Summary

• Background to the IOGP Guidelines for the Conduct of Offshore Drilling Hazard Site Surveys (DHSS)
• Objective of the Guidelines and the Technical Notes
  • Most significant Recommendations in the Guidelines
• Planned future updates
  • What is driving the update of 373-18-1 now?
• Q & A
## A Brief Document History

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>“Guidelines for the Conduct of Mobile Drilling Rig Site Surveys“, Volumes 1 and 2 issued by UKOOA</td>
</tr>
<tr>
<td>1997</td>
<td>“Guidelines for the Conduct of Mobile Drilling Rig Site Surveys“, Volumes 1 and 2 update issued by UKOOA</td>
</tr>
<tr>
<td>2000</td>
<td>&quot;Guidelines for the Conduct of Mobile Drilling Rig Site Investigations In Deep Water&quot;, Addendum published by UKOOA</td>
</tr>
<tr>
<td>2006</td>
<td>UKOOA Guidelines adopted by the IOGP Geomatics Committee</td>
</tr>
<tr>
<td>2007</td>
<td>IOGP Launch Initiative to update the UKOOA Documents</td>
</tr>
<tr>
<td>2011</td>
<td>“Guidelines for the conduct of Offshore Drilling Hazard Site Surveys”, 373-18-1 published by IOGP</td>
</tr>
<tr>
<td>2012</td>
<td>“Guidelines for the conduct of Offshore Drilling Hazard Site Surveys”, 373-18-1 update published by IOGP</td>
</tr>
<tr>
<td>2016</td>
<td><strong>Update of 373-18-1 on normal update cycle</strong></td>
</tr>
</tbody>
</table>
IOGP Task Force: a True Cross Industry Group

- Andrew W. Hill  BP (Initial Chair)
- Palle J. Jensen  Maersk Oil (Current Chair)
- Gareth A. Wood  BP
- Dag Lundquist  Statoil
- Thierry des Vallieres  Total (now retired)
- Øyvind Ruden  Shell
- Eric Cauquil  Total
- Ken Games  Gardline Geosurvey
- Richard Salisbury  Fugro Geoconsulting
- [Karen Dalton]  RPS Energy
- Mick Cook  IECO
Two Documents

Conduct of offshore drilling hazard Site Surveys – Technical Notes
Right Tool, Right Manner, Right Time, Right Place

- Short Offset Reprocessed Exploration 3D
- High Resolution P-Cable 3D
- Surface Towed Pinger
- Near Seabed AUV Chirp Profiler
Every site has to be considered on its individual needs based on:
- The Geological setting (complexity)
- The Planned operation
- The data already to hand

Using a carbon copy survey template is inappropriate
- Ignores the setting, operation etc.

The Desk study therefore at the start of a project is an imperative

Project timing is also highly dependent on local regulatory timing (Environmental permits, contract approvals, acquisition permits etc.)

Data validity guidance is guidance: needs careful appraisal on a site to site, operation to operation basis.
The Technical Notes

• Built to support application of the “Guidelines” and explain use of relevant specialist tools:
  
  • Greater detail on Survey Planning and linkages to other IOGP Documents (e.g. Report 432, Managing HSE in a Geophysical Contract)
  • Explanation on the different types of equipment, their operation and data output
  • Brief guidance on interpretation and reporting
  • Much expanded Glossary of terms

• 112 pages in all!
IOGP Guidelines Document Recommendations – or bones of contention?

- Project Schedule
- Site Survey Decision tree
- Data validity
- Use of 3D exploration seismic data
Conceptual project timeline
Site Survey Decision Tree
Site Survey Decision Tree (Detail)

- What data are available: review critically for validity for your project!
- Compare to site constraints to be addressed.
- What rig type will be used?
- Design survey or use existing data (Site Survey or 3D)
Pre-Existing Data Validity Guidance

Table 2: pre-existing data validity guidance

<table>
<thead>
<tr>
<th>Activity Condition</th>
<th>Seabed Data</th>
<th>Subsurface Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Activity</td>
<td>5 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Engineering Activity</td>
<td>1 year</td>
<td>10 years</td>
</tr>
<tr>
<td>Well Control Incident</td>
<td>Invalid</td>
<td>Invalid</td>
</tr>
</tbody>
</table>

- Validity decision is not black and white: *Pre 1990 vs pre 2000 vs ???*
  - Data volume specific: *age, availability (paper, tapes), equipment used, line spacing, direction, processing, overall quality etc.*

- Past activity in area: *wells drilled, pipelines laid, etc.*

- Replacement or enhancement with 3D data: *targeted reprocessing?*

- Value added to other activities: *Environmental baseline assessment?*

- Technology advancement: *new data would be a step change?*
Main Line Spacing Guidance

Table 3: Main line spacing guidance

<table>
<thead>
<tr>
<th>Data type</th>
<th>Water depth range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;25m</td>
</tr>
<tr>
<td>Swathe bathymetry</td>
<td>≤50m</td>
</tr>
<tr>
<td>Side scan sonar/profiler</td>
<td>50m</td>
</tr>
<tr>
<td>2D HR seismic</td>
<td>25m – 50m</td>
</tr>
</tbody>
</table>

- Normally acquired in structural dip direction
  - Depending on environmental constraints:
    - Currents? Obstructions? Infill to existing data?
- Activity type planned: *Wildcat exploration vs. Development*??
3D data acceptability criteria for SI Purposes

- Spatial, temporal, bit resolution and sampling interval
- Data loading criteria and data resolution
- Recommended minimum quality standards for:
  - Frequency content
  - Seafloor reflection integrity
  - Acquisition artifacts
  - Merge points
  - Bin sizes
  - Sample interval
  - Imaging: velocity model and migration.
  - Multiple energy
  - Data coverage
  - Minimum water depth
## Hazard Impact Tables

<table>
<thead>
<tr>
<th>Constraint, hazard or concern</th>
<th>Bottom founded rig or platform</th>
<th>Impact on operations</th>
<th>Dynamically positioned rig</th>
<th>Investigatory data requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water depth</strong></td>
<td>Suitability of Rig:</td>
<td></td>
<td></td>
<td>Derived from results of a precise bathymetric survey using Swath Bathymetry and single channel echo sounder systems (see section 5.5.1). For individual well locations in water depths greater than 750m, that are not related to a field development, use of a properly depth converted exploration 3D Seabed event may be an adequate replacement (see sections 5.5.2 and 5.6).</td>
</tr>
<tr>
<td></td>
<td>• Barge draught</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Barge freeboard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Leg length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Expected seabed penetration — relative to vessel draught or leg length</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Achievable air gap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural seabed features</strong></td>
<td>Choice of:</td>
<td></td>
<td></td>
<td>Mapped on the basis of an integrated use of:</td>
</tr>
<tr>
<td></td>
<td>• Seabed topography and relief</td>
<td></td>
<td></td>
<td>• Bathymetric data</td>
</tr>
<tr>
<td></td>
<td>• Seafloor sediments</td>
<td></td>
<td></td>
<td>• Side scan sonar data</td>
</tr>
<tr>
<td></td>
<td>• Sand: banks, waves, and mega-ripples</td>
<td></td>
<td></td>
<td>• Profiler data</td>
</tr>
<tr>
<td></td>
<td>• Mud: flows, gullies, volcanoes, lumps, lobes</td>
<td></td>
<td></td>
<td>See section 5.5.1.</td>
</tr>
<tr>
<td></td>
<td>• Fault escarpments</td>
<td></td>
<td></td>
<td>In some cases in shelf waters, where bottom founded rigs would operate, exploration 3D seismic imagery might assist an integrated study depending on 3D data quality. In water depths over 750m exploration 3D data can replace the need for bathymetry or side scan sonar data (see sections 5.5.2 and 5.6).</td>
</tr>
<tr>
<td></td>
<td>• Diapiric structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Gas vents and pockmarks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Unstable slopes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Slumps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Collapse features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Fluid expulsion features</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Rock outcrops, pinnacles and boulders</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Reefs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Hardgrounds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Seabed channels and scours</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Man made features</strong></td>
<td>Choice of:</td>
<td></td>
<td></td>
<td>Presence identified from a desk study review of:</td>
</tr>
<tr>
<td></td>
<td>• Platforms: active, abandoned, or toppled</td>
<td></td>
<td></td>
<td>• Nautical charts for the area</td>
</tr>
<tr>
<td></td>
<td>• Pipelines: on or buried below the seabed</td>
<td></td>
<td></td>
<td>• Communications cable databases</td>
</tr>
<tr>
<td></td>
<td>• Power and umbilical lines</td>
<td></td>
<td></td>
<td>• Published Pipeline and Cable route charts</td>
</tr>
<tr>
<td></td>
<td>• Communications cables</td>
<td></td>
<td></td>
<td>See Section 4.</td>
</tr>
<tr>
<td></td>
<td>• Wellheads and abandoned well locations</td>
<td></td>
<td></td>
<td>Mapped from the integrated use of:</td>
</tr>
<tr>
<td></td>
<td>• Manifolds and templates</td>
<td></td>
<td></td>
<td>• Side scan sonar data</td>
</tr>
<tr>
<td></td>
<td>• Pipeline terminations, valves and protection frames</td>
<td></td>
<td></td>
<td>• Towed magnetometer</td>
</tr>
<tr>
<td></td>
<td>• Subsea isolation valves</td>
<td></td>
<td></td>
<td>• data</td>
</tr>
<tr>
<td></td>
<td>• Rock dumps</td>
<td></td>
<td></td>
<td>• Profiler data</td>
</tr>
<tr>
<td></td>
<td>• Non oil and gas infrastructure such as navigation buoys, wind turbines etc.</td>
<td></td>
<td></td>
<td>See Section 5.5.1.</td>
</tr>
<tr>
<td></td>
<td>• Ordnance and chemical dumping grounds</td>
<td></td>
<td></td>
<td>When the above data are not acquired in water depths greater than 750m, the well location should be visually inspected by the rig’s ROV immediately prior to, and during spudding, of the well.</td>
</tr>
<tr>
<td></td>
<td>• Miscellaneous debris</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Impacts on:

- Risk of scouling
- Rig stability
- Spud can damage

### Impacts on:

- Anchor deployment and slippage
- Requirement for piggy back anchors
- Difficulty of spudding the well
- Leveling of wellhead
- Wellhead scuff caused by current focusing
- Direction of departure in event of emergency disconnect, hanging off with riser fully deployed, or approaching back on to location to latch on to BOP.

### Impacts on:

- Anchor deployment and slippage
- Requirement for piggy back anchors
- Difficulty of spudding the well
- Leveling of wellhead
- Wellhead scuff caused by current focusing
- Direction of departure in event of emergency disconnect, hanging off with riser fully deployed, or approaching back on to location to latch on to BOP.

### Impacts on:

- Anchor deployment and slippage
- Requirement for piggy back anchors
- Difficulty of spudding the well
- Leveling of wellhead
- Wellhead scuff caused by current focusing
- Direction of departure in event of emergency disconnect, hanging off with riser fully deployed, or approaching back on to location to latch on to BOP.
Document Update Drivers

• General technology update
• Global application:
  • Irrespective of Water Depth or Geological Setting
• Wider target audience
• Improved usability
• Use of 3D Exploration Seismic Data
• Exhaustive list of potential drilling hazards
  • Applicability to Rig Type
• Data Longevity
• Glossary of Terms
Remit Driver: Safety & Environment

• Safety and Environment
  • The underlying remit of all Marine Geohazards work:
    • *To deliver safe, compliant and reliable operations*
      ▪ Across all phases of offshore operations:

➢ Exploration and Appraisal
➢ Drilling
➢ Development
➢ Production
➢ Abandonment
Remit Drivers: Operational Life Cycle

Access -> Exploration

Appraisal

Development

Production

Abandon

Drilling / Well Activity
Remit Drivers: Operational Time Frame

- Magnus, Northern North Sea
  - Discovered: 1974
  - Platform Installed: 1981
  - First Oil: 1983
  - Projected Life: Mid 1990s
  - Water-Alternating-Gas Injection
    - Project start-up: 2003
  - Restarting Drilling: 2015
  - Current Projected Life: 2020s
    .... and beyond....
Magnus HR Multichannel Data 1984 Vintage
Remit Drivers: Operational Life Cycle

Access → Exploration → Appraisal → Development → Production → Abandon

Drilling / Well Activity
Drivers for Integrated Study

• Scope
  • Scale and Complexity
• Available Technologies
  • Geophysical technology take-up in the round
• Delivery
  • Across the Life of License
Example Geohazards Lifecycle
Update Schedule

• 373-18-1 (Originally updated 2012),
  • Automatic scheduled review about to start
    • Sub-Committee Members have submitted issues to be addressed
    • Presenter has visited Ministry in Trinidad and Tobago, BOEM in GoM USA and will visit EGAS in Cairo in two weeks time to gather comments

• Input and comment from all OGP members would be welcomed
  • Some feedback already received highlights need to tighten up wording e.g. “Requirements vs. Guidance”

• Technology moves on: acquisition and processing capability

• 373-18-2 (Published October 2015)
  • No scheduled update for two years.
3D Data Usage

• This is an area that has limits that are changing constantly

• Five years ago OBC and OBN surveys would not have been considered for use in or support of Site Investigation
  • Mirror migration has changed this

• In Deep Water however use of 3D has become very much a standard approach around the world – with few provisos
  • Advent of Broadband seismic solutions is making this approach even more valid
  • Careful processing is making even WATS data usable for geohazards screening
1995 2DHR – Dip Line SE of Central Azeri
2012 3DHR – Dip Line SE of Central Azeri
Imaging: 2DHR vs. OBC upgoing wavefield

**2DHR**
- Poor channel imaging
- Poor fault imaging
- Out of plane energy
- Severe seismic blanking beneath gas

**Up-going OBC 3D**
- Poor/no shallow coverage
- Low vertical resolution

200ms TWT
500m

Amplitude
Imaging: 2DHR vs. OBC downgoing wavefield

**2DHR**

- Poor channel imaging
- Out of plane energy
- Severe seismic blanking beneath gas

**Down-going OBC 3D**

- Complete shallow coverage
- Sharp fault imaging
- Good channel imaging
- Improved vertical resolution
- Image beneath shallow gas

Amplitude
Broadband Seismic Technology

![Graph of normalized amplitude in dB vs time (ms) for different seismic technologies.](image)

- **2 ms 6.25x25x2 m**
- **3 ms 6.25x25x2 m**
- **3 ms 12.5x25x4 m**
- **2 ms 12.5x25x4 m**
WATS 3D Data Processed for Shallow Imaging

3D WATS - Original

3D - WATS Reprocessed for Geohazards
Update Schedule

• 373-18-1 (Originally updated 2012)
  • *Input and comment from all OGP members would be welcomed*

• 373-18-2 (Published October 2015)
  • *No scheduled update for two years.*

Download the Documents from [www.iogp.org](http://www.iogp.org) or via direct links below:


*Formal Questions or Comments:*
Lucyna Kryla-Straszewska: [lks@iogp.org](mailto:lks@iogp.org)
Andy W Hill: [hillaw@bp.com](mailto:hillaw@bp.com)