GIS in the Oil Field Life Cycle

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Usage of GIS in the oil industry

- Spatial Analysis
- Spatial Data Management
- Cartographic Mapping
- Surface Modeling & Visualization
Challenges in the Oil industry

Most informative decision with the least effort

• Exploration & production decisions involve more variables:
  • Finding prospects
  • Economical
  • Legal
  • Environmental

• Optimization in the cycle time:
  – Focus prospect generation

• Preserving Knowledge as an asset

• Change management
How oil companies operate?
How oil companies operate?
Drilling and Completions
Production Operation
Does GIS help to **optimize** E&P workflows?
GIS and specialized O&G tools

Spatial Data Management
Mapping
Spatial Analysis
Modeling
Spatial Data Management - Currently

Usage:
- Spatial storage
- Spatial engines
- Spatial feature manipulation
- Spatial data storage modeling

Trends:
- Corporate Spatial Warehouses
- Standardization - Geodetic integrity
- Expanding into the context

Users:
- Data Managers
- GIS is main tool
- Limited value for Decision making
Spatial Data Management - Currently

**Usage:**
- Spatial data publishing
  - Discovery
  - Data exposure

**Trends:**
- Governmental agencies
- In-house usage oil companies
- Expanding into information and knowledge ($)

**Users:**
- Data Managers and IT technical end-users
- Map Servers / Thin client
- **Medium-high value**
Spatial Data Management - Future

**Future:**
- Integrated repositories
- Spatial data with standards
- Management of spatial Information & results
- Workflow tracking, history and processes
- Metadata

**Users:**
- Data Managers and IT
- GIS is main tool
- Increase value
Mapping - Currently

Usage:
- Hardcopy maps
- Geo-processed maps
  - Graduated symbols
  - Bubble maps
  - Classification
  - Density maps

Trends:
- Use for regional studies
- Working maps

Users:
- Geologist
- Geophysicist
- Data technicians
- Specialized tools
- GIS occasionally use
Mapping - Future

Users:
- Geologist & Geophysicist
- Data technicians
- Specialized tools
- More use of the GIS

Future:
- GIS for working and presentation hardcopy maps
- Maps for exploring regional patterns
- Discover trends on time-change maps
<table>
<thead>
<tr>
<th>Benefit</th>
<th>Functionality</th>
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<tbody>
<tr>
<td>• Concentration of hydrocarbons</td>
<td>• Raster calculation</td>
</tr>
<tr>
<td>• Define play areas</td>
<td>• Multivariable analysis</td>
</tr>
<tr>
<td>• Buffering and feature overlay</td>
<td>• Pattern recognition</td>
</tr>
<tr>
<td>• Distance Analysis</td>
<td>• Asset classification</td>
</tr>
<tr>
<td>• Interpolation: Krigging, spline &amp; IDW</td>
<td>• Surface generation</td>
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<tr>
<td>• Distance surface</td>
<td>• Contouring</td>
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<td>• Travel cost</td>
<td>• Pipeline management</td>
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<tr>
<td>• Upstream oil/gas distribution network</td>
<td>• Fluid flow model</td>
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<tr>
<td>• Subsurface modeling</td>
<td>• Volume calculation</td>
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</tbody>
</table>
Spatial Data Analysis

Users:
• Geologist & Geophysicist
• Specialized tools
  – large emphasis in 3D geo-calculation
• GIS occasionally use – initial analysis
• Raster algebra helps identify structures & patterns

• Build multivariable models

Source: Basin modeling using GIS
Institute of Geological and Nuclear Sciences
Lower Hutt, New Zealand
## Surface Modeling – Currently & Future

### Usage:
- Data exploration
- Surface generation
- Prediction uncertainty

### Trends:
- GIS use for generic studies
- Easy & fast surface generation
- 3D important for calculations

### Users:
- Geologist & Geophysicist
- Specialized tools
GIS and specialized O&G tools

GIS

Spatial Data Management

GIS

Mapping

GIS

Spatial Analysis

GIS

Modeling

GIS

Specialized tools

GIS
Value Proposition for Asset Team

GIS Limited value

- Need for specialized tools
- GIS focus usage on:
  - Data integration, all data in one common window
  - Data discovery
  - Cartographic mapping
How oil companies operate?

Portfolio management

Asset management

Acquisitions

Explore & Appraise

Plan & Develop

Construct & Install

Produce & Transport

Disposals & Abandonment

Company strategy & practices

How oil companies operate?
Global Portfolio Decision Makers

Complex scenario more than just E&P:

- Legal information
- Environmental information
- Political risks
- Technical evaluation
- Other....
Global Portfolio Decision Makers

Data & information disparate sources:
- National Data Banks
- Government Agencies
- International Agencies
- Data vendors
- In-house asset information
- Satellite imagery
- Consultancy studies
How a GIS can help?

• Data & information discovery:
  – Search for all available data in one location
• Combine disparate data
• Regional and local scale
• GIS Spatial analysis:
  – Multivariable map weighting
  – Spatial decision support system
Modeling the value of prospects

- Ranked proposed assets
- Environmental rating
- Political risk
- Legal constraints
Industry Challenges

- Role that GIS plays in workflows
- Better integration of GIS with industry specific tools
- Exploring new usage within the current workflows
- Mind shift – more automation
- GIS providers continue to be responsive to industry needs
Conclusion

• **GIS key component** for decision makers – global portfolio management

• **GIS data management** :
  – Move to **knowledge** management

• **Challenges** :
  – GIS role
  – **Integration** with industry specific tools
Questions

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