

**REALISING BUSINESS VALUE THROUGH DEFORMATION MONITORING**

M. Thompson (Statoil) & C. MacBeth (Institute of Petroleum Engineering, Heriot-Watt University)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>08:30</td>
<td><strong>Th PRM 01</strong> - InSAR - Pro-active Remote Sensing for Reservoir Management and Monitoring Environmental Safety - M.E. Allan (SkyGeo LLC), P.B. Leezenberg* (SkyGeo LLC) &amp; R.F. Hanssen (SkyGeo LLC)</td>
</tr>
<tr>
<td>08:45</td>
<td><strong>Th PRM 02</strong> - How 4D Gravity and Subsidence Monitoring Provide Improved Decision Making at a Lower Cost - M. Lien* (Octo Gravitute), R. Agerborg (Octo Gravitute), L.T. Hille (Octo Gravitute), J.E. Lindgård (Octo Gravitute), H. Ruiz (Octo Gravitute) &amp; M. Vatshelle (Octo Gravitute)</td>
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<tr>
<td>09:00</td>
<td><strong>Th PRM 03</strong> - Four Decades of Gravity Monitoring of the Groningen Gas Field - O. Eiken* (Quad Geometrics Norway AS), M. Giegola (Shell), S. Liu (NAM) &amp; M.A. Zumberge (Quad Geometrics)</td>
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<tr>
<td>09:15</td>
<td><strong>Th PRM 04</strong> - A Long-term Seafloor Deformation Monitoring Campaign at Ormen Lange Gas Field - R. de Vries* (Shell Global Solutions), T. Noble (A/S Norske Shell), P. Hatchell (Shell Global Solutions), S. Dunn (Sonodynamic International Ltd.), T. Frajford (A/S Norske Shell) &amp; A. van den Beukel (Shell Global Solutions)</td>
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<tr>
<td>09:30</td>
<td>Discussion</td>
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<tr>
<td>10:00</td>
<td>Coffee break</td>
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</table>
PROMISING TECHNOLOGIES IN ACQUISITION AND PROCESSING
P. Johann (Petrobras) & J. Henderson (Nexen Petroleum U.K. Ltd)

10:30 Th PRM 05 - The Impact of Environmental and Acquisition Variations for PRM 4D Processing - Snorre Case Study - K. McCluskey* (CGG), S. Buizard (CGG), M. McCluskey (CGG), R. Zietal (CGG) & N. Moyle (Statoil ASA)

10:45 Th PRM 06 - Very Sparse OBS Acquisition for 3D/4D Reservoir Imaging with High-order Multiples. Application to Jubarte PRM - D. Lecerf* (Petroleum Geo-Services), C. Barros (PGS), E. Hodges (PGS), A. Valencungi (PGS), N. Chemingui (PGS), S. Lu (PGS), P. Johann (Petrobras) & E. Thedy (Petobras)

11:00 Th PRM 07 - Dip-angle Image Filtering for 4D Processing of Towed-streamer and OBN Datasets - R.R. Haacke* (CGG), L. Casasanta (CGG), S. Hou (CGG) & J.R. Henderson (Nexen)

11:15 Th PRM 08 - DAS VSP in Deepwater GoM for Reservoir Monitoring - Lessons Learned - M. Tatanova* (Shell), D. Chalenski (Shell), A. Mateeva (Shell), P. Zwartjes (Shell), Z. Yang (Shell) & J. Lopez (Shell)

11:30 Discussion

12:00 Lunch break

PUSHING THE BOUNDARIES OF INTEGRATION TO CREATE VALUE
K. Wang (Shell Exploration & Production Company) & M. Thompson (Statoil)

13:00 Th PRM 09 - Improving 4D Seismic Interpretation and Seismic History Matching Using the Well2seis Technique - Z. Yin* (Heriot-Watt University), M. Ayzenberg (Statoil ASA) & C. MacBeth (Heriot-Watt University)


13:45 Th PRM 12 - 4D Seismic History Matching of the Norne Field Model Using Ensemble-based Methods with Distance Parameterization - Y. Zhang* (TNO), D. Leeuwenburgh (TNO), S. Carpenter (TNO) & P. Steeghs (TNO)

14:00 Discussion

14:30 Coffee break

15:00 Summary & Closing - J. Henderson (Nexen Petroleum U.K. Ltd, United Kingdom)

Social Programme

Icebreaker Reception
Monday 6 March, 18:00 – 20:00 hrs

The Icebreaker Reception will take place on Monday evening in the Wine Bar at the Casa Hotel. This is a perfect occasion to meet the other workshop participants and an opportunity to pick up your workshop badge.

Workshop Dinner
Wednesday 8 March, 19:00 - 23:00 hrs

The Workshop Dinner will take place at a historic location, situated at the Central Station in Amsterdam. Grand Café Restaurant 1e Klas is a unique monumental hospitality venue in Amsterdam, a hidden gem at platform 2B of the Central Station. The old waiting rooms in Grand Café Restaurant 1e Klas have been fully renovated and kept intact for the public to enjoy, therefore guests can still enjoy the old (waiting) times of the past.

Registration Overview of the registration fees

<table>
<thead>
<tr>
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<th>Registered and paid</th>
<th>01/02/2017</th>
<th>02/02/2017 - onsite</th>
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<tbody>
<tr>
<td>Workshop</td>
<td>EAGE members</td>
<td>€ 655</td>
<td>€ 755</td>
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<tr>
<td></td>
<td>EAGE student members*</td>
<td>€ 305</td>
<td>€ 355</td>
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<tr>
<td></td>
<td>Non-member</td>
<td>€ 705</td>
<td>€ 805</td>
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<td></td>
<td>Full-time student</td>
<td>€ 355</td>
<td>€ 405</td>
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<tr>
<td></td>
<td>non-member</td>
<td>€ 355</td>
<td>€ 405</td>
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Please note: to qualify for the member registration fee, your EAGE membership dues for 2017 must have been paid and confirmed. The processing time for membership applications or renewals is 10 working days.

1 To qualify for the reduced student registration fee:
   • Students must be enrolled in a full-time study programme at a recognized university or institute
   • The registration must be accompanied by a copy of a student ID card and/or official proof of enrolment.
   • Please note: student non-members cannot be older than 34 years of age (when registering)

2 The non-member fee includes EAGE membership for 2017.
How to register

We recommend that you register via the online registration form on the EAGE website (www.eage.org/event/prm-2017). However, a downloadable registration form, which should be completed and returned to the EAGE Head Office, is also available on the EAGE website.

Sponsoring

Practical Reservoir Monitoring 2017 offers excellent sponsoring opportunities to create high visibility. For more information about sponsoring, please refer to the ‘Sponsor Guide’ that is available on the workshop website or contact us at sponsoring@eage.org.

Main sponsor

Contact

For further up-to-date information, please visit the workshop website www.eage.org/event/prm-2017 or contact the EAGE Head Office at +31 88 9955055.