N209: Applied ArcGIS Techniques for Geoscientists

Tutor(s): To be confirmed

4 Days	Competence Level: Basic Application
Classroom Course	
Computer Usage	

Summary

Participants explore the benefits (and limitations) of applying Geographic Information Systems (GIS) to their E&P workflows. Participants will develop ArcGIS skills fundamental to the building of an E&P base map and the use of geoprocessing tools and spatial analysis applications. By the end of this course, participants will be able to in dependently create an ArcGIS project using existing E&P datasets; integrate, create and edit spatial data using ArcMap and ArcCatalog; and query, analyse and output spatial information to support decision-making.

Learning Outcomes

Participants will learn to:

1. Compare the data storage properties of vector and raster data and give an example of each.
2. Contrast the types of information that are stored in a layer file versus a feature class.
3. Import and link non-spatial datasets with spatial data using the georeferencing, join and relate tools.
4. Analyse and query spatial data to select and exclude data for the purpose of creating new data layers and support decision making.
5. Undertake advanced editing to develop spatial data to be used in the play fairway analysis and check the integrity of digitised data using the Topology toolbar.
6. Generate play component datasets by converting point data to continuous surfaces using Interpolation, Contour, Reclassify and Raster Calculator tools in Spatial Analyst.
7. Perform a block ranking analysis by combining selection queries, field calculations and geoprocessing tools.
8. Create a combined probability map from a series of common elements datasets in vector and raster format.
9. Import and display LIDAR data using 3D Analyst tools in ArcScene, create a Terrain Dataset and contrast the use of Triangulated Irregular Networks versus raster data.
10. Produce a 3D sub-surface visualisation of wells, top and bottom formation, and hydrocarbon pools in ArcScene.

Duration and Training Method

A five-day computer-based classroom course. Predominately hands-on computer based learning supplemented by short, targeted lectures and group discussions. Participants apply knowledge gained incrementally through instructor led training tasks to the development of a project that reinforces and validates the classroom learning.

Who Should Attend

Geologists, Geophysicists, Geotechnicians and Technical Support staff who are going to be using GIS tools are the primary target audience. However, project and line managers, IM/IT and other staff having a role in managing or interfacing with a corporate GIS will derive a better understanding of the required geospatial workflows from having taken this course.

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Prerequisites and Linking Courses

No GIS or spatial knowledge is assumed of participants beyond the general ability to use geological maps. E&P sector knowledge is advantageous, but not required for the successful completion of this course.

Course Content

ArcGIS has become an E&P industry standard for GIS and this course aims to provide participants with the most direct learning pathway to enable their effective use of these powerful spatial tools. The instructors will lead participants through task-based E&P workflows that cover essential GIS functionality in five modules:

1. GIS Basics
2. Integrating and Linking Data
3. Creating and Editing Spatial Data
4. Data Query and Analysis
5. Presenting and Exporting Spatial Information
6. Use and Management of Digital Elevation Models in ArcGIS
7. Use of Surface Tools in Mapping
8. 3D Visualisation Methods in ArcGIS

Participants will undertake a number of interlinked, hands-on tasks during the course that culminate in the development of a fairly complex project. The course project provides participants with self-validation of the learning that they've undertaken incrementally with the instructor during the training tasks.

Section 1: GIS Basics

1.1: Build an E&P Project

- Familiarise users with the graphical user interface (GUI) of ArcMap and ArcCatalog and the workflows involved building an E&P base map.

1.2: Map Layer Management

- Manage a compilation of map layers in an ArcGIS "map document" and use the ESRI 'layer metaphor' to visualise spatial data.

Section 2: Integrating and Linking Data

2.1: Georeferencing Images

- Take an image of a structural geology map from an electronic presentation/ document package and use it within ArcGIS to add information into the project.

2.2: Join Tabular Well Data

- Modify a play map for the exploration area by integrating reservoir thickness data into the project from an existing well data table.

2.3: Link to an External Well Database

- Employ a different method of bringing non-spatial data into the project by linking to a relational database.

2.4: Create Simple Hyperlinks

- Implement hyperlinks in a fast and simple way using the Identify tool.

2.5: Build Hyperlinks into an Attribute Table

- Enable hyperlinking by embedding hyperlinks into the attribute table, allowing a specific file path to be permanently saved with the dataset for use in other ArcMap documents.

Section 3: Creating and Editing Spatial Data

3.1: Create a Well Layer from X,Y Coordinates

- Enable ArcGIS users to import tables of coordinates (e.g. from GPS, or navigational data) and create spatial point data layers.

3.2: Build a Fault Map

- Create a fault map and develop an understanding of the process of building Feature Classes within a File Geodatabase.

3.3: Edit a Simple Play Fairway Map

- Modify existing play map using subsurface grid of geological unit thickness as a guide.

Section 4: Data Query and Analysis

4.1: Spatial Data Query

- Use spatial relationships to identify licence blocks which overlay the play of interest, where 2D seismic already exists.

4.2: Attribute Query with SQL

- Further refine the search for licence blocks that we might want to acquire by querying seismic data ownership.

4.3: Simple Spatial Data Analysis

- Undertake some very simple spatial data analysis to quantify the available seismic data for a specific owner over the licence blocks of interest.

Section 5: Presenting and Exporting Spatial Information

5.1: Export Attribute Table

- Export numeric data that was generated by in the previous task.

5.2: Producing Map Layouts

- Present findings from the data analysis in a map layout suitable for printing, or for use as an object within other desktop applications.

5.3: Export Map Images

- Export maps as images for use in other applications from both the map & layout

Section 6: Use and Management of Digital Elevation Models in ArcGIS

6.1: Import, use and manage Digital Elevation Models

- Use of Raster and Vetor DEMs

6.2: High resolution DEMs - LiDAR

- Import LiDAR data and build a terrain dataset

Section 7: Use of Surface Tools in Mapping

7.1: Use the “Terrain” modelling functionality in ArcGIS

- Use of Surface Tools in Terrain
- Integrate terrain models and satellite image data Mapping

7.2: Flow Analysis - Hydrology Mapping

- Perform distance analysis - cost path mapping

Section 8: 3D Visualisation Methods in ArcGIS

8.1: 3D Visualisation Methods in ArcGIS

- Display integrated remotely sensed data and terrain models in 2D and 3D perspective views to undertake ‘virtual geoscience mapping’

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Advanced Topics Lecture:

To provide participants with a 'look ahead' in terms of more advance geoprocessing capabilities beyond the topics covered in this course

- Grid based analysis using Spatial Analyst.
- Terrain modelling using 3D Analyst.
- Geoprocessing: a block ranking example.

Course Project:

Part 1: Updating the Play Fairway

- Update a play fairway base map by consolidating newly acquired information on the deepwater plays of the North Sea Central Graben.

Part 2: Assessing Potential Acreage

- Create a very simple licence block-based acreage assessment report based on the available play information created in the previous validation task.

Part 3: Using surface and terrain data in E&P workflows

- Learn how to use geoprocessing tools and models using Spatial Analyst and 3D Analyst for surface analysis geoscience applications