The next wave of North Sea projects?

Developing the discovered & undiscovered oil & gas fields

Business Design Centre, London
Wednesday 13 December 2017
Session Two 12:30-12:50hrs
Introduction

Where will the next wave of North Sea projects come from?
How will we find them?

Fewer Workers
Lower Exploration Investment
Fewer Wells
Fewer Chances for Success

Case Studies:
1) Outer Moray Firth - Rejuvenating a Mature Basin
2) Integrating Legacy Subsurface Data (Examples)

We Must Work Smarter & Collaborate
A simplified history and key enabling technologies

“Drilling bumps”

Stratigraphic plays

Fairway extension

2D PC ERD Excel 3D Horizontal (Multifract) Geosteer Broadseis
Prospect and Leads: 359
Unsanctioned Discoveries: 95

Unsanctioned Discovery database area differs from Exploration area – more sensitive to likely tie-backs in AOI
Maximum Infrastructure

Only major pipelines shown. No differentiation on service (oil/gas/both)
INFRASTRUCTURE – 2025 Projection – to be SIG Output

- **Fixed Platforms** (11 - 48 years old)
- **FPSO (FPV)** (only one?)
- **Subsea Tieback**

- **Blake** 2001
- **Buzzard** 2007
- **Golden Eagle** 2014
- **Claymore** 1977
- **Scott** 1993
- **Piper** 1976/1992
- **Scapa**

- **Alba** 1998
- **Britannia** 1998
- **Callanish**
- **Enocduh**
- **Brodgar**
- **Alder**

- **Britannia (St Fergus)**
- **Peregrine**
- **Solitaire**
- **FLOTTA (FCA)**
- **Flag & Watchford (St Fergus)**
- **FLAG (Brent-St Fergus)**
- **BRAE-FORTIES (FPS)**
INFRASTRUCTURE – 2025 Projection – Current Undeveloped Discoveries

Not all undeveloped discoveries are shown – larger and representative captured.
Findings in a Mature Basin

Floating production systems vulnerable to economic realities of rising opex/barrel in low commodity price environment.

<table>
<thead>
<tr>
<th>Ivanhoe/Rob Roy</th>
<th>Alba</th>
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<tbody>
<tr>
<td>MacCulloch</td>
<td>Captain</td>
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<tr>
<td>Ettrick</td>
<td>Blake/Ross</td>
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<tr>
<td>Athena</td>
<td>Dumbarton</td>
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<tr>
<td>Buchan</td>
<td>Chestnut</td>
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<td>Balmoral</td>
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Slowing investment:

- Fewer new pipelines (Buzzard & GEAD)
- Fewer new platforms (Buzzard & GEAD)
- Fewer exploration wells (1-3 per year)

Subsea tiebacks

New technology (e.g. NUI)

Our view on the way forward:

- Brain drain - fewer workers
- Revisit past learnings
- "The easy stuff has all been found"

Turn data into Insight

Hunt for game-changers

Has it? - Collaboration

1st Subsurface
Future Challenges

<table>
<thead>
<tr>
<th>Heavy</th>
<th>Captain &amp; Kraken experience</th>
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<tbody>
<tr>
<td>HPHT</td>
<td>Few finds in OMF, experience in CNS</td>
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<tr>
<td>Sour</td>
<td>Perth (Engineered solution) &amp; Lowlander</td>
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<td>Tight</td>
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<td></td>
<td>• Await results of onshore Carboniferous test.</td>
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<td>• Offshore mature KCF holds promise.</td>
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Brownfields

• Numerous former fields may be redeveloped (e.g. Buchan, Ivanhoe/Rob Roy)
Northern & Central North Sea (incl. OMF)

Prospective Resource (mmboe)

Unrisked PR total: 12.2 Billion boe
Prospective Resource – NNS, CNS & OMF

- Largest PR mapped in the Jurassic (mainly Late Jurassic)

- Combined Early-Late Jurassic, including non-assigned data

- With either In-Place +/- Prospective Resource quoted
Average Technical Risk: Prospect & Leads – NNS, CNS & OMF

- Represents what hasn’t been drilled – therefore, is selective
- No clear trend
Prospective Resource v Technical Chance of Success: NNS, CNS & OMF
Game Changers - Fairway Extensions

Game changers are high risk, high reward.

Edvard Grieg

Maxwell Gasfield

Devil’s Hole Horst

North American Shale
£1,400,000,000 per week additional revenue

Field Production of Crude Oil Annual

4.4 million barrels per day in only seven years

Source: U.S. Energy Information Administration

Prospectivity of Inverted Basins

The Barents Sea and Unst Basins
Two wells in Unst Basin, in southeast. Jurassic reservoirs. Immature Jurassic source rocks.

Charge from the Faroe-Shetland Trough? (Oil occurs all along the Rona Ridge).

Shallow reservoirs (e.g. Wisting discovery Jurassic & Triassic reservoirs at 500 – 700 mss)

Charged from Jurassic, Carboniferous & Devonian source rocks.

Unst Basin has been related to the Viking Graben. Basement finds along the Rona Ridge show oil has migrated out of the Atlantic Margin and could have entered the Unst Basin from the north-west.
TROVE  Collating rich technical content for each opportunity.

Seeded with open source data, but SIG Participants & Trove subscribers now contributing data.
Fields & Unsanctioned Discoveries data used to predict fluid properties of Prospects & Leads

Data quality and validity improved with input from SIG participants
Recovery Factor - UK & Norway

- Brent
- Forties
- Statfjord (Brent)
- Statfjord (Statfjord)

- 60% RF
- 40% RF
- 20% RF
- UK NNS
- UK CNS

1st Subsurface
No obvious difference in performance
No apparent differences in range of developed field sizes
Billion barrel fields – high recoveries in largest fields
With huge thanks to:

Co-Authors

Paul Lindop, Maurice Bamford, Kinga Wroblewska, Angie Rooksby, Malcolm Pye, Benjamin Duncan, Matthew Belshaw

SIG Participants

Contact info@1stsom.com for subscription information
Field & Discoveries covered in Trove databases?

You are looking for data on a specific oilfield, gasfield, discovery, prospect or lead.

Your search has found that the Trove databases contain the technical open source subsurface data that you are looking for – and they are all just a key mouse clicks away!

Contact: info@1stsom.com

1) State what you are looking for.
2) State your company/position (preferably)
3) We will help where and when we can and will advise the best way forward.
4) Demonstrations available in your office.
5) Competitively priced market-leading technical databases.

Trove databases cover the entire UKCS, Ireland, Norway, Eastern Canada, Faroe Islands & UK Onshore.

If there are data missing – tell us and, if it fits, we’ll add it!