History

Two projects 1996-1997

Chairman
1996-2002 (Statoil)
2002-2003 (BP)
2003-2011 (Norske Shell)

Project Management
Seabed - Statoil (Norsk Hydro)
Metocean – Statoil (Norske Shell)
Environmental Norske Shell (Statoil, BP)
Subsea – Statoil
Riser & Mooring – Statoil (BP)

Five projects 1997-2011
What is NDP
- It is an organisation of the deep water licences awarded in 15th round (1996) in the Norwegian Sea. Later extended to include 16th, 17th, 18th, 19th and 20th round deepwater licences. About MNOK 350 in projects investment since start. 2010 budget estimated close to MNOK 20. (100% from Licences)

Objectives:
- To join forces and carry out cost effective preparations for safe and efficient drilling and field development

The programme phases

2011 members
- Statoil - PL218, PL283, PL327, PL328, PL524, PL602, PL603
- Shell - PL326, PL392, PL538
- Chevron – PL527, PL598
- Suncor Energy Norge - PL528, PL604
- ENI – PL529
- Total – one license fee
Who are we?

Steering Committee

- Chairman - Helge Skjæveland (Shell)  helge.skjaveland@shell.com
- Knut Chr. Grindstad (Statoil) KCG@statoil.com
- Arild Sigurdsen (Chevron) asig@chevron.com
- Erik Bjornbom (ENI) Erik.Bjornbom@eninorge.com
- Nina Gravdal (Suncor Energy Norge ) ngravdal@suncor.com

Project Managers

(each project have representatives from license partners)

- Metocean – Einar Nygaard (Statoil) enyg@statoil.com
- Seabed - Craig Hanlon (Statoil) crah@statoil.com
- Subsea - Keijo J. Kinnari (Statoil) KJKI@statoil.com
- Riser & Mooring - Kjetil Skaugset (Statoil) KJSKA@statoil.com
- Environmental – Gina Ytteborg (Shell) Gina.Ytteborg@shell.com
NDP Technical Committees Members

- **Statoil:** Martine de Vries / Craig Hanlon (Seabed Project), Einar Nygaard (Metocean Project), Lars Petter Myhre (Environmental Project), Keijo J. Kinnari (Subsea Project), Kjetil Skaugset (Riser & Mooring Project)

- **Shell:** Jostein Haga (Seabed Project), John Upton / Hans Jørgen Sætre (Metocean Project), Gina Ytteborg (Environmental Project), Ulfert Klomp / Gregory Hatton / Lisa Paulson (Subsea Project), Lars-Petter Solie (Riser & Mooring Project)

- **ConocoPhillips:** Arne Solberg / Chris Perry (Seabed Project), Dave Peters (Metocean Project)

- **ENI:** Stephen Tarran (Seabed Project), Erik Bjørnbom (Environmental Project)

- **RWE Dea:** Harald Brunstad / John Clark (Seabed Project)

- **Chevron:** Markuu Santala / James Stear (Metocean), Gunnar Lille (Environmental), Arild Sigurdson (Subsea), Owen Oakley (Riser & Mooring Project)
NDP Technical Committees Members

- **GDF SUEZ:** Wim Lekens / Bjørg Solheim (Seabed Project), Eva Fagernes (Metocean Project), Tom Steinskog (Riser & Mooring Project)

- **Petoro:** Constantine Makrygiannis (Riser & Mooring Project) / (Subsea Project)

- **Total:** Hédi Dendani (Seabed Project), Edmond Coche (Metocean Project), Laurence Pinturier / Grethe Kjeilen-Eilertsen (Environmental Project), Biljana Djoric / Philippe Glenat / Thierry Palermo (Subsea Project), Paul Wiet (Riser & Mooring Project)

- **Ptil:** Gerhard Ersdal (Metocean Project)

- **Suncor:** Urban Williams (Metocean Project)

- **ExxonMobil:** Eugene Berek (Metocean Project), Guanggiang Yang (Riser & Mooring Project)
Funding licences 2011

• Statoil PL 218, 283, 327, 328, 524, 602*, 603*
• Shell PL 326, 392, 538
• Chevron PL 527, 598*
• ENI PL529
• Suncor Energy Norge PL 528, 604*
• Total pay one license fee

*New members in 2011
A flexible, easy-to-run organization

Joint Licenses Steering Committee
(Operators)
Chairman: Norske Shell

- **Statoil**
  - PL218, PL283, PL327, PL328, PL524, PL602, PL603
- **Norske Shell**
  - PL326, PL392, PL538
- **Chevron**
  - PL527, PL598
- **ENI Norge**
  - PL529
- **Suncor Energy Norge**
  - PL528, PL604
- **Total E&P Norge**
  - PLXXX

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- **Seabed Project**
  - Statoil
- **Metocean Project**
  - Statoil
- **Subsea Project**
  - Statoil
- **Environmental Project**
  - Shell
- **Riser & Mooring Project**
  - Statoil
NDP Cost Summary by Year

Cost summary 1996 - 2011

Annual cost, all projects

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost (KNOK)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>16,602</td>
<td>4%</td>
</tr>
<tr>
<td>1997</td>
<td>55,553</td>
<td>15%</td>
</tr>
<tr>
<td>1998</td>
<td>52,887</td>
<td>14%</td>
</tr>
<tr>
<td>1999</td>
<td>30,069</td>
<td>8%</td>
</tr>
<tr>
<td>2000</td>
<td>8,188</td>
<td>2%</td>
</tr>
<tr>
<td>2001</td>
<td>20,674</td>
<td>6%</td>
</tr>
<tr>
<td>2002</td>
<td>24,750</td>
<td>7%</td>
</tr>
<tr>
<td>2003</td>
<td>37,228</td>
<td>10%</td>
</tr>
<tr>
<td>2004</td>
<td>19,172</td>
<td>5%</td>
</tr>
<tr>
<td>2005</td>
<td>12,085</td>
<td>3%</td>
</tr>
<tr>
<td>2006</td>
<td>19,192</td>
<td>5%</td>
</tr>
<tr>
<td>2007</td>
<td>20,009</td>
<td>5%</td>
</tr>
<tr>
<td>2008</td>
<td>16,822</td>
<td>4%</td>
</tr>
<tr>
<td>2009</td>
<td>11,868</td>
<td>3%</td>
</tr>
<tr>
<td>2010</td>
<td>13,266</td>
<td>4%</td>
</tr>
<tr>
<td>2011</td>
<td>15,960</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>374,355</td>
<td>100%</td>
</tr>
</tbody>
</table>
NDP Cost Summary by Project

Cost summary 1996 - 2011

<table>
<thead>
<tr>
<th>Seabed</th>
<th>Metocean</th>
<th>Subsea</th>
<th>R &amp; M</th>
<th>Environm.</th>
<th>Acc.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>132 675</td>
<td>46 196</td>
<td>71 070</td>
<td>95 955</td>
<td>20 016</td>
<td>1 858</td>
<td>367 770</td>
</tr>
<tr>
<td>36 %</td>
<td>13 %</td>
<td>19 %</td>
<td>26 %</td>
<td>5 %</td>
<td>1 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>
The Seabed project 1/3

Aims:
• To improve the regional and local understanding of hazards, the geotechnical challenges and other related processes and features on the seabed and in shallow sediments.

Specific work in 2011:
• The Finneidfjord-Vesterålen project (a cooperation between NGI, NGU & UiB) was continued from 2010. The project tries to correlate and interpret the relation of sediment properties and subseabed geohazard features (glide planes/shallow gas) between the Finneidfjord Field Laboratory (Sheltered Fjord Setting) and the offshore Vesterålen margin setting (offshore deepwater area).
• Supporting a general geotechnical investigation on temperature effects on deepwater clay sediments.
Specific work in 2011 cont:

- Joint Seabed and Metocean project with NGU and UiT, aiming to combine data from high res 3D seismic with both in situ current measurements and numerical simulations to gain a better understanding of the morphology and behaviour of sand waves.
The Seabed project 3/3

Technical Committee managed by Statoil

- Statoil: Martine de Vries (until 11/11) / Craig Hanlon (from 12/11)
- Shell: Jostein Haga (jostein.haga@shell.com)
- ConocoPhillips: Arne Solberg (arne.p.solberg@conocophillips.com), Chris Perry (chris.c.parry@conocophillips.com)
- ENI: Stephen Tarran (stephen.tarran@eninorge.com)
- RWE Dea: Harald Brunstad and John Clark (john.clark@rwe.com)
- Total: Hédi Dendani (hedi.dendani@total.com)
- GDF SUEZ - Wim Lekens (wim.lekens@gdfsuezep.no) - Bjørg Solheim (bjorg.solheim@gdfsuezep.no)
Metocean Project 1/5

Aims:

To establish a metocean conditions data bases of for use in operations and design of deep water installations by:

- acquisition of ocean current data (short and long term)
- modelling and establishment of hindcast for currents and waves
- analysis of remote sensing data and research on ocean dynamics in order to understand the deepwater currents

Extreme significant wave height (Hs) from NORA10 data (1958 – 2010)

Extreme Hs (m). Return period 100-year.
Metocean Project 2/5

Specific work in 2011:

- Updated NORA10 for 2010 - Norwegian Meteorological Institute

- LoVeCur II. Comparison of surface current from six different current hindcast models in the Lofoten Vesterålen area. The work will be completed in 4Q 2011.

- Project on monitoring and understanding sand waves in 400-700 m water depths in the Northern Norwegian Sea.

- Project on recommendations of Marine Growth in deep water in the Norwegian Sea.

- Project on establishing Metocean Reference Software (MERS) on extreme analysis.
Metocean Project 3/5

Benefits to licenses

- **NORA10 – wind and wave hindcast:** The database contains wave and wind data in 10 km resolution from West of Ireland to the Arctic for the period 1957 to 2010. Data can be used for planning purposes of both exploration and field development. Validation studies show that the database has very high quality.

- **Lofoten Vesterålen Current hindcast (LoVeCur II):** LoVeCur II is a comparison of surface drift trajectories from six different models. The results from the study will be of great importance for evaluations future oil drift studies.

- **Sand wave project:** The sand wave project will provide operators in the Norwegian Sea with important information on development and propagation on sand waves in deep water in the Norwegian Sea.
Metocean Project 4/5

Benefits to licenses (cont.)

- **Marine Growth**: The Marine Growth project will provide operators in the Norwegian Sea with updated recommendation on marine growth in the Norwegian Sea.

- **Metocean Reference Extreme Software (MERS)**: The MERS project will benefit all operators in Norwegian Sea with a common standard software on Metocean extreme analysis. This will be extremely useful for comparison of Metocean data and analysis.
Technical Committee managed by Statoil

- Statoil: Einar Nygaard (Chairman)
- Shell: Hans Jørgen Sætre
- ConocoPhillips: Dave Peters
- GDF Suez: Eva Fagernes
- Exxon: Eugene Berek
- Total: Edmond Coche
- Suncor: Urban Williams
- Chevron: Markuu Santala
- Ptil: Gerhard Ersdal (observer)
The Environmental project 1/3

Aims:

• To reduce environmental risks related to exploration drilling and field development in deep water areas through:
  • Multidisciplinary approach to identify and close gap of knowledge.
  • Study deep sea fauna and improve taxonomical expertise.
  • Establishment of sound environmental monitoring.
  • Study possible effects of particulates on sponges.
  • Improve knowledge and methods for oil spill response in deep water areas.

The video rig Campod landed on a small trawlmark in a flat area of the Barents Sea at 940 m depth. (Photo: MAREANO)
The Environmental project 2/3

Specific work in 2011:

• First phase of developing a more complete model system to support both the contingency planning and potential response to a high GOR blowout or pipeline rupture incident.
• Preparations to a workshop in early 2012 to follow up work on subsea dispersants and deepwater Oil Spill Response (OSR) initiated after Macondo and relevance for Norwegian Continental Shelf

Benefits to licenses

• Increasing the safety of workers and operations by providing a surface void fraction map to help define exclusion zone for vessels Providing a map of surfacing gas flow rates (kg/m2/s), which can be used as input to atmospheric dispersion models for explosion danger analysis.
• Will give a better picture of the flow of gas bubbles and oil to the surface.
• Important part of getting permission to explore and develop licenses having thorough understanding of not harming marine life.
The Environmental project 3/3

Technical Committee managed by Shell

- Shell: Gina Ytteborg
- Statoil: Lars Petter Myhre
- Total: Laurence Pinturier/Grethe Kjeilen-Eilertsen
- ENI: Erik Bjørnbom
- Chevron: Gunnar Lille
The Subsea project 1/3

Aims:

- To develop low cost subsea technology concepts, methods and procedures for installation and operation of subsea systems in deep waters as well as making suppliers and contractors aware of the challenges for future field developments in deep water areas in the Norwegian Sea.

Specific work in 2011:

- Assess the criticality of hydrate formation in different subsea production system areas in order to determine its impact on functional requirements, physical design and operational procedures. The work has had continued focus on hydrate plugging in subsea systems. Special focus has been on studying the effect of condensate on plugging. New discoveries have been made related to plugging tendency. Results indicate that corrosion products can have a positive impact on hindering hydrate plugging. A more detailed test program is planned to confirm this hypothesis.
The Subsea project 2/3

Benefits to licenses:

- Criticality of hydrate plugging in templates and similar system elements can be related to the critical threshold water level concept, i.e. no plugging below a given water content.

- Improved design and operational guidelines resulting in:
  - Reduced chemical usage
  - More time available for corrective operational measures rather than focusing on hydrate control measures
  - Improved design
  - Safer operation
The Subsea project 3/3

Technical Committee managed by Statoil

- Statoil: Keijo J. Kinnari
- Shell: Ulfert Klomp, Lisa Paulson, Gregory Hatton
- Total: Biljana Djoric, Philippe Glenat, Thierry Palermo
- Chevron: Arild Sigurdsen
- Petoro: Constatine Makrygiannis
The Riser and Mooring Project  1/4

Aims:
To identify cost-efficient riser and mooring configurations by focusing on critical elements and building on world-wide expertise and experiences with the focus on:

• Development of new riser solutions for deepwater and harsh environments
• Development of new devices for suppression of vortex induced vibrations
• Fundamentals for design of deep water riser and mooring systems

Specific work in 2011:
The work this year is focusing on:
• Steel riser solutions for harsh environment and deep water
• Start qualification process for NDP fairing
• Contact between marine risers
• Dynamics of flexible risers
The Riser and Mooring Project 2/4

Benefits to licenses:

• **Steel riser solutions for harsh environment and deep water:**
  – New riser configurations suitable for high motion vessels (FPSO, Buoy)
  – Increase flexibility of steel risers (improved fatigue life, more robust compared to traditional SCR solutions)
  – Enable steel risers on marginal field developments and increase flexibility of floater concepts
  – FMECA reports of relevant hang-off arrangements
  – Analysis methodology for riser-soil interaction.

• **Damping of flexibles:**
  – Assessment of hysteresis damping behavior of deep water flexibles (flexible risers and umbilicals) by numerical tools
  – Sensitivity on VIV response to damping level
  – Methodology for consistent assessment of VIV induces stresses on complex cross-sections
Benefits to licenses cont.:

- **Contact between marine risers:**
  - Better prediction of the behaviour of interaction between marine risers
  - Review feasibility of allowing marine riser contact during operation

- **Fairing:**
  - Formulated TQP for development qualification of NDP fairing. To be executed in 2012.
  - Improved method for hydrodynamic stability analysis of fairings
The Riser and Mooring Project  4/4

Technical Committee managed by Statoil

- Statoil: Kjetil Skaugset
- Shell: Lars-Petter Solie
- Total: Paul Wiet
- Chevron: Owen Oakley
- ExxonMobil: Guanggiang Yang
- GDF SUEZ: Tom Steinskog
- Petoro: Constantine Makrygiannis
NDP is a Success!

• **A cost efficient way of working**
  • Significant savings in co-ordinated and shared operations
  • Avoided duplication of work
  • Cheap administration, less than 1%

• **It has been an open and sharing way of work**
  • High degree of openness and experience transfer
  • Good personal relations and co-operation with external institutions
  • Increased co-operation between external institutions

• **We have learned a lot!**
  • Increased competence and knowledge base
  • Improved communication between involved companies
  • Personal relations and increased network

• **The licensees got results**
  • Very useful data base for further work
  • Reduced work load and costs for each license
2011 Budget (MNOK)

- Seabed Project 4.6
- Environmental Project 2.0
- Metocean Project 4.0
- Riser & Mooring Project 6.0
- Subsea Project 4.0
- Administration 0.5

TOTAL 20.1